Live, Work, Play 'Aiea

Final Environmental Impact Statement

VOLUME 2 of 2

(Appendices AA - I)

Prepared for:

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Accepting Authority:

City & County of Honolulu
Department of Planning and Permitting

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Project Master Plan

CITY AND COUNTY OF HONOLULU
DEPARTMENT OF PLANNING AND PERMITTING'SPROJECT MASTER PLAN DETAILED REQUIREMENTS

Live, Work, Play 'Aiea

Project Master Plan

August 2012

PBR HAWAII & ASSOCIATES, INC.

MVE PACIFIC

The proposed Live, Work, Play 'Aiea community is located in the Primary Urban Center District and will require a zone change. According to the City and County of Honolulu, Department of Planning and Permitting (DPP) criteria, the proposed Live, Work, Play 'Aiea community would be considered a "significant" zone change.

According to DPP, a Project Master Plan must be included as part of an Environmental Assessment (EA) or Environmental Impact Statement (EIS) for significant zone changes which are larger than a specified project size. Per the City & County of Honolulu's *Primary Urban Center Development Plan* a "significant zone" change is defined as: "Any change in zoning of five or more acres to a resort, commercial, industrial or mixed-use zoning district from a less-intensive zoning district…". The Live, Work, Play 'Aiea community site is greater than five acres and is proposed to be rezoned from the B-2 Community Business District (B-2) to the more intensive BMX-3 Community Business Mixed Use District (BMX-3).

According to DPP, "The Project Master Plan is intended solely as a guide to help describe in words and illustrations how a project promotes the vision, policies, principles and guidelines for the Development Plan (DP) or Sustainable Communities Plan (SCP) area…The Project Master Plan should be based on the best information available to the applicant at the time the Environmental Assessment or Environmental Impact Statement is submitted to the City."

The following is a Master Plan for the proposed Live, Work, Play 'Aiea community, which will be updated as necessary (i.e. if there are any significant changes) when the zone change application is submitted.

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1.0 STATEMENT OF CONSISTENCY WITH THE DEVELOPMENT PLAN OR SUSTAINABLE COMMUNITIES PLAN

The Live, Work, Play ʻAiea community, as shown on the Conceptual Master Plan (Figure 1) will be consistent with the vision, policies, and guidelines stated in the *Primary Urban Center Development Plan* (Primary Urban Center DP), as described in *Section 5.2.2 Primary Urban Center Development Plan* of the EIS.

2.0 SITE ANALYSIS

The following is a description of prominent site features and their relationship to the proposed development of the property.

2.1 Site Features

2.1.1 Topography

The Site was graded and filled many years ago to make a large, relatively flat area for movie viewing for the Kamehameha Drive-In Theatre. Overall, the site generally slopes from north to the south (toward the ocean) with the high point occurring near the intersection of Moanalua Road and Kaʻōnohi Street. The slopes on the main part of the site are generally between two and five percent, although steeper areas occur at the existing Site entrances and on embankments. Along the west side, a sloped embankment with a two to 10-foot drop occurs from north to south along the adjacent St Timothy's Episcopal Church and Harbor Pointe Condominiums properties. Along the east side, there are retaining walls and an embankment with an overall drop of as much as 30-feet down to Kaʻōnohi Street. On-site elevations range from approximately 34-feet mean sea level (MSL) at the lower Kaʻōnohi Street entrance to approximately 97 feet MSL at the northeast corner of the property.

2.1.2 Soils

Three soil suitability studies have been prepared for lands in Hawaiʻi. The principal focus of these studies is to describe the physical attributes and relative productivity of different land types for agricultural production within the State of Hawaiʻi. The three studies are the U.S. Department of Agriculture (USDA) *Natural Resources Conservation Service Soil Survey*, the University of Hawaiʻi Land Study Bureau *Detailed Land Classification*, and the State of Hawaiʻi, Department of Agriculture's *Agricultural Lands of Importance to the State of Hawaii* (ALISH). The three soil suitability studies are discussed below.

Natural Resources Conservation Service (NRCS) Soil Survey
According to the NRCS soil survey, there are three soil types from two soil series underlying the Site. Soils from the Lahaina Series can be found on the western half of the Site, while soils from the Waipahu Series are generally found on the eastern half (Figure 2).

Descriptions of the NRCS soil survey types follow:

Lahaina silty clay, 3 to 7 percent slopes (LaB) – This soil is found on smooth uplands. Cobblestones are common on the surface in a few places. Near the coastal plains, the profile may contain fragments of coral, stones, gravel, or sand. In a representative profile, the surface layer is dark reddish-brown silty clay about 15 inches thick. The sub-soil is about 45 inches thick and consists of dusky-red and dark reddish brown subangular blocky silty clay and silty clay loam. The substratum is soft weathered basic igneous rock. Permeability is moderate, runoff is slow and the erosion hazard is slight.

Lahaina silty clay, 7 to 15 percent slopes (LaC) – This soil type, found on the northeast tip of the Site, has similar characteristics and profile to the LaB soil type. Runoff is medium and the erosion hazard is moderate.

Waipahu silty clay, 6 to 12 percent slopes (WzC) – This soil is found on dissected terraces adjacent to the ocean. In a representative profile, the surface layer is dark grayish-brown silty clay about 12 inches thick. The subsoil is about 58 inches thick and is a dark-brown silty clay that has a prismatic structure. The substratum is clayey alluvium. Runoff is slow and the erosion hazard is slight.

Land Study Bureau (LSB) Detailed Land Classification
The University of Hawai'i LSB document titled *Detailed Land Classification, Island of Hawai'i* classifies non-urban land by a five-class productivity rating system, using the letters A, B, C, D and E, where "A" represents the highest class of productivity and "E" the lowest. Soils at the Site are not classified by the LSB (Figure 3).

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

The Site is not classified by the ALISH system and therefore is not considered important agricultural land (Figure 4).

2.1.3 Drainage

Currently, nearly the entire Site is paved due to the former use of the Site for the Kamehameha Drive-In Theatre. Runoff from the Site drains as surface flow over the paved surfaces. Approximately 80 percent of this runoff collects at a single grated drain inlet located in the southeastern portion of the Site. The existing drain inlet connects via an 18-inch drain line to the City & County of Honolulu (C&C) drainage system on Ka'ōnohi Street. During heavy rain events, the single drain inlet and 18-inch drain line do not have enough capacity to convey the entire runoff from the Site. Consequently, during large storms runoff overtops the concrete wall behind the drain inlet, flowing to catch basins on Ka'ōnohi Street.

Runoff from the eastern edge of the site (east of the grated drain inlet) surface flows directly to Ka'ōnohi Street. Three C&C catch basins on the west side of Ka'ōnohi Street accept runoff from these areas. There is also a relatively small portion of paved area in the southwest corner of the Site that sheet flows south to the neighboring Westridge Shopping Center property.

In addition to the 18-inch drain line in the southeastern portion of the Site that connects to the C&C drainage system on Ka'ōnohi Street, there is also a 30-inch diameter drain stub-out from the Ka'ōnohi storm drain near the northeast corner of the site; however the elevation at the stub connection is higher than most of the Site making it infeasible for much of the Site runoff to drain in that direction.

While the Site fronts Moanalua Road to the north, the Site slopes away from Moanalua Road and runoff from the Site does not flow toward Moanalua Road. The two C&C catch basins located along Moanalua Road only receive runoff from the off-site roadway area. The Preliminary Engineering Report (PER) calculates the overall existing (pre-development) drainage from the Site to be 90.23 cubic feet per second (cfs), based on a 10-year storm.

Creation of the Live, Work, Play 'Aiea community will reduce the overall amount of runoff from the Site by increasing pervious areas. The Live, Work, Play 'Aiea community's landscaped urban parks, plazas, and gathering areas will allow more storm water to penetrate the ground compared to the existing conditions where nearly the entire site is paved. The PER calculates that with the Live, Work, Play 'Aiea community, overall drainage from the Site (post-development) will decrease to 85.08 cfs, based on a 10-year storm—a five percent reduction over existing conditions.

The Live, Work, Play 'Aiea community's drainage system will consist of roof downspouts, drain inlets, and catch basins connected by new underground storm

drain lines. All drainage improvements will be in conformance with the City Department of Planning and Permitting (DPP) Storm Drainage Standards which require that there be no increase in runoff compared to existing conditions.

On-site runoff will generally drain toward new internal curbed roadways and parking lot areas where it will be collected by the inlets and catch basins. Storm water runoff from most of the Site will be directed to the existing drain inlet at the southeastern portion of the Site that connects to the C&C drainage system. The existing 18-inch drain line will likely need to be increased to 30 inches to remedy the current overflow condition that happens during heavy rains. Drainage improvements will be designed to capture as much of the runoff as possible so that surface flow to Ka'ōnohi Street is minimized. While there will be more piped flow to the existing drain inlet, the overall the flow to the C&C drainage system will be less due to the increase in pervious surfaces.

A small portion of the Site that directly fronts Ka'ōnohi Street will not flow into the on-site storm drain system. This area will continue to drain as surface flow to Ka'ōnohi Street similarly to existing conditions; however the amount of surface flow going to Ka'ōnohi Street is relatively small and will be reduced from existing conditions due to replacement of some paved surfaces with landscaping.

Flows from the southwestern corner of the site will continue to drain toward Westridge Shopping Center due to the low elevation there; however the amount of runoff flowing in this direction will be reduced from existing conditions.

Development of the Live, Work, Play 'Aiea community includes widening Moanalua Road and Ka'ōnohi Street to provide additional lanes that will be dedicated to the City. On Moanalua Road, the increased pavement width will result in slightly increased flows to the C&C catch basins located along Moanalua Road. On Ka'ōnohi Street, the increased pavement will increase flows; however, this will be off-set by the reduced flows from the Site.

2.1.4 Grading

Earthwork and grading will be necessary for construction of Live, Work, Play 'Aiea community. The Site will be re-graded for new building pads, parking lots, driveways, sidewalks, and landscaped areas. Retaining walls will be used where large grade changes occur, such as along Ka'ōnohi Street. Overall grading patterns will continue to slope in a general north-south direction.

Significant adverse impacts to topography and landforms attributable to grading activity are not anticipated. Appropriate engineering, design and construction measures will be implemented to minimize potential erosion of soils during construction (see Section 3.4 below). All ground-altering activity will be conducted in accordance with the State Department of Health (DOH) and City & County of Honolulu regulations relating to erosion and sedimentation control. Grading plans will attempt to balance excavation and embankment quantities to the extent practicable.

2.1.5 Geotechnical Considerations

For the geotechnical engineering exploration 30 borings were made to depths of approximately 9.5 to 26.5 feet. The borings generally encountered fills underlain by residual and saprolitic soils consisting of silty and clayey soils. Soft to medium stiff silty and clayey soils were encountered within the upper five feet of several borings and basalt rock was encountered at several borings at depths ranging from 15 to 23 feet below the ground surface. No significant geological and/or geotechnical constraints that would preclude the proposed development are expected to be encountered.

2.1.6 Flora

The little vegetation that grows on the Site is dominated by non-native species and consists of grasses and herbaceous weeds with a few scattered trees and shrubs. A total of 69 plant species were recorded. Of these, 15 species were ornamental plants and five species were food plants that were being cultivated. Just one common indigenous species, the ʻuhaloa, was found. ʻUhaloa is common throughout the lowlands of Hawaiʻi and is found throughout the tropics worldwide.

2.1.7 Fauna

No mammals of any kind were observed during the course of the survey, although it is possible that mice, rats, and feral cats may inhabit the Site. No evidence of, or presence of, the Hawaiian hoary bat, a federally listed Endangered species, was detected.

Diversity of birdlife was low due to the highly altered environment and only non-native species were observed. Common species included the rock dove or pigeon (Columba livia), zebra dove (Geopelia striata), house finch (Passer domesticus) and the common myna (Acridotheres tristis).

The habitat is not suitable for Oʻahu's native forest birds which are presently restricted to good quality native forests at higher elevations. The habitat also is not

suitable for native seabirds such as the Endagered ʻuaʻu (Pterodroma sanwichensis) and the Threatened ʻaʻo (Puffinus newelli) which nests in dense, wet fern shrubland near the summits of the mountains.

2.1.8 Historic Sites

Cultural Surveys Hawaiʻi conducted an archaeological literature review and field check (2006) for the Site. The study found that relatively few burials have been reported near the Site and there is no clear pattern of traditional Hawaiian burial locations in the vicinity.

The study concludes that it is unlikely that any significant subsurface cultural deposits related to habitation or significant paleoenvironmental data exist on the Site or in the area. Anything of cultural interest would likely have been destroyed during the Site's use for sugar cane cultivation or grading associated with the development of the Kamehameha Drive-In Theatre. Although buildings onsite such as the snack shop may be nearly 50 years old, they are not considered significant historic structures.

No impacts to archaeological or historic resources are anticipated as none are likely to be present. Cultural Surveys Hawaii recommends that no further archaeological or cultural study of the Site is necessary and has submitted the archaeological literature review and field check report to the State Historic Preservation Division (SHPD) for review and concurrence with this recommendation.

CP Kam Properties LLC and its contractors will comply with all State and County laws and rules regarding the preservation of archaeological and historic sites. Should historic sites such as walls, platforms, pavements and mounds, or remains such as artifacts, burials, concentrations of shell or charcoal be inadvertently encountered during the construction activities, work will cease immediately in the immediate vicinity of the find and the find will be protected. The contractor shall immediately contact SHPD, which will assess the significance of the find and recommend appropriate mitigation measures, if necessary.

2.2 View Analysis

The Site affords views of Pearl Harbor, Ford Island, and distant vistas of Diamond Head to the east and the Waiʻanae Mountains to the west. Portions of the Site also provide views of the Koʻolau Mountains to the northeast, although mauka views to the northeast are partially obstructed by several tall buildings mauka of Moanalua Road. In the vicinity there are 10 residential buildings taller than 150 feet high, including the approximately 300-foot tall Lele Pono condominium directly across

Moanalua Road from the Site and the approximately 380-foot tall Pearlridge Square condominium directly mauka of Lele Pono. Figure 5 compares the height of existing high-rise buildings in the vicinity to the proposed the Live, Work, Play ʻAiea community buildings.

The *Primary Urban Center Development Plan* identifies significant panoramic views in the Primary Urban Center, which includes the ʻAiea/Waiau/Pearl City area. The only significant views in this area depicted on the *Primary Urban Center Development Plan* "Significant Panoramic Views" map are views from the shoreline near Rainbow Bay Marina toward Pearl Harbor East Loch and Pearl City. The *Aiea-Pearl City Livable Communities Plan* contains an objective to enhance mauka-makai views along key streets, including Kaʻōnohi Street.

The Live, Work, Play ʻAiea community is not expected to significantly impact public panoramic views identified in the *Primary Urban Center Development Plan* or conflict with the objective of enhancing mauka-makai views along Kaʻōnohi Street stated in the *Aiea-Pearl City Livable Communities Plan*. A visual analysis of the Live, Work, Play ʻAiea community buildings from key vantage points (Figure 6) shows that:

- From Rainbow Bay Marina the Live, Work, Play ʻAiea community buildings will be visible but they are similar in height and scale to existing nearby high-rise buildings (Figure 6A);
- From Neal Blaisdell Park the Live, Work, Play ʻAiea community buildings may be more prominent, but they are still not out of context with the area (Figure 6B); and
- From mauka areas of Kaʻōnohi Street makai views toward Pearl Harbor are not significantly impacted as the existing Lele Pono and Pearlridge Square buildings and vegetation already block some views of Pearl Harbor (Figure 6C).
- From the intersection of Kamehameha Highway and Kaʻōnohi Street mauka views up Kaʻōnohi Street are not significantly impacted, although the Live, Work, Play ʻAiea community buildings are very prominent east of Kaʻōnohi Street (Figure 6D).

In addition, both the *Primary Urban Center Development Plan* and the *Aiea-Pearl City Livable Communities Plan* call for the creation of a "Pearl Harbor Regional Town Center" in the Pearlridge area where higher density commercial and residential mixed-use "livable neighborhoods" are encouraged. In particular the *Aiea-Pearl City Livable Communities Plan* specifies that: "the Pearl Harbor Regional Town Center should be designated for a greater diversity of uses than the other town centers, emphasizing an integration of high density residential and

commercial development." In general, higher densities are proposed mauka of Kamehameha Highway, while lower densities and building heights are proposed makai of Kamehameha Highway to preserve views of the harbor. Thus both the *Primary Urban Center Development Plan* and the *Aiea-Pearl City Livable Communities Plan* anticipate high-density residential uses on the Site, which would most likely include taller high-rise residential buildings to create density.

Further, the Site is within a highly urban environment with several existing high-rise buildings in the immediate vicinity. The Live, Work, Play 'Aiea community is an "in-fill" development that is complementary to the surrounding existing urban environment. There are ten buildings in the vicinity taller than 150 feet including four that are taller than 250 feet. Also many of the existing buildings in the neighborhood are at a higher ground elevation than the Live, Work, Play 'Aiea community's proposed tallest building and so the existing buildings may actually be more prominent. For example the 300-foot tall Lele Pono building is built at a ground elevation of 95 feet above sea level and the 380-foot tall Pearlridge Square building is at a ground elevation of 110 feet above sea level. In comparison, the Live, Work, Play 'Aiea community's proposed tallest building would be built at a ground elevation of approximately 70 feet above sea level. Figure 7 contains a section drawing showing the ground elevation of the Live, Work, Play 'Aiea community buildings in relationship to ground elevations of the Lele Pono and Pearlridge Square buildings.

Prior to the current Live, Work, Play 'Aiea community master plan, a plan with three 350-foot high residential towers and two 60 to 90 foot tall buildings was considered and presented at several community meetings. However, because of community feedback, the plan was refined to narrow the width and vary the height of the residential buildings.

The current master plan includes two buildings at 150 feet tall, one building at 250 feet tall, one building at 300 feet tall, and one building at 350 feet tall. This design creates a more appealing urban form while breaking up the vertical mass of the buildings to:

- Provide wider view corridors between buildings due to the narrower building profiles;
- Create a more interesting skyline with different building heights; and
- Allow for better views from existing residential towers mauka of the Live, Work, Play 'Aiea community.

The current master plan with narrower buildings also facilitates the objective of the *Aiea-Pearl City Livable Communities Plan* to enhance mauka-makai views along

Ka'ōnohi Street, because the Live, Work, Play 'Aiea community buildings will be set back from Ka'ōnohi Street, thus from mauka areas of Ka'ōnohi Street makai views of Pearl Harbor will be preserved, as shown in Figure 6C.

Although views from private property are not provided regulatory protection, a view analysis was prepared for vantage points from the Lele Pono condominium building, which is the condominium directly mauka of the Live, Work, Play 'Aiea community. The 300-foot tall Lele Pono condominium has wings facing southeast (East Wing), south (Center Wing), and southwest (West Wing). Units in each wing have view planes of approximately 180 degrees. Figure 8 shows the 180-degree view plane from each Lele Pono wing along with the percentage of how much of the view plane would be affected by the Live, Work, Play 'Aiea buildings. As shown in Figure 8, the 180-degree view plane would be affected as follows:

- **East Wing:** approximately 13 percent of view plane impacted;
- **Center Wing:** approximately 27 percent of view plane impacted; and
- **West Wing:** approximately 28 percent of view plan impacted.

However, because not all the Live, Work, Play 'Aiea community buildings will be the same height, the degree of impact from specific Lele Pono units will differ depending on what floor the unit is on. For example, for the West Wing, views from units on higher floors will be impacted less than units on lower floors because two of the Live, Work, Play 'Aiea community buildings will only be 150 feet high, thus Lele Pono units on higher floors will be able to see over these buildings. In addition while the general percentage of how much view will be affected from each wing is given, because of the spacing between Live, Work, Play 'Aiea buildings there will still be view corridors between the Live, Work, Play 'Aiea community buildings. Figure 9 shows what views would look like with the Live, Work, Play 'Aiea community buildings from the Lele Pono pool deck (4th floor) and the 20th floor.

In addition to the visual analyses, a shadow analysis of the Live, Work, Play 'Aiea community buildings has been prepared (Figure 10). The shadow analysis looked at two days of the year: 1) June 21, which is the day of the year when the sun is in the most northern position; and 2) December 21, which is the day of the year when the sun is in the most southern position. As can be seen on Figure 10, the shadows cast by the Live, Work, Play 'Aiea community buildings on neighboring properties (primarily Harbor Pointe and Saint Timothy's Episcopal Church) would be the greatest at 9 am (both on Dec 21 and June 21, with Dec 21 having the longest shadows); however, by noon and then by 3 pm (both on Dec 21 and June 21) nearly all shadows cast are within the Live, Work, Play 'Aiea community boundaries or have little to no impact on neighboring properties.

2.3 Analysis of Surrounding Urban Areas

The Live, Work, Play ʻAiea community is an "in-fill" development on a previously developed site that is complementary to the surrounding existing urban environment. Uses in the vicinity of the Site include:

North: Moanalua Road is located immediately north of the Site. Uses across from Moanalua Road include Pearl Ridge Elementary School, Pearl Ridge Community Park, and a high-density residential district consisting of several high-rises and town home complexes including the 34-story Lele Pono condominium high-rise immediately across from the Site.

East: Kaʻōnohi Street and the Pearlridge Shopping Center are located east of the Site. The Pearlridge Shopping Center is Hawaiʻi's second-largest mall and is home to more than 170 stores, restaurants, and services. Major anchors include Macy's, Sears, Ross Dress for Less, and Toys R Us.

South: The Westridge Shopping Center is adjacent to and immediately south of the Site on land leased from the State of Hawaiʻi. The shopping center has approximately 58,000 square feet of gross leasable area and is home to a number of restaurants, retail stores, and offices.

West: Adjacent to and immediately west of the Site are the St. Timothy's Episcopal Church and Harbor Pointe condominiums. Harbor Pointe consists of 87 townhome units in 18 three-story buildings.

Southwest: Adjacent to and immediately southwest of the Site is an industrial zoned (I-2) property with an industrial building housing Access file storage.

The Honolulu Rapid Transit Project's Pearlridge Station is currently planned to be located near the intersection of Kaʻōnohi Street and Kamehameha Highway, about 1/4-mile south of the Site. The *Aiea-Pearl City Neighborhood TOD Plan Public Review Draft* proposes residential and commercial uses at the Site and calls the Kamehameha Drive-In property "catalytic" in providing the opportunity for enhanced shopping opportunities and high-density housing. As stated in the plan: "By providing residences in this area, workforce housing options will increase, transit ridership will improve and nearby retail uses and restaurants will have a stronger customer base." The Site is within a 5-10 minute walk to the planned Pearl Ridge transit station and it is anticipated that many of the Live, Work, Play ʻAiea community residents will find the rail system a convenient transportation alternative.

3.0 LAND USE

There are several objectives for the Live, Work, Play 'Aiea community. First, the Live, Work, Play 'Aiea community facilitates the development of complementary land uses (Figure 1), which is consistent with the City's growth management objectives. The Site is presently zoned B-2, Community Business District, and has a height limit of 60-feet. The B-2 zoning district allows for a range of commercial uses such as retail shops, offices, and restaurants. The existing allowable Floor Area Ratio (FAR) is 2.5 (3.5 with open space FAR bonus) allowing for up to 1.52 million square feet of commercial floor area (2.13 million square feet with open space FAR bonus). While a strictly commercial project currently can be developed at the Site, a mixed-use residential and commercial development has several benefits. First, integrating residential and commercial uses is complementary and enhances both uses. For the Live, Work, Play 'Aiea community residents, integrating commercial uses provides easy access to retail, dining, and commercial services and promotes a "village" character and sense of a neighborhood. For commercial establishments, the close proximity of residents provides a customer base that enhances the viability for a broader spectrum of businesses. The integration of uses in a pedestrian friendly design, as is being proposed, also reduces automobile dependence since residents are able to walk and/or bike to shops, restaurants, and places of employment. Chapter 5 of this EIS provides discussion on the consistency of the Live, Work, Play 'Aiea community and the proposed zone change with City plans and policies.

A second objective is to fulfill a need for housing, for which there is a shortage on O'ahu, particularly affordable and workforce housing. If the zone change is approved, a range of residential units at varying price points are proposed, including units priced in accordance with the City & County of Honolulu's Affordable Housing Rules. Section 4.6 of the EIS contains specific information regarding the market demand for the Live, Work, Play 'Aiea community.

A third objective is to create a pattern of land use that is consistent with principles of transit-oriented development (TOD). TOD encourages the development of higher density residential and commercial uses within walking and/or bicycling distance to transit stations to increase transit accessibility to residents and increase transit ridership. Although the Live, Work, Play 'Aiea community is designed not to be dependent (no variances from standard requirements are being requested), on the Honolulu Rail Transit Project, the rail project will be an amenity for the Live, Work, Play 'Aiea community residents and favorable for the Live, Work, Play 'Aiea community businesses by increasing mobility and transportation options.

Creation of the Live, Work, Play 'Aiea community will require a change in zoning of the Site from the B-2 Community Business District (60-foot height limit) to the BMX-3 Community Business Mixed-Use District with a 350-foot height limit. The B-2 zoning district allows for a range of retail, office, food establishment, and other commercial uses, however, residential uses are not permitted. The BMX-3 zoning district allows for similar commercial uses as the B-2 zoning district but also permits residential uses.

4.0 OPEN SPACE

The City & County of Honolulu Department of Parks and Recreation maintains an islandwide system of parks on O'ahu. The nearest public park is Pearl Ridge Community Park, located directly across of Moanalua Road from the Site. The nine-acre park has a baseball field, basketball courts, tennis courts, and a comfort station. Other public parks in the vicinity include Waimalu Neighborhood Park, Newtown Neighborhood Park, Pearl City District Park, and the Manana Community Park and Youth Facility.

The City & County of Honolulu's Park Dedication Ordinance (Chapter 22, Article 7, Revised Ordinances of Honolulu) requires new residential projects to dedicate land in perpetuity for park facilities, pay a fee in-lieu of dedication, or a combination of both.

The Live, Work, Play 'Aiea community will include landscaped urban parks, plazas, and gathering areas open to the public but privately maintained. (Figure 1) In addition the Live, Work, Play 'Aiea community's residential buildings will include private recreation areas and facilities (such as condominium pools, recreation decks, barbeque areas, fitness facilities, and other areas) for residents' use. In general the Live, Work, Play 'Aiea community will promote healthy lifestyles by its compact design thereby allowing residents to walk to a variety of stores and services and thus reducing the need to drive for all daily needs

Representatives from the Live, Work, Play 'Aiea community, have had preliminary meetings with the Department of Parks and Recreation and have spoken with DPP regarding park dedication requirements. The Live Work, Play 'Aiea community is being designed to meet the park dedication requirements with on-site facilities; however if the total area of the on-site facilities does not provide all of the area required under the Park Dedication Ordinance, a fee in lieu of the difference in area may be paid. As design progresses, Representatives from the Live, Work, Play 'Aiea community will continue to coordinate with the Department of Parks and Recreation and DPP regarding the satisfaction of the Park Dedication Ordinance. Representatives from the Live, Work, Play 'Aiea community will also consult with the City & County of Honolulu Department of Design and Construction.

5.0 CIRCULATION

The Live, Work, Play ʻAiea community incorporates a Main Street through the Site connecting Moanalua Road and across Kaʻōnohi Street through the Pearl Ridge Shopping Center (as shown on draft Pearlridge Station Area Plan). The Main Street will be thoughtfully designed to create a pedestrian-friendly connection and sense of identity for the neighborhood. Landscaping and building design along Moanalua Road and Kaʻōnohi Street will also give strong consideration to improving the pedestrian experience.

Live, Work, Play ʻAiea is being designed to maximize pedestrian and vehicular connectivity within and to/from surrounding properties. Presently, the current site does not allow for visitors of St. Timothy's Episcopal Church and residents of Harbor Pointe condominiums to have direct pedestrian or vehicular connection to Pearl Ridge Elementary School, Pearl Ridge Community Park, and Pearl Ridge Shopping Center. As shown on the Master Plan (Figure 1) and Figure 11, Live, Work, Play ʻAiea incorporates several improvements to promote greater connectivity with neighboring properties and the community at large.

The following transportation improvements have been incorporated into the Master Development Plan:

1. Creation of a "Main Street" through the Live, Work, Play ʻAiea community linking Moanalua Road and Kaʻōnohi Street;
2. Signalization of the Moanalua Road/Main Street intersection opposite of the driveway to Pearl Ridge Elementary School. A crosswalk to Pearl Ridge Elementary School will also be provided.
3. Signalization of the Kaʻōnohi Street/Main Street intersection opposite of Pearlridge Center Driveway 1. A crosswalk will also be provided.
4. Widening Moanalua Road and creating a second eastbound left-turn lane at the intersection of Moanalua Road/Kaʻōnohi Street.
5. Widening Kaʻōnohi Street and creating an additional southbound lane.
6. Removal of the median along the northbound approach of Kaʻōnohi Street.
7. Providing access for Harbor Pointe and St. Timothy's Episcopal Church to the newly signalized intersections at Moanalua Road/Main Street and Kaʻōnohi Street/Main Street via an internal connection to Main Street with the existing Harbor Pointe/St. Timothy's Episcopal Church access road.

The majority of the above improvements will be provided during the Live, Work, Play ʻAiea community's first phase, and prior to occupancy. To illustrate the above improvements, Figure 11 shows proposed roadway improvements, including new dedicated left and right turn lanes, new signals, and added lanes on Moanalua

Road and Ka'ōnohi Street created by reducing the property lot size and dedicating this additional right-of-way to the City and County of Honolulu.

6.0 DESIGN THEME AND CHARACTER

The design theme and character for the Live, Work, Play 'Aiea community, is described below.

6.1 Design Theme

The Live, Work, Play 'Aiea community is envisioned to be an integrated cohesive mixed-use community that combines residential, retail, commercial, and public spaces in a compact and walkable urban village. The Live, Work, Play 'Aiea community's mission statement is to:

> *Create a community, which encompasses smart growth design in homage to the property's location in the urban core, fostering an environment of "live-work-play" and using sustainable building and design practices to minimize the environmental footprint of the community.*
>
> *Create an urban village where all community members can experience the social, cultural, educational, and economic benefits of a properly planned, carefully designed, and well-built community.*

The Live, Work, Play 'Aiea community's design strives to integrate commercial uses, homes, and urban gathering area's and open spaces to create a complete community. Great attention is being given to creating a pedestrian-oriented, highly walkable environment that connects uses both internally and to adjacent neighbors with streets and pathways. Figures 12 and 13 contain renderings showing the vision of the Live, Work, Play 'Aiea community from various perspectives.

The Live, Work, Play 'Aiea community master plan (Figure 1) includes two residential buildings at 150 feet tall, one residential building at 250 feet tall, one residential building at 300 feet tall, and one residential building at 350 feet tall. Prior to the current master plan, a plan with three 350-foot high residential buildings and two 60 to 90 foot tall buildings was considered and presented at several community meetings. However because of community feedback, the plan was refined to narrow the width and vary the height of the residential buildings. The current design creates a more appealing urban form while breaking up the vertical mass of the buildings to:

- Provide wider view corridors between buildings due to the narrower building profiles;

- Create a more interesting skyline with different building heights; and
- Allow for better views from existing residential towers mauka of the Live, Work, Play 'Aiea community.

Additional buildings in the conceptual master plan (Figure 1) include: 1) a mixed-use building (approximately 60 feet tall) that will combine ground floor shops and restaurants with upper floor offices, homes, and possibly a limited-service "kama'āina" hotel or a senior housing/assisted living facility; 2) a grocery store (approximately 40 feet tall as measured from the interior parking lot level); and 3) freestanding retail buildings (approximately 25 feet tall) along Moanalua Road and at the corner of Moanalua Road and Ka'ōnohi Street.

6.2 Main Street Character

A "Main Street" linking Moanalua Road to Ka'ōnohi Street (Figures 1 and 11) will be the catalyst and heart of the Live, Work, Play 'Aiea community. The Main Street will combine ground floor retail and restaurants, upper floor residential units, office space, possibly hotel units and/or senior housing/assisted living and public gathering areas to create an active and vibrant environment. The Main Street will also alleviate neighborhood traffic congestion by providing an alternate mauka-makai route for area residents. The Main Street will have one travel lane in each direction with on street parking and other traffic calming provisions as it is designed to provide a safe and pleasant environment for pedestrians. The Main Street's roadway width of about 35-feet (between parking stalls) accommodates vehicular traffic while maintaining a safe and comfortable pedestrian environment.

A high-level of design attention will be given to the Main Street's form to create an attractive, functional, and active streetscape, pedestrian promenade, and gathering areas. Building massing, form, and articulation along Main Street will create integrated indoor-outdoor spaces for retailers and restaurateurs. Shelter for outdoor seating and other areas will be provided by a combination of naturally-ventilated structures, canopies, and shade trees. Human-scaled dimensions, interesting sightlines, and appropriate lighting, along with landscaped areas, water features, and street furniture such as benches and tables, will invite people to linger, enjoy the great public space, and participate in spontaneous interactions with neighbors and visitors. Shop display windows and entrances will be oriented toward the Main Street to create physical and visual connections and encourage pedestrian activity along the wide landscaped sidewalks.

Toward the makai end of Main Street a large plaza/event lawn will provide a community gathering place for free concerts, community ceremonies, school performances, and other public events designed to make Main Street a focal point,

not only for Live, Work, Play ʻAiea residents, but also for the greater ʻAiea/Pearl City community. Designed with consideration for safespaces and "eyes on the street" surveillance by residents, visitors, and shop owners and employees, Main Street will be a safe place to visit. With day and night activities for residents and visitors, Main Street will provide a unique urban lifestyle experience where people will come to be part of civic life.

New signalized intersections will be created at the Main Street's intersection with: 1) Moanalua Road opposite of the existing driveway to Pearl Ridge Elementary School; and 2) Kaʻōnohi Street opposite of the driveway to the Pearlridge Shopping Center. Crosswalks on Moanalua Road and Kaʻōnohi Street will be provided at both intersections.

6.3 Residential Character

The Live, Work, Play ʻAiea community will provide up to 1,500 homes, primarily in the three buildings ranging from 250 to 350 feet tall, although some homes may be provided on the upper floors of mixed-use buildings along the Main Street. Homes will be designed to accommodate a variety of family sizes and income ranges with at least 30 percent of the homes priced in the affordable range per the City & County of Honolulu housing rules. Homes for specialized markets, such as senior housing and assisted living housing, are also being considered. Senior housing/assisted-living/long-term and convalescent care within the Live, Work, Play ʻAiea community, combined with medical services, a grocery store, other shopping, and restaurants, could create a synergy making the Live, Work, Play ʻAiea community a highly desirable place for both seniors and businesses.

Paths and landscaping will integrate and connect the residential and commercial uses. It is anticipated that the planned retail, food, and commercial establishments, and employment opportunities, will be a highly desirable amenity to Live, Work, Play ʻAiea community residents as well as existing area wide residents.

6.4 Commercial Character

Planned commercial uses include approximately 143,000 square feet of retail floor area, and 80,000 square feet of office space or an approximately 150-room neighborhood hotel. Anticipated commercial tenants include a supermarket, retail shops, food establishments, and office space for professionals, businesses, and medical services. The master plan provides for flexibility and alternative uses for a portion or portions of the total office space, such as: 1) a hotel; 2) senior-oriented medical, service, residential, and convalescent care facilities; or 3) or other residential uses.

There is reasonable market justification for inclusion of a limited-service "kamaʻāina" type hotel within the Live, Work, Play ʻAiea community, although the Site is not in a resort-quality location nor will the Live, Work, Play ʻAiea community have a visitor-oriented theme. As opposed to a resort hotel, the Live, Work, Play ʻAiea community's "kamaʻāina" hotel would be significantly smaller in scale than a resort hotel and would not include facilities or ancillary services typically found at resorts. An appropriate-sized hotel would be housed in approximately 40,000 square feet of floor space, which would provide an optimum number of rooms to allow efficient operation without over-building relative to demand.

Potential market segments contributing to hotel guest demand in the area are: 1) guests of ʻAiea/Waiau/Pacific Palisades residents, whose only current hotel alternatives are in Waikiki; 2) medical-oriented guests, such as Pali Momi Medical Center patients and their family from neighbor islands that need to stay overnight or longer; 3) visitors to Pearl Harbor, the leading visitor attraction in Hawaii; and 4) shoppers from neighbor islands and elsewhere attracted to Pearlridge, Pearl Highlands, the Waikele outlet stores. A limited-service "kamaʻāina" type hotel is also expected to be a complementary use for the vibrant activity center that the Live, Work, Play ʻAiea community is envisioned to become.

The proposed hotel would be developed only if appropriate zoning is available through an amendment to the City& County of Honolulu's Land Use Ordinance (LUO), the planned TOD zoning ordinance, or other appropriate means. Hotels presently are not a permitted use in the BMX-3 or B-2 zoning districts. If a hotel cannot be included, the space that would be used for a hotel would be used for office uses, residential uses, or possibly senior housing/assisted-living/long-term and convalescent care facilities.

The potential use of a portion of the Live, Work, Play ʻAiea community's office space for senior-oriented uses recognizes that the ʻAiea/Pearl City area has a large existing senior population that is likely to increase in the next several decades; according to the 2010 census, 38 percent of the total population is above age 50 and 19 percent is above age 65. Providing senior-oriented medical, service, and convalescent care facilities could serve this rapidly expanding population and would synergistically interact with any senior housing units within the Live, Work, Play ʻAiea community, increasing the attraction of the housing units by providing ready access to needed services while providing a steady stream of customers for the office space businesses.

6.5 Relation to/Character of Ka'ōnohi Street and Moanalua Road Frontages

Live, Work, Play 'Aiea will clearly and intentionally engage Ka'ōnohi Street and Moanalua Road both architecturally and functionally. Design challenges along Ka'ōnohi Street include: 1) the significant slope of Ka'ōnohi Street down from Moanalua Road to the new Main Street intersection; 2) slopes up (embankments) from the street level of Ka'ōnohi Street to the interior of the Site; and 3) the need to congregate and orientate Live, Work, Play 'Aiea retail uses in a logical and efficient manner to facilitate customer convenience and tenet desires. Design challenges along Moanalua Road include a two to10 foot slope down from the street level of Moanalua Road to the interior of the Site.

Along Ka'ōnohi Street design of building and parking structure massing will help minimize the visual impact of the 50-70 foot elevation change between Kaonohi Street and the retail level of Live, Work, Play 'Aiea. Further differentiation will be provided by access points at: 1) the Main Street connection with Ka'ōnohi Street; 2) a mid-block service dock entrance under the retail level; 3) a tree-lined pedestrian and vehicle ("right-in right-out") entrance from Ka'ōnohi Street to the interior Live, Work, Play 'Aiea area. Intervals of structured parking beneath the retail level will further break up building massing. Other key design components will include: 1) building exteriors treated with articulating forms to break up large walls; 2) fenestration with metal screens, and green walls, and 3) building setbacks areas layered with trees and plants of appropriate scale, texture, and color. Figure 12 shows a design concept study of Live, Work, Play 'Aiea from the gateway intersection of Main Street and Ka'ōnohi Street.

The pedestrian connection at the intersection of Main Street and Ka'ōnohi Street is a critical element in the design and function Live, Work, Play 'Aiea and the relationship with the surrounding area. This key public node provides the first point of interaction between Live, Work, Play 'Aiea and Pearlridge Center to the east, Westridge Center to the south and the Pearlridge Transit Station further south at the intersection of Kamehameha Highway and Ka'ōnohi Street. The Main Street entry will be the gateway to Live, Work, Play 'Aiea, and as such, the architecture is designed to be welcoming and inviting.

At the corner of Ka'ōnohi Street and Main Street the key feature will be a striking entry portal designed as a grand gateway that will transport people from Kaonohi Street—vertically—to a panoramic view plaza, some 45 feet above. From the plaza, visitors can take in the view of Pearl Harbor, enjoy outdoor seating adjacent cafes and shops, and continue on to additional shops and restaurants on Main Street. The architectural composition of the portal and surrounding structures will

engage pedestrians and others passing by with alluring features, elegant lighting, and interesting fenestration, including areas for green walls, public artwork, or other engaging details. The portal is expected to be a dynamic element that involves the community along this edge, both day and evening, with banners, lighted graphics, and spaces that provide opportunities to display community history, art, and information about Live, Work, Play ʻAiea and the surrounding neighborhood. Main Street will also feature sidewalks from Kaʻōnohi Street to the heart of Live, Work, Play ʻAiea and eventually connecting to Moanalua Road.

Pedestrians walking up or down Kaʻōnohi Street will be shaded by tree canopies covering the landscaped sidewalk. Alcove seating areas will create interest and rest areas along the route. The canopy trees and alcove seating, combined with articulated building features, will serve to reduce the scale of the buildings from the pedestrian perspective and integrate this edge of Live, Work, Play ʻAiea with the neighboring community. Compared to the Pearlridge Center side of Kaʻōnohi Street, the Live, Work, Play ʻAiea side will provide a welcoming environment for people walking and biking to and from the Pearlridge Transit Station at the intersection of Kamehameha Highway and Kaʻōnohi Street. In addition to pedestrian improvements provided on Kaʻōnohi Street, a dedicated bike lane will be provided as part of the road widening along this edge of Live, Work, Play ʻAiea.

At the intersection of Kaʻōnohi Street and Moanalua Road a gateway plaza will greet pedestrians entering Live, Work, Play ʻAiea from mauka high-rise buildings and other areas. Features of this plaza may include, landscaping, a water feature, and steps gracefully terracing down to allow an easy transition from the existing intersection elevation to the Live, Work, Play ʻAiea retail level. Figure 13 shows a design concept study of Live, Work, Play ʻAiea from the corner Kaʻōnohi Street and Moanalua Road.

Along Moanalua Road, due to the two to10 foot elevation change from the street level to the interior of the Site, buildings will be lower than the road elevation. As such it is not possible to provide direct pedestrian entrances from the roadway sidewalk (with the exception to the gateway plaza at the corner of Moanalua Road/ Kaʻōnohi Street). However buildings along Moanalua Road will be low rise, designed in contemporary, island vernacular style, and well-spaced to allow landscaping in between and views into the central Live, Work, Play ʻAiea area. An important point design point will be the engagement of these buildings' architecture outward, toward Moanalua Road. Key to this gesture will be fenestration and details allowing for an inviting and finished look on the building exteriors. So while formal entrances would be from the interior of Live, Work, Play ʻAiea, there would be no "blank facades" of the buildings facing Moanalua Road.

Setbacks and landscaped areas surrounding buildings along Moanalua Road will allow for a continuity of plants and indoor/outdoor spaces.

6.6 Transit-Oriented Development Character

A transit-oriented development is a compact, mixed-use development situated near transit. TOD's typically concentrate a mix of land uses, such as residential, office, retail, civic uses, and entertainment within easy walking distance to a transit station. The Site is less than one-quarter mile from the Honolulu Rail Transit Project's planned Pearlridge Station. Although Live, Work, Play 'Aiea's viability is not dependent on the rail transit project, it is being designed to be "transit-ready" by incorporating design elements to encourage walking and bicycling within the Site and to/from the Site. These design elements include: 1) incorporating a mix of uses that will encourage transit ridership: 2) providing wide landscaped sidewalks (on Ka'ōnohi Street and Moanalua Road along the frontage of the Site), paths connecting uses, both within the Site and to adjacent properties: 3) storefronts opening to the Main Street: 4) creating gathering places; 5) a transit-supportive density; and 6) a high level of attention to landscaping and building design.

7.0 TELECOMMUNICATIONS

Telephone and cable television service will be extended to the Site from the existing Hawaiian Telcom (HTCO) Moanalua Road duct system. Separate conduit laterals will be provided for HTCO and Oceanic Time Warner Cable (OTWC) however, all conduits will be connected to HTCO's duct system since OTWC does not presently have an underground duct system in Moanalua Road. In general, where OTWC does not have its own underground duct system, OTWC will enter into a leasing agreement with HTCO for space in HTCO's duct system. Should there be insufficient space in HTCO's existing duct system to accommodate the OTWC trunk cable, an alternative would be for an OTWC cable to cross Ka'ōnohi Street and connect to the existing overhead line.

FIGURE 1

Master Plan

Live, Work, Play 'Aiea

CP Kam Properties, LLC. ISLAND OF O'AHU

NORTH

LINEAR SCALE (FEET)

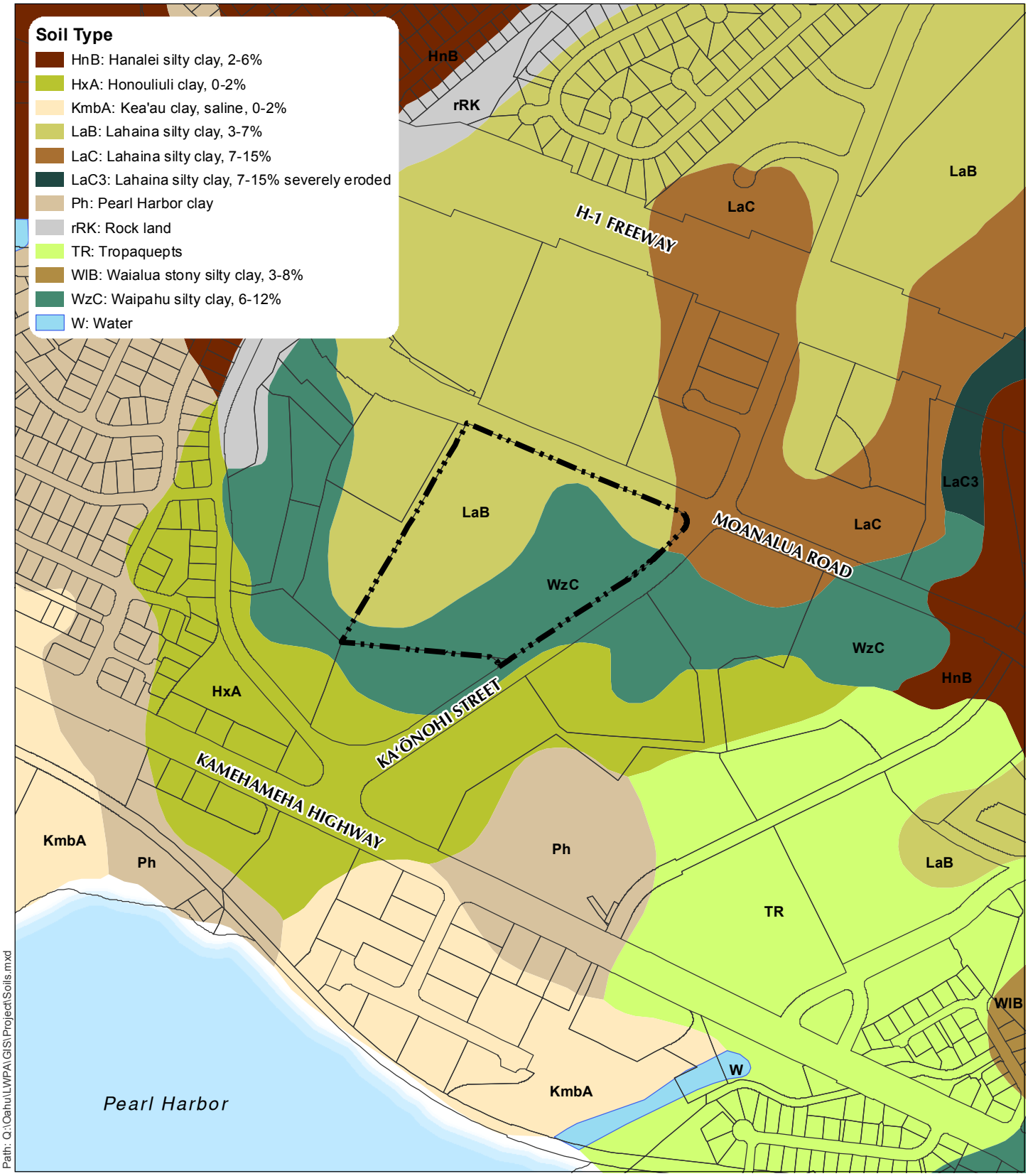
250 125 0 250

1" = 250'

Master Plan prepared by

MVE PACIFIC

PBR HAWAII & ASSOCIATES, INC.



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DATE: 8/2/2012

LEGEND

Live, Work, Play 'Aiea

FIGURE 2:
NRCS Soil Survey

Live, Work, Play 'Aiea

CP Kam Properties, LLC
Island o O'ahu

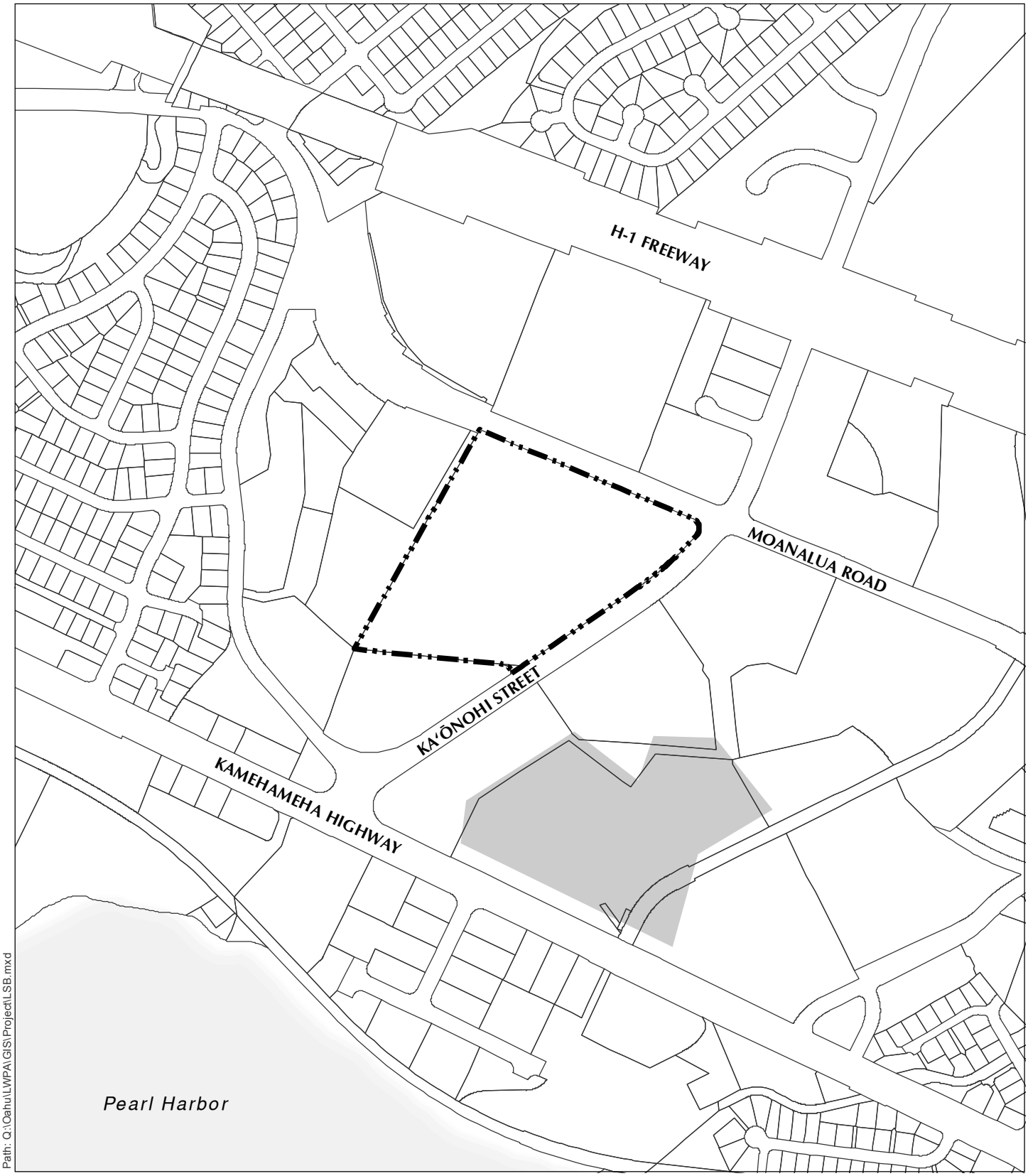
North

Linear Scale (feet)
0 125 250 500

PBR HAWAII & ASSOCIATES, INC.

Source: Natural Resources Conservation Service

Disclaimer: This Graphic has been prepared for general planning purposes only and should not be used for boundary Interpretations or other spatial analysis.



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DATE: 8/2/2012

LEGEND

Live, Work, Play 'Aiea

Classification

C: Fair

N: Not Classified

FIGURE 3:

Land Study Bureau
Detailed Land Classification

Live, Work, Play 'Aiea

CP Kam Properties, LLC

Island o O'ahu

North

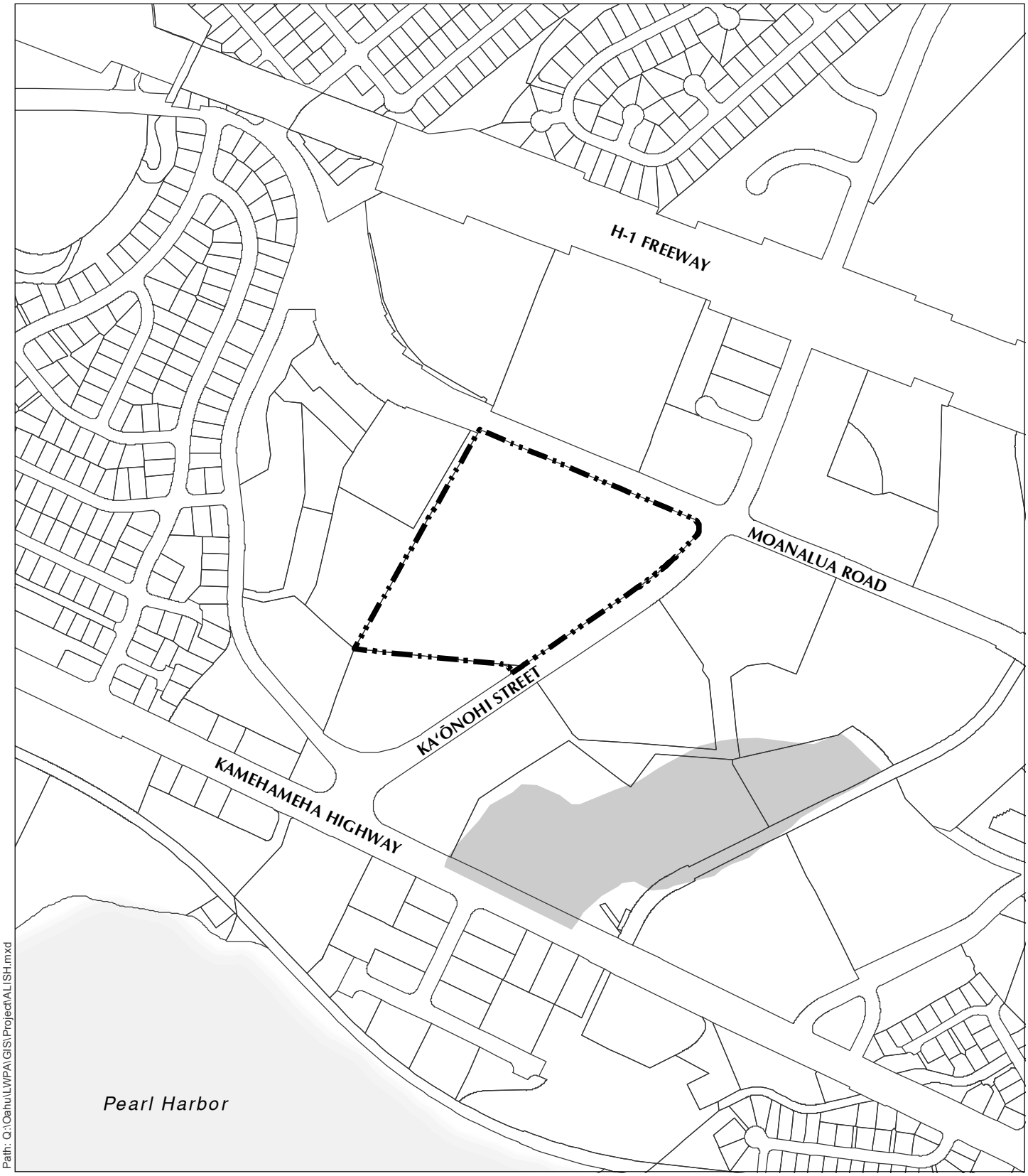
Linear Scale (feet)

0 125 250 500

PBR HAWAII & ASSOCIATES, INC.

Source: Land Study Bureau (1972)

Disclaimer: This Graphic has been prepared for general planning purposes only and should not be used for boundary Interpretations or other spatial analysis.



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DATE: 8/2/2012

LEGEND

Live, Work, Play 'Aiea

Classification

Unique

Unclassified

FIGURE 4:

Agricultural Lands of Importance to the State of Hawai'i

Live, Work, Play 'Aiea

CP Kam Properties, LLC

Island o O'ahu

North

Linear Scale (feet)

0 125 250 500

PBR HAWAII & ASSOCIATES, INC.

Source: State of Hawai'i Department of Agriculture (1977)

Disclaimer: This Graphic has been prepared for general planning purposes only and should not be used for boundary Interpretations or other spatial analysis.

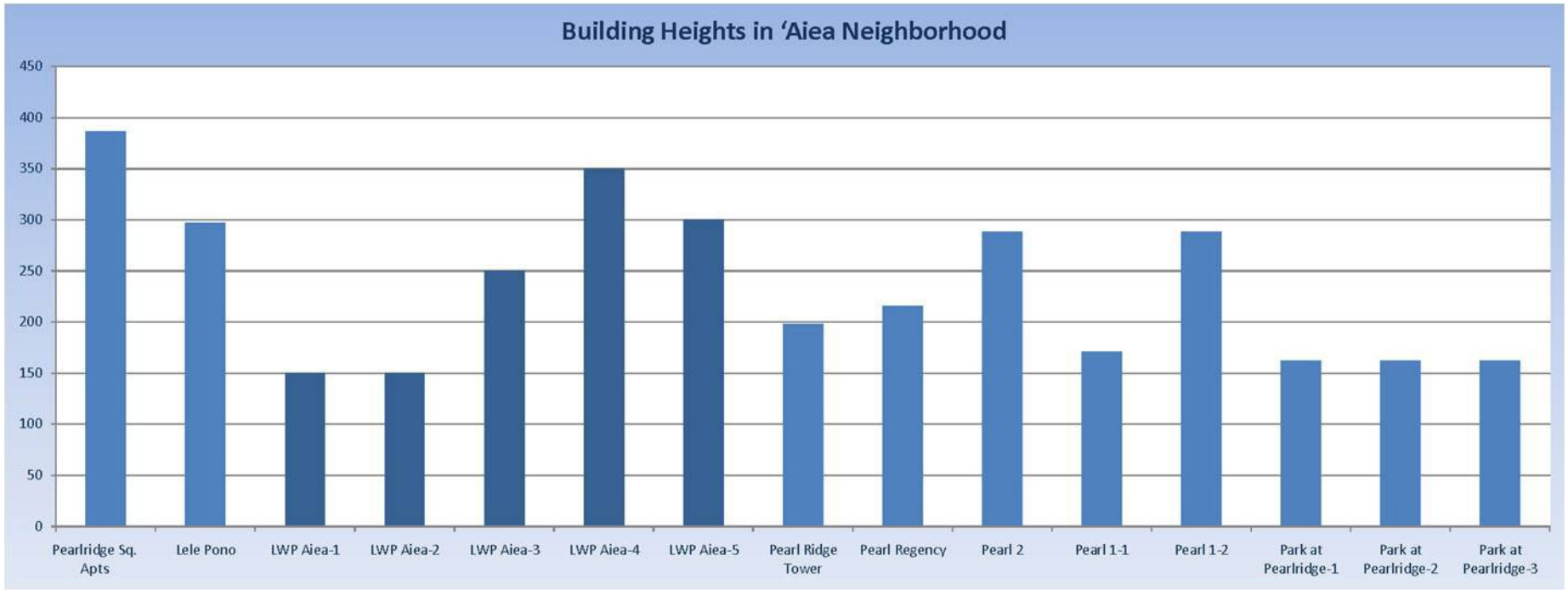


FIGURE 5

Pearlridge Area
Building Height Comparison

Live, Work, Play 'Aiea

CP Kam Properties, LLC. ISLAND OF O'AHU

PBR HAWAII & ASSOCIATES, INC.

A. View from Rainbow Bay Marina

B. View from Blaisdell Park

C. View makai from Ka'ōnohi Street

D. View mauka from Kamehameha Highway/Ka'ōnohi Street intersection

Key Map

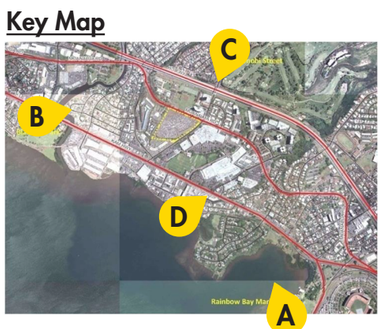


FIGURE 6
Visual Analysis - Public Views
Live, Work, Play 'Aiea
CP Kam Properties, LLC.
ISLAND OF O'AHU
PBR HAWAII & ASSOCIATES, INC.

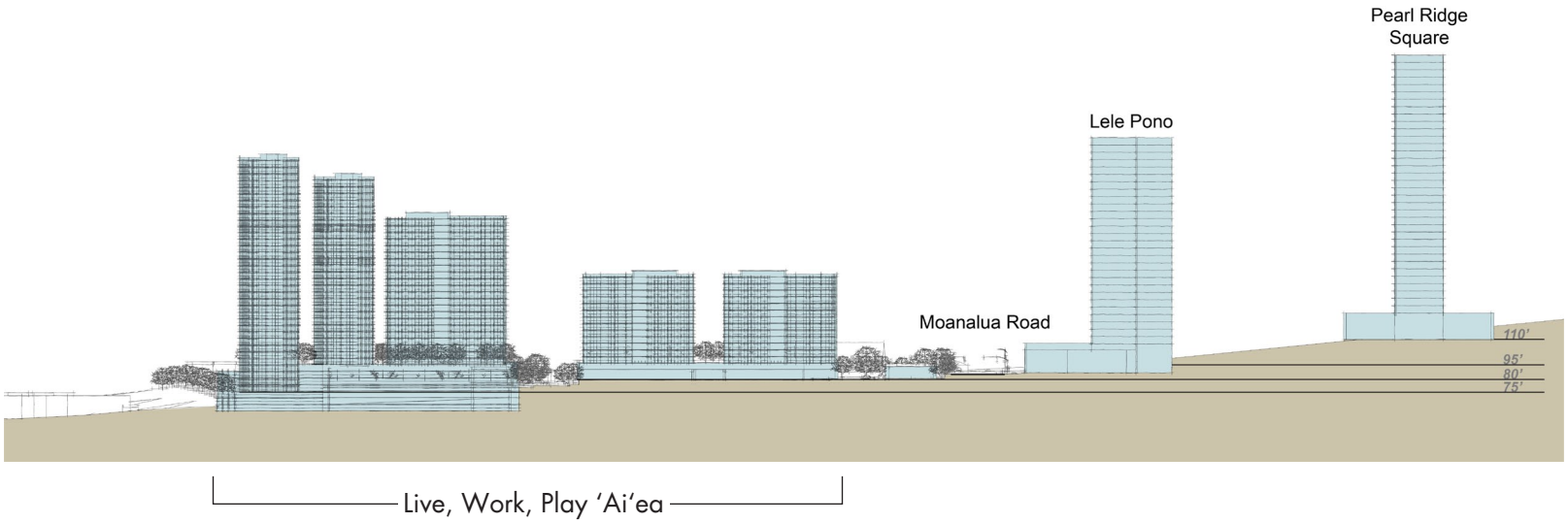


FIGURE 7

Building Height Section

Live, Work, Play 'Aiea

CP Kam Properties, LLC.

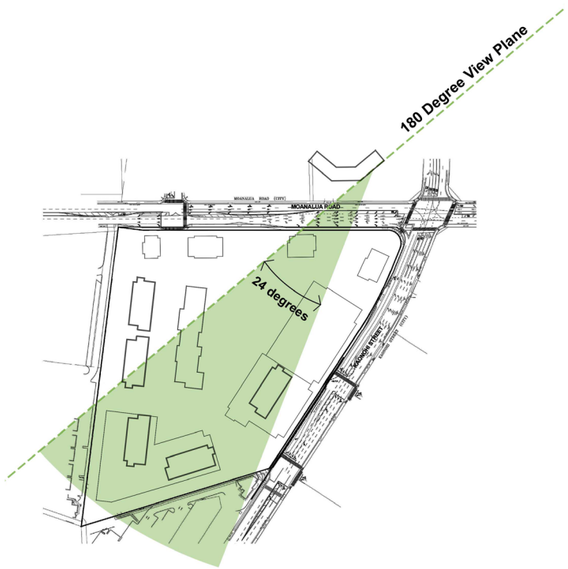
ISLAND OF O'AHU

LINEAL SCALE (FEET)

0 50 100 200

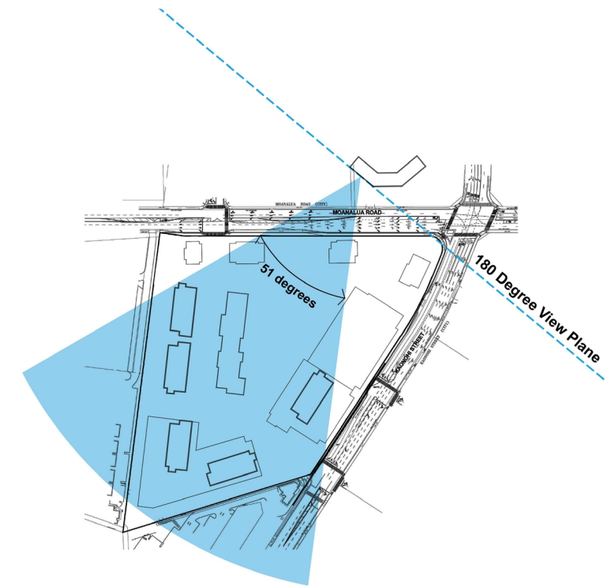
1"=200'

PBR HAWAII & ASSOCIATES, INC.



East Wing, 24 Degrees = 13% of view impacted

Center Wing, 48 Degrees = 27% of view impacted



West Wing, 51 Degrees = 28% of view impacted

FIGURE 8

View Analysis from Lele Pono

Live, Work, Play ‘Aiea

CP Kam Properties, LLC. ISLAND OF O'AHU

PBR HAWAII & ASSOCIATES, INC.

View from Lele Pono 20th floor.

View from Lele Pono 4th floor pool deck.

FIGURE 9

Views from Lele Pono

Live, Work, Play ‘Aiea

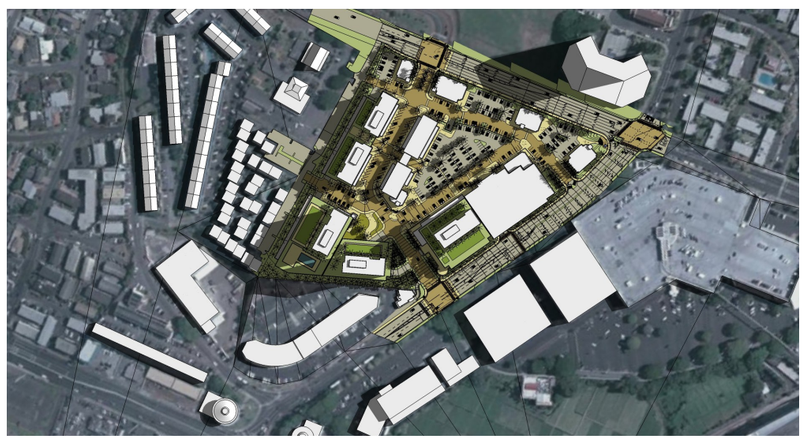
CP Kam Properties, LLC. ISLAND OF O‘AHU

PBR HAWAII & ASSOCIATES, INC.

December 21, 9 am

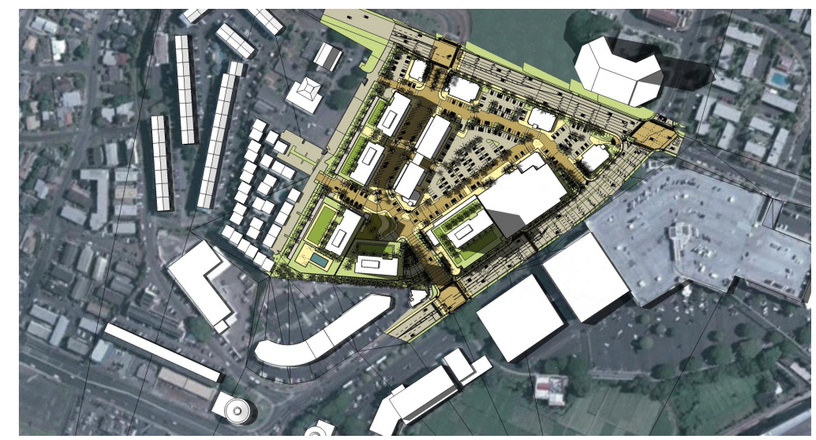
December 21, 12 pm

December 21, 3 pm



June 21, 9 am

June 21, 12 pm



June 21, 3 pm

FIGURE 10

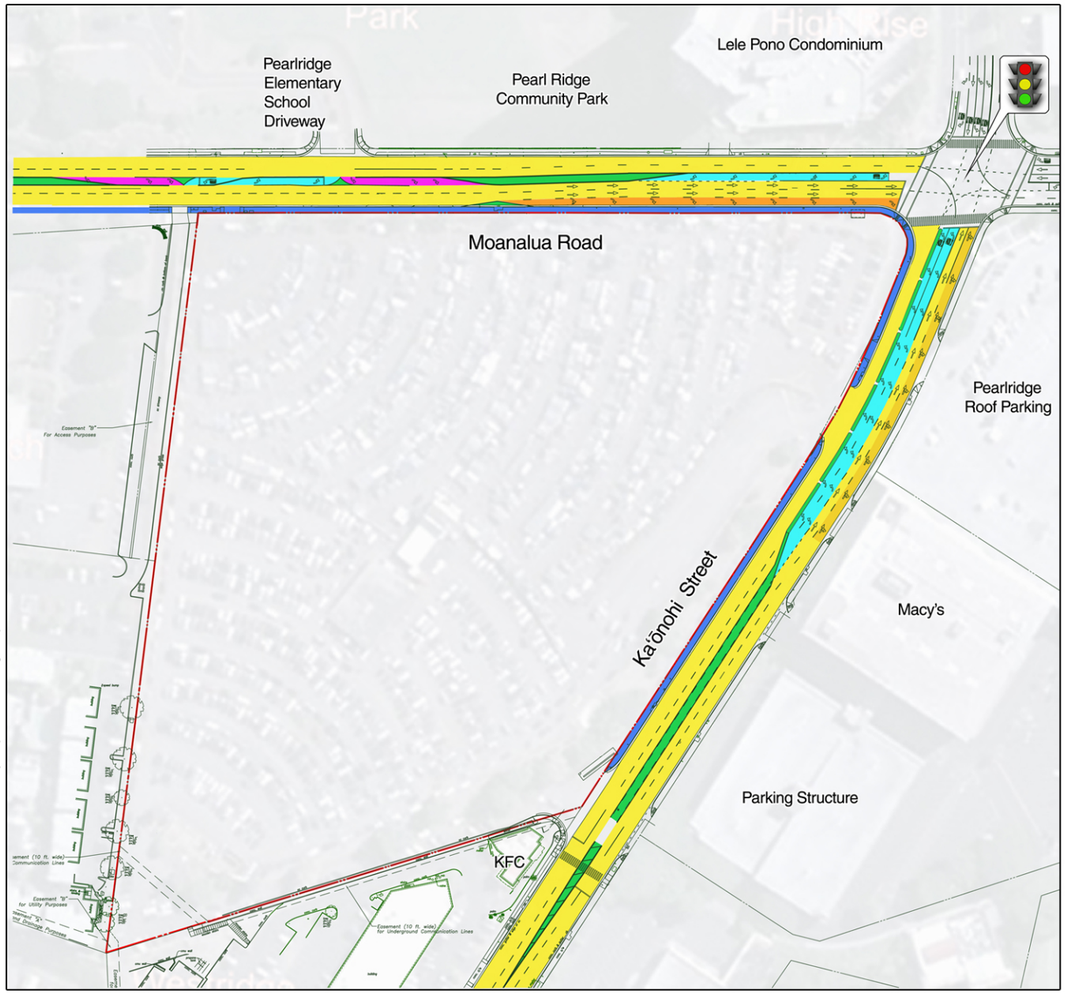
Shadow Analysis

Live, Work, Play ‘Aiea

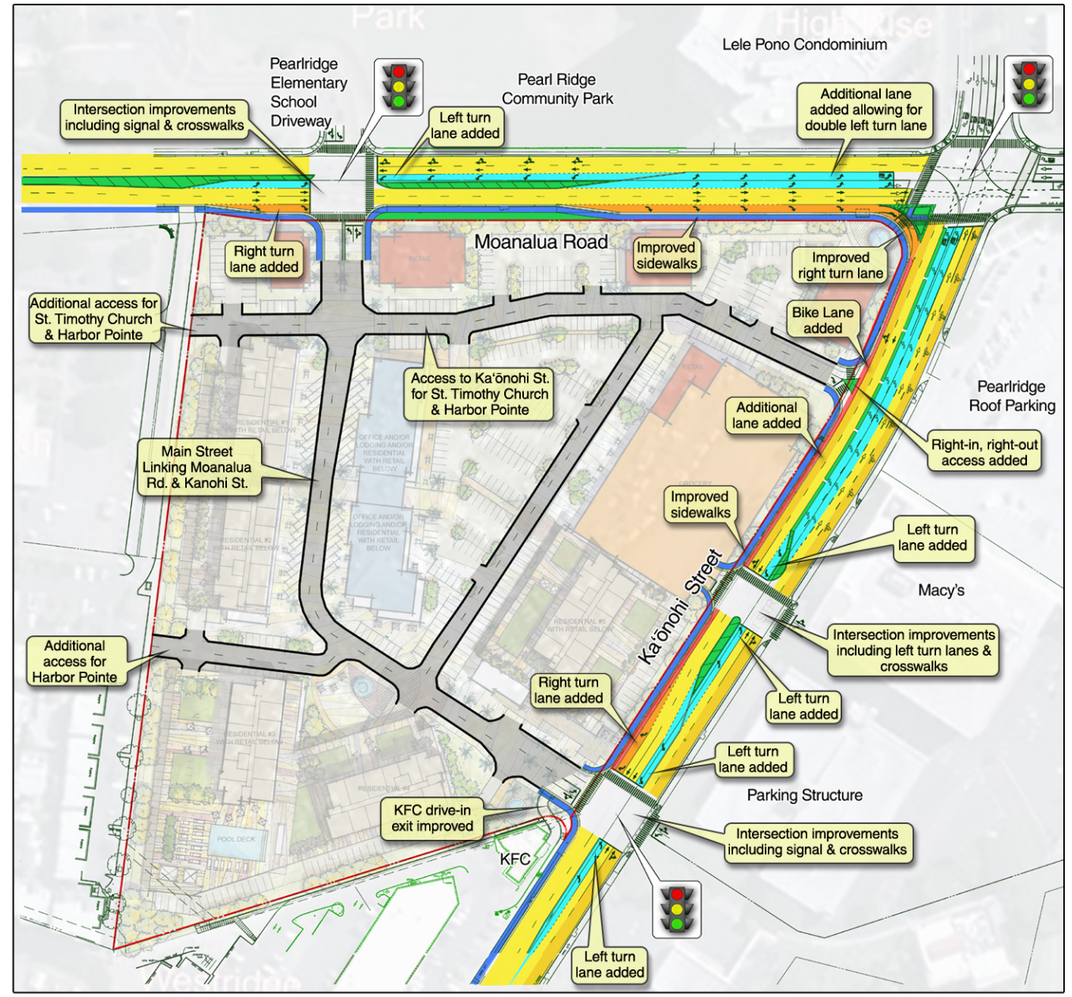
CP Kam Properties, LLC. ISLAND OF O‘AHU

PBR HAWAII & ASSOCIATES, INC.

EXISTING ROADWAYS



PROPOSED ROADWAYS



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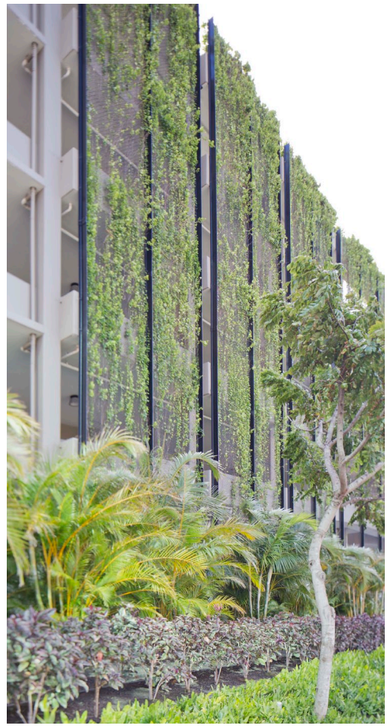
LEGEND

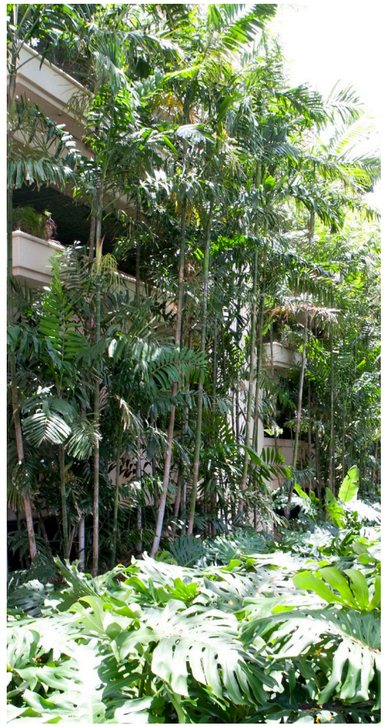
- Through Lane
- Left Turn Lane
- Right Turn Lane
- Shared Through/Right Turn Lane
- Median (Landscaped or Striped)
- Refuge Lane
- Sidewalk
- Crosswalk
- Bike Lane

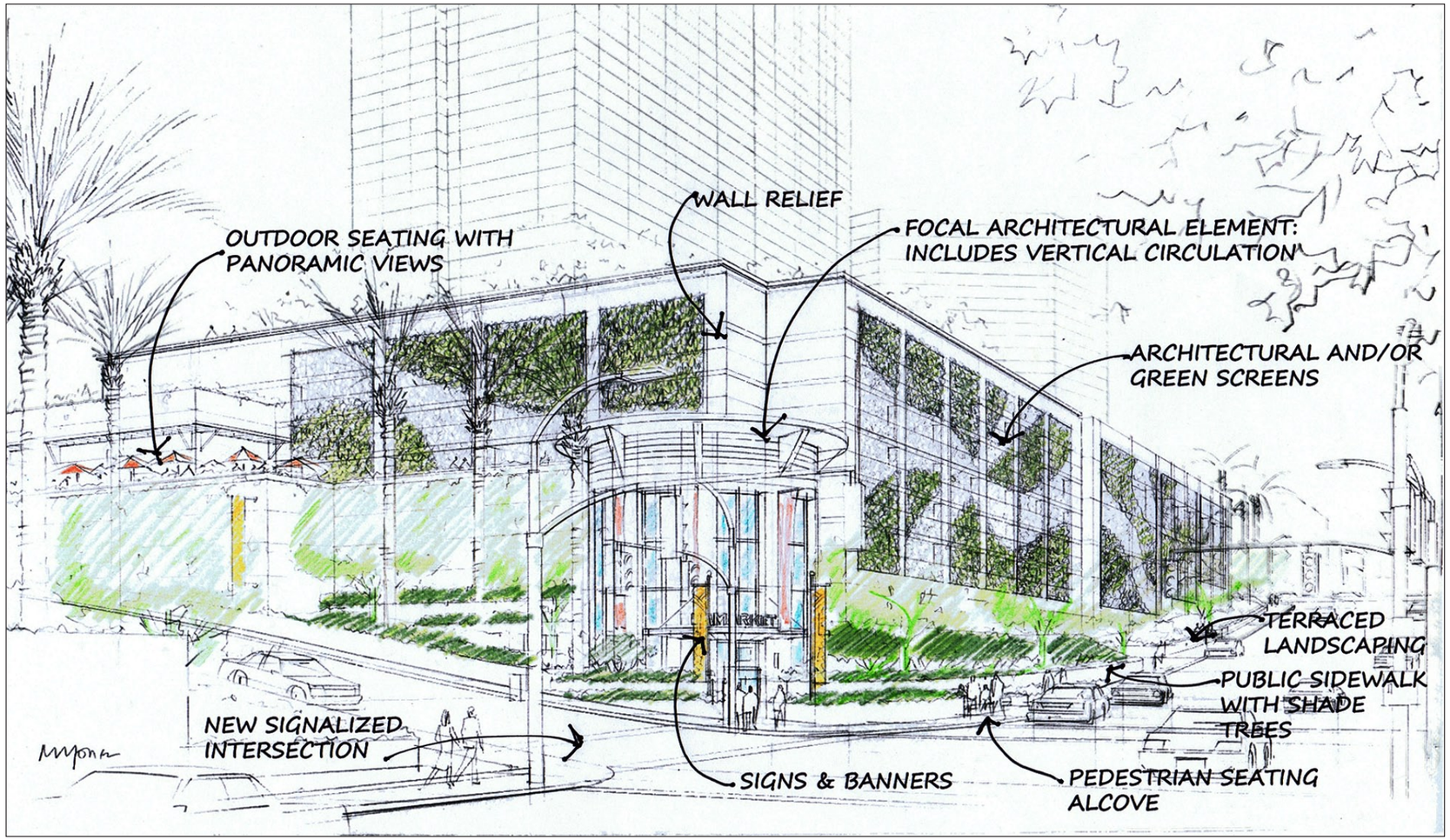
FIGURE 11:
Proposed Roadway Improvements
Live, Work, Play 'Aiea

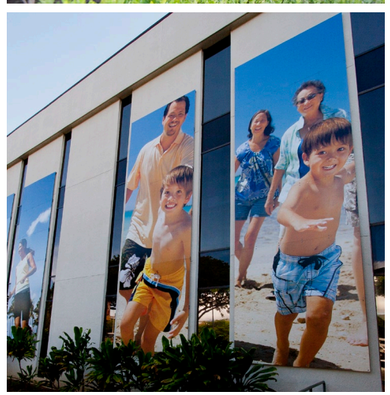
CP Kam Properties, LLC
Island of O'ahu
North
Linear Scale (in feet)
0 50 100 200
PBR HAWAII & ASSOCIATES, INC.

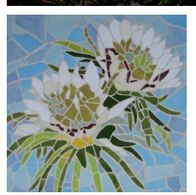
Disclaimer: This graphic has been prepared for general planning purposes only and should not be used for boundary interpretations or other spatial analysis.

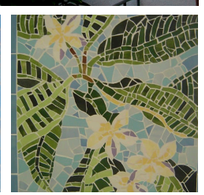


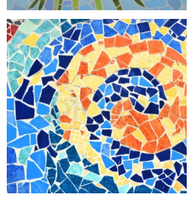


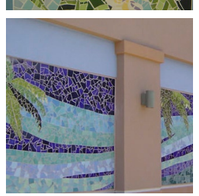












Exterior building massing:

- Articulated forms, color and texture

Exterior fenestration with varied scale, type and treatment:

- Vegetative screens
- Architectural metals
- Layered landscaping
- Graphic panels;
  - Community history, Local art
  - Photo, paint, Ceramic tile mosaic

FIGURE 12

Main Street / Kaʻōnohi Street
Design Concept Study

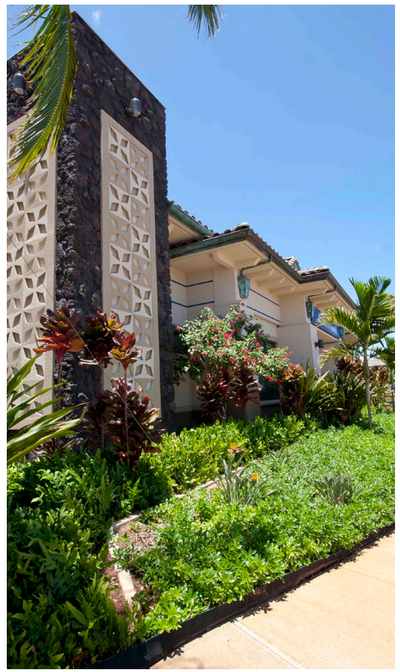
Live, Work, Play ʻAiea

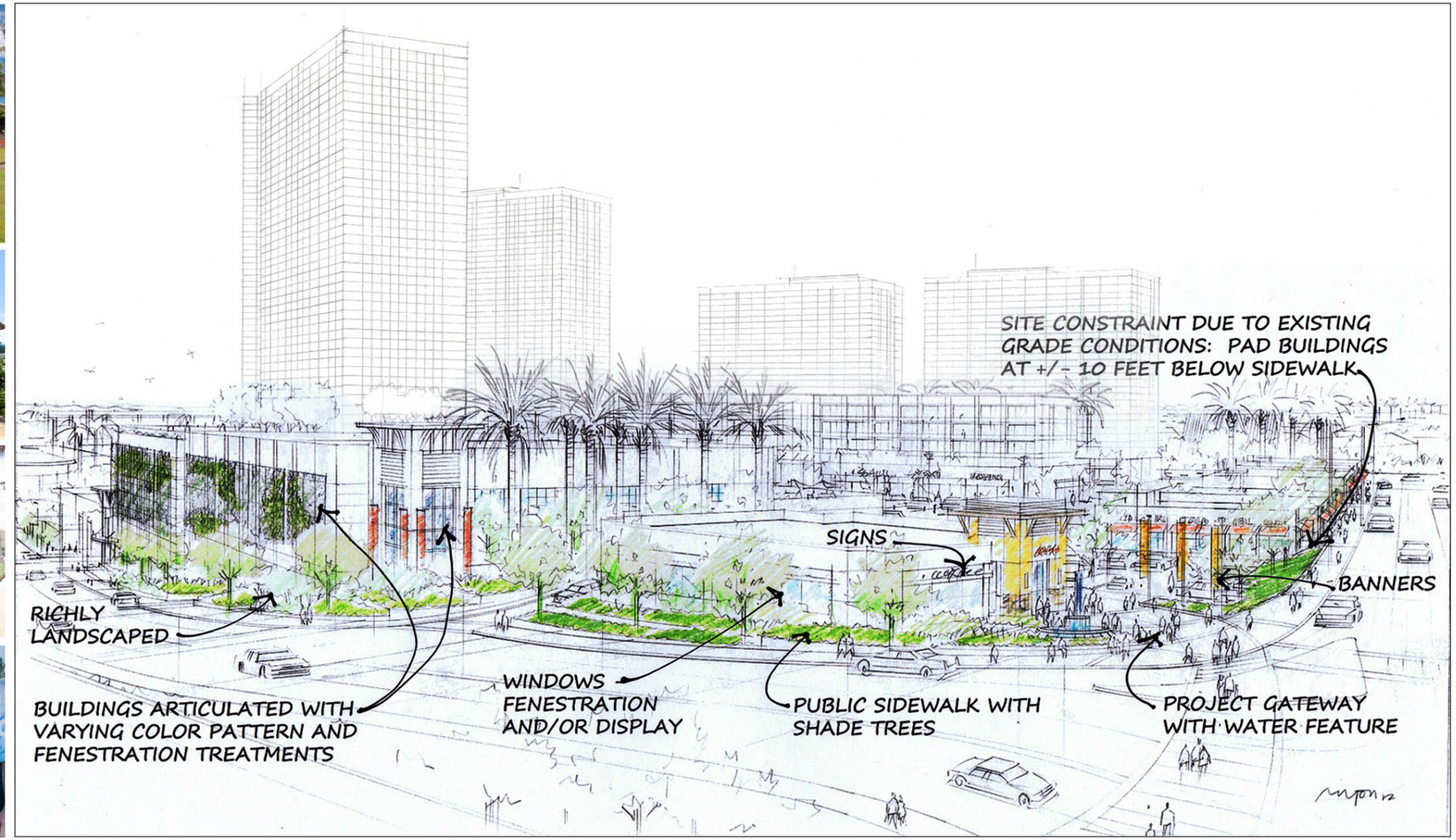
CP Kam Properties, LLC.

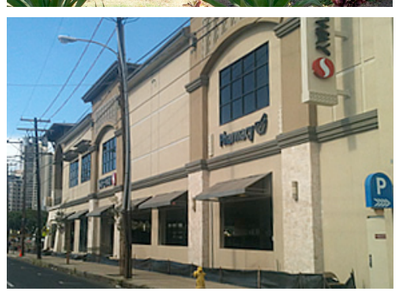
ISLAND OF O'AHU

MVE PACIFIC

PBR HAWAII & ASSOCIATES, INC.







Feature buildings retail/ commercial pads:

- Contemporary island vernacular
- Low rise scale
- Significant landscaping
- Views between buildings
- Buildings address public streets

Exterior fenestration with varied scale, type and treatment:

- No blank facades
- Finished look – windows as appropriate
- Layered landscaping

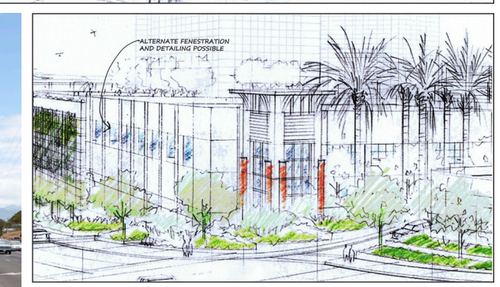


FIGURE 13

Ka'ōnohi Street / Moanalua Road Design Concept Study

Live, Work, Play 'Aiea

CP Kam Properties, LLC. ISLAND OF O'AHU

MVE PACIFIC PBR HAWAII & ASSOCIATES, INC.

Appendix A

Trade Winds Impact Computational Fluid Dynamics Study

22 December, 2011

Tom Schnell
Senior Associate
PBR Hawaii
1001 Bishop Street / Suite 650
Honolulu, HI 96813

RE: Honolulu Trade Winds Impact CFD Study, Executive Summary, CPP 6132

Dear Tom,

To assess potential changes in wind flow downwind of the proposed Live, Work, Play Aiea community project, a wind impact study was conducted by developing a detailed Computational Fluid Dynamics (CFD) model of the proposed Live, Work, Play Aiea community buildings and the existing buildings in the immediate surroundings.

In Honolulu and the Aiea area winds are predominantly trade winds from the east northeast except for occasional periods when Kona storms may generate strong winds from the south or when the trade winds are weak and land breeze/sea breeze circulations may develop. Wind speeds typically vary between about five and 15 miles per hour. Based on wind rose data from the Honolulu International Airport:

- **East-northeasterly** tradewinds are the most frequent wind direction and occur about 38 percent of the time;
- **Northeasterly** tradewinds are the second most frequent wind direction and occur about 19 percent of the time;
- **Easterly** tradewinds are the third most frequent wind direction and occur about ten percent of the time; and
- **North-northeasterly** tradewinds are the fourth most frequent wind direction and occur about four percent of the time

In total the east-northeasterly, northeasterly, easterly and north-northeasterly tradewinds occur approximately 70 percent of the time. For the remaining 30 percent of the time winds can occur from a variety of directions, or wind conditions may be calm.

Depending on the direction of prevailing winds, wind speeds downwind of Live, Work, Play Aiea community buildings may be moderately affected, either through acceleration of wind speeds by channeling wind flows or deceleration of wind speeds through shielding effects.

The CFD model simulated wind patterns and speeds with the surrounding existing buildings and with the proposed Live, Work, Play Aiea community buildings. The wind impact study determined that with the Live, Work, Play Aiea community buildings, mean wind speeds to the west of the Site may be reduced or accelerated as follows:

- **East-northeasterly shielding:** Average approximately 20% to 25% (range from 10% to 50%)
- **East-northeasterly acceleration:** Average approximately 10% to 12% (range from 0% to 30%)
- **Northeasterly shielding:** Average approximately 12.5% (range from 0% to 25%)
- **Northeasterly acceleration:** None
- **Easterly shielding:** Average approximately 25% (range from 0% to 50%)
- **Easterly acceleration:** None
- **North-northeasterly shielding:** Average approximately 10% (range from 0% to 20%)
- **North-northeasterly acceleration:** None

The reductions and accelerations above are provided in ranges and averages because the values would vary with the specific downwind location.

On behalf of CPP, Inc.,

Alexy Kolesnikov, Ph.D.
Senior Associate
akolesnikov@cppwind.com

Ronald L. Petersen, Ph.D., CCM
Principal and Vice President
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Fort Collins, Colorado 80524, USA
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Honolulu Trade Winds Impact CFD Study

PREPARED FOR
PBR Hawaii & Associates, Inc.

PREPARED BY:
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Air Quality and Wind Engineering Consultants
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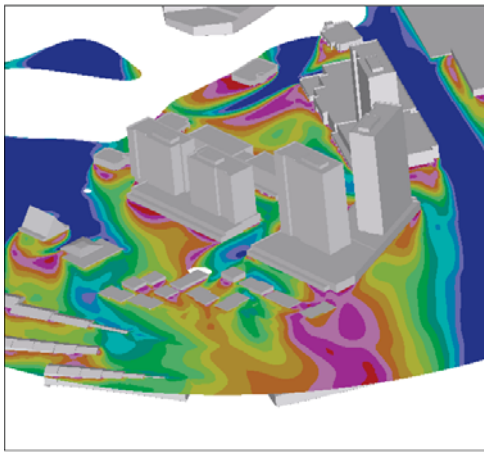

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• Summary of Results	4
• Documentation	11
– Description of Model	12
– Description of Analysis	14

Model Overview

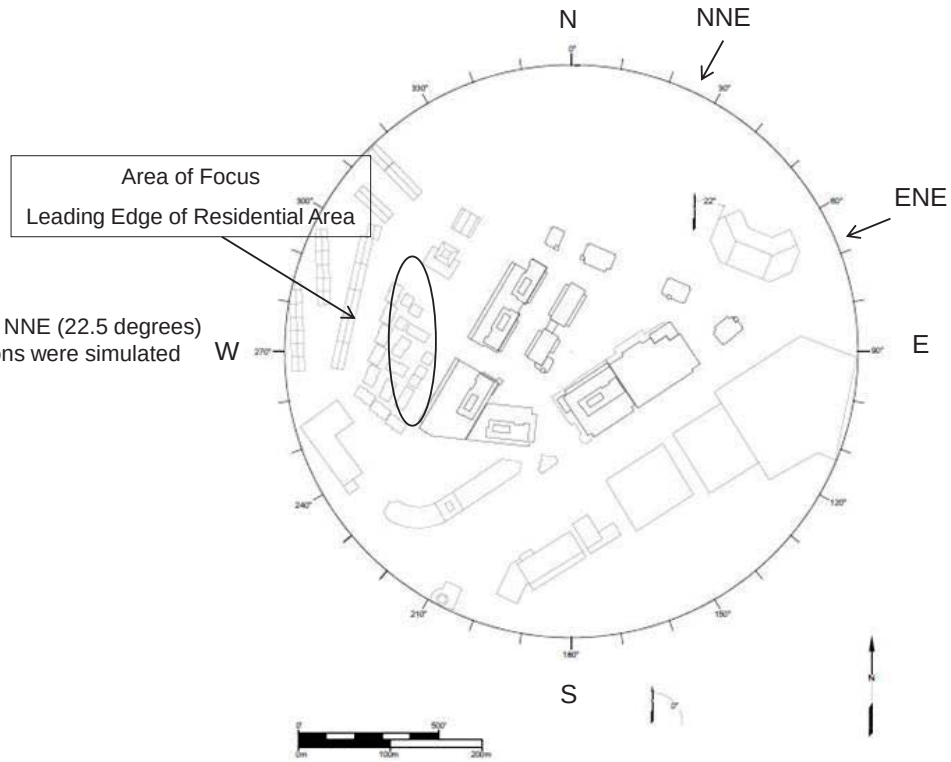
- A detailed CFD model of the proposed development and its immediate surroundings was developed. The model consisted of approximately 7,500,000 fluid cells to facilitate the analysis
- The wind approach profile was specified assuming the approach surface roughness length was 0.35 m and the wind profile followed a power relation with a power law exponent of 0.21.
- Two simulations were conducted:
  - ENE wind approach direction (the main trade winds direction – see page 6)
  - NNE wind approach direction (less frequent trade winds)
- NE and E wind directions are also associated with the trade winds but are less frequent (see page 6). Results for these directions were inferred from the results for the ENE and NNE wind direction simulations
- Velocity contours are presented (see pages 7-10) along a horizontal cross-section taken at two constant elevations (2 and 3 m) full scale over the average elevation of the Harbor Pointe neighborhood to the West of Live, Work, Play Aiea.
- Velocity magnitudes are normalized by the approaching wind speed that is not influenced by the new development. Values of one would indicate wind speeds are the same as those in the approaching trade winds. Value less than one indicate the relative reduction in the trade wind speed.

Key Results – Estimated Effects on the Harbor Pointe Neighborhood to the West (see page 5 for area of study focus)

1) East Northeast (ENE) Trade Winds (most frequent direction of trade winds, occurring 38% of the time)
   - The shielding effect of the proposed Live, Work, Play Aiea buildings is estimated to reduce the mean wind speeds by approximately 10 to 50% (depending on location) averaging approximately 20%-25% .
   - The wind acceleration effect of the proposed Live, Work, Play Aiea buildings is estimated to increase the mean wind speeds up to 30%, averaging approximately 10% -12 %. *The acceleration effect is confined to the ENE wind approach and is not observed for the NE, E or NNE wind approach directions.*
2) Northeasterly (NE) Trade Winds (second most frequent direction of trade winds, occurring 19% of the time)[1]
   - The shielding effect (based on interpolation) is estimated to reduce wind speeds in the range of 0 to 25% averaging approximately 12.5% for the NE approach wind direction.
   - The wind acceleration- no effect see above.
3) Easterly (E) Trade Winds (third most frequent direction of trade winds, occurring 10% of the time)[1]
   - The shielding effect (based on extrapolation) is expected to be in the range of 0 to 50% (depending on location) averaging approximately 25% for the E approach wind direction.
   - The wind acceleration- no effect see above.
4) North Northeast (NNE) Trade Winds (fourth most frequent wind direction, occurring 4% of the time)
   - The shielding effect is estimated to reduce wind speeds in the range of 0% to 20% averaging approximately 10% for the NNE approach direction.
   - The wind acceleration- no effect see above.

- *Foot note 1) Results for these wind directions based on interpolation or extrapolation*.

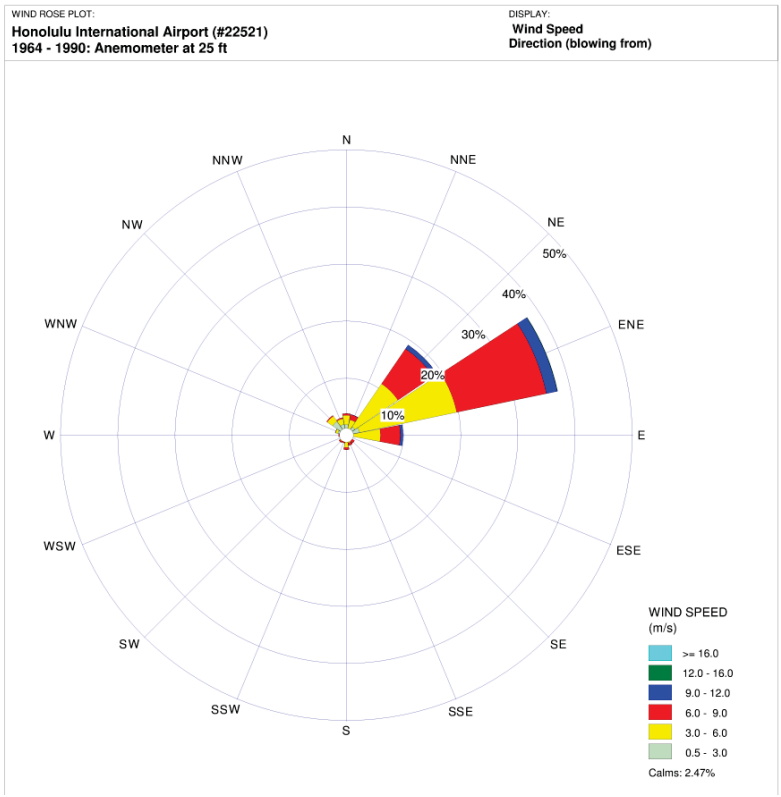
Site Plan of Area Modeled



ENE (67.5 degrees) and NNE (22.5 degrees) wind approach directions were simulated

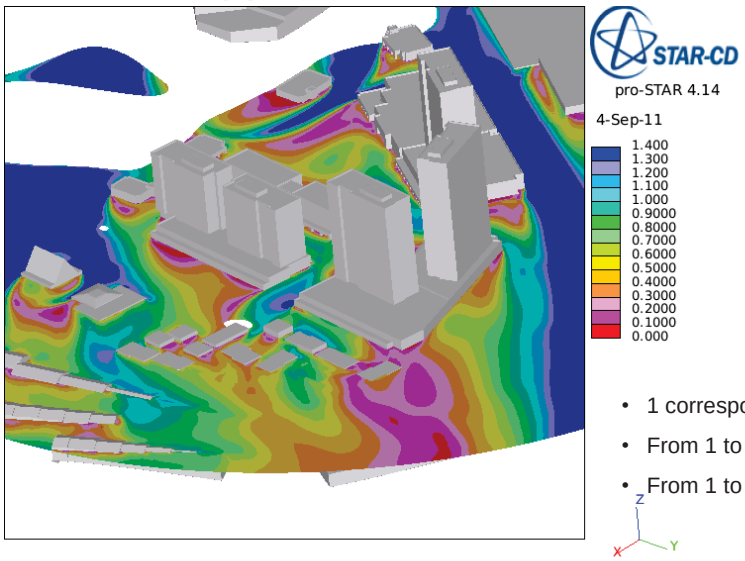
Wind Rose

- Data Period: 1/1/64 – 12/31/90
- Calm Winds – 2.47%
- Average Wind Speed – 4.89 m/s
- Total Count – 160701 hours



Key Results

ENE Wind Approach Wind Direction



Color Scale Detail

- 1 corresponds to no change in approach wind speed
- From 1 to 1.4 – wind speed acceleration (0 – 40%)
- From 1 to 0 wind speed shielding (0 – 100%)

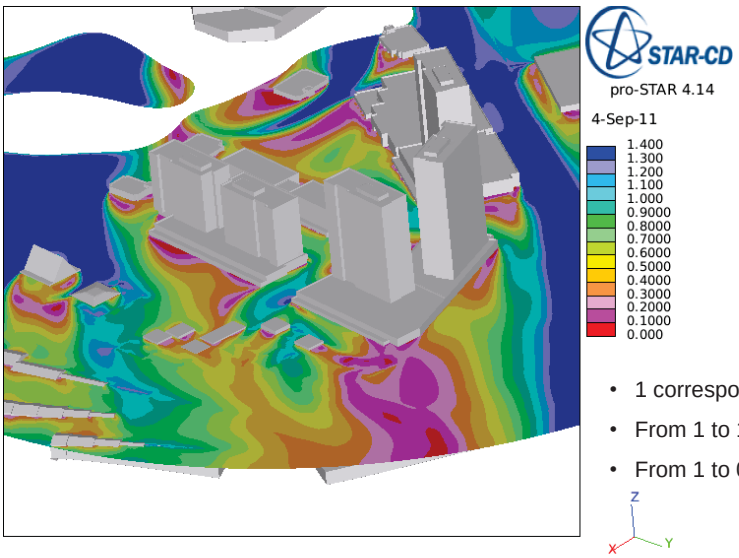
Normalized velocity contours at a constant elevation of 2m over the surface of the neighborhood.
Normalizing velocity is speed that is not influenced by the new development

Honolulu Trade Winds Impact CFD Study

cpp

Key Results

ENE Wind Approach Wind Direction



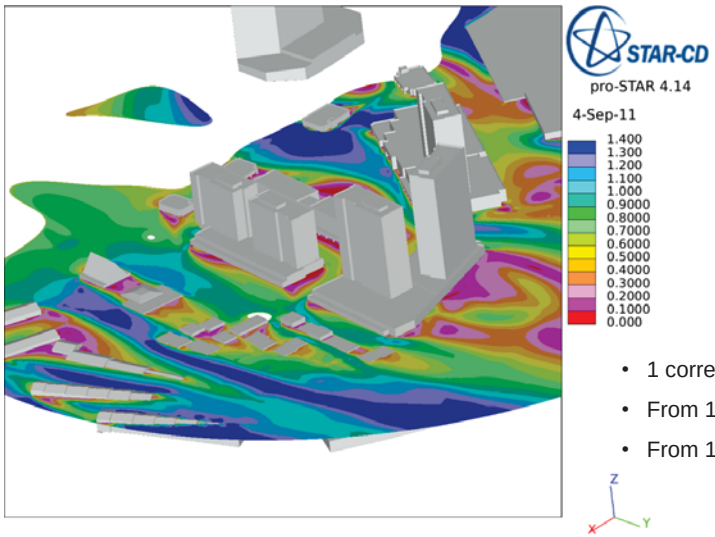
Color Scale Detail

- 1 corresponds to no change in approach wind speed
- From 1 to 1.4 – wind speed acceleration (0 – 40%)
- From 1 to 0 wind speed shielding (0 – 100%)

Normalized velocity contours at a constant elevation of 3m over the surface of the neighborhood.
Normalizing velocity is speed that is not influenced by the new development

Key Results

NNE Wind Approach Wind Direction



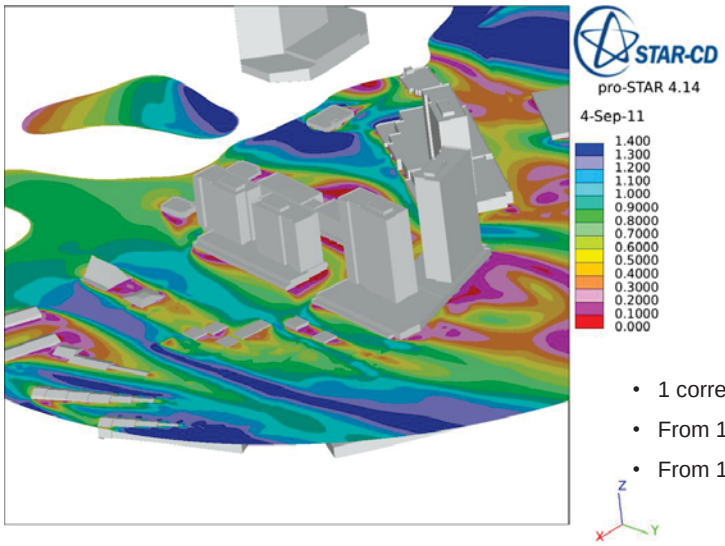
Color Scale Detail

- 1 corresponds to no change in approach wind speed
- From 1 to 1.4 – wind speed acceleration (0 – 40%)
- From 1 to 0 wind speed shielding (0 – 100%)

Normalized velocity contours at a constant elevation of 2m over the surface of the neighborhood.
Normalizing velocity is speed that is not influenced by the new development

Key Results

NNE Wind Approach Wind Direction



Color Scale Detail

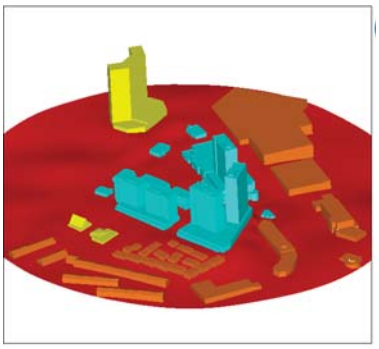
- 1 corresponds to no change in approach wind speed
- From 1 to 1.4 – wind speed acceleration (0 – 40%)
- From 1 to 0 wind speed shielding (0 – 100%)

Normalized velocity contours at a constant elevation of 3m over the surface of the neighborhood.
Normalizing velocity is speed that is not influenced by the new development

Documentation

Description of Model

Computational Domain



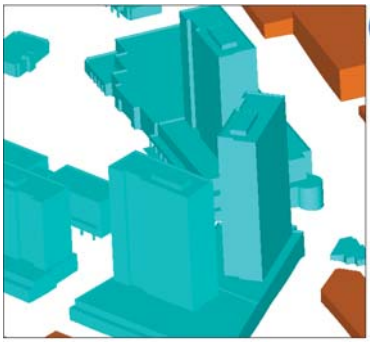
Computational Model

- Model Scale 1:180
- Total model size approximately 7,500,000 fluid cells
  - 6,000,000 cells in the core mesh
  - 1,500,000 cells in the extrusion layer
  - Typical cell size:

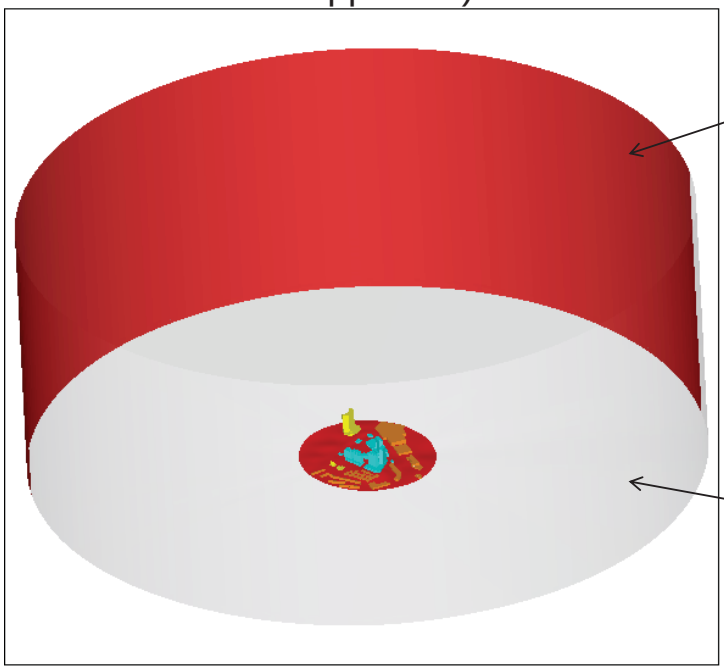
    Core Mesh 48 mm.

    Terrain 12mm.

    Buildings 1.5-6 mm.
  - Extrusion Layer Thickness: 1 mm



Boundary Conditions ENE Approach (Boundaries Appropriately Rotated for the NNE Approach)



Inlet

U=10m/s*(Z/0.056m)**0.21

Domain Size

- Turntable – 300 m Radius
- Virtual Wind Tunnel – 1500 m Radius (CFD Model purposes only)

Outlet

Material Properties

FLUID	Property	Value
Air	Density (kg/m^3)	1.205
	Molecular Weight (g/mole)	28.96
	Viscosity (kg/ms)	1.81e-05
	Specific Heat (J/kg ºK)	1006
	Thermal Conductivity (W/m ºK)	0.02637

Analysis Setup

ANALYSIS FEATURE	METHOD
Time Domain	Steady-State
Density	Constant
Turbulence	k-ε (Low-Reynolds Number Hybrid Wall Functions)

Appendix B

Biological Survey

BIOLOGICAL RESOURCES SURVEY AND ASSESSMENT

for the

AIEA ZONE CHANGE PROJECT

KALAUAO, EWA, OAHU, HAWAII

by:

Robert Hobdy
Environmental Consultant
Kokomo, Maui
January 2011

Prepared for:
CP Kam Properties LLC

AIEA ZONE CHANGE
KALAUAO, EWA, OAHU, HAWAII

INTRODUCTION

The subject property lies on 14.99 acres of open urban land in Kalauao, TMK 9-8-13:013. Its northeast boundary is Moanalua Road, its southeast boundary is Kaonohi Street, and its south and west boundaries are developed urban properties (see Figure 1). This biological resources survey was initiated in response to environmental requirements of the rezoning process.

SITE DESCRIPTION

This property lies on gently sloping land that is nearly entirely paved with asphalt with two small structures in the center. Elevations range from 40 feet to 100 feet above sea level. Soils are deep, well-drained, and of alluvial origin. They consist of Waipahu and Lahaina silty clays (Foote et al, 1972). Rainfall averages 30 inches per year with most falling between November and April (Armstrong, 1983). The only vegetation on the property is situated along its perimeters and consists of scattered trees, grasses and weedy growth.

BIOLOGICAL HISTORY

This general area formerly had a fairly dense population of Hawaiians who grew kalo in the nearby fertile stream bottoms and fished in Pearl Harbor. Following World War II the area became urbanized. The property was converted to a large drive-in movie operation which operated for several decades. Since the drive-in went out of business the site has been largely vacant with part time use for weekly swap meets and vehicular parking. The expanse of asphalt affords little space for any significant plant or animal life, and the diversity of species and their total numbers are low. Little remains of the original plant and animal species and their habitats.

SURVEY OBJECTIVES

This report summarizes the findings of a flora and fauna study of the Aiea zone change property (TMK 9-8-13:013) that was conducted in January 2011. The objectives of the survey were to:

1. Document what plant and animal species occur on the property or may likely occur in the existing habitat.
2. Document the status and abundance of each species.
3. Determine the presence or likely occurrence of any native flora and fauna, particularly any that are Federally listed as Threatened or Endangered. If such occur, identify what features of the habitat may be essential for these species.
4. Determine if the project area contains any special habitats which if lost or altered might result in a significant negative impact on the native flora and fauna in this part of the island.
5. Note which aspects of the proposed development pose significant concerns for plants or for wildlife and recommend measures that would mitigate or avoid these problems.

BOTANICAL SURVEY REPORT

SURVEY METHODS

A walk-through botanical survey was used to cover this approximately 15 acre property. All representative habitats were examined including grasslands, brush, trees and disturbed areas. Notes were made on species present, abundance, distribution and status. Close attention was given to ascertaining whether any native Hawaiian plants or Endangered species were present.

DESCRIPTION OF THE VEGETATION

The vegetation on this property forms a narrow ring around this mostly paved area. It consists mostly of grasses and herbaceous weeds with a few scattered trees and shrubs. The four most common species include: Guinea grass (*Megathyrsus maximus*), buffelgrass (*Cenchrus ciliaris*), (*Calyptocarpus vialis*) no common name and red ‘ilima (*Sida ciliaris*).

A total of 69 plant species were recorded during the survey. Of these 15 species were ornamental plants and 5 species were food plants that were being cultivated. Just one common indigenous native species was found, ‘uhaloa (*Waltheria indica*). ‘Uhaloa is common throughout the lowlands of Hawaii and is found throughout the tropics worldwide.

DISCUSSION AND RECOMMENDATIONS

The little vegetation that does grow on this property is dominated by non-native species. Just one common, indigenous species, the ‘uhaloa was found. ‘Uhaloa is of no particular conservation concern. No federally designated Endangered or Threatened plant species (USFWS, 2009) were found, nor were any that are candidates for such status seen. No such species are known to occur in the vicinity of this property in this urban environment. No special native plant habitats were found here either.

This property lies half way between Waimalu Stream and Kalauao Stream and is about a half mile distant from both of them. It is not situated in any gullies or depressions and no water accumulates here. The soils are deep, well-drained silty clays that lie on gently sloping land. This site has no observable wetland characters and is an upland site in every way.

Because the vegetation on this property and in the surrounding urban neighborhood is dominated by common non-native plants, and because there are no rare or protected native species in or near this area, there is little of botanical concern with regard to this property. Redevelopment of the property is not expected to have a significant negative impact on the botanical resources in this part of O’ahu.

No special recommendations with reference to plants are deemed appropriate or necessary.

PLANT SPECIES LIST

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of two groups: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants (Monocots and Dicots) are in accordance with Wagner et al. (1999) and Staples & Herbst, (2005).

For each species, the following information is provided:

1. Scientific name with author citation.

2. Common English or Hawaiian name.

3. Bio-geographical status. The following symbols are used:

   endemic = native only to the Hawaiian Islands; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   non-native = all those plants brought to the islands intentionally or accidentally after western contact.
   polynesian = brought by the Hawaiians during Polynesian migrations.

4. Abundance of each species within the project area:

   abundant = forming a major part of the vegetation within the project area.
   common = widely scattered throughout the area or locally abundant within a portion of it.
   uncommon = scattered sparsely throughout the area or occurring in a few small patches.
   rare = only a few isolated individuals within the project area.

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
DICOTS			
ARACEAE (Aroid Family)			
Colocasia esculenta (L.) Schott	taro, kalo	Polynesian	rare
ASPARAGACEAE (Asparagus Family)			
Cordyline fruticosa (L.) A. Chev.	ti, ki	Polynesian	rare
COMMELINACEAE (Spiderwort Family)			
Commelina benghalensis L.	hairy honohono	non-native	uncommon
CYPERACEAE (Sedge Family)			
Cyperus gracilis R. Br.	McCoy grass	non-native	rare
Cyperus rotundus L.	nut sedge	non-native	uncommon
MUSACEAE (Banana Family)			
Musa acuminata x balbisiana Colla	banana	non-native	rare
POACEAE (Grass Family)			
Bothrichloa bladhii (Retz.) S.T. Blake	----------	non-native	uncommon
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	non-native	rare
Cenchrus ciliaris L.	buffelgrass	non-native	common
Cenchrus echinatus L.	common sandbur	non-native	uncommon
Chloris barbata (L.) Sw.	swollen fingergrass	non-native	uncommon
Cynodon dactylon (L.) Pers.	Bermuda grass	non-native	uncommon
Digitaria insularis (L.) Mez ex Ekman	sourgrass	non-native	uncommon
Eleusine indica (L.) Gaertn.	wiregrass	non-native	uncommon
Eragrostis amabilis (L.) Wight & Arnott	Japanese lovegrass	non-native	rare
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	non-native	uncommon
Megathyrsus maximus (Jacq.) Simon & Jacobs	Guinea grass	non-native	common
Melinis repens (Willd.) Zizka	Natal redtop	non-native	rare
ACANTHACEAE (Acanthus Family)			
Asystasia gangetica (L.) T. Anderson	Chinese violet	non-native	uncommon

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
AMARANTHACEAE (Amaranth Family)			
Alternanthera caracasana Kunth	mat chaff flower	non-native	rare
Alternanthera pungens Kunth	khaki weed	non-native	rare
Amaranthus viridis L.	slender amaranth	non-native	rare
APOCYNACEAE (Dogbane Family)			
Plumeria rubra L.	plumeria	non-native	rare
ARALIACEAE (Ginseng Family)			
Polyscias fruticosa (L.) Harms	parsley panax	non-native	rare
Polyscias guilfoylei (W.Bull) L.H. Bailey	panax	non-native	uncommon
ASTERACEAE (Sunflower Family)			
Bidens alba (L.) DC.	----------	non-native	rare
Calyptocarpus vialis Less.	----------	non-native	common
Emilia fosbergii Nicolson	red pualele	non-native	rare
Emilia sonchifolia (L.) DC.	violet pualele	non-native	rare
Sonchus oleraceus L.	pualele	non-native	rare
Sphagneticola trilobata (L.) Pruski	wedelia	non-native	rare
Tridax procumbens L.	coat buttons	non-native	uncommon
BIGNONIACEAE (Bignonia Family)			
Spathodea campanulata P. Beauvois	African tulip tree	non-native	uncommon
Tabebuia heterophylla A. P. de Candolle	pink tecoma	non-native	rare
CONVOLVULACEAE (Morning Glory Family)			
Ipomoea aquatica Forsskal	ong choi	non-native	rare
Ipomoea batatas (L.) Lamarck	uala, sweet potato	Polynesian	rare
Ipomoea horsfalliae J.D. Hooker	Kuhio vine	non-native	rare
Ipomoea obscura (L.) Ker-Gawl.	----------	non-native	uncommon
Ipomoea triloba L.	little bell	non-native	rare
CUCURBITACEAE (Gourd Family)			

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Coccinea grandis (L.) Voigt	ivy gourd	non-native	uncommon
EUPHORBIACEAE (Spurge Family)			
Euphorbia hirta L.	hairy spurge	non-native	uncommon
Euphorbia hypericifolia L.	graceful spurge	non-native	rare
Euphorbia prostrata Aiton	prostrate spurge	non-native	rare
Euphorbia thymifolia L.	----------	non-native	uncommon
Manihot esculenta Crantz	cassava, manioc	non-native	rare
FABACEAE (Pea Family)			
Cassia x nealiae H.S. Irwin & Barneby	rainbow shower	non-native	uncommon
Desmanthus pernambucanus (L.) Thellung	slender mimosa	non-native	rare
Indigofera hendecaphylla Jacq.	creeping indigo	non-native	rare
Leucaena leucocephala (Lam.) de Wit	koa haole	non-native	uncommon
Macroptilium atropurpureum (DC.) Urb.	siratro	non-native	rare
Pithecellobium dulce (Roxb.) Benthe.	'opiuma	non-native	uncommon
Prosopis pallida (Humb.& Bonpl. ex Willd.) Kunth	kiawe	non-native	rare
MALVACEAE (Mallow Family)			
Hibiscus rosa-sinensis L.	Chinese hibiscus	non-native	rare
Malva parviflora L.	cheese weed	non-native	rare
Malvastrum coromandelianum (L.) Garcke	false mallow	non-native	uncommon
Sida ciliaris L.	red 'ilima	non-native	common
Sida spinosa L.	prickly sida	non-native	rare
Waltheria indica L.	'uhaloa	indigenous	uncommon
MORACEAE (Mulberry Family)			
Ficus elastica Hornemann	India rubber tree	non-native	rare
Ficus microcarpa L. fil.	Chinese banyan	non-native	rare
MYRTACEAE (Myrtle Family)			
Melaleuca quinquenervia (Cav.) S.T. Blake	paperbark	non-native	rare

SCIENTIFIC NAME	COMMON NAME	STATUS	ABUNDANCE
Syzygium cumini (L.) Skeels	Java plum	non-native	uncommon
NYCTAGINACEAE (Four-o'clock Family)			
Boerhavia coccinea Mill.	scarlet spiderling	non-native	uncommon
Bougainvillea spectabilis Willd.	bougainvillea	non-native	uncommon
OLEACEAE (Olive Family)			
Ligustrum japonicum Thunberg	Japanese privet	non-native	rare
PLANTAGINACEAE (Plantain Family)			
Plantago lanceolata L.	narrow-leaved plantain	non-native	rare
PORTULACACEAE (Purslane Family)			
Portulaca oleracea L.	pigweed	non-native	uncommon
SOLANACEAE (Nightshade Family)			
Cestrum nocturnum L.	night-blooming jasmine	non-native	rare
Solanum lycospersicum L.	cherry tomato	non-native	rare

FAUNA SURVEY REPORT

SURVEY METHOD

A walk-through fauna survey method was used in conjunction with the botanical survey. All parts of the property were covered. Observations were made with the use of binoculars and notes were made of species, distribution, abundance and signs of tracks, feeding, droppings and vocalizations. In addition, an evening survey was made to look for the possible presence of the Endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*).

MAMMALS

No mammals of any kind were observed within the property during two site visits. While this habitat, within a largely urban setting, is not ideal for mammalian wildlife, it is still suitable for such animals as mice (*Mus domesticus*), rats (*Rattus* spp.), mongoose (*Herpestes auronpunctatus*) and the occasional feral cat (*Felis catus*). Mice and rats feed on seeds, fruits and herbaceous vegetation while mongoose and cats would prey on these rodents and birds.

A special effort was made to look for the native Hawaiian hoary bat which is a federally listed Endangered species. An evening survey was conducted using both visual and electronic techniques. When present in an area these bats are clearly visible in the glow of twilight as they forage for insects that become active during evening hours. In addition a bat detecting device (Batbox IIID) was used, set to the frequencies of 27,000 to 28,000 hertz at which these bats are known to echolocate. No evidence of presence of Hawaiian hoary bat was detected.

BIRDS

Diversity of birdlife was low due to the highly altered nature of the environment. Only non-native species were observed during two site visits. Common species included the rock dove or pigeon (*Columba livia*), zebra dove (*Geopelia striata*), house finch (*Passer domesticus*) and the common myna (*Acridotheres tristis*).

A few other non-native birds may also occasionally use this property. The habitat, however, is not suitable for O'ahu's native forest birds which are presently restricted to good quality native forests at higher elevations. The habitat is also not suitable for native seabirds such as the Endagered 'ua'u (*Pterodroma sanwichensis*) and the Threatened 'a'o (*Puffinus newelli*) which nests in dense, wet fern shrubland near the summits of the mountains.

REPTILES

No reptiles were observed during the survey. However, one or more species of introduced geckos or skinks could utilize this habitat.

INSECTS

Insect diversity was also low due to the altered nature of most of the habitat. Just six non-native species were observed during two site visits. Neither the habitat nor the presence of any suitable host plant species makes the project area attractive for any native insects and none were seen. The only insect species that was common was the dung fly (*Musca sorbens*).

MOLLUSKS

No mollusk species were seen during the survey. Only the non-native African snail (*Achatina fulica*) and the cannibal snail (*Euglandina rosea*) are likely to occur here.

DISCUSSION AND RECOMMENDATIONS

No native mammals, birds, or insects were seen during the course of the survey. No federally designated Endangered or Threatened mammal, bird, reptile, insect, or mollusk species (USFWS, 2009) were found, nor were any that are candidates for such status seen. All species observed were common, non-native species that are of no special environmental interest or concern. No special fauna habitats occur on or around this small urban property. No Critical Habitat for any Endangered animal species is designated within the project area or its vicinity.

It is determined that the redevelopment of this property will not have a significant negative impact on the fauna resources in this part of O'ahu.

It is recommended, however, that any outdoor lighting associated with the redevelopment of this property be hooded to direct the light downward. This will prevent these bright lights from disorienting night-flying seabirds which could crash and be injured or killed.

ANIMAL SPECIES LIST

Following is a checklist of the animal species inventoried during the field work. Animal species are arranged in descending abundance within two groups: Mammals and Birds. For each species the following information is provided:

1. Common name

2. Scientific name

3. Bio-geographical status. The following symbols are used:

   endemic = native only to Hawaii; not naturally occurring anywhere else in the world.
   indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s).
   migratory = bird species that spend the fall and winter months in Hawaii and the spring and summer months breeding in the arctic.
   non-native = all those animals brought to Hawaii intentionally or accidentally after western contact.

4. Abundance of each species within the project area:

   abundant = many flocks or individuals seen throughout the area at all times of day.
   common = a few flocks or well scattered individuals throughout the area.
   uncommon = only one flock or several individuals seen within the project area.
   rare = only one or two seen within the project area.

COMMON NAME	SCIENTIFIC NAME	STATUS	ABUNDANCE
MAMMALS (none)			
BIRDS			
Rock dove, Pigeon	*Columba livia* Gmelin	non-native	common
Zebra dove	*Geopelia striata* L.	non-native	common
House sparrow	*Passer domesticus* L.	non-native	common
Common myna	*Acridotheres tristis* L.	non-native	common
Red-vented bulbul	*Pycnonotus cafer* L.	non-native	uncommon
Spotted dove	*Streptopelia chinensis* Scopoli	non-native	uncommon
Orange-cheeked waxbill	*Estrilda melpoda* vieillot	non-native	rare

COMMON NAME	SCIENTIFIC NAME	STATUS	ABUNDANCE
REPTILES (none)			
INSECTS			
DIPTERA (Flies)			
CALLIPHORIDAE (Blow Fly Family)			
Bluebottle fly	*Calliphora vicina* Robineau-Desvoidy	non-native	rare
MUSIDAE (Housefly Family)			
Dung fly	*Musca sorbens* wiedemann	non-native	common
HYMENOPTERA (Bees & Wasps)			
APIDAE (Honey Bee Family)			
Sonoran carpenter bee	*Zylocopa sonorina* Smith	non-native	uncommon
LEPIDOPTERA (Butterflies & Moths)			
LYCAENIDAE (Gossamer-winged Butterfly Family)			
long-tailed blue butterfly	*Lampides boeticus* L.	non-native	uncommon
PIEIDAE (White & Sulphur Butterly Family)			
large orange sulphur butterfly	*Phoebis agarithe* Boisduval	non-native	uncommon
ODONATA (Drangonflies & Damselfies)			
LIBELLULIDAE (Skimmer Family)			
scarlet skimmer	*Crocothemis servilia* Drury	non-native	rare

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Appendix C

Archaeological Literature Review and Field Check

Archaeological Literature Review and Field Check for the Kamehameha Drive In Lands

Kalauao Ahupua'a, 'Ewa District, O'ahu

TMK: [1] 9-8-013:013 & 015

Prepared for

Robertson Properties Group

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Section 1 Introduction

1.1 Project Background

Cultural Surveys Hawai'i, Inc. was contracted by the Robertson Properties Group to prepare this archaeological study primarily for the purpose of helping assess the parcel's suitability for purchase. The present study area was a well-known drive-in between approximately 1962 and 1998. The parcel, that appears to be zoned "B-2 Community Business District" would appear to be less than fully utilized in its present capacity as the location for a swap meet. Development plans are not known by us at this time.

1.2 Scope of Work

This study was not intended to meet the requirements of an inventory-level survey per the rules and regulations of the State Historic Preservation Division SHPD; Department of Land and Natural Resources, State of Hawai'i). However, the level of work would be sufficient to address site types, locations, and allow for future work recommendations if appropriate. The literature review and field inspection are to include a report detailing research methods and any finds. The agreed upon scope of work is as follows:

Scope of Work

1. Historical research to include study of archival sources, historic maps, Land Commission Awards and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near this property.
2. Field inspection of the project area to identify any surface archaeological features and to investigate and assess the potential for impact to such sites. This assessment will identify any sensitive areas that may require further investigation or mitigation before the project proceeds.
3. Preparation of a report to include the results of the historical research and the fieldwork with an assessment of archaeological potential based on that research, with recommendations for further archaeological work, if appropriate. It will also provide mitigation recommendations if there are archaeologically sensitive areas that need to be taken into consideration.

1.3 Environmental Setting

1.3.1 Natural Environment

The project lands consist of approximately 13.980-acres corresponding to the former Kamehameha Drive-In location on the southwest corner of Moanalua Road and Kaonohi Street located in the traditional Hawaiian land division of Kalauao Ahupua'a, 'Ewa District O'ahu. The project area lies between Pearl City to the northwest and Aiea to the southeast in a general vicinity known as Waimalu. Waimalu Stream lies approximately 0.7 km to the west and Kalauao

Stream lies approximately 0.7 km to the east. The East Loch of Pearl Harbor is only 400 m to the south.

The project area lies on the seaward brow of a low but pronounced bluff some 40 to 80 feet above sea level. The steepness of the slope just to the south (east loch of Pearl Harbor) suggests a marine terrace perhaps created during the Waimanalo (plus 7.5 m) stand of the sea (Macdonald et al. 1983:426). The soils within the project area are shown in soil survey maps (Foote et al. 1972) to be predominantly Lahaina silty clay 3 to 7 percent slopes (LaB) on the north and west sides and Waipahu silty clay 6 to 12 percent slopes (WzC) on the southeast side. A small area of Lahaina silty clay 7 to 15 percent slopes (LaC) appears to lie at the extreme east corner of the project area and a small area of Honouliuli clay 0 to 2 percent slopes (HxA) lies in the southwest corner. The Lahaina series consists of dark reddish-brown well-drained soils on uplands developed in material weathered from basic igneous rock. Permeability is moderate and runoff is slow to medium. The Waipahu series consists of well-drained soils on marine terraces with the WzC soils having moderately slow permeability and slow or very slow runoff.

The project area receives between 800 and 1,0000 mm (31 to 39 inches) of rain per year (Giambelluca et al. 1986) with most coming in with the prevailing trades out of the northeast in the winter months.

1.3.2 Built Environment

The former Kamehameha Drive-In is understood to have been built in 1962 and is first shown on a 1968 Defense Mapping Agency map (see Figure 10). The Kamehameha Drive In is understood to have closed as a Drive-In Theater in 1998. The Kam Swap Meet started circa 1976. The Kam Swap meet is run by the California based Pacific Theatres that runs some seven swap meet businesses (all the rest are in California). Since 1998 the land has been primarily used for a swap meet with vendors and the public paying admission four days a week (Wednesday and Friday through Sunday).

The land is a vast expanse of pavement as appropriate to a former drive-in theatre. The majority of the project land slopes gently to the south with a relatively steep drop on the southeast (Kaonohi Street) and southwest sides. In the center of the parcel are a small one story building understood as a 5,100-square-foot commercial building built in 1961 and used as a restaurant for drive-in movie patrons and a small, 1,440-square-foot two-story building built in 1979 with adjacent covered area used as a projection booth. A 10-foot wide easement for underground communication lines (TMK: 9-8-13:15; 617 square feet lies near the seaward edge of the parcel.

The project area lies midway between the H-1 Freeway inland and Kamehameha Highway on the coast. The Westridge Shopping Center and the large Pearl Ridge Shopping Center complex lie just to the southeast.

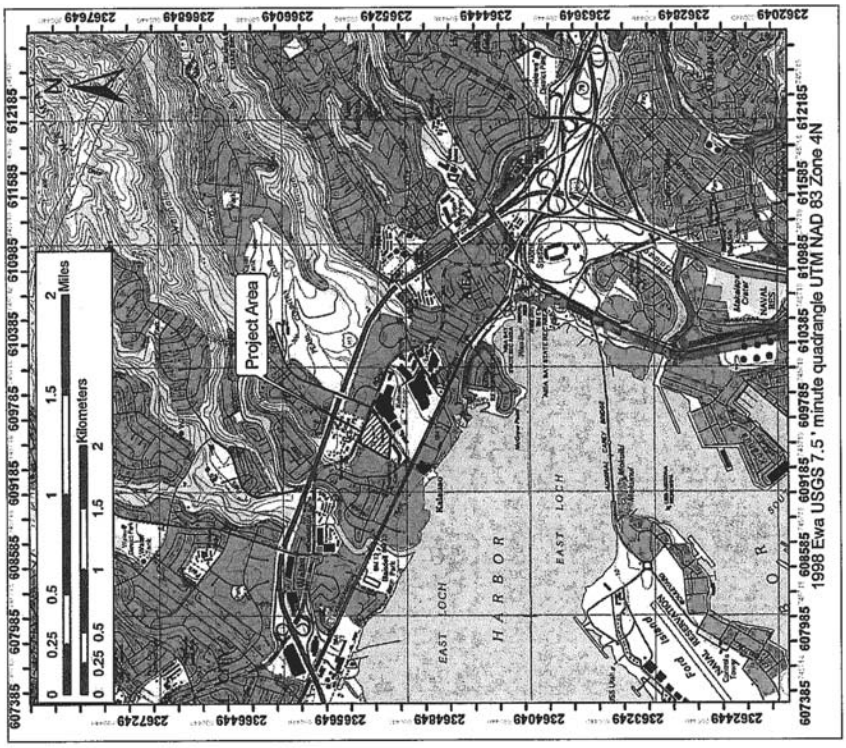

Figure 1. U.S. Geological Survey quad map showing project area

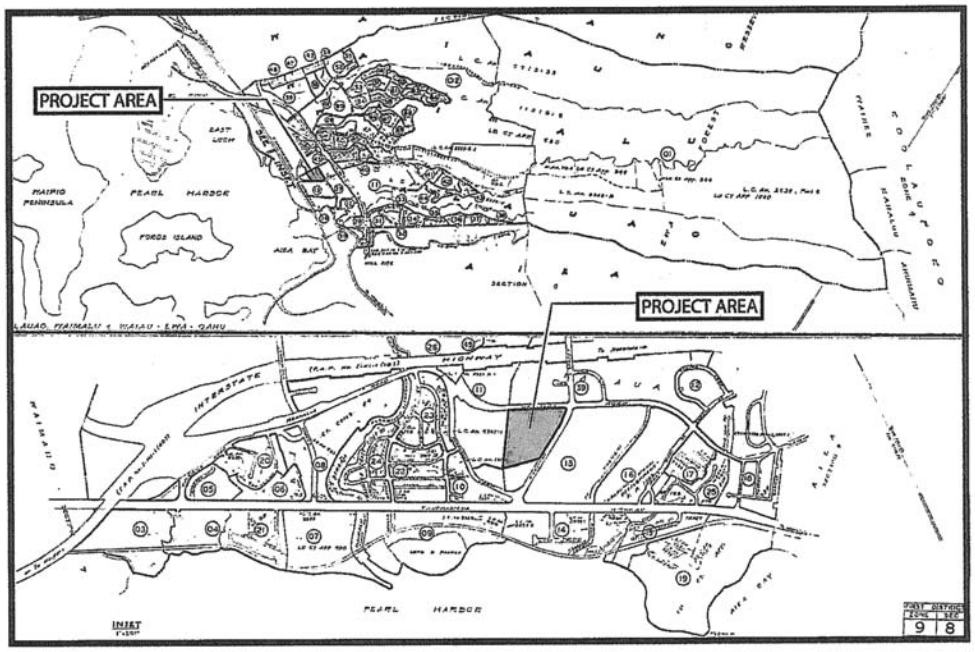

Figure 2. Tax Map Key (TMK) 9-8 showing project area

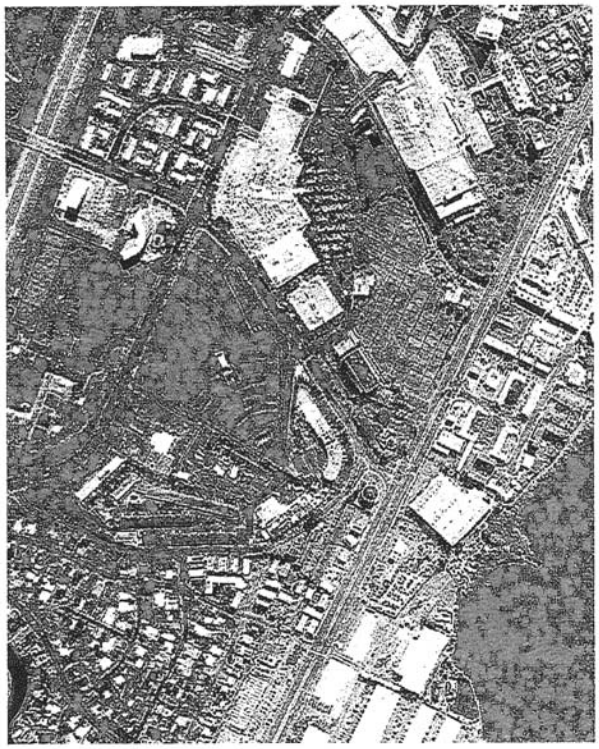

Figure 4. Aerial photograph showing Kamehameha Drive In (center) The large water cress farm just to the southeast abutting the inland side of Kamehameha Highway was an area of very intensive pond field taro cultivation and residence in traditional Hawaiian times

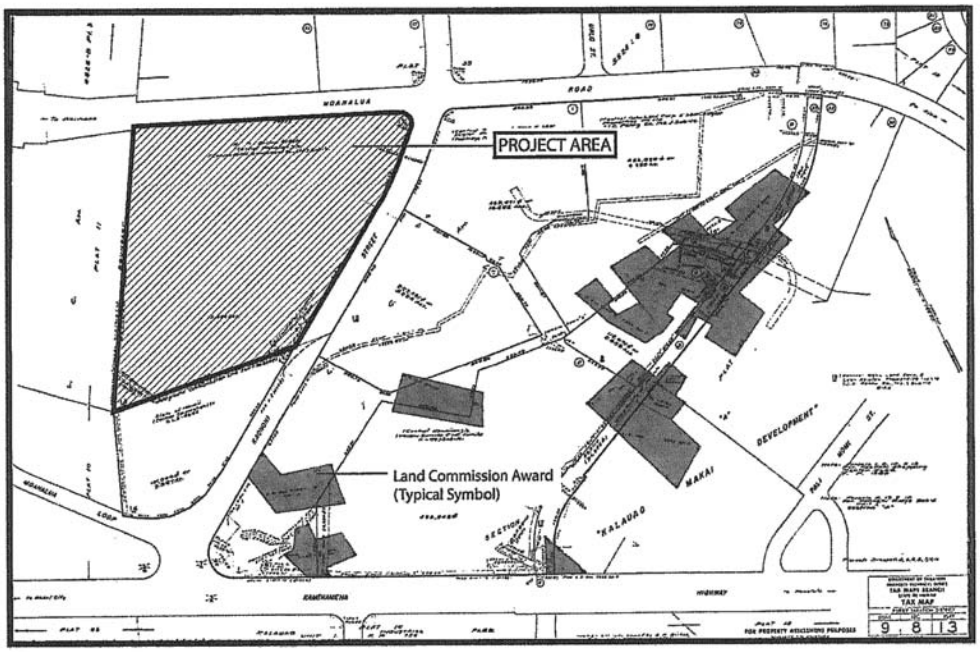

Figure 3. Tax Map Key (TMK) 9-8-13 showing project area and numerous Land Commission Awards to the southeast

Section 2 Background Research

The project lands are located in the traditional Hawaiian *'ili* of Kaonohi in the land division of Kalauao Ahupua'a, 'Ewa District O'ahu that lies between Waimalu Ahupua'a to the northwest and Aiea Ahupua'a to the southeast.

2.1 Traditional and Historical Background

2.1.1 Mythological and Traditional Accounts

The name Ka-lau-ao

The name Ka-lau-ao means "the multitude of clouds" (Pukui et al. 1976). A different meaning is suggested in a *Chant for Kūali'i* (Fornander Volume IV:400) where the ahupua'a of 'Ewa are enumerated (many with false etymologies) and we find the phrase "*E ala kāua ua au-e – o Kalauao* (Let us arise, it is daylight – at Kalauao)" a play on the words "arise" (*ala*) and "daylight" (*ao*)

The Works of the Chiefess Kalamanu'ia at Kalauao

McAllister (1933:103) makes reference to three archaeological sites in the *ahupua'a* of Kalauao. All three (McAllister site 108 Loko Paaiau fishpond, site 109 Loko Opu fishpond, and site 110 Kūki'iahu) are connected with Kalamanu'ia, a chiefess and *mō'ī* of O'ahu, 10 generations before Ka'ahumanu (16th century according to Kame'elehiwa 1992:80). She lived most of the time in Kalauao, following in her mother's (Kukaniloko's) footsteps. No foreign or domestic wars appear to have occurred during her reign (Fornander). The foundation of her houses (Site 110) stood in Kalauao until recent [1933] times (McAllister 1933). Kalamanu'ia was credited with having built the fishponds of Kapaakea in Waimalu, and Opu (Site 109), and Paaiau (Site 108) in Kalauao along Pearl Harbor.

The Kahuawai Bathing Place of Chiefs at Kalauao

Hawaiian language newspapers give us accounts of a bathing place reserved for *ali'i* named Kahuawai at Kalauao.

> Here is another thing. I went to see the diving place of the chiefs where they used to bathe. It is very close to the pump at Kalauao. It is cemented and deep. The name of this pool is Kahuawai. On the eastern side are some taro patches that are somewhat like ponds. They were deep in the olden days and these were the taro patches owned by Kaho, in which he planted all the time. (W. K. Apuakehau *Ka Nupepa Kuokoa* July 18, 1919)

> Kahuawai was a noted bathing place since ancient times and was guarded so that any one did not bathe in it except the chiefs. Later it was used by all. Kākuhihewa's daughters and the hero Kalelealuaka (their husband) bathed in this pool. Kaeokulani, the chief of Kaua'i also bathed here when he came to war here

> on O'ahu. He was killed at Kuki'iahu. Many visitors from Hawai'i to Kaua'i that came to see this pool and it was well known to 'Ewa's inhabitants. (Kaehuiki Mano o Pu'uloa *Ke Au Hou* December 21, 1910 Place Names O'ahu)

> They went to the taro patches of Aiea, up the plain of Kuki'iahu, below the road where Ka'eo, chief of Kaua'i, was killed by Kalanikūpule. From there they went along the taro patches on the upper side of Kohokaho, til they came to Kahuewai, a little waterfall. A little way above it was a spring, a place where travelers sat and rested. They went up a little way to a small plain and ascended the low cliff of Waimalu and went along between the taro patches of that land ("*Nāhunahuna no ka Mo'olelo Hawai'i*", *Kuokoa* January 1, 1870 [see also 'Ī'ī 1959:95

The location of the bathing place called Kahuawai is unclear but it was almost certainly well east (outside) of the present project area.

The Story of the Heavy Sleeper Opelemoemoe of Kalauao

Fornander relates an account of a resident of Kalauao akin to the story of Rip Van Winkle.

> Opelemoemoe made his home at Kahuoi in Kalauao. He had the strange power of being able to sleep days and months on end only being awakened by thunder.

> One day he left Kalauao and went to Pu'u Kapolei where he fell asleep. Two men from Kaua'i looking for a human sacrifice found him and took him to Pokai in Wai'anae where their canoes were moored and from there to Kaua'i. There he was placed on the altar as a sacrifice and left. Eventually a thunder storm woke him. He then married and settled on Kaua'i for some time. Finally he decided to return to his home in Kalauao. Before leaving he gave his spear to his wife and said that if she bore a son to name him Kalelealuaka.

> The son grew up as a mischievous boy. His mother at last told him who his father was and he came to Kalauao where they were reunited. Fornander Collection Volume V Part 1 p. 168)]

Traditional Agriculture at Kalauao

Handy describes the settlement of the ahupua'a as follows: "The lowlands were all formerly terraces irrigated from Kalauao stream, but Kalauao Gulch was too narrow to have terraces inland. By the 1930s most of the lowlands were in cane or bananas" (Handy 1940:81).

2.1.2 Early Historic Period

The Battle of 'Ewa

The Hawaiian historian Samuel M. Kamakau gives the following account of a battle in the vicinity of the present project area fought in 1794.

> A battle was fought on the plains of Pu'unahawele in which some foreigners were killed by Mare Amara. Natives also fell, and Kalanikūpule was forced to retereat. Some six days later another battle was fought in which Ka'eo was again victorious. This gain he followed up by approaching further upon 'Ewa, hoping to push on to Waikiki which was at that time the center of government. On December 12, 1794, a great battle was fought on the ground of Kalanimanuia between Kalauao and 'Aiea in 'Ewa. The heights of Kuamo'o, Kalauao, and 'Aiea were held by the right wing of Kalanikūpule's forces commanded by a warrior named Koa-lau-kani; the shore line of Malie [was held] by the left wing under the command of Ka-mohomoho, Kalanikūpule himself with the main army held the middle ground between 'Aieas and the taro patches; Captain Brown's men were in boats guarding the shoreline. Thus surrounded Ka'eo found his men fighting at close quarters and cut off by Koa-lau-kani between Kalauao and Kuamoo'o, he was hemmed in on all sides and compelled to meet the onset, which moved like the ebb and flow of the tide. Shots from guns and cannon, thrusts of the sword and spear fell upon his helpers. Ka'eo with six of his men escaped into a ravine below 'Aiea and might have disappeared there had not the red of his feather cloak been seen from the boats at sea and there shots drew attention to those on land. Hemmed in from above, he was killed fighting bravely. His wives were killed with him, and his chiefs and warriors. This war called Kuki'iahu, was fought from November 16 to December 12, 1794 at Kalauao in 'Ewa. (Kamakau 1961:169)

Fornander gives much the same account

During the first decades of the 19th century, western visitors begin to describe the 'Ewa landscape above Pearl Harbor as it had been developed by the Hawaiians by the early decades of western contact. Archibald Campbell, travelling through 'Ewa in 1809, recorded:

> We passed by footpaths winding through an extensive and fertile plain, the whole of which is in the highest state of cultivation. Every stream was carefully embanked, to supply water for taro beds. Where there was no water, the land was under crops of yams and sweet potatoes. The roads and numerous houses are shaded by cocoa-nut trees, and the sides of the mountains are covered with wood to a great height. (Campbell 1967:103)

The botanist F.J.F. Meyen, visiting in 1831, confirms the profusion described by Campbell:

> At the mouth of the Pearl River the ground has such a slight elevation, that at high tide the ocean encroaches far into the river, helping to form small lakes which are so deep, that the long boats from the ocean can penetrate far upstream. All around these water basins the land is extraordinarily low but also exceedingly fertile and nowhere else on the whole island of Oahu are such large and continuous stretches of land cultivated. The taro fields, the banana plantations, the plantations of sugar cane are immeasurable. (Meyen 1981:63)

A contrasting picture of 'Ewa is recorded in the missionary William Ellis' description from 1823-24 of the 'Ewa lands away from the coast:

> The plain of Eva is nearly twenty miles in length, from the Pearl River to Waiarua, and in some parts nine or ten miles across. The soil is fertile, and watered by a number of rivulets, which wind their way along the deep water-courses that intersect its surface, and empty themselves into the sea. Though capable of a high state of improvement, a very small portion of it is enclosed or under any kind of culture, and in travelling across it, scarce a habitation is to be seen. (Ellis 1963:7)

Censuses taken by Protestant missionaries throughout the Hawaiian Islands beginning in 1831 provide the earliest record of the size of the native population after the first decades of western contact. In the 1831-32 census of O'ahu, a population of 4,015 was recorded within the 'Ewa district. Four years later, in 1836, the 'Ewa population had dropped to 3,423 (Schmitt 1973: 9,36).

2.1.3 Mid- to late-1800s

In the Māhele land division of 1848 and the subsequent Kuleana Act a total of 54 Land Commission Awards (LCAs) were granted to a total of 38 people (several individuals were granted more than 1 award) within Kalauao Ahupua'a. Virtually all (possibly all) of the commoner (*kuleana*) Land Commission Awards were located within 500 m of the coast well seaward of the present Moanalua Road

The largest land holding in Kalauao (LCA 5524; 1603 acres) went to Laura Konia the ninth largest land-holder in the Kingdom. She: "was a daughter of Pā'uli Ka'ōleiokū, reputed *po'olua* son of Kamehameha I and Kalaniōpu'u by Kānekapolei (Kame'eleihiwa 1992:228) Thus she was either a granddaughter or grandniece of Kamehameha the Great. She received 22 *ahupua'a*-sized lands of which she relinquished 11 back to the Kingdom by way of taxes. The fact that she retained her Kalauao lands suggests she may have regarded them as particularly good lands. The present project area is understood as having been entirely within her holdings with no commoner LCAs.

The second largest landholder at Kalauao was John Meek, an important merchant involved in the sandalwood trade, who was awarded a long narrow strip of 1300 acres on the east (opposite) side of Kalauao Ahupua'a. (Kuykendall 1938:435). Little data is supplied in association with Meek's claim but it appears he resided there (at least part-time) from 1824 to 1853. The Native Register account supporting his Kalauao lands claim is given below:

N.R. 768v3 No. 591, John Meek, Parcel 6

I, Kamehameha III, the King of the Hawaiian Islands, do hereby give a certain parcel of land, bounded as follows: The stream in the middle of Kalauao is the boundary on the west, there also it adjoins the leased land of John Meek. The division between Kalauao and Aiea is the boundary on the east. The highway is the makai boundary and the mountain is the mauka boundary. The length measured from the highway is one hundred and ninety six fathoms. To John Meek and his heirs born under the King of Hawaii and living in these islands. This land shall not be conveyed to a foreigner, nor shall spirit be distilled or vended on said land, but he shall live on it in righteousness under the law of the land. In witness whereof I set my hand in Honolulu on this day.

KAMEHAMEHA III (seal)

The Foreign Testimony account supporting John Meek's Kalauao lands claim is given below:

F.T. 468v3 No. 591, John Meek, July 11th, 1853, Sec. 6 part 1 Chief Justice Lee, states that he called this day on His Majesty, the King, with the Grant presented by claimant for the land called "Kalauao" and that His Majesty reaffirmed the said grant and stated that it was executed some time in the year 1839.

John Ii, sworn by the Word of God and stated, ... 3. "There is another (land) at Kalawao in Ewa. Kamehameha had given (land) in the year 1824 and residence was since then to the present time...

Only one other land award at Kalauao was greater than 5 acres, LCA 5365 awarded to Colonel William Stevens. His claim follows:

No. 5365, K.U. Giwini /William Stevens/ February 2, 1848 N.R. 44-45v5 To the Honorable and Esteemed Land Commissioners, Greetings: I, Colonel William Stevens, have thought of telling you correctly of my claim for land, in accordance with the law which designated Ministers for the Government and which says for claimants to petition for their land claims. Therefore, I hereby petition for my land claim which was from King Kamehameha III, as follows: Paaiau 'Ili in the Ahupua'a of Kalauao, Ewa, Island of Oahu, described as follows: North, Kauapooli and Keahua, along the Muliwai, south, the edge of the sea of Kapaeli and the edge of the sea of Kapuai, east, Kauapoi and the kula from thence to the far upland of the pali of Koolau, south, the edge of the kula of Aiea, north, the edge of the kula of Kalauao. The nature of the kula on the west of Paaiau, is that the people must wade in the sea outside the western boundary of this 'ili. Colonel William Stevens N.T. 428v10 No. 5365, Wm. E. Stevens (he is U.K. Guvini) Wm. Stevens land distribution. Paaiau 'Ili for Kalanao, Ewa, Oahu [Kalauao] True Copy Honolulu, 11 November 1854 A.G. Thurston, Chief Clerk [Award 5365; R.P. 5687; Paaiau Kalauao Ewa; 1 'āp.; 62.15 Acs]

Table 1. Land Commission Awards within Kalauao Ahupua'a

LCA #	Awardee	Location	Area	# of 'Āpana
591	John Meek	Kalauao	1300 acres	1
2494	Julia Kekoa (Kekou)	Kaonohi	4.538	4
5365	Wm. Stevens	Paaiau	62.15 acres	1
5524	L. Konia	Kaonohi	1603 acres	1
5576	Kuawahie	Kaonohi	0.38 acres (incl LCA 9313)	3
5577	Kamakahiki	Kaonohi	1.12 acres (incl LCA 9354)	2
5581	Kalaimanuia	Kaonohi	0.58 acres	2
5583	Kauwaole	Kaonohi	1.332 acres (incl LCA 9303)	1
5651	Kaumiumi	Kaonohi	0.125 acres (with LCA 9382)	1
5669	Kupihea	Paaiau	0.62 acres (incl LCA 5839 & 9346)	2
5817	Kamoku	Kaonohi	0.99 acres	2
5839	Kupihea	Paaiau	0.62 acres (incl LCA 5669 & 9346)	2
5840	Kuohao	Kaonohi	1.32 acres (incl LCA 9308)	2
5844	Puleonui	Kaonohi	0.758 acres (incl LCA 9350)	1
5878	Kukiiahu	Paaiau	2.043 acres (incl LCA 9311 & 9342)	3
5888	Kapua	Paaiau	0.53 acres (incl LCA 9347)	2
5906	Pupue	Kaonohi	0.84 acres (incl LCA 9307)	2
5910	Piko	Kaonohi	1.07 acres (incl	1

LCA #	Awardee	Location	Area	# of 'Āpana
			LCA 5934)	
5934	Piko	Kaonohi	1.07 acres (incl LCA 5910)	1
6054	Walehau	Kaonohi	1.243 acres (incl LCA 9321)	1
6090	Makauwila for Kahela Luahalaikai	Kaonohi	0.523 acres (incl LCA 9355)	1
6104	Mahiai	Kaonohi	2.026	1
6156	Nua	Kaonohi	1.318	2
6156B (misreported as 6157B)	Mahoe	Kaonohi	2.23 acres	2
6156 E	Naue	Kaonohi	2.998	3
6158	Pao	Kauaopai	0.522 acres (incl LCA 9289 (misreported as 9239)	2
6184	Ino	Kaonohi	0.985 acres (incl LCA 9296)	2
7450 B	Kaiaka	Kauaopai	1.08 acres	1
8324	Kaleionehu	Alaeanui	-	1
9288	Kaina	Kaonohi	0.406	2
9289 (misreported as 9239)	Pao	Kauaopai	0.522 acres (incl LCA 6158)	2
9296	Ino	Kaonohi	0.985 acres (incl LCA 6184)	2
9297	Kanikela	Kaonohi	0.73 acres	1
9302	Aluli (Kukai, heir)	Kaonohi	0.63 acres	1
9303	Kauwaole	Kaonohi	1.332 acres (incl LCA 5583)	1
9307	Pupue	Kaonohi	0.84 acres (incl	2

LCA #	Awardee	Location	Area	# of 'Āpana
			LCA 5906)	
9308	Kuohao	Kaonohi	1.32 acres (incl LCA 5840)	2
9311	Kukiiahu	Paaiau	2.043 acres (incl LCA 5878 & 9342)	3
9313	Kuawahie	Kaonohi	0.38 acres (incl LCA 5576)	3
9321	Walehau	Kaonohi	1.243 acres (incl LCA 6054)	1
9322	Ukuiwi	Kaonohi	0.604 acres	1
9342	Kukiiahu	Paaiau	2.043 acres (incl LCA 5878 & 9311)	3
9346	Kupihea	Paaiau	0.62 acres (incl LCA 5669 & 5839)	2
9347	Kapua	Paaiau	0.53 acres (incl LCA 5888)	2
9350	Puleonui	Kaonohi	0.758 acres (incl LCA 5844)	1
9353	Palau	Kaonohi	0.61 acres	2
9354	Kamakahiki	Kaonohi	1.12 acres (incl LCA 5577)	2
9355	Makauwila for Kahela Luahalaikai	Kaonohi	0.523 acres (incl LCA 6090)	1
9382	Kaumiumi	Kaonohi	0.125 acres (with LCA 5651)	1
9393	J. W. Opunui	Kauapololei & Paaiau	0.44 (incl LCA 9394)	1
9394	J. W. Opunui	Kauapololei & Paaiau	0.44 (incl LCA 9393)	1
9400	Hilo for Kaoio	Kaonohi & Manukuaha	1.545 acres	2

LCA #	Awardee	Location	Area	# of 'Āpana
9402	Hikiau for Lino	Paaiau	1.18 acres	2
9404	Nowelo	Alaeanui	3.42 acres	2

Another land commission award worth noting in passing, LCA 8525 B Apana 3 in Waimalu that forms the west side of the present study area. Julia Alapa'i Kauwa was a *Kaukau Ali'i* junior chiefess who received 14 *ahupua'a*-sized lands in the Māhele of 1848. Her LCA No. 8525B*O includes two *'ili* land divisions in Waimalu: Waieli of 455 acres ,and . Kainakoi, of 67.06 acres.

Virtually no specifics of land use are available for any of the large parcel land owner's (Laura Konia, John Meek, Colonel William Stevens, Julia Alapa'i Kauwa) lands in the vicinity of the present study area. The two closest commoner (*kuleana* awards were LCA 2494 Apana 3 and 6156B *'Āpana* 2. Both of these were located approximately 200 m to the southeast of the southeast corner of the present project area.

Julia Kekou (Kekoa) claimed 4 pieces *('āpana)* within her LCA 2494 land claims at Kalauao. All of her claims appear to have included 2 ponded taro fields (*lo'i*). While there is some uncertainty whether her claimed piece *('āpana) number 3* described below is the same as the *('āpana)* 2 shown as the closest land claim to the present project area, the land pieces described are similar in indicated an intensely developed cultural landscape just to the southeast of the present study area:

F.T. 10-11 v 9 No. 2494, Julia Kekou, claimant

> *'Āpana* 3, two *lois*, is bounded: *Mauka* by land of mine in Kaonohi Honolulu by land of mine in Kaonohi *Makai* by the *mo'o* (narrow strip of land) of Alapai Wai'anae by the *mo'o* of Alapai. The claimant received it from Pākī in 1844 and has held quiet possession of the same ever since.

Mahoe's claim for LCA 6156B was for:

> ... a *mo'o kalo* named Paauki, in the *'ili* of Kaonohi, Kalauao, Ewa, Oahu. It consists of 11 *lois* & a *kula* (dry land or pasture) in one piece (there are eleven *koele* of *konohiki* in middle) & is bounded: *Mauka* by the *mo'o 'āina* Kamanu aka puaa, Honolulu by *lois* of *kalo koele*, *Makai* by the fish pond Opu, Wai'anae by *pā 'āina*.

Again an intensely developed cultural landscape is indicated just to the southeast of the present study area.

The only map of Kalauao identified from the nineteenth century is Lyon's map of Kalauao Ahupua'a dated 1872 (Figure 5). Although numerous features are noted along the coast (*Kuapā* or walled fishpond, *Nuku Muliwai*, mouth of the stream) and the southwest edge of the *ahupua'a* (*Kuaana*, uncertain; *Kila* or high place; *Pali ma Kapa Alanui* or cliff at the edge of the main path; *Lae pali* or brow of the cliff) there are no such annotations in the vicinity of the present study area. The nearest annotation is just to the effect that the west boundary of the ahupua'a goes "Maluna Pali" or along the cliff.

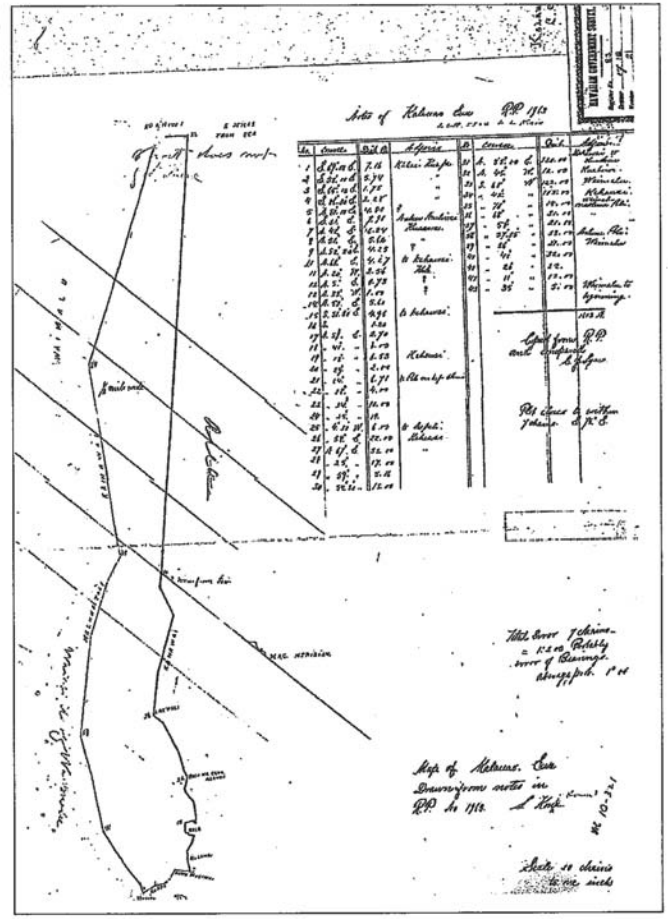

Figure 5. 1872 Lyons map of Kalauao, 'Ewa, Oahu

2.1.4 1900s

Close inspection of the 1919 Fire Control map (Figure 6) appears to indicate that the immediate vicinity was planted in Honolulu Plantation Company sugar cane fields. The Honolulu Plantation Company, incorporated in 1899, took over lands that had been cultivated decades earlier by the defunct Honolulu Sugar Company. The "Honolulu Plantation" railroad ran roughly parallel to the coast approximately where the H-1 freeway is and the OR& L railroad ran along the coast approximately along the Kamehameha Highway alignment.

Benjamin Dillingham organized the Oahu Railway and Land (O.R.&L.) Company in 1889 which connected outlying areas of O'ahu to Honolulu. During the last decade of the 19th century, the railroad would reach from Honolulu to Pearl City in 1890, to Waianae in 1895, to Waialua Plantation in 1898, and to Kahuku in 1899 (Kuykendall 1967:100). Pearl City itself was a promotion of Dillingham who, in 1890, conceived a residential subdivision on and above the present Pearl City peninsula. The Pearl City development was

> ...one of [Dillingham's] devices to build railway traffic during the first years of the struggling Oahu Railway and Land Company.
>
> Newspapers in 1890 carried numerous announcements of the "great land sale of Pearl City lots" at public auction, with special excursion rates on the new railway.
>
> Lots were sold with a guarantee that O.R. and L. would transport buyers and their families between Pearl City and Honolulu for nine years at one cent per mile, second class. (Johnson 1956)

A portion of present day Moanalua Loop that arcs around the seaward edge of the present project area is part of the major road system around Pearl Harbor. Most of the houses in Kalauao are very close to the coast as was the pattern in traditional Hawaiian times. A few are located near the OR&L Kalauao Station at the boundary of Kalauao and Waiau with a larger aggregate just inland along Kalauao Creek and Aiea Mill.

If anything the 1928 map (Figure 7) and the 1943 map (Figure 8) appear to show even less activity in the vicinity. By the 1954 map (Figure 9) there is a great deal more development in the general vicinity but the present project area still remains undeveloped except that a road is shown arcing through the inland edge. The naval station at McGrew Point is a major addition to the landscape.

2.1.5 Modern Land Use

The 1968 USGS map (Figure 10) shows the Kamehameha Drive In (understood as constructed in 1961/1962 but the vicinity is still remarkably undeveloped. The Kamehameha Drive In is understood to have closed as a Drive-In Theater in 1998. The Kam(ehameha) Swap Meet started circa 1976. The Kam Swap meet is run by the California based Pacific Theatres that runs some seven swap meet businesses (all the rest are in California). Since 1998 the land has been primarily used for a swap meet with vendors and the public paying admission four days a week (Wednesday and Friday through Sunday).

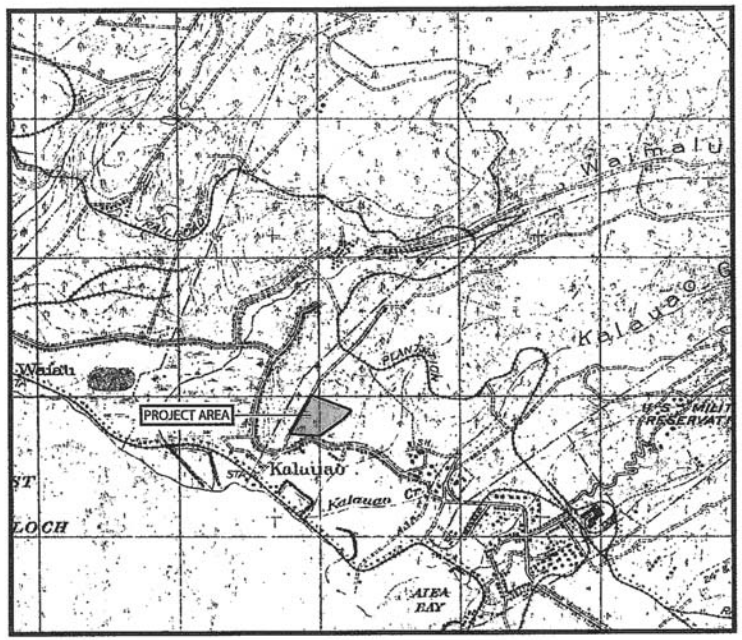

Figure 6. 1919 Fire Control Pearl Harbor quad map showing location of project area

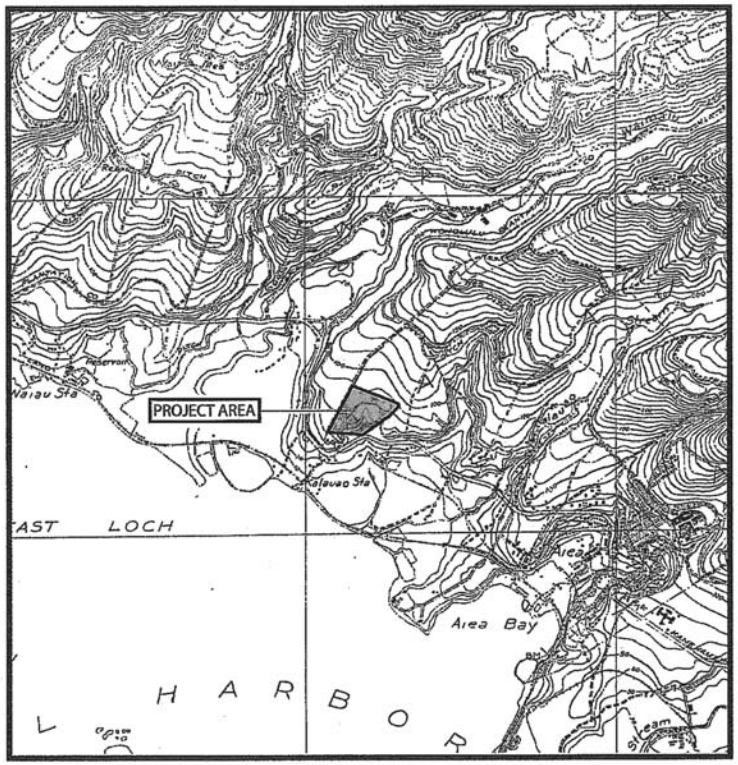

Figure 7. 1928 U.S. Geological Survey Waipahu quad

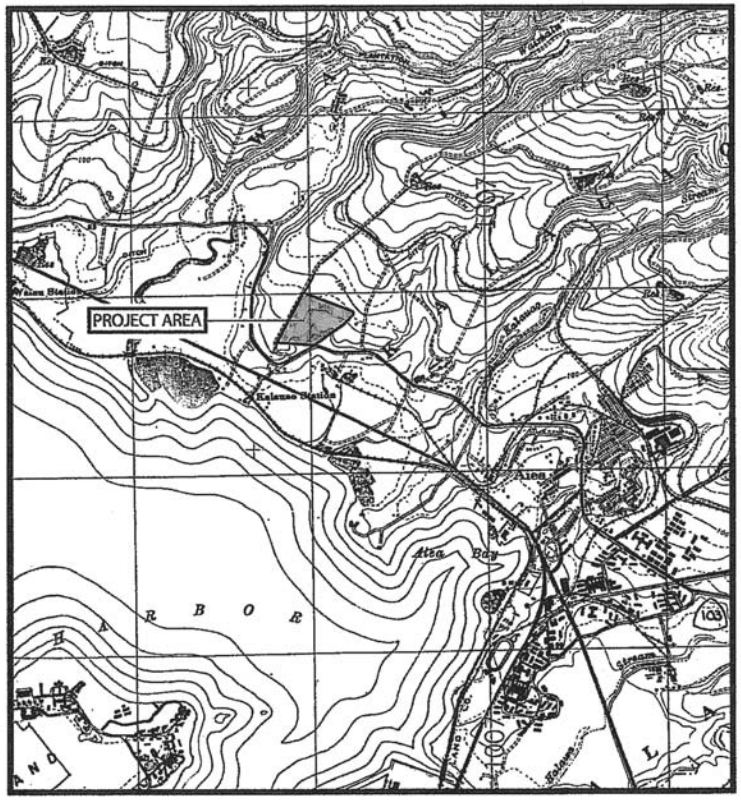

Figure 8. 1943 War Department Aiea Quad map showing project area

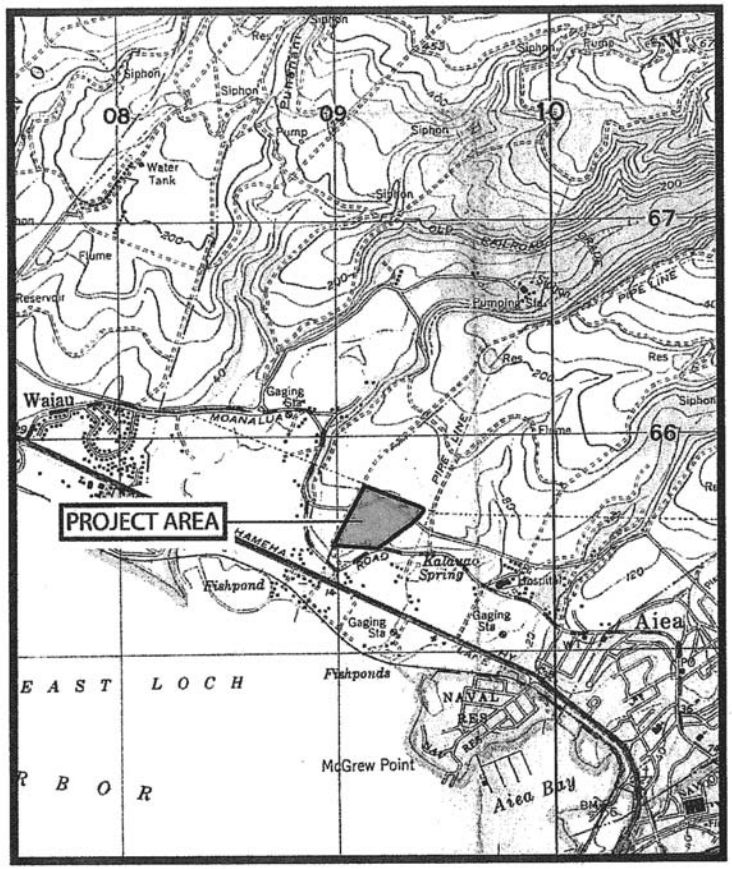

Figure 9. 1954 Army Map Service

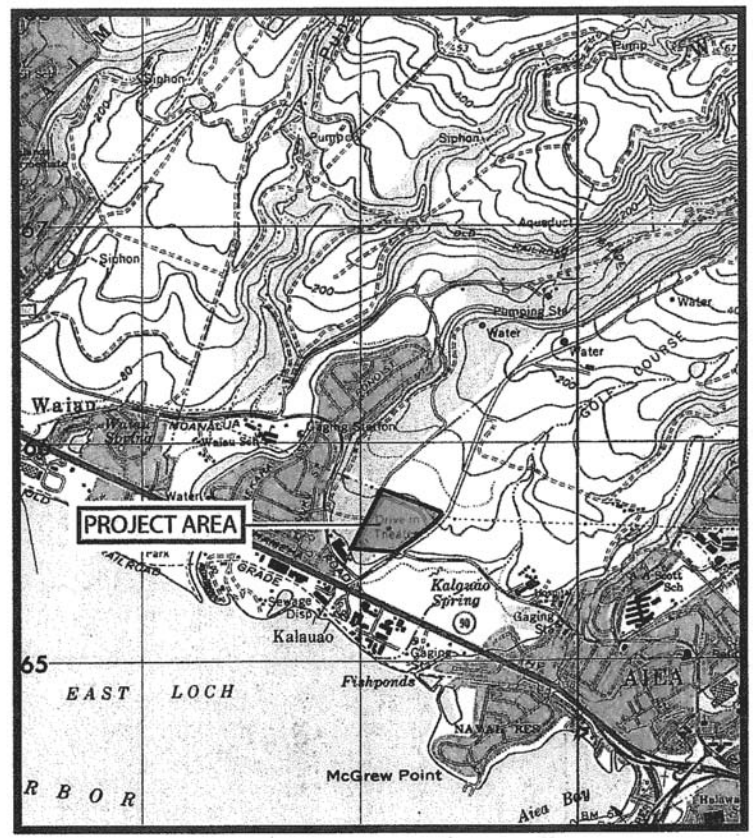

Figure 10. 1968 Defense Mapping Agency map showing project area

2.2 Previous Archaeological Research

McAllister (1933:103) lists three sites (108, 109 & 110) at Kalauao Ahupua'a

> Site 108 Loko Paaiau, fishpond at Kalauao.
>
> Rectangular in shape, roughly 190 by 600 feet, surrounded by land on three sides. The wall on the harbor side is three to four feet wide, two feet wide with one *mākāhā*. The three sides toward the land have been evenly faced with waterworn basalt to a height of about two feet. The pond was evidently fed by the water from the surrounding taro patches. Tradition credits its construction to Kalaimanuia.
>
> Site 109. Loko Opu, fishpond at Kalauuao.
>
> Has not been completely filled in. It was 10.5 acres in size and apparently completely surrounded by a wall 2700 feet in extent. It was built by Kalaimanuia.

Site 110 Kukiiahu, Kalauao.

> Here Kalaimanuia, chiefess of O'ahu, lived most of the time. Until recently the foundations of her houses were pointed out, according to Kaohe. She is said to have built the fishponds of Kapaakea (Site 111), Opu (Site 109), and Paaiau (Site 108). This is also the land upon which occurred the battle of Kuki'iahu, in which Kalanikūpule assisted by a "force of armed seamen from the English vessels Jackal and Prince Leboo under the command of Captain Brown," defeated his uncle Ka'eo, who was proceeding to Kaua'i with a large force, but turned upon Kalanikūpule in order to divert the energy of his warriors, which was centered upon mutiny.

The Loko Paaiau Loko Opu fishponds were built out into the East Loch of Pearl Harbor and the Kukiiahu site is understood as well east of the present study area.

Our research indicates only two other archaeological studies undertaken within Kalauao Ahupua'a (Hammatt 1996 and Hammatt and Chiogioji 1998; Figure 11).

In a January 1, 1996 letter the State Historic Preservation Division mentions a site found about 1 mile (1.6 kilometers) upstream in Kalauao Valley approximately 1.5 kilometers northeast of the present study area. This site SIHP # 50-80-09-527 is described as a stacked boulder wall and terrace, identified as an agricultural *kuleana*. The letter also mentions 4 other similar sites further up the valley. It is of interest here that during the field work for the Hammatt 1996 study the two archaeologists wandered out of the project area down to the banks of Kalauao Stream parallel to the southeastern bank of the stream, and within 10 feet of the stream they noted a stone wall 20 m. long and 1.5 m. wide with a maximum height of 60 cm. A similar wall was noted on the other side of the stream. It was concluded that this wall appeared to be a historic-era wall to retain the stream flow and may have been associated with commercial agricultural but could possibly be a *kuleana* wall. This wall appeared to function solely for flood control and not as part of a traditional irrigation system. Some large boulders were stacked along the edge of the

stream adjacent to the wall. These boulders must have been moved by mechanical means, suggesting commercial agricultural activities. No terracing or *'auwai* were noted in the vicinity of this wall.

The Hammatt and Chiogioji (1998) study examined a 7.6 km portion of the H-1 Highway from Hālawa to the H-1, H-2 Interchange at Waiawa crossing the width of Kalauao Ahupua'a. No significant sites were documented.

Given the proximity to the many cultural resources of Pearl Harbor, the margins have had remarkably little archaeological study (studies are located in Figure 11, summarized in Table 2 and in the references cited at the end of this study). The archaeological sites reported are diverse and include petroglyphs, burials, pre-contact cultural layers, fishponds, and plantation infrastructure. Relatively few burials have been reported and these are widely scattered (Bath, 1988; Chafee and Anderson, 1995; Jourdane, 1995a; Ostroff, et al., 2001a; Perzinski, et al., 2004). No clear pattern of traditional Hawaiian burial locations is evident. A number of studies (Nagaoka and Davis, 1989; Athens, 2000) have emphasized the potential for recovery of paleoenvironmental data along the margins of Pearl Harbor.

Many projects emphasize the extent of agricultural and urban disturbance with several reporting thick fill layers near Pearl Harbor. One aspect of the long residential development of these lands is mention of former plantation camps, old bridges, and dressed basalt wall segments that may be of historic preservation concern.

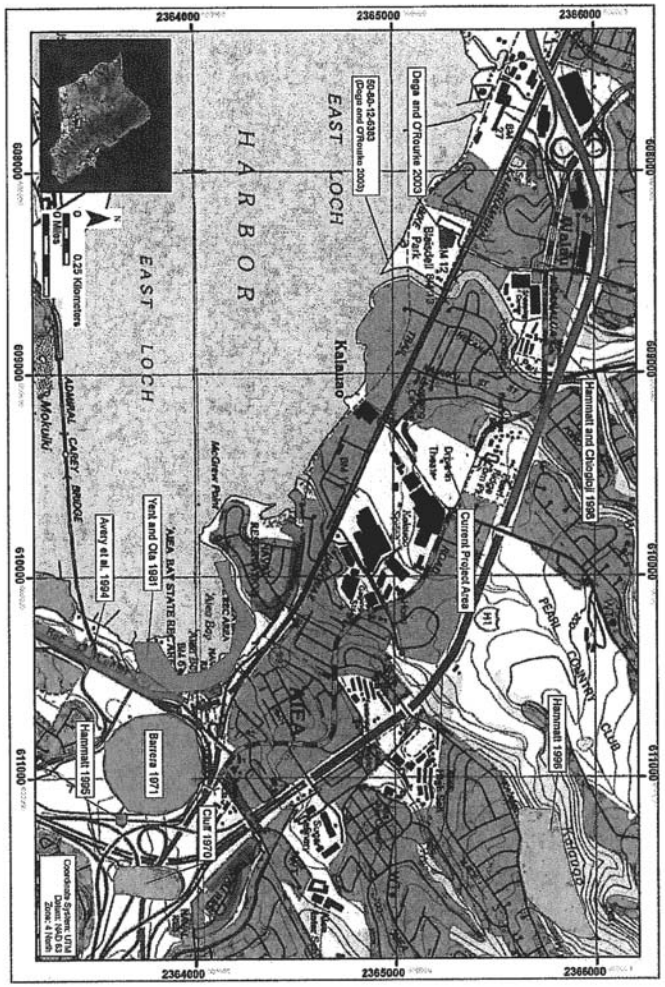

Figure 11. Map showing previous archaeological studies in the vicinity

Table 2. Archaeological Studies in the Vicinity of the Kamehameha Drive In and Kalauao Ahupua'a

Source	Nature of Study	TMK [1] - -	Location
Cluff, 1970	Inventory Survey	9-9-	Hālawa Interchange
Barrera, 1971	Archaeological Site Survey	9-9-	Honolulu Stadium
Yent and Ota, 1981	Reconnaissance Survey	9-8-, 9-9-	Proposed Rainbow Bay State Park
Avery, et al., 1994	Paleo-environmental Study	9-9-001, 9-9-003:	Hālawa Stream Mouth
Hammatt, 1995	Reconnaissance Survey	9-9-003:035	Proposed Hālawa Well – 2 acres
Hammatt and Chiogioji, 1998	Assessment	9-4-011	Approximately 7.6 kilometer-long portion of the H-1 from Hālawa to the H-1/H-2 Interchange
Athens, 2000	Hawaiian Fishpond Study	Various	U.S. Navy Lands Pearl Harbor
Dega and O'Rourke, 2003	Archaeological Evaluation	9-8-007:020	Blaisdell Park (Waiau Drum Storage Facility), Pearl City
Sinoto, 1986	Archaeological Surface Survey	9-8-014:003, 9-8-014:006, 9-8-014:007, 9-8-015:044, 9-8-015:045	Proposed Pearl Promenade, Kalauao
Sinoto, 1989	Cultural Resources Reassessment	9-8-014, 9-8-015:057, 9-8-015:058 ,9-8-019:003, 9-9-001:008, 9-9-001:015, 9-9-001:016, 9-9-003:032	Ford Island Causeway Study
Sinoto and Nakamura, 1984	Cultural Resources Assessment	9-8-014, 9-8-015:057, 9-8-015:058, 9-8-019:003, 9-9-001:008, 9-9-001:015, 9-9-001:016, 9-9-003:032	Proposed Ford Island Causeway Pearl Harbor
Dye, 1999	Archaeological Resources Survey	9-9-001:001; 9-9-002:004; 9-9-003:026, 9-9-003:029, 9-9-003:056	Hālawa Bridge, Hālawa
Erkelens, 1995	Archaeological Study	9-9-001:	Ford Island Bridge
Yent and Ota, 1981	Reconnaissance Survey	9-8-, 9-9-	Proposed Rainbow Bay State Park

2.3 Background Summary and Predictive Model

The area 200 m to the southeast of the present study area (popularly known today as a watercress farm) was the locus of a major Hawaiian community focused on ponded taro fields (*lo'i*) with interspersed residences (see Figures 3 & 4). These were very much focused on the low coastal wet lands. We have found no evidence of land use of the present project area except for:

- Apparent cultivation in sugar cane by the Honolulu Plantation Company following 1899 (see Figure 6),
- The apparent presence of a road through the north portion of the project area c. 1954 (see Figure 9), and
- The establishment of the Kamehameha Drive In c. 1961/1962.

It seems very unlikely that there were ever any significant subsurface cultural deposits related to habitation or significant paleoenvironmental data to be found within the project area. Anything of cultural interest as may have been present would likely have been destroyed by decades of commercial sugar cane cultivation and the grading associated with the establishment of the Kamehameha Drive In

Relatively few burials have been reported from the greater vicinity and these are widely scattered (Bath, 1988; Chafee and Anderson, 1995; Jourdane, 1995a; Ostroff, et al., 2001a; Perzinski, et al., 2004). No clear pattern of traditional Hawaiian burial locations is evident. As a general rule Hawaiians did not bury their dead in wet agricultural land as dominated coastal Kalauao Ahupua'a. The project area does lie on the seaward edge of a prominent coastal bluff with good views to the East Loch of Pearl Harbor. We need to be clear that there is no evidence whatsoever of any burials within the project area. Furthermore the creation of the Kamehameha Drive In almost certainly involved mass grading transforming the top 1 m of the bluff. We simply cannot rule out the possibility of human burials.

Section 3 Results of Fieldwork

The field check confirmed what is popular believed and shown by the aerial photos (Figure 4) about the Kamehameha Drive In that it is a vast expanse of graded asphalt parking lot (Figures 12 – 14). The central snack bar and projection building infrastructure (Figure 15) are less than 50 years old and appear to have little unique architectural merit. There is an abrupt drop to the south and southwest of the project area with good views of Pearl Harbor and adjacent lands (Figures 16 & 17).

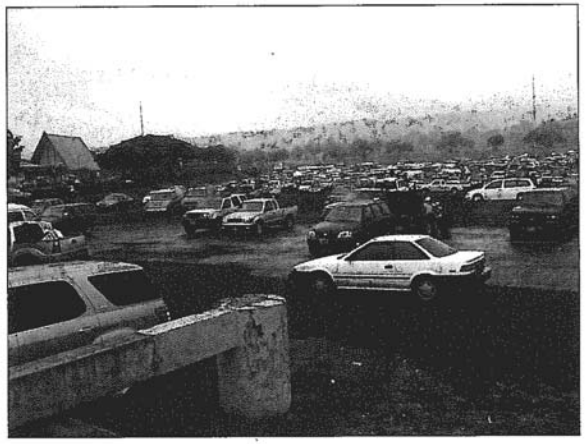

Figure 12. General view of west side of project area from southwest corner to north

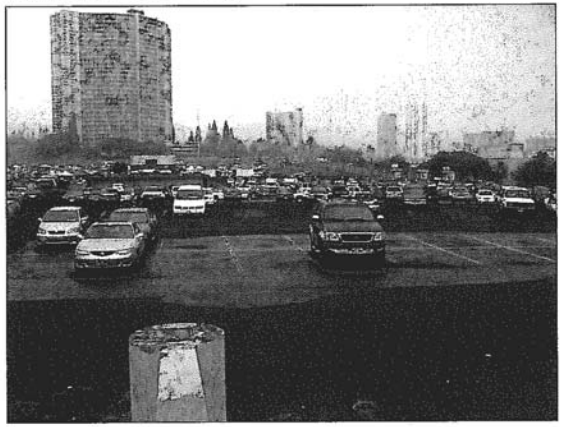

Figure 13. General view of east side of project area from southwest corner to northeast

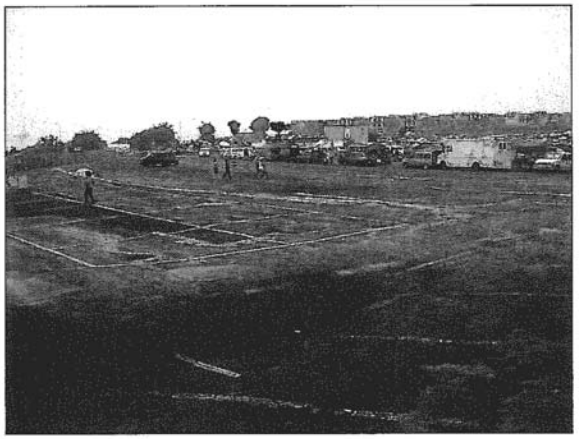

Figure 14. General view of west side of project area from northeast corner to southwest

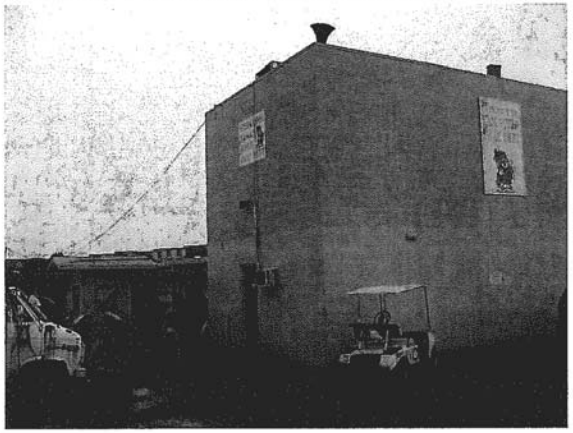

Figure 15. General view of central snack bar and projection building infrastructure to southwest

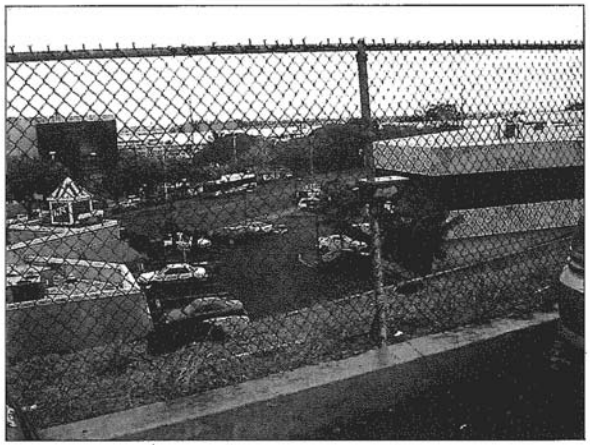

Figure 16. View towards Pearl Harbor from southwest corner, view to southwest

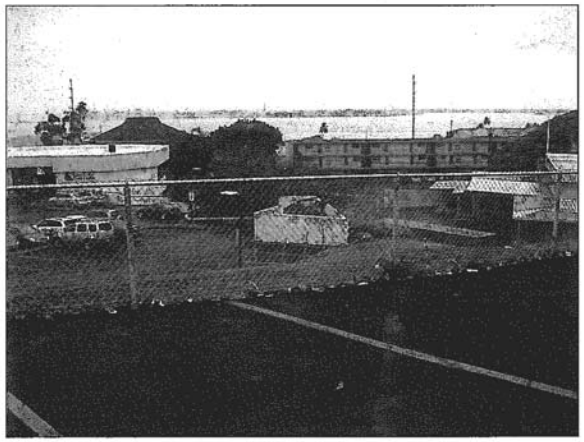

Figure 17. View towards Pearl Harbor from southeast corner, view to south

Section 4 Summary and Interpretation

It seems very unlikely that there were ever any significant subsurface cultural deposits related to habitation or significant paleoenvironmental data to be found within the project area. Anything of cultural interest as may have been present would likely have been destroyed by decades of commercial sugar cane cultivation and the grading associated with the establishment of the Kamehameha Drive In

Relatively few burials have been reported from the greater vicinity and these are widely scattered (Bath, 1988; Chafee and Anderson, 1995; Jourdane, 1995a; Ostroff, et al., 2001a; Perzinski, et al., 2004). No clear pattern of traditional Hawaiian burial locations is evident. As a general rule Hawaiians did not bury their dead in wet agricultural land such as dominated coastal Kalauao Ahupua'a. The project area does lie on the seaward edge of a prominent, well drained coastal bluff with good views to the East Loch of Pearl Harbor. We need to be clear that there is no evidence whatsoever of any burials within the project area. Furthermore the creation of the Kamehameha Drive In almost certainly involved mass grading transforming the top 1 m of the bluff. We simply cannot rule out the possibility of human remains.

Cultural Surveys recommends no further archaeological or cultural study of this massively graded and developed project area. If in the unlikely event that human remains or any other significant find should be revealed in the course of any future development of this parcel all work in the immediate vicinity should stop and the State Historic Preservation Division should be promptly notified.

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Appendix D

Cultural Impact Assessment

SCS Project Number 1180-CIA-3

A CULTURAL IMPACT ASSESSMENT OF APPROXIMATELY 14 ACRES, FORMERLY KAMEHAMEHA DRIVE-IN LAND, KALAUAO AHUPUA`A, `EWA DISTRICT, O`AHU, HAWAI`I [TMK: (1) 9-8-013:013]

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December 2011
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INTRODUCTION

Scientific Consultant Services (SCS), Inc. has been contracted by PBR & Associates, Inc., to conducted a Cultural Impact Assessment (CIA) of approximately 14 acres of land that is currently used for the Kam Swap Meet and was formerly the Kamehameha Drive-In Theater, Kalauao Ahupua`a, `Ewa District, O`ahu, Hawai`i [TMK: (1) 9-8-013:013] (Figures 1 and 2).

The Constitution of the State of Hawai`i clearly states the duty of the State and its agencies is to preserve, protect, and prevent interference with the traditional and customary rights of native Hawaiians. Article XII, Section 7 (2000) requires the State to "protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by *ahupua`a* tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778." In spite of the establishment of the foreign concept of private ownership and western-style government, Kamehameha III (Kauikeaouli) preserved the peoples traditional right to subsistence. As a result in 1850, the Hawaiian Government confirmed the traditional access rights to native Hawaiian *ahupua`*a tenants to gather specific natural resources for customary uses from undeveloped private property and waterways under the Hawaiian Revised Statutes (HRS) 7-1. In 1992, the State of Hawai`i Supreme Court, reaffirmed HRS 7-1 and expanded it to include, "native Hawaiian rights…may extend beyond the *ahupua`a* in which a native Hawaiian resides where such rights have been customarily and traditionally exercised in this manner" (Pele Defense Fund v. Paty, 73 Haw.578, 1992).

Act 50, enacted by the Legislature of the State of Hawai`i (2000) with House Bill (HB) 2895, relating to Environmental Impact Statements, proposes that:

> …there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawaii's culture, and traditional and customary rights…[H.B. NO. 2895].

Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on government agencies a duty to promote and protect cultural beliefs and practices, and resources of native Hawaiians as well as other ethnic groups. Act 50 also requires state agencies and other developers to assess the effects of proposed land use or shore line developments on the "cultural practices of the community and State" as part of the HRS Chapter 343 (2001) environmental review process.

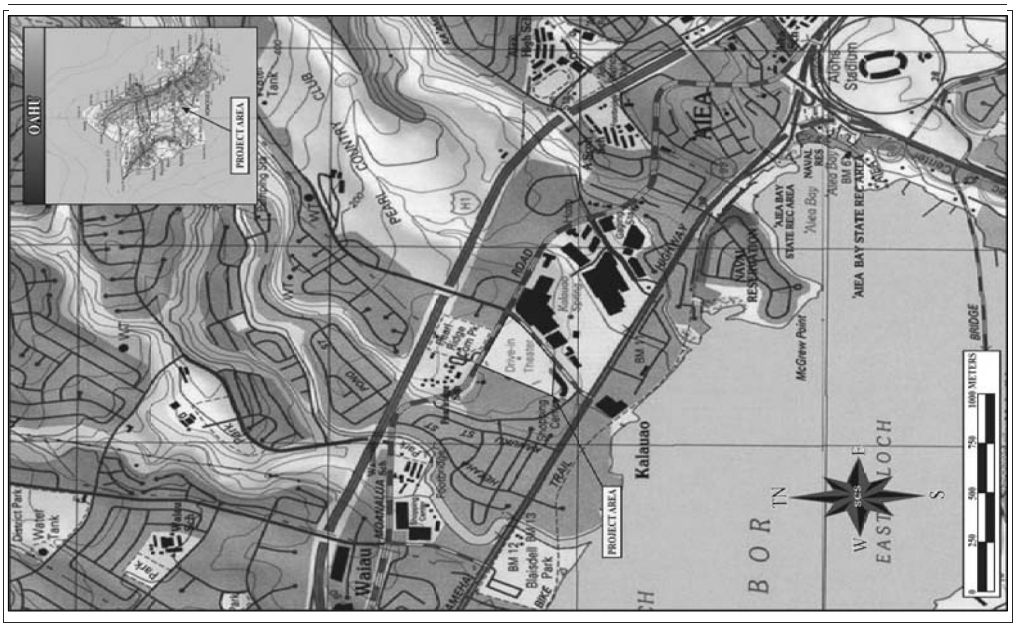

Figure 1: USGS Waipahu Quadrangle Map Showing Project Area.

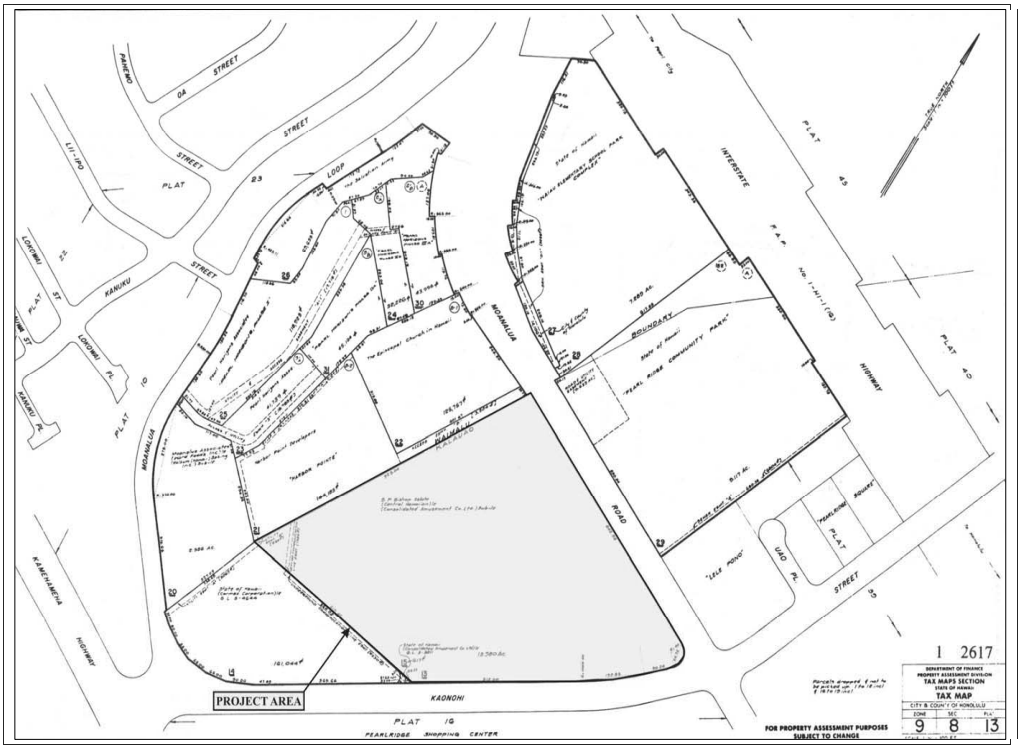

Figure 2: Tax Map Key [TMK: (1) 9-8-013] Showing Project Area.

It also re-defined the definition of "significant effect" to include "the sum of effects on the quality of the environment including actions impact a natural resource, limit the range of beneficial uses of the environment, that are contrary to the State's environmental policies . . . or adversely affect the economic welfare, social welfare or cultural practices of the community and State" (H.B. 2895, Act 50, 2000). Cultural resources can include a broad range of often overlapping categories, including places, behaviors, values, beliefs, objects, records, stories, etc. (H.B. 2895, Act 50, 2000).

Thus, Act 50 requires that an assessment of cultural practices and the possible impacts of a proposed action be included in Environmental Assessments and Environmental Impact Statements, and to be taken into consideration during the planning process. The concept of geographical expansion is recognized by using, as an example, "the broad geographical area, e.g. district or *ahupua`a*" (OEQC 1997). It was decided that the process should identify 'anthropological' cultural practices, rather than 'social' cultural practices. For example, *limu* (edible seaweed) gathering would be considered an anthropological cultural practice, while a modern-day marathon would be considered a social cultural practice.

Therefore, the purpose of a Cultural Impact Assessment is to identify the possibility of on-going cultural activities and resources within a project area, or its vicinity, and then assess the potential for impacts on these cultural resources. The CIA is not intended to be a document of in depth archival-historical land research, or a record of oral family histories, unless these records contain information about specific cultural resources that might be impacted by a proposed project.

According to the Guidelines for Assessing Cultural Impacts established by the Hawaii State Office of Environmental Quality Control (OEQC 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religions and spiritual customs. The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural, which support such cultural beliefs.

The meaning of "traditional" was explained in *National Register Bulletin*:

> Traditional" in this context refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations', usually orally or through practice. The traditional cultural significance of a historic property then is significance derived from the role the property plays in a community's historically rooted beliefs, customs, and practices. . . . [Parker and King 1990:1]

METHODOLOGY

This Cultural Impact Assessment was prepared in accordance with the suggested methodology and content protocol in the Guidelines for Assessing Cultural Impacts (OEQC 1997). In outlining the "Cultural Impact Assessment Methodology", the OEQC states that:

> "…information may be obtained through scoping, community meetings, ethnographic interviews and oral histories…"

This report contains archival and documentary research, as well as communication with organizations having knowledge of the project area, its cultural resources, and its practices and beliefs. Copies of the letters of inquiry are presented below in Appendix A; copies of posted legal notices are presented in Appendix B; and copies of the letters responding to the initial query letter are presented below in Appendix C. This Cultural Impact Assessment was prepared in accordance with the suggested methodology and content protocol provided in the Guidelines for Assessing Cultural Impacts (OEQC 1997) (OEQC Guidelines) whenever possible. According to the OEQC Guidelines, the assessment concerning cultural impacts may include, but not be limited to, the following matters:

(1) if consultation is available, a discussion of the methods applied and results of consultation with individuals and organizations identified by the preparer as being familiar with cultural practices and features associated with the project area, including any constraints of limitations which might have affected the quality of the information obtained;

(2) a description of methods adopted by the preparer to identify, locate, and select the persons interviewed, including a discussion of the level of effort undertaken;

(3) if conducted, ethnographic and oral history interview procedures, including the circumstances under which the interviews were conducted, and any constraints or limitations which might have affected the quality of the information obtained;

(4) biographical information concerning the individuals and organizations consulted, their particular expertise, and their historical and genealogical relationship to the project area, as well as information concerning the persons submitting information or being interviewed, their particular knowledge and cultural expertise, if any, and their historical and genealogical relationship to the project area;

(5) a discussion concerning historical and cultural source materials consulted, the institutions and repositories searched, and the level of effort undertaken, as well as the particular perspective of the authors, if appropriate, any opposing views, and any other relevant constraints, limitations or biases;

(6) a discussion concerning the cultural resources, practices and beliefs identified, and for the resources and practices, their location within the broad geographical area in which the proposed action is located, as well as their direct or indirect significance or connection to the project site;

(7) a discussion concerning the nature of the cultural practices and beliefs, and the significance of the cultural resources within the project area, affected directly or indirectly by the proposed project;

(8) an explanation of confidential information that has been withheld from public disclosure in the assessment;

(9) a discussion concerning any conflicting information in regard to identified cultural resources, practices and beliefs;

(10) an analysis of the potential effect of any proposed physical alteration on cultural resources, practices, or beliefs; the potential of the proposed action to isolate cultural resources, practices, or beliefs from their setting; and the potential of the proposed action to introduce elements which may alter the setting in which cultural practices take place, and;

(11) the inclusion of bibliography of references, and attached records of interviews which were allowed to be disclosed.

If on-going cultural activities and/or resources are identified within the project area, assessments of the potential effects on the cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

ARCHIVAL RESEARCH

Archival research focused on a historical documentary study involving both published and unpublished sources. These included legendary accounts of native and early foreign writers; early historical journals and narratives; historic maps, land records, such as Land Commission

Awards, Royal Patent Grants, and Boundary Commission records; historic accounts, and previous archaeological reports.

INTERVIEW METHODOLOGY

Interviews are conducted in accordance with Federal and State laws, and guidelines, when knowledgeable individuals are able to identify cultural practices in, or in close proximity to, the project area. If they have knowledge of traditional stories, practices and beliefs associated with a project area or if they know of historical properties within the project area, they are sought out for additional consultation and interviews. Individuals who have particular knowledge of traditions passed down from preceding generations and a personal familiarity with the project area are invited to share their relevant information concerning particular cultural resources. Often people are recommended for their expertise, and indeed, organizations, such as Hawaiian Civic Clubs, the Island Branch of Office of Hawaiian Affairs (OHA), historical societies, Island Trail clubs, and Planning Commissions are depended upon for their recommendations of suitable informants. These groups are invited to contribute their input, and suggest further avenues of inquiry, as well as specific individuals to interview. It should be stressed again that this process does not include formal or in-depth ethnographic interviews or oral histories as described in the OEQC's *Guidelines for Assessing Cultural Impacts* (1997). The assessments are intended to identify potential impacts to on-going cultural practices, or resources, within a project area or in its close vicinity.

If knowledgeable individuals are identified, personal interviews are sometimes taped and then transcribed. These draft transcripts are returned to each of the participants for their review and comments. After corrections are made, each individual signs a release form, making the interview available for this study. When telephone interviews occur, a summary of the information is usually sent for correction and approval, or dictated by the informant and then incorporated into the document. If no cultural resource information is forthcoming and no knowledgeable informants are suggested for further inquiry, interviews are not conducted.

Letters were sent to organizations whose jurisdiction included knowledge of the area. Consultation was sought from Phyllis (Coochie) Cayan, State Historic Preservation Division (SHPD), History and Culture Branch Chief; Clyde Nāmu`o, Director of the Office of Hawaiian Affairs (OHA), O`ahu; Leimaile Quitevis, member of the O`ahu Island Burial Council (OIBC); and George Kaeliwai, Jr., `Ewa Hawaiian Civic Club, and Michael K. Lee (Appendix A). In addition, a Cultural Impact Assessment Notice was published on January 30, 2010, February 2 and 3, 2011 in *The Honolulu Star-Advertise*r and the February issue of the OHA newspaper, *Ka*

Wai Ola (Appendix B). These notices requested information of cultural resources or activities in the area of the proposed project, stated the TMK number, and where to respond with pertinent information. Based on the responses, an assessment of the potential effects on cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

PROJECT AREA AND VICINITY

The project area is located within the `ili of Kaonohi, Kalauao Ahupua`a, `Ewa District, Island of O`ahu [TMK: (1) 9-8-013:013] (Figure 3 and 4). The approximately 14-acre parcel is located mauka of (north) Kamehameha Highway, in a heavily commercialized area. The project area is currently the site of the Kam Swap Meet. To the east is Pearlridge Shopping Center, to the north is Moanalua Road, and to the west is commercial development.

CULTURAL AND HISTORICAL CONTEXT

The island of O`ahu ranks third in size of the eight main islands in the Hawaiian Archipelago. The Wai`anae and Ko`olau Mountain ranges were formed by two volcanoes. Through the millennia the constant force of water carved fertile amphitheater-headed valleys and rugged passes eroded at lower elevations providing access from one side of the island to another (Macdonald and Abbott 1970).

PAST POLITICAL BOUNDARIES

Traditionally, the division of Oahu's land into districts (*moku*) and sub-districts (*`ili*) was said to be performed by Mā`ilikukahi, a ruling chief of O`ahu, who was chosen by the chiefs to be the *mō`īho `oponopono o ke aupuni* (administrator of the government; Kamakau 1991). It was Mā`ilikukahi who had the Island of O`ahu thoroughly surveyed, and permanently defined the boundaries between the different divisions and lands (Fornander 1969:89). Cordy (2002: 25) places Mā`ilikukahi's reign over O`ahu at the beginning of the 16th Century. Mā`ilikukahi created six districts and six district chiefs (*ali`i `ai moku*). Land was considered the property of the king or *ali`i `ai moku* (chief who rules a *moku*) (Pukui and Elbert 1986: 20), which he held in trust for the gods. The title of *ali`i `ai moku* ensured rights and responsibilities to the land, but did not confer absolute ownership. The king kept the parcels he wanted, his higher chiefs received large parcels from him and, in turn, distributed smaller parcels to lesser chiefs. The *maka`āinana* (commoners) worked the individual plots of land. It is said that Mā`ilikukahi gave land to *maka`āinana* all over the island of O`ahu (*ibid*).

Figure 3: Google Earth Image Showing Current Use of the Project Area as the Kam Swap Meet.

Figure 4: Plan View Map Limits of *Ahupua`a*.

In general, several terms, such as *moku*, *ahupua`a*, *`ili* or *`ili` āina* were used to delineate various land sections. A district (*moku*) contained smaller land divisions (*ahupua`a*) that customarily continued inland from the ocean and upland into the mountains. Extended household groups living within the *ahupua`a* were therefore able to harvest from both the land and the sea. Ideally, this situation allowed each *ahupua`a* to be self-sufficient by supplying needed resources from different environmental zones (Lyons 1875:111). The *`ili `āina* or *`ili* were smaller land divisions next in importance to the *ahupua`a* and were administered by the chief who controlled the *ahupua`a* in which it was located (Lyons 1875:33; Lucas 1995:40). The *mo`o`āina* were narrow strips of land within an *`ili*. The land holding of a tenant or *hoa `āina* residing in an *ahupua`a* was called a *kuleana* (Lucas 1995:61).The present project area was located in the *ahupua`a* of Kalauao, which literally means "the multitude [of] clouds" (Pukui *et al*.1974:75).

TRADITIONAL SETTLEMENT PATTERNS

Archaeological settlement pattern data suggests that initial colonization and occupation of the Hawaiian Islands first occurred on the windward shoreline areas of the main islands between A. D. 850 and 1100, with populations eventually settling in drier leeward areas during later periods (Kirch 2010). Although coastal settlement was dominant, Native Hawaiians began cultivating and living in the upland *kula* (plains) zones. Greater population expansion to inland areas began around the 14th Century and continued through the 16th Century. Large scale or intensive agriculture was implemented in association with habitation, religious, and ceremonial activities.

The Hawaiian economy was based on agricultural production and marine exploitation, as well as animal husbandry and collecting wild plants and birds. Extended household groups settled in various *ahupua`a*. During pre-Contact times, there were primarily two types of agriculture, wetland and dry-land, both of which were dependent upon geography and physiography. River valleys provided ideal conditions for wetland *kalo* (*Colocasia esculenta*) agriculture that incorporated pond fields and irrigation canals. Other cultigens, such as *kō* (sugarcane, *Saccharum officinaruma*) and *mai`a* (banana, *Musa* sp.), were also grown and, where appropriate, such crops as *`uala* (sweet potato, *Ipomoea batatas*) were cultivated. This was the typical agricultural pattern seen during traditional times on all the Hawaiian Islands (Kirch and Sahlins 1992, Vol. 1:5, 119; Kirch 1985). Agricultural development on the leeward side of O`ahu was likely to have begun early in what is known as the Expansion Period (AD1200-1400, Kirch 1985).

The district of `Ewa was an *ali`i* stronghold undoubtedly made attractive because of the natural springs and numerous fishponds that were constructed at different points around the bay (named *Ka-awa-lau-o-Pu`uloa* by the Hawaiians). There was a great variety of shellfish, the most important being the *pipi*, or Hawaiian pearl oyster, known as *i`a hamau leo o `Ewa* (`Ewa's silent sea creature). The *pipi* was eaten raw and the shell furnished shiny shanks used in bonito (*Sarda sarda*) hooks. It was believed that this valuable oyster had been brought from Kahiki by a *mo`o* (lizard demi-god/goddess) named Kane-kua`ana (Handy and Handy 1972). Other bivalves gathered and eaten raw, or cooked with young taro leaves included *papaua*, *`owa`owaka*, *nahawele*, *kupekala*, and *mahamoe* (*ibid.*).

Originally called *Ke Apana o `Ewa*, the District of `Ewa not only provided ideal circumstances for fishponds, but also included high interior plains and several deep valleys of the Ko`olau mountains, as well as traditionally, the Wai`anae Range. Bananas and yams were cultivated in the lower parts of the valleys and *`awa* (kava) could be found higher inland. Perennial streams spilled from the valleys on to the lowlands creating ideal conditions for taro pond-fields (*lo`i*) and fresh water springs were abundant. Terraces extended up the river valleys, some as far as a mile (e.g., Waikele Stream) and lower terraces were watered from springs, such as those in Waipahu and Kalauao. The forests, or upland jungles (*wao*) contained gardens of *wauke* and *mamaki* grew freely on the slopes. Birds and *olonā* could be found in the *wao* along with mountain apples and other necessary resources (*ibid.*).

Along Kalauao Stream, there was a resting place and bathing pool reserved for the *ali`i* named Kahuawai (called 'Kahuewai' by `I`i 1959:95-97).

> Here is another thing. I went to see the diving place of the chiefs where they used to bathe. It is close to the pump at Kalauao. It is cemented and deep. The name of this pool is Kahuawai. On the eastern side are some taro patches that are somewhat like ponds. They were deep in the olden days and these were the taro patches owned by Kaho, in which he planted all the time [W.K. Apuakehau, *Ka Nupepa Kuokoa*, July 18, 1919].

> Kahuawai was a noted bathing place since ancient times and was guarded so that any one did not bathe in it except the chiefs. Later it was used by all. Kakuhihewa`s daughters and the hero Kalelealuaka (their husband) bathed in this pool. Kaeokulani, the chief of Kaua`i also bathed here when he came to war here on O`ahu. He was killed at Kuki`iahu. Many visitors from Hawai`i to Kaua`i that came to see this pool and it was well known to `Ewa's inhabitants [Keaehuiki Mano O Pu`uloa, *Ke Au Hou*, December 21, 1910, "Place names of O`ahu"].

A map by Rockwood was constructed from `I`i's trail description showing the approximate location of the bathing pool and other important sites, which have since been lost to development of the 20th century (Figure 5).

WAHI PANA (PLACES OF IMPORTANCE)

Scattered amongst the agricultural and habitation sites of `Ewa were other places of cultural significance to the *kama`āina* of the district. Most of the surviving stories and legends encompass the entire `Ewa region, but the location of these sites have been lost to agriculture and 20th century development within the *ahupua`a* of Kalauao. A *heiau* dedicated to the healing arts was located in the uplands of `Aiea, on its border with Kalauao and not near the project area. Keaiwa Heiau was said to have been built at the time of the great O`ahu chief, Kakuhihewa (c. A.D. 1640-60, Cordy 2002). Thrum recorded that the *heiau* was named after its *kahuna* and another source translates the meaning of "Keaiwa" as "mysterious" or "incomprehensible" (Thrum 1909 in Sterling and Summers 1978). Here, the students of healing would spend hours in fasting and meditation, preparing their skills. Special prayers were memorized to assist the potency of the medicine and a garden containing healing herbs was cultivated outside the walls of the *heiau* (Sterling and Summers 1978).

At the western end of the `Ewa District, in another *ahupua`a*, was the large spring of Waipahu (meaning exploding water). It reportedly "leaped out with the force of a river" (*Ku `oko`a*, August 22, 1868) and was believed to flow through the Ko`olau Mountains from a spring in Kahuku named Puna-ho`olapa (meaning "spring boiling up"; Handy and Handy 1972). The route of this river was discovered by a woman in Kahuku who hid her *kapa*-beating anvil by Puna-ho`olapa. One day it disappeared. When hit, the anvil made a distinctive sound, so she set out around the island to find where it had gone. Arriving in `Ewa, she heard the sound of her anvil being pounded by a `Ewa woman who had found it near Waipahu. The area of `Ewa was traditionally known as "Ka-pukana-wai-o-Kahuku" (outlet-of-water-from-Kahuku; *Ka Loea Kalai`aina*, June 3, 1899).

Another story reports that the boundaries of `Ewa District were established by the traveling gods, Kāne and Kanaloa (Handy and Handy 1972). At the western end, the boundary of Waikele and Hoe`ae`ae was marked by a stone named Pohaku-pili (Border stone). Set on the edge of a sheer precipice, this stone stands firm, as it was placed by the gods. Kāne and Kanaloa blessed the lands of `Ewa with coconut groves, fishponds and taro plantations. Traditional history tells us that the first breadfruit tree in Hawai`i was brought from Kahiki by Kaha`i, son of Mo`ikeha, and planted at `Ewa (*ibid.*).

Trails of leeward Oahu as described by Ii. Map by Paul Rockwood.

Figure 5: Map by Rockwood, Adapted Showing Underlined Places o Significance (`Ī`ī 1959:96).

Closer to the project area were several sites of importance to Hawaiian history. A chiefess of O`ahu, known as Kalaimanuia, lived at Kalauoa in the early 1600s (Cordy 2002) and was said to have built the fishponds of Kapa`akea, Opu, and Pa`aiau on the coast of Kalauoa and its vicinity (McAllister 1971) (Figure 6). For many years the foundations of her residence could still be identified on the shore and it was here that the battle of Kuki`iahu was fought in 1894 between Ka`eo and his nephew, Kalanikupule, discussed below (*ibid.*, Site 110). Today, the fishponds of Kapa`akea and Opu have been filled in and built on, Loko Pa`aiau is filled in and all but over grown (west side of McGrew's Point). Many of the gardens plots, the site of the Battle called Kuki`iahu and the house foundations of Kalaimanuia are now occupied by the Pearl Ridge and Pearl Kai shopping Centers (Figure 7).

EARLY POST-WESTERN CONTACT

To encompass all the history of the `Ewa District is not feasible or necessary for this report, however, John `I`i, whose home was originally in `Ewa, gave us a glimpse of the significant sites in the vicinity of the project area when he described a trail that extended across its land, through Kalauao Ahupua`a, in the early 1800s (See Figure 5):

> The trail began again in the opposite side to the lowland of Halawa; on to Kauwamoa, a diving place and much liked resting place. It was said to be the diving place where Pe`ape`a leaped. . . There the trail led to the taro patches in Aiea and up the plain of Kukii-ahu. Just below the trail was the spot where Ka`eo, chief of Kauai was killed by Kalanikupule. From there the trail went along the taro patches to the upper part of Kohokoho and on to Ka-huewai, a small waterfall. On the high ground above, a little way, was a spring also a favorite resting place for travelers. From a spot above, it continues over a small plain; down the small hill of Waimalu and along the taro patches that laid in the center of the land. . . . I went down toward the stream then up again to go above the taro patches of Waiau; up to a maika field; to Waimano; to Manana and to Waiawa; to the stream of Kukehi; up to two other maika fields, Pueohulunui and Hau-pu`u. At Pueo-hulu-nui was the place where the trail branched to go to Waialua and the other to descend to Honouliuli. . . . [1959:95-97]

In 1794, a battle called Kuki`iahu, was fought between the ruling chief of O`ahu, Kalanikupule, son of Kahekili, and his uncle, Ka`eokulani from Kaua`i. The place of battle was the down on the plain where the foundations of the houses of Chiefess Kalaimanuia were located, between Kalauao Ahupua`a and `Aiea Ahupua`a in `Ewa District:

> The heights of Kuamo`o, Kalauao, and `Aiea were held by the right wing of Kalanikūpule's forces commanded by a warrior named Koa-lau-kani; the shore line of

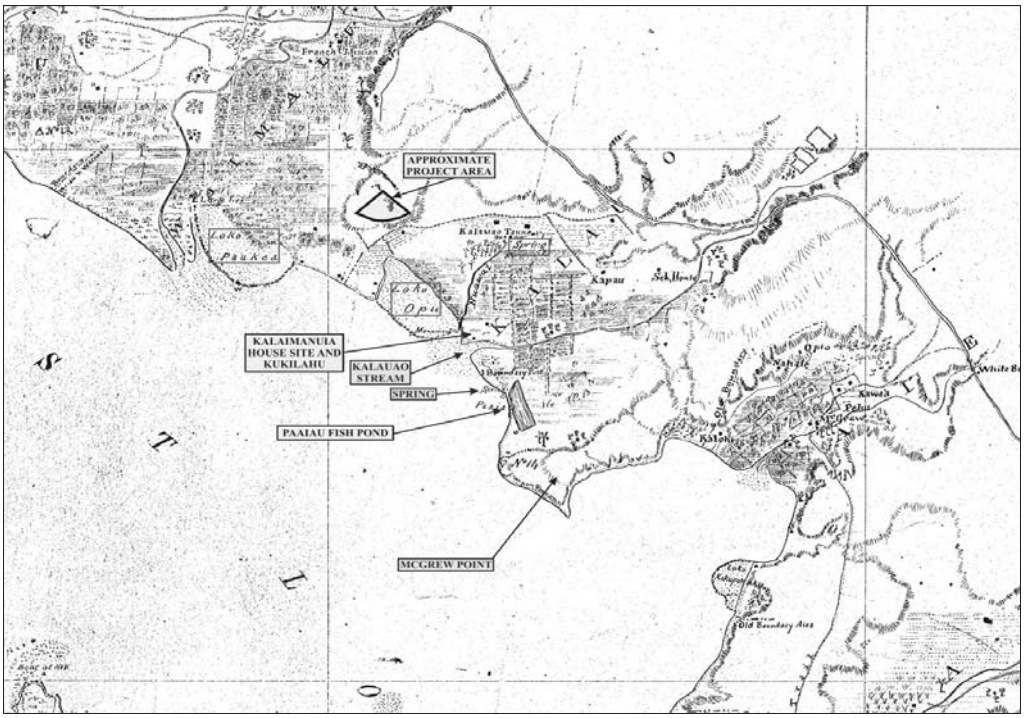

Figure 6: Map By Lyons, "Hydro Chart", 1873, Adapted, Showing Significant Sites and Approximate Project Area (Reg. No. 752).

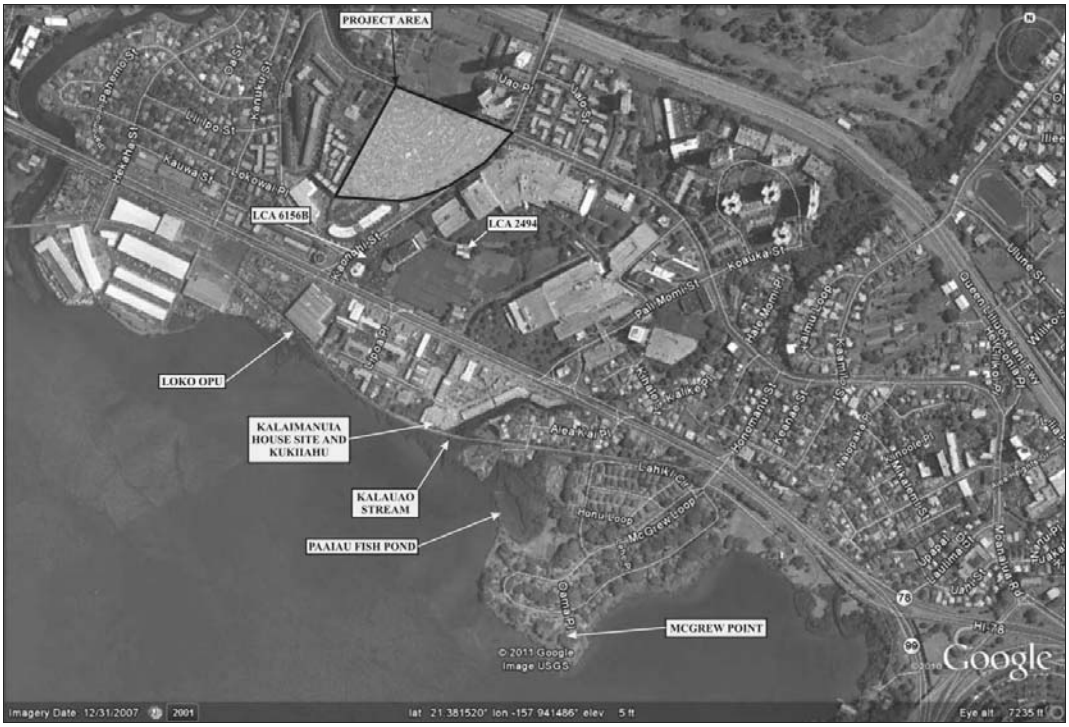

Figure 7: Google Map Showing Project Area and Vicinity Today.

> Malie by the left wing under the command of Ka-mohomoho, Kalanikūpule himself with the main army held the middle ground between `Aiea and the taro patches; Captain Brown's boatmen were in boats guarding the shoreline. Thus surrounded Ka`eo found his men fighting at close quarters and cut off by Koa-lau-kani between Kalauao and Kuamo`o, he was hemmed in on all sides and compelled to meet the onset, which moved like the ebb and flow of the tide. Shots from guns and cannon, thrusts of the sword and spear fell upon his helpers. Ka`eo with six of his men escaped into a ravine below `Aiea and might have disappeared there had not the red of his feather cloak been seen from the boats at sea and their shots drew attention to those on land. Hemmed in from above, he was killed fighting bravely. His wives were killed with him, and his chiefs and warriors. This war call Kuki`iahu, was fought from November 16 to December 12, 1794 at Kalauao in `Ewa [Kamakau 1961:169].

In March of 1810, Archibald Campbell (1967:103-04), an English seaman, described the agricultural area around Pearl Harbor, below `Aiea Heights.

> In the month of November the king [Kamehameha] was pleased to grant me about sixty acres of land, situated upon the Wymummee [Waimomi], or Pearl-water, an inlet of the sea . . . We passed by footpaths, winding through an extensive and fertile plain, the whole of which is in the highest state of cultivation. Every stream was carefully embanked, to supply water for the taro beds. Where there was no water, the land was under crops of yams and sweet potatoes. The roads and numerous houses are shaded by cocoa-nut trees, and the sides of the mountains covered with wood to a great height . . . [1967:103]

Gilbert Mathison (1825: 416) was in Hawai`i in 1821-22 and described the `Ewa region while returning from Waialua:

> The adjoining low country is overflowed both naturally and by artificial means, and is well stocked with tarrow plantations, bananas, etc. . . . The land belongs to many different proprietors; and on every estate there is a fishpond surrounded by a stone wall. . .

The Scottish Botanist, James Macrae, also recorded his impression of `Ewa District in 1825:

> The neighborhood of the Pearl River is very extensive, rising backwards with a gentle slope toward the woods, but is without cultivation, except around the outskirts to about half a mile from the water. The country is divided into separate farms or allotments belonging to the chiefs, and enclosed with walls from 4 to 6 feet high, made of a mixture of mud and stone. [1972: 37]

Another botanist, F.J.F. Meyen, gave his impression of the land around the "Pearl River" in 1831:

> At the mouth of the Pearl River the ground has such a slight elevation, that at high tide the ocean encroaches far into the river, helping to form small lakes which are so deep, that the long boats from the ocean can penetrate far upstream. All around these water basins the land is extraordinarily low but also exceedingly fertile and nowhere else on the whole island of Oahu are such large and continuous stretches of land cultivated. The taro fields, the banana plantations, the plantations of sugar cane are immeasurable [1981:63].

THE MĀHELE

In the 1840s, traditional land tenure shifted drastically with the introduction of private land ownership based on western law. While it is a complex issue, many scholars believe that in order to protect Hawaiian sovereignty from foreign powers, Kauikeaouli (Kamehameha III) was forced to establish laws changing the traditional Hawaiian economy to that of a market economy (Kame`eleihiwa 1992:169-70, 176; Kelly 1983:45, 1998:4; Daws 1968:111; Kuykendall 1938 Vol. I:145). The Great Māhele of 1848 divided Hawaiian lands between the king, the chiefs, the government, and began the process of private ownership of lands. The subsequently awarded parcels were called Land Commission Awards (LCAs).

Once lands were thus made available and private ownership was instituted, the *maka`āinana* (commoners), if they had been made aware of the procedures, were able to claim the plots on which they had been cultivating and living. These claims did not include any previously cultivated but presently fallow land, *`okipū* (on O`ahu), stream fisheries, or many other resources necessary for traditional survival (Kelly 1983; Kame`eleihiwa 1992:295; Kirch and Sahlins 1992). If occupation could be established through the testimony of two witnesses, the petitioners were awarded the claimed LCA and issued a Royal Patent after which they could take possession of the property (Chinen 1961:16). Fifty-four LCAs were awarded in the *ahupua`a* of Kalauao and most were located near the shore, on the *makai* side of Kamehameha Highway.

The Kalauao Ahupua`a was awarded to Laura Konia along with other lands. John Meek leased some land and was given a narrow strip of 1300 acres at the far eastern side of Kalauao from Kamehameha III that was for him and his heirs, but he could not sell any part of it to foreigners, or brew any liquor on (N.R. 768v3, Parcel 6). Another parcel (LCA 5365) was awarded to a Colonel William Stevens. It was located in the *`ili* of Paaiau, in Kalauao and consisted of approximately 62 acres (Waihona `Aina 2011).

For the most of the 19th century, the majority of the land parcels in the lower portion of Kalauao were farmed by different families, who continued in traditional subsistence farming,

including harvesting the fish ponds. No LCAs were identified in the project area. However, two LCAs in close proximity recorded land use in the 1840s (see Figure 6). LCA No. 2494, awarded to Julia Kekou, was located under what is now Monterey Bay Canners Restaurant, across Kaonohi Street to the east from the project area (TMK: 9-8-13). She claims two *lo`i* (*`āpana* 3), and went on to state that to the north and east of this *`āpana* was more of her land (no size stated), to the south and west were narrow strips of land (*mo`o*), belonging to Alapai. Apparently, Alapai did not claim his *mo`o*, as there is no record of his claim, its size, or its use (F.T. 10-11 v 9 No. 2494). Mahoe's LCA 6156B was located further south in the vicinity of a parking lot and the Bed, Bath, and Beyond store. He claimed a *mo`o kalo* consisting of 11 *lo`i* with a dry land or pasture section (*kula*). To the north was the *mo`o `āina* belonging to Kamanu, to the east were *lo`i kalo kō`ele* (pond-field farmed for *ahupua`*a chief), to the south was the Opu fishpond, and to the west a *pā`āina* (fenced land). Again, no records were found for Kamanu's land, so its size, or use is not known (F.T. 10-11 v 9).

Handy and Handy (1972:472) said: "No area better exemplifies the industry and skills of the Hawaiian Chiefs and their people than do the terraced plantation areas and numerous fishponds of `Ewa." What's left of these pond-fields are seen in the Sumida's Watercress Farm, still using the pure, spring water, and flourishing in a modern-day urban environment.

In the latter part of the 19th century, land use in Hawai`i began to change. Well water was discovered in 1879 in the `Ewa District, opening the area to commercial ventures. The addition of heavy-duty pumps dispensed water throughout the region and allowed the conversion of much of the land into sugarcane fields. The introduction of the sugar industry also changed the agricultural focus of parcels skirting the fishponds from Honouliuli to `Aiea. In 1899, Honolulu Plantation Company leased 6,500 acres in and around Pearl Harbor, erected a mill in `Aiea, and built a plantation railroad for the transfer of cane to the mill (Dorrance and Morgan 2000). By 1905, the mill had an active refinery to produce sugar for local consumption. The mill's annual average output was about 20,000 tons of refined sugar. A 1919 Fire Control map shows the cultivation of sugar cane in an around the project area, as well as a railroad built by Dillingham, known as the O.R.&L., or the Oahu Railway and Land Company, extending along the coast, approximately within the Kamehameha Highway alignment (Hammatt and Shideler 2006). This railroad tied the sugar plantations on O`ahu together and extended around the island from Honolulu, to Pearl City, to Wai`anae, Waialua, and finally, Kahuku, all producing vast amounts of cane. By the mid-1930s, the plantation consisted of 23,000 acres of leased land around `Aiea, including the project area. Pu`uloa Camp was built for the plantation workers near

Watertown and adjacent cane fields to the southeast. Sugar cane was planted throughout the `Ewa district, including the project area.

Handy (1940) stated that the previously terraced land of Kalauao, watered from the stream of Kalauao, was now in sugarcane with a scattering of banana groves.

In 1887, the Navy leased Pearl Harbor from the Hawaiian Kingdom, and in 1908, the Naval Shipyard was established in what had become a U.S. Territory. Realizing the military value of the harbor, the U.S. government began aquiring more and more parcels of land from the Honolulu Plantation Company's agricultural fields (Kuykendall 1938). The land containing the Pu`uloa Plantation Camp and Watertown, which had been leased by the Honolulu Sugar Company and consisted of 15% of the Pu`uloa plantation land, was purchased in 1935 by the U.S. Army and became Hickam Air Force Base. Additional land was given up in WW II. Handy (1940: 81) records much of the old terracing gone: "The small area of low flatland covered by plantation camp, railroad, etc. below the old highway, was formerly in terraces. . . .."

After WWII, the pressing needs of urban growth ended sugarcane cultivation for the Honolulu Plantation Company. In January 1947 the Honolulu Plantation Company shut down, the `Aiea Mill closed its doors, was dismantled, and shipped off to the Philippines (Dorrance and Morgan 2000). The refinery continued to operate until 1996 and became the home to the Hawai`i Agricultural Research Center. `Aiea has developed, sections of highway, shops and shopping centers on its lower slopes, with residential areas in the uplands surrounding the project area. However, a portion of the past *lo`*i were protected by Moriichi and Makiyo Sumida. In spite of the pressure from commercial enterprises to obtain their land, the 11-acre watercress farm that they had tended since 1928, remains. Representatives from Robertson Properties Group, met with David and Barbara Sumida of Sumida Farm in July of 2010, who had no knowledge of anything of cultural significance outside the Sumida Farm section.

Kamehameha Drive-In Theater was constructed in 1960-61 and closed as a drive-in theater in 1998. The Kam Swap Meet had already started in 1976 and is still in operation as of the date of this report.

SUMMARY

The "level of effort undertaken" to identify potential effect by a project to cultural resources, places or beliefs (OEQC 1997) has not been officially defined and is left up to the Cultural Impact Assessment investigator. A good faith effort can mean contacting agencies by

letter, interviewing people who may be affected by the project or who know its history, research identifying sensitive areas and previous land use, holding meetings in which the public is invited to testify, notifying the community through the media, and other appropriate strategies based on the type of project being proposed and its impact potential. Sending inquiring letters to organizations concerning development of a piece of property that has already been totally impacted by previous activity and is located in an already developed urban area may be a "good faith effort." However, when many factors need to be considered, such as in coastal or mountain development, a good faith effort would undoubtedly mean an entirely different level of research activity.

Letters of inquiry were sent to organizations whose jurisdiction included knowledge of the area. Initially, consultation was sought from Phyllis (Coochie) Cayan, History and Culture Branch Chief with SHPD; Clyde Nāmu`o, Director Office of Hawaiian Affairs, O`ahu; Leimaile Quitevis, member of the O`ahu Island Burial Council; and George Kaeliwai, Jr., `Ewa Hawaiian Civic Club. In addition, a Cultural Impact Assessment Notice was published on January 30, 2010, February 2 and 3, 2011 in *The Honolulu Star-Advertise*r and the February issue of the OHA newspaper, *Ka Wai Ola*. These notices requested information of cultural resources or activities in the area of the proposed project, stated the TMK number, and where to respond with pertinent information. Based on the responses, an assessment of the potential effects on cultural resources in the project area and recommendations for mitigation of these effects can be proposed.

Historical and cultural source materials were extensively used and can be found listed in the References Cited section of this report. Such scholars as I`i, Kamakau, Malo, Beckwith, Chinen, Kame`eleihiwa, Fornander, Kirch, Kuykendall, Kelly, Handy and Handy, Puku`i and Elbert, Thrum, Sterling, and Cordy have contributed, and continue to contribute, to our knowledge and understanding of Hawai`i, past and present. The works of these and other authors were consulted and incorporated in this report where appropriate. Land use document research was supplied by the Waihona `Aina 2011 Data base and the State Survey Office.

No archaeological sites were identified in the project area. An Archaeological Literature Review and Field Check for the Kamehameha Drive-In lands was compiled in 2006 and lists studies in the broad vicinity (Hammatt and Shideler 2006:26). The study included a field inspection of the project area to identify any surface archaeological features and to investigate and assess the potential for impact to such sites. The report concluded that it would be unlikely for any significant subsurface cultural deposits related to habitation, etc., to be found within the

project area, as they would have been destroyed by ". . . decades of commercial sugar cane cultivation . . ." and ". . . the mass grading transforming the top 1 m of the bluff . . .", for the drive-in (*ibid*.:32).

Archaeology deals with material remains, and although cultural beliefs are often reflected through some sort of architecture, like *heiau*, or *ko`a,* there are many examples of cultural associations still important to the community with no physical structures to mark their significance. One such place, *Ulukukui O Lanikāula*, located on Moloka`i, is considered an extremely sacred spot. Another might be Kīlauea and Halema`uma`u, home of Pele o Hawai`i Island. These places have become important sites supporting a traditional belief system still held by the many peoples of Hawai`i. They contain no identified archaeological features, however they are highly meaningful "…because of [their] association with cultural practices or beliefs of a living community . . ." (King 2003:3).

CULTURAL IMPACT ASSESSMENT INQUIRY RESPONSE

Analysis of the potential effect of the project on cultural resources, practices or beliefs, the potential to isolate cultural resources, maintain practices or beliefs in their original setting, and the potential of the project to introduce elements that may alter the setting in which cultural practices take place is a requirement of the OEQC (No. 10, 1997). As stated earlier, this includes the cultural resources of the different groups comprising the multi-ethnic community of Hawai`i. In response to the announcement in the *Ka wai Ola*, Kupuna Reeves, from the Big Island called on February 2, 2011, asking where the project area was located. Phyllis (Coochie) Cayan, SHPD History and Culture Branch Chief, responded with a letter and her suggestions resulted in inquiries of the Sumida family, Shad Kane and Kawika McKeague, both of whom are members of the O`ahu Island Burial Council (Appendix C). Clyde W. Nāmu`o, Chief Executive Officer of the OHA, responded with the recommendation that "any identified archaeological and cultural sites be considered in the scope of the CIA…" (see Appendix C). None have been identified.

In response to the request from the SHPD History and Culture Branch Chief, Scientific Consultant Services, Inc. wrote letters of inquiry to both Shad Kane and Kawika McKeague and representatives from Robertson Properties Group, met with members of Sumida Farm in July of 2010, who had no knowledge of anything of cultural significance outside the Sumida Farm section. To date responses have not been received from Mr. Kane, Mr. McKeague, Leimaile Quitevis, member of the O`ahu Island Burial Council (OIBC); and George Kaeliwai, Jr., `Ewa Hawaiian Civic Club, or Michael K. Lee. In August of 2011, another set of inquiry letters were sent to the same individuals and organizations previously addressed (Appendix D). As of the

production of the CIA report, there were no suggestions for additional avenues of investigation concerning the identification of on-going traditional cultural activities in the project area or its vicinity.

In August of 2011, telephone contact was made with several Hawaiian Civic Clubs in the project's vicinity. Charles Kaeliwai of the `Ewa Hawaiian Civic Club referred us to Lawrence Woode Jr. of the `Ewa-Pu`uloa Hawaiian Civic Club. Mr. Woode suggested contacting Moana Sanders of the Pearl Harbor Civic Club, for more specific parcel information. Ms. Sanders recommended Mr. Charles Kapua as a long time resident of the Kalauao area. Mr. Kapua, stated that he did not know of any on-gong cultural resources or activities taking place in or around the project area. He also mentioned the previous existence of the many springs that had been covered up by development, the locations of which were not now known.

CULTURAL ASSESSMENT AND RECOMMENDATIONS

Based on no additional suggestions or information from the contacted organizations, newspapers, and negative results of the archival research, it is reasonable to conclude that, pursuant to Act 50, the exercise of native Hawaiian rights, or any ethnic group, related to gathering, access or other customary activities will not be affected by development activities. Because there were no cultural activities identified within the project area, there are no adverse effects.

Therefore, it is reasonable to conclude that, pursuant to Act 50, the exercise of native Hawaiian rights, or any ethnic group, related to gathering, access or other customary activities will not be negatively affected by the proposed development of the approximately 14-acre project area.

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APPENDIX A: CULTURAL IMPACT ASSESSMENT INQUIRY LETTERS

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

March 1, 2011

Shad Kane
'Ewa OIBC representative
kiha@hawaii.rr.com

Dear Mr. Kane:

Scientific Consultant Services, Inc. (SCS) has been contracted by PBR Hawaii & Associates, Inc.to conduct a Cultural Impact Assessment (CIA) of approximately 13 acres, in Kalauoa Ahupua'a, 'Ewa District, O'ahu Island [TMK:9-8-013:013]. According to documents supplied by PBR Hawaii & Associates, Inc., the project proposes to develop the land that was formerly known as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

Archaeological reports of studies conducted in the area can be found on file at the SHPD office. According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs…The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural which support such cultural beliefs…

We are asking you for any information that might assist us in gathering knowledge of traditional activities, or traditional rights that might be impacted by development of the property. The results of our assessments rely greatly on the assistance and response of individuals and organizations such as yours. Enclosed are maps showing the proposed project area. Please contact me at our SCS Honolulu office at (808) 597-1182; my cell phone, 225-2355; or home, (808) 637-9539, with any information or recommendations concerning this Cultural Impact Assessment.

Sincerely yours,

Leann McGerty

Leann McGerty,
Senior Archaeologist
Enclosures (2)

A1

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

January 25, 2011

Ms. Leimaile Quitevis
O'ahu Island Burial Council
leimaile.q@gmail.com

Dear Ms. Quitevis:

Scientific Consultant Services, Inc. (SCS) has been contracted by PBR Hawaii & Associates, Inc.to conduct a Cultural Impact Assessment (CIA) of approximately 13 acres, in Kalauoa Ahupua'a, 'Ewa District, O'ahu Island [TMK:9-8-013:013]. According to documents supplied by PBR Hawaii & Associates, Inc., the project proposes to develop the land that was formerly known as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

Archaeological reports conducted in the area can be found on file at the SHPD office. According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs…The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural which support such cultural beliefs…

We are asking you for any information that might assist us in gathering knowledge of traditional activities, or traditional rights that might be impacted by development of the property. The results of our assessments rely greatly on the assistance and response of individuals and organizations such as yours. Enclosed are maps showing the proposed project area. Please contact me at our SCS Honolulu office at (808) 597-1182; my cell phone, 225-2355; or home, (808) 637-9539, with any information or recommendations concerning this Cultural Impact Assessment.

Sincerely yours,

Leann McGerty

Leann McGerty,
Senior Archaeologist
Enclosures (2)

A2

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

Michael K. Lee
91-1200 Keaunui Drive, Unit 614
'Ewa Beach, HI 96706

January 25, 2011

Dear Mr. Lee:

Scientific Consultant Services, Inc. (SCS) has been contracted by PBR Hawaii & Associates, Inc.to conduct a Cultural Impact Assessment (CIA) of approximately 13 acres, in Kalauoa Ahupua'a, 'Ewa District, O'ahu Island [TMK:9-8-013:013]. According to documents supplied by PBR Hawaii & Associates, Inc., the project proposes to develop the land that was formerly known as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

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Sincerely yours,

Leann McGerty

Leann McGerty,
Senior Archaeologist
Enclosures (2)

Ph: 808-597-1182 SCS... SERVING ALL YOUR *ARCHAEOLOGICAL* NEEDS Fax: 808-597-1193
Neighbor Island Offices • Hawai'i Island • Maui • Kaua'i

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

George Kaeliwai, Jr.
Hawaiian Civic Club of 'Ewa
2460-A Na'ai Street
Honolulu, HI 96819

January 25, 2011

Dear Sir:

Scientific Consultant Services, Inc. (SCS) has been contracted by PBR Hawaii & Associates, Inc.to conduct a Cultural Impact Assessment (CIA) of approximately 13 acres, in Kalauoa Ahupua'a, 'Ewa District, O'ahu Island [TMK:9-8-013:013]. According to documents supplied by PBR Hawaii & Associates, Inc., the project proposes to develop the land that was formerly known as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

Archaeological reports conducted in the area can be found on file at the SHPD office. According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

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Sincerely yours,

Leann McGerty

Leann McGerty,
Senior Archaeologist
Enclosures (2)

Ph: 808-597-1182 SCS... SERVING ALL YOUR *ARCHAEOLOGICAL* NEEDS Fax: 808-597-1193
Neighbor Island Offices • Hawai'i Island • Maui • Kaua'i

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

Phyllis Coochie Cayan, History and Culture Branch Chief
C/O State Historic Preservation Division
601 Kamokila Blvd. Room 555
Kapolei, Hawai'i 96707

January 25, 2011

Dear Ms. Cayan:

Scientific Consultant Services, Inc. (SCS) has been contracted by PBR Hawaii & Associates, Inc.to conduct a Cultural Impact Assessment (CIA) of approximately 13 acres, in Kalauoa Ahupua'a, 'Ewa District, O'ahu Island [TMK:9-8-013:013]. According to documents supplied by PBR Hawaii & Associates, Inc., the project proposes to develop the land that was formerly known as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

Archaeological reports conducted in the area can be found on file at the SHPD office. According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

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Sincerely yours,

Leann McGerty

Leann McGerty,
Senior Archaeologist
Enclosures (2)

Ph: 808-597-1182 SCS... SERVING ALL YOUR ARCHAEOLOGICAL NEEDS Fax: 808-597-1193
Neighbor Island Offices • Hawai'i Island • Maui • Kaua'i

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

Clyde Nāmu'o, Director
C/o Office of Hawaiian Affairs
711 Kapi'olani Blvd, Suite 500
Honolulu, HI 96813

January 25, 2011

Dear Mr. Nāmu'o:

Scientific Consultant Services, Inc. (SCS) has been contracted by PBR Hawaii & Associates, Inc.to conduct a Cultural Impact Assessment (CIA) of approximately 13 acres, in Kalauoa Ahupua'a, 'Ewa District, O'ahu Island [TMK:9-8-013:013]. According to documents supplied by PBR Hawaii & Associates, Inc., the project proposes to develop the land that was formerly known as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

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Sincerely yours,

Leann McGerty

Leann McGerty,
Senior Archaeologist
Enclosures (2)

Ph: 808-597-1182 SCS... SERVING ALL YOUR ARCHAEOLOGICAL NEEDS Fax: 808-597-1193
Neighbor Island Offices • Hawai'i Island • Maui • Kaua'i

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

Kawika McKeague
'Ewa OIBC representative
kawikam@hawaii.rr.com

March 1, 2011

Dear Mr. McKeague:

Scientific Consultant Services, Inc. (SCS) has been contracted by PBR Hawaii & Associates, Inc.to conduct a Cultural Impact Assessment (CIA) of approximately 13 acres, in Kalauoa Ahupua'a, 'Ewa District, O'ahu Island [TMK:9-8-013:013]. According to documents supplied by PBR Hawaii & Associates, Inc., the project proposes to develop the land that was formerly known as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

Archaeological reports of studies conducted in the area can be found on file at the SHPD office. According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs…The types of cultural resources subject to assessment may include traditional cultural properties or other types of historic sites, both man made and natural which support such cultural beliefs…

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Sincerely yours,

Leann McGerty

Leann McGerty,
Senior Archaeologist
Enclosures (2)

Ph: 808-597-1182 SCS... SERVING ALL YOUR ARCHAEOLOGICAL NEEDS Fax: 808-597-1193
Neighbor Island Offices • Hawai'i Island • Maui • Kaua'i

APPENDIX B: CULTURAL IMPACT ASSESSMENT NOTICES

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
CULTURAL IMPACT ASSESSMENT NOTICE:

STATE OF HAWAII }
} SS.
City and County of Honolulu }

Doc. Date: FEB - 3 2011 **# Pages:** 1
Notary Name: Patricia K. Reese **First Judicial Circuit**
Doc. Description: Affidavit of Publication

Notary Signature FEB - 3 2011 Date

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 06-467 STATE OF HAWAII

CULTURAL IMPACT ASSESSMENT NOTICE:
Information requested by SCS:
Of cultural resources or on-going cultural activities on or near the former Kam Drive-In
TMK: (1) 9-8-013:013
Please respond within 30 days to SCS
at (808) 597-1182
(0027694 1/30, 2/2, 2/3/11)

Rose Rosales being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser and MidWeek, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the aforementioned newspapers as follows:

Honolulu Star-Advertiser 3 times on:
01/30, 02/02, 02/03/2011

Midweek Wed. 0 times on:

_____ times on:

And that affiant is not a party to or in any way interested in the above entitled matter

Rose Rosales

Subscribed to and sworn before me this 3rd day
of Feb A.D. 20 11

Patricia K. Reese, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Oct 07 2014

PATRICIA K. REESE NOTARY PUBLIC Comm. No. 06-467 STATE OF HAWAII

Ad # 0000276944 LN: _____

B1

OHA
Office of Hawaiian Affairs

OHA OFFICES

HONOLULU
711 Kapi'olani Blvd., Ste. 500
Honolulu, HI 96813
Phone: 808.594.1888
Fax: 808.594.1865

EAST HAWAI'I (HILO)
162-A Baker Avenue
Hilo, HI 96720
Phone: 808.920.6448
Fax: 808.920.6431

WEST HAWAI'I (KONA)
75-5706 Hanama Pl., Ste. 107
Kailua-Kona, HI 96740
Phone: 808.327.9525
Fax: 808.327.9528

MOLOKA'I
Kilana Tow, P.O. Box 1717
Kaunakakai, HI 96748
Phone: 808.560.3611
Fax: 808.560.3568

LĀNA'I
P.O. Box 631442
Lana'i City, HI 96763
Phone: 808.565.7930
Fax: 808.565.7931

KAUAI / NI'IHAU
3970 Eiwa Street, Ste. 103
Lihue, HI 96766-1053
Phone: 808.241.3380
Fax: 808.241.3580

MAUI
360 Papa Place, Ste. 105
Kahului, HI 96732
Phone: 808.873.3364
Fax: 808.873.3384

WASHINGTON, D.C.
(New address)
900 2nd Street NE, Suite 107
Washington, DC 20002
Phone: 202.454.3572
Fax: 202.396.7991

Classified ads only $12.50 - Type or clearly write your ad in no more than 175 characters (including spaces and punctuation) and mail along with a check for $12.50, to: **Ka Wai Ola Classifieds, Office of Hawaiian Affairs, 711 Kapi'olani Blvd., Honolulu, HI 96813**. Make check payable to **OHA**. (We cannot accept credit cards.) Ads and payment must be received by the 15th for the next month's edition of Ka Wai Ola. Send your information by mail, or e-mail **kwo@oha.org** with the subject "Makeke/Classified". OHA reserves the right to refuse any advertisements, for any reason, at our discretion.

$449,000/3BR 1-1/2 BA. Charming home at Waimanalo. Built in 1957, new roof, fridge, enclosed 2 car garage. Prime area, across from Kapuna housing + Kam pre-school. Call George 220-6735.

AAA PRINCIPLE BUYERS ONLY: Puukapu 10 ac. farm, 48+ 38th. Home/Off, Food Processing Rm. Loading Area. Ag-Bus Bldg; Utility Bldg. $450,000 West Oahu Realty Wilhelm JK Bailey 808.228.9236 RealEstate@WKBailey.com.

AAA KAPOLEI EAST II "Undivided Interest" lease asking $35,000. West Oahu Realty, Inc. Wilhelm JK Bailey @ 808.228.9236. Email: RealEstate@WKBailey.com. Web: http://www.wilhelm-jk-bailey.com/.

ANYONE INTERESTED in swapping my Arapahoe agricultural three acre lot, water meter already in, for your Waiohuli, Kula agricultural or pastoral? Please call (808) 633-5107 Kalani Valente of Mattie Kees.

BIG ISLAND: "La'i'opua" in Kona 38R/2BA home situated on 9.028sf corner lot. Built in 1998, landscaped property with privacy fencing and rockwall!Convenient location. Kimberly A.K.Parks,R(B),Prudential Orchid Isle Properties Call (808)969-7863 or (808) 987-0285.

BIG ISLAND - DHHL Reduced to $130K cash. Kaauakaha-near ocean 1 acre w/1600sf hm. 2 bd/2ba. large rec rm lower level can be master bdrm. Call Lei (808) 935-8623 or (808) 895-1612.

BIG ISLAND - Waimea Country Home with attached commercial Kitchen/Warehouse Tractor Shed, Office/Storage Building. 10 acres fenced Farm. All utilities. DHHL Requirements. 1-808-756-2688.

BOBBIE KENNEDY - (RA), with Graham Realty, Inc. years of experience with DHHL properties and general real estate, on all islands. (808) 545-5099 (808) 221-6570. Email: kabuchal@aol.com

BREATHTAKING KAMUELA - 305 acres Pasture lot Mana Rd. call for more details, photos on WWW.Charmaine QuilitPoki.Com. Charmaine QuilitPoki (R) (808) 295-4474.

CHARMAINE I. QUILIT POKI - (REALTOR). Specialized in Hawaiian Home Lands & Fee Simple Properties. WWW.Charmaine QuilitPoki.Com. (808) 295-4474 Prudential Locations LLC

KAMUELA - Big Island 5.8 Acres. Paukauila farmlot DHHL lease for sale. Fenced/Landscaped with 1 bd. 1 ba. Home has County water. Electric. Avail. $250,000 Call 808-217-3475.

KANAKA MAOLI Flags and t-shirts, decals, stickers, t-shirts for every island, sizes from S to 5XXL, $17 (S,M,L) and $21 (XL, 2XL, 3XXL). www.kanakamaolipower.org or 808-332-5220.

KAPOLEI - Kapuna, only 3 years old 4/2, lgs open back yard. DHHL Lease. Graham Realty Inc., Bobbie Kennedy (RA) 808-221-6570 – email: kabuchal@aol.com

LALAMILO - West new upgraded 4/2, Model 2 home, metal roof, (not avail on future homes), fenced yard. - East Lalamilo 4/2 new home. DHHL Lease Graham Realty Inc., Bobbie Kennedy (RA) 808 221-6570

NANAKULI - Princess Kahanu Estates. Corner lot 5 bdrm/ 2.5 baths $370,000 offer. Kaupe'a(Kapolei) 4 bdrm/3 baths $410,000 cul-de-sac Charmaine I. Quilit Poki (R) (808) 295-4474.

WAIMANALO - undivided interest lease for the next new home offering.

WAIANAE 2/2/3 large home – newly upgraded beautiful 3/2/2 home, fenced yd. DHHL Leases. Graham Realty, Inc. Bobbie Kennedy (RA) (808) 221-6570.

WAIMANALO - Corner lot - $300,000/offer / Hse. 21,560 sf.lot $30,000 Hoolehua-Molokai 3/2 $185,000/Kalamaula-Molokai 1acre lot $25,000. Charmaine I. Quilit Poki (R) (808) 295-4474.

WAIMEA - 10 Acres Pastoral w/house, shed - 5 acres w/house, fenced, in heart of Waimea, all util. KAWAIHAE MAUKA – 2/2 lge lot, new DHHL Leases. Graham Realty Inc. Bobbie Kennedy (RA) 808 221-6570.

WAIMEA - Kamuela Puukapu 10 leasehold pastoral acres with a well designed 3 bedroom, 2.5 bath spacious home. A must see to enjoy both inside and out. Covered Lanai and many extras. Listed $328,000. Interested in selling or buying call me, G.K. "Pua" Correa (RS) 808-896-6888.

WAIOHULI HHL - (KULA,MAUI) PRICE REDUCED TO $299,000.00 Custom home with views(Lease). Must qualify with HHL. Edwina Pennington R(S). Call (808) 291-6823 ERA Pacific Properties.

WILL SELL 21,560sf Keaukaha house lot - 458 Nahale-a St for $30K. Willing to work w/buyer or will build for buyer. Call Bryan at 732-5751.

WANTED: Used shipping containers-Needed (8) 40' long x 8' wide shipping containers, (5) 20' long x 8' wide. For farm equipment storage. Please call 808-221-4820, leave message. Email: sue@stechnologies.com

NO KA ILINA
PUBLIC NOTICES

BURIAL NOTICE

KAWAIAHA'O CHURCH

Any 'ohana who have family members buried in marked or unmarked gravesites at Kawaiaha 'o Church are requested to respond immediately to this notice. Kawaiaha'o Church is planning to build a multi-purpose hall at the site of the former Likeke Hall. Sixty-nine Iwi Kūpuna (bones and burial remains) have been dug up from the church's cemetery to date. The iwi were discovered, unearthed and disinterred at this construction site with permission of Kawaiaha 'o Church, the State of Hawai 'i Department of Land and Natural Resources and the Department of Health.

The Iwi Kūpuna are currently in the basement of the church at the bottom of the bell tower. Our relatives need to be put back to rest and treated with the highest respect. The immediate concern is that construction will resume before family members have been contacted to discuss the current situation.

Please call Kawaiaha 'o Church at 522-1333 and express your concerns and request a halt to all construction until meetings with family members have been held and all concerns have been addressed and discussed.

NORTHERN LEG OF THE WESTERN BYPASS ROAD
Kōloa Ahupua'a and Kōloa Districts, Kaua'i
TMKs: (4) 2-7-003: 002 (por.) and 014; 2-8-006: 001 (por.)

Pursuant to Section 106 of the National Historic Preservation Act of 1966 (Amended 2006), notice is hereby given that the County of Kaua 'i Department of Public Works, in coordination with the Federal Highway Administration and State of Hawai 'i Department of Transportation, proposes to construct the Northern Leg of the existing Western Bypass Rd. (Ala Kalanikaumaka) in the Kōloa District, Kaua 'i. The 0.4-mile long Northern Leg will connect the Western Bypass Rd. with Ala Kinoiki (Eastern Bypass Rd.). The Northern Leg will include a 150-foot wide right-of-way, and a 520-foot long, 60-foot wide bridge.

Native Hawaiian Organizations and Native Hawaiian descendants with lineal or cultural ties to, cultural knowledge or concerns for, and cultural or religious attachment to the historic resources of the Kōloa ahupua 'a are requested to contact Mr. Wallace Kudo or Mr. Ken Tesiima, Department of Public Works, County of Kaua 'i, (808) 241-4996, 4444 Rice Street #275, Lihu 'e, HI 96766-1340, wkudo@kauai.gov or kteshima@kauai.gov. Please respond by Wednesday, March 2, 2011. ■

CULTURAL IMPACT ASSESSMENT NOTICE

Information requested by SCS of cultural resources or ongoing cultural activities on or near the former Kam Drive-In TMK:9-8-013:013. Please respond within 30 days to SCS at (808) 597-1182. ■

KA WAI OLA CULTURAL IMPACT ASSESSMENT NOTICE

B2

APPENDIX C: CULTURAL IMPACT ASSESSMENT INQUIRY RESPONSES

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

GUY H. KAULUKUKUI
FIRST DEPUTY

WILLIAM M. TAM
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

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

February 16, 2011

Ms. Leann McGerty
Scientific Consultant Services, Inc.
711 Kapiolani Blvd. Suite 975
Honolulu, Hawaii 96813

Log No.2011.0293
Doc.No.1102pc003

Dear Ms. McGerty:

Subject: Cultural Impact Assessment (CIA) of approximately 13 acres formerly known as the Kamehameha Drive-In, Kalauoa Ahupua'a, 'Ewa District, O'ahu Island. TMK: 9-8-013:013.

This CIA for the above former lands of 13 acres known as the Kamehameha Drive-In has a proposed project for commercial space and residential units is on heavily developed land used for a drive-in and swap meet and other commercial activities since at least the 1960's. The area as you know has since been heavily urbanized with residential and commercial developments except for small non-urban parcels such as the Sumida watercress farm not far from this project area.

The State Historic Preservation Division (SHPD) suggests the following strategies to help in your efforts to identify any traditional cultural rights and/or practices for this area:

1. Talk story with the Sumida Family of the Sumida Watercress Farm as they are one of the longest folks living there who can recall what it was like before urbanization.

2. Talk story with any senior citizen groups in the general area i.e., Pearl City, 'Aiea, who may have lived and/or worked in the area before urbanization.

3. Contact the following O'ahu Island Burial Council (OIBC)members for their mana'o:
   - Kawika McKeague, 'Ewa OIBC representative at kawikam@hawaii.rr.com
   - Shad Kane, 'Ewa OIBC representative at kiha@hawaii.rr.com

4. Contact realtors who grew up in the area such as Royce Naito at Horita Realty at #487-1561.

Mahalo for the opportunity to offer mana'o. Any questions, please contact me at 808-692-8025.

Sincerely,

Phyllis Coochie Cayan

Phyllis Coochie Cayan
History & Culture Branch Chief
State Historic Preservation Division

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

HRD11/5542

February 23, 2011

Leann McGerty, Senior Archaeologist
Scientific Consulting Service, Inc.
711 Kapi'olani Boulevard, Suite 975
Honolulu, Hawai'i 96813

Re: Pre-Cultural Impact Assessment Consultation
Kamehamhea Drive-In Redevlopment
'Ewa, Island of O'ahu

Aloha e Leann McGerty,

The Office of Hawaiian Affairs (OHA) is in receipt of your January 25, 2011 letter initiating consultation ahead of a cultural impact assessment (CIA) for the proposed redevelopment of a tax map key parcel currently occupied by the abandoned Kamehameha Drive-In. The development of commercial space and residential units is proposed.

We are disappointed to note that through the statement in your letter that "*archaeological reports conducted in the area can be found on file at the SHPD office*" you seem to disconnect any archaeological resources from the scope of your CIA. OHA strongly advocates that any identified native Hawaiian archaeological and cultural sites be considered in the scope of the CIA, as there is a direct connection between these types of resources and the traditions, beliefs and culture practiced by the Native Hawaiian people today.

OHA has no additional comments on the CIA at this time. We do request the opportunity to review the completed CIA. Thank you for initiating consultation. Should you have any questions or concerns, please contact Keola Lindsey at 594-0244 or keolal@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Chief Executive Officer

APPENDIX D: UPDATED REQUESTS

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

August 17, 2011

George Kaeliwai, Jr.
Hawaiian Civic Club of 'Ewa
2460-A Na'ai Street
Honolulu, HI 96819

Dear Sir:

As a follow up to our previously sent letter of inquiry of January 25, 2011, Scientific Consultant Services, Inc. (SCS), is sending a second request for information concerning the Kamehameha Drive-In project.

Scientific Consultant Services, Inc. has been contracted by PBR Hawaii & Associates Inc., to conduct a Cultural Impact Assessment (CIA) of approximately 13- acres in Kalauou Ahupua'a, 'Ewa District, O'ahu Island (TMK: 9-8-013:013). According to documents supplied by PBR Hawaii & Associates Inc., the project proposes to develop the land that was formerly know as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

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Sincerely yours,

P.P. Suzzia Baker

Leann McGerty
Senior Archaeologist
Enclosures (2)

D1

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

August 17, 2011

Clyde Nāmu'o, Director
C/o Office of Hawaiian Affairs
711 Kapi'olani Blvd, Suite 500
Honolulu, HI 96813

Dear Mr. Nāmu'o:

As a follow up to our previously sent letter of inquiry of January 25, 2011, Scientific Consultant Services, Inc. (SCS), is sending a second request for information concerning the Kamehameha Drive-In project.

Scientific Consultant Services, Inc. has been contracted by PBR Hawaii & Associates Inc., to conduct a Cultural Impact Assessment (CIA) of approximately 13- acres in Kalauou Ahupua'a, 'Ewa District, O'ahu Island (TMK: 9-8-013:013). According to documents supplied by PBR Hawaii & Associates Inc., the project proposes to develop the land that was formerly know as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

According to the *Guidelines for Assessing Cultural Impacts* (Office of Environmental Quality Control, Nov. 1997):

> The types of cultural practices and beliefs subject to assessment may include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. . . The types of cultural resources subject to assessment may include traditional cultural properties, or other types of historic sites, both man made and natural which support such cultural beliefs. . .

We are asking you for any information that might assist us in gathering knowledge of traditional activities, or traditional rights that might be impacted by development of the property. The results of our assessment rely greatly on the assistance and response of individuals and organizations such as yours. Enclosed are maps showing the proposed project area. Please contact me at our SCS Honolulu office at (808) 597-1182, or my cell phone, 225-2355, with any information or recommendations concerning this Cultural Impact Assessment.

Sincerely yours,

P.P. Suzzia Baker

Leann McGerty
Senior Archaeologist
Enclosures (2)

D2

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

Michael K. Lee
91-1200 Keaunui Drive, Unit 614
'Ewa Beach, HI 96706

August 17, 2011

Dear Mr. Lee:

As a follow up to our previously sent letter of inquiry of January 25, 2011, Scientific Consultant Services, Inc. (SCS), is sending a second request for information concerning the Kamehameha Drive-In project.

Scientific Consultant Services, Inc. has been contracted by PBR Hawaii & Associates Inc., to conduct a Cultural Impact Assessment (CIA) of approximately 13- acres in Kalauou Ahupua'a, 'Ewa District, O'ahu Island (TMK: 9-8-013:013). According to documents supplied by PBR Hawaii & Associates Inc., the project proposes to develop the land that was formerly know as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

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Sincerely yours,

pp. Suarra Baker

Leann McGerty
Senior Archaeologist
Enclosures (2)

Ph: 808-597-1182 SCS... SERVING ALL YOUR ARCHAEOLOGICAL NEEDS Fax: 808-597-1193
Neighbor Island Offices • Hawai'i Island • Maui • Kaua'i

Shad Kane
'Ewa OIBC Representative
kiha@rrhawaii.com

August 17, 2011

Dear Mr. Kane:

As a follow up to our previously sent letter of inquiry of March 1, 2011, Scientific Consultant Services, Inc. (SCS), is sending a second request for information concerning the Kamehameha Drive-In project.

Scientific Consultant Services, Inc. has been contracted by PBR Hawaii & Associates Inc., to conduct a Cultural Impact Assessment (CIA) of approximately 13- acres in Kalauou Ahupua'a, 'Ewa District, O'ahu Island (TMK: 9-8-013:013). According to documents supplied by PBR Hawaii & Associates Inc., the project proposes to develop the land that was formerly know as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

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Sincerely yours,

pp. Suarra Baker

Leann McGerty
Senior Archaeologist
Enclosures (2)

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

Ms. Leimaile Quitevis
O'ahu Island Burial Council
leimaile.q@gmail.com

August 17, 2011

Dear Ms. Quitevis:

As a follow up to our previously sent letter of inquiry of January 25, 2011, Scientific Consultant Services, Inc. (SCS), is sending a second request for information concerning the Kamehameha Drive-In project.

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Sincerely yours,

P.P. Suzanne Baker

Leann McGerty
Senior Archaeologist
Enclosures (2)

SCIENTIFIC CONSULTANT SERVICES, Inc.
711 Kapiolani Blvd., Suite 975 Honolulu, Hawai'i 96813

Kawika McKeague
'Ewa OIBC Representative
kawikam@hawaii.rr.com

August 17, 2011

Dear Mr. McKeague:

As a follow up to our previously sent letter of inquiry of March 1, 2011, Scientific Consultant Services, Inc. (SCS), is sending a second request for information concerning the Kamehameha Drive-In project.

Scientific Consultant Services, Inc. has been contracted by PBR Hawaii & Associates Inc., to conduct a Cultural Impact Assessment (CIA) of approximately 13- acres in Kalauou Ahupua'a, 'Ewa District, O'ahu Island (TMK: 9-8-013:013). According to documents supplied by PBR Hawaii & Associates Inc., the project proposes to develop the land that was formerly know as the Kamehameha Drive-In with commercial space and residential units in the "workforce/affordable" price range.

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Sincerely yours,

P.P. Suzanne Baker

Leann McGerty
Senior Archaeologist
Enclosures (2)

Ph: 808-597-1182 SCS... SERVING ALL YOUR ARCHAEOLOGICAL NEEDS Fax: 808-597-1193
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Appendix E

Traffic Impact Analysis Report

TRAFFIC IMPACT ANALYSIS REPORT
LIVE WORK PLAY AIEA
AIEA, OAHU, HAWAII

December 12, 2011

Prepared for:

Robertson Properties Group
120 North Robertson Boulevard
Los Angeles, CA 90048-3102

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Honolulu • Wailuku • Hilo, Hawaii

TRAFFIC IMPACT ANALYSIS REPORT
LIVE WORK PLAY AIEA
Aiea, Oahu, Hawaii

Prepared for

Robertson Properties Group

Prepared by
Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
Honolulu • Wailuku • Hilo, Hawaii

December 12, 2011

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A. TRAFFIC COUNT DATA

B. LEVEL OF SERVICE CRITERIA

C. LEVEL OF SERVICE CALCULATIONS

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

KENNETH K. KUROKAWA, P.E.
TERRANCE S. ARASHIRO, P.E.
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STANLEY T. WATANABE
IVAN K. NAKATSUKA, P.E.
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TRAFFIC IMPACT ANALYSIS REPORT

LIVE WORK PLAY AIEA

Aiea, Oahu, Hawaii

I. INTRODUCTION

This report documents the findings of a traffic study conducted by Austin, Tsutsumi & Associates, Inc. (ATA) to evaluate the potential traffic impacts resulting from the property redevelopment project or Live, Work, Play Aiea, hereinafter referred to as Proposed Project. The Proposed Project would include a mixed-use of commercial retail, office space and dwelling units.

A. Location

The Proposed Project is situated on approximately 14 acres of land in Aiea, Hawaii, specifically identified as TMK(s): (1) 9-8-013:013 & 015. The Proposed Project site is located directly across (west) of the existing Pearlridge Center. The Proposed Project will be bordered by Moanalua Road to the north, Kaonohi Street to the east, Westridge Shopping Center to the south and St. Timothy's Church and Harbor Pointe Condominium Community (HPCC) to the west. See Figure 1 for the Proposed Project location.

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HONOLULU, HAWAII
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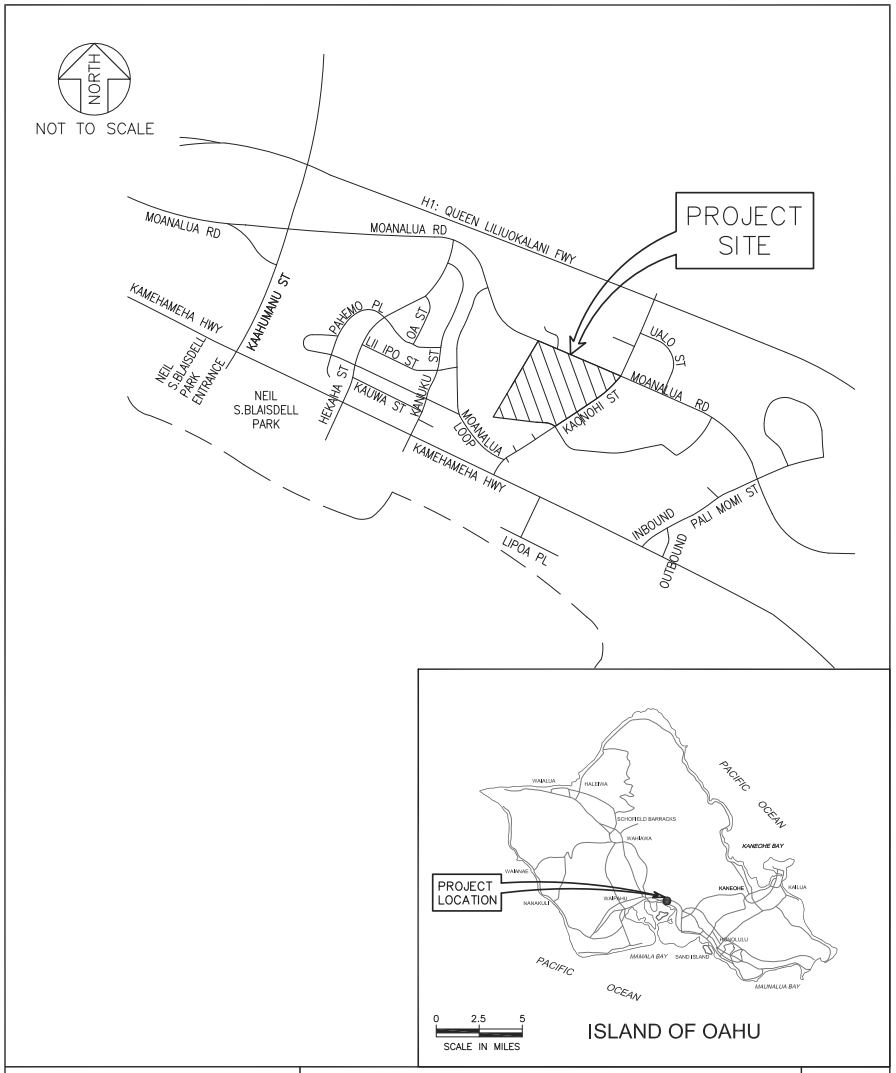

LIVE WORK PLAY AIEA	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII	FIGURE
	LOCATION MAP	1

B. Proposed Project Description

The Proposed Project will be a mixed-use development made up of approximately 143,400 square feet (SF) of commercial space, 80,000 SF of office or hotel space and 1,500 residential dwelling units. The commercial space will consist of a grocery store, retail shops and restaurants. Current plans for the residential space call for two (2) mid-rise buildings and three (3) high-rise buildings.

Vehicular access will be provided via one (1) driveway on Moanalua Road and three (3) driveways on Kaonohi Street. The driveway on Moanalua Road will be aligned with the existing driveway to the Pearlridge Elementary School on the north side of Moanalua Road. Along Kaonohi Street, the northernmost driveway will serve as a right-in, right-out (RIRO) access only due to its proximity to the signalized intersection of Moanalua Road/Kaonohi Street. The middle driveway on Kaonohi Street is proposed to be aligned with the existing Pearlridge Center driveway located between Macy's and the parking garage, hereinafter referred to as Pearlridge Center Driveway 1. The proposed driveway will provide underground access to the Proposed Project's grocery store's loading zone and two (2) underground parking structures, with one servicing customer traffic and the other servicing one of the three proposed residential high-rise buildings. The southernmost driveway is proposed to use the existing KFC driveway and realign it with the existing Pearlridge Center driveway located south of the parking garage, hereinafter referred to as Pearlridge Center Driveway 2. See Figure 2 for the Proposed Project site plan.

C. Study Methodology

This study will address the following:

1. Existing traffic operating conditions at key locations within the study area.
2. Base Years (buildout year for the Proposed Project's several phases) traffic projections (without the Proposed Project) including traffic generated by a defacto growth rate and the other known developments in the vicinity of the Proposed Project which would be completed and occupied by each Base Year and are expected to generate significant traffic demand within the study area.

3. Trip generation and traffic assignment characteristics for the Proposed Project for each phase.
4. Determination of the impact of Proposed Project-generated traffic by phase.
5. Recommendations for roadway improvements or other mitigative measures, as appropriate, to reduce or eliminate the adverse impacts resulting from traffic generated by the Proposed Project.

LIVE WORK PLAY AIEA	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII	FIGURE
	SITE PLAN	2

II. EXISTING CONDITIONS

A. Roadway System

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

Kamehameha Highway

Kamehameha Highway is a six-lane, two-way, divided east-west, major arterial roadway in the vicinity of the Proposed Project. Kamehameha Highway's posted speed limit, within the study area, is 35 miles per hour (mph). Traffic signals with left-turn channelization are provided at all intersections within the Proposed Project study area. Kamehameha Highway provides access to Central Oahu, Interstate Routes H-1 and H-2 Freeways, and Farrington Highway through the Waiawa Interchange to the west of the Proposed Project site and to the east provides access to the Honolulu area via the Moanalua Freeway and Nimitz Highway.

Moanalua Road

Moanalua Road is a five-lane, two-way, east-west, undivided arterial road within the Proposed Project area that provides access between Aiea and Pearl City. Moanalua Road also provides access to the H-1 Freeway through the Waiau Interchange. The posted speed limit on Moanalua Road is 30 mph. Traffic signals with left-turn channelization are provided at the major intersections. Moanalua Road begins at its intersection with Waimano Home Road, and ends at its intersection with Kaimakani Street.

Hekaha Street

Hekaha Street is a two-lane, two-way, north-south, undivided collector road. The intersection begins south of its intersection with Kamehameha Highway where it provides access to businesses/industrial area. North of its intersection with Kamehameha Highway, the roadway provides access to a residential area as well at the Waimalu Shopping Center and terminates at its intersection with Moanalua Road.

Kanuku Street

Kanuku Street is a two-lane, two-way, undivided collector road. It begins at its intersection with Kamehameha Highway to the south, provides access to businesses and the Waimalu Shopping Center located directly north of the intersection. Further north the roadway provides access to a residential area and terminates at its intersection with Hekaha Street. South of its intersection with Kamehameha Highway is the driveway to Best Buy and to an industrial area.

Kaonohi Street

Kaonohi Street is generally a four-lane, two-way, north-south, collector road providing access to shopping centers, such as the Pearlridge Center and Westridge Shopping Center between its intersection with Kamehameha Highway and Moanalua Road. Kaonohi Street stems from its intersection with Kamehameha Highway to beyond Moanalua Road. Kaonohi Street becomes a steep roadway north of its intersection with the Pearlridge Center Driveway 1. A median with fence is provided along Kaonohi Street between Moanalua Road and Pearlridge Center Driveway 1. On Wednesdays, Saturdays and Sundays, the Swap Meet takes place within the current Proposed Project site between 5:00 AM and 1:00 PM and from 6:00 AM to 1:00 PM on Fridays. Kaonohi Street provides the only access into the Swap Meet via the RIRO driveway near Moanalua Road and an exit driveway adjacent to the KFC restaurant and across Pearlridge Center Driveway 2.

Lipoa Street

Lipoa Street is a two-lane, two-way, undivided collector road. Lipoa Street forms a "T"-intersection with Kamehameha Highway to the north where it begins and provides access to a residential area as well as some businesses.

Pali Momi

Pali Momi at the study intersections is split into two (2) intersections: inbound and outbound. Pali Momi begins at its intersection with Kamehameha Highway to the south and terminates to the north at its intersection with Koauka Street/Moanalua Road. Pali Momi provides ingress/egress from the Pearlridge Center as well as the Kapiolani Medical Center at Pali Momi.

B. Existing Traffic Volumes

The hourly turning movements data utilized in this report were collected on October 14 and 16, 2010 for the intersections along Moanalua Road and Kaonohi Street. The study area was then expanded along Kamehameha Highway as a result of discussion with the Hawaii State Department of Transportation (HDOT) and resulted in five (5) additional intersections. Data at these additional intersections were collected on May 10 and 14, 2011.

Based on the proximity to the Proposed Project site, the following 16 intersections were studied:

1. Moanalua Road/Timothy's Church/Harbor Pointe Driveway (Unsignalized)
2. Moanalua Road/Pearlridge Elementary School Driveway (Unsignalized)
3. Moanalua Road/Kaonohi Street (Signalized)
4. Kaonohi Street/Right-In Right-Out (RIRO) Driveway (Unsignalized)
5. Kaonohi Street/Pearlridge Center Driveway 1 (Unsignalized)
6. Kaonohi Street/Pearlridge Center Driveway 2 (Unsignalized)
7. Kaonohi Street/Westridge (north) Driveway (Unsignalized)
8. Kaonohi Street/Westridge (south) Driveway (Unsignalized)
9. Kaonohi Street/Pearlridge Center - Anna Miller's Driveway (Unsignalized)
10. Kaonohi Street/Moanalua Loop (Unsignalized)
11. Kamehameha Highway/Hekaha Street (Signalized)
12. Kamehameha Highway/Kanuku Street (Signalized)
13. Kamehameha Highway/Kaonohi Street(Signalized)
14. Kamehameha Highway/Lipoa Street (Signalized)

15. Kamehameha Highway/Pali Momi Inbound (Signalized)

16. Kamehameha Highway/Pali Momi Outbound (Signalized)

Based on traffic count data, the peak hours of traffic were determined to be from 7:00 AM to 8:00 AM and 3:30 to 4:30 PM on weekdays (AM and PM peak hours, respectively) and 11:15 AM to 12:15 PM on Saturdays Mid-day (Sat MD peak hour). Although the counts were not all taken in the same period, it was found that no significant changes occurred between the two counts. The traffic count data is provided in Appendix A.

C. Existing Traffic Conditions Analysis and Observations

Level of Service (LOS) is a qualitative measure used to describe the conditions of traffic flow at intersections, with values ranging from free-flow conditions at LOS A to congested conditions at LOS F. The Highway Capacity Manual – Special Report 209 (HCM), dated 2000, methods for calculating volume to capacity ratios, delays and corresponding Levels of Service were utilized in this study. LOS definitions for signalized and unsignalized intersections are provided in Appendix B.

Methodology

Analysis for the Proposed Project intersections peak hour counts was performed using the traffic analysis software Synchro, which is able to prepare Highway Capacity Manual (HCM) reports. The reports contain quantitative delay results, as based on intersection lane geometry, signal timing (including coordination and actuated minimums and maximums), and hourly traffic volume. In addition, Synchro was used to estimate queue lengths at some intersections.

Based on the vehicular delay, reserve capacity and critical gaps at the intersection, a LOS is assigned (see Appendix B) as a qualitative measure of performance. These results, as confirmed or refined by field observations, constitute the technical analysis that will form the basis of the recommendations outlined in this report. Below is a brief description of the LOS for signalized intersection:

Level of Service for Signalized Intersections		
Level of Service (LOS)	**Average Control Delay (sec/veh)**	**General Description (signalized intersections)**
A	≤ 10	Free Flow
B	> 10 -20	Stable Flow (slight delays)
C	> 20 - 35	Stable Flow (acceptable delays)
D	> 35 - 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	> 55 - 80	Unstable Flow (intolerable delay)
F	> 80	Forced Flow (jammed)

Source: Highway Capacity Manual, Transportation Research Board Special Report 209, 2000.

Regional Analysis

Commuter traffic is a major contributor to congested roadways in the vicinity of the Proposed Project. Since Pearl City/Aiea is primarily a residential community, Moanalua Road and Kamehameha Highway experience heavy eastbound traffic during the AM peak hour and heavy westbound traffic during the weekday PM peak hour, with many residents commuting to and from the Central Business District of Honolulu. Further west of Pearl City, Kamehameha Highway provides a connection to the Kapolei, Ewa Beach and Waipahu regions via Farrington Highway and H-1 Freeway and also connects to the Waipio and Mililani regions via H-2 Freeway. Due to the congestion along the H-1 Freeway - approximately 2,000 vehicles/lane/hour in the peak direction[1] - during the weekday AM and PM peak hours of traffic, the Pearl City and Aiea residents use Kamehameha Highway to avoid the H-1 Freeway.

The existing Proposed Project site is currently being used by the Swap Meet which occurs on Wednesday, Friday, Saturday and Sunday mornings. During the Saturday and Sunday swap meets, congestion occurs along Moanalua Road and Kaonohi Street due to the single entrance located just south of the intersection of Moanalua Road/Kaonohi Street causing a bottleneck along Kaonohi Street. The exit is located approximately 570 feet south of the entrance

[1] The ideal freeway lane capacity is 1,900 vehicles/lane/hour.

across the Pearlridge Center Driveway 2. The entrance and exit were swapped in July 2011 and were anticipated to relieve some of the congestion caused by the Swap Meet. However, traffic counts and observation were taken prior to the adjustment and therefore only discuss prevailing conditions at the time of the observations.

Results of Intersection Analysis

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

Moanalua Road/Harbor Pointe Driveway

This unsignalized T-intersection operates at LOS D or better during the peak hours of traffic. Due to heavy through traffic along Moanalua Road, a median acceleration lane is provided for northbound left-turning vehicles at the intersection. This allows a vehicle to find gaps in traffic one direction at a time. Once there is a gap in the eastbound flow of traffic, a vehicle will turn onto Moanalua Road into the median acceleration lane and wait to find a gap in the westbound flow of traffic before continuing westbound. As a result, no heavy queuing occurs along the northbound approach.

Moanalua Road/Pearlridge Elementary School Driveway

This unsignalized T-intersection is located approximately 200 feet east of the Moanalua Road/Harbor Pointe intersection and operates at LOS C or better during the AM and Sat MD peak hours of traffic

The following were observed at the Pearlridge Elementary School Driveway:

- Vehicles making left-turn movements out despite the before and after school periods prohibition.
- Left-turn vehicles blocking the heavier right-turn movements.
- Long delays during the PM peak hour of traffic, LOS E, due to the difficulty making the left-turn out despite the refuge lane along Moanalua Road.

Restriping the driveway with an exclusive right-turn lane and left-turn lane would allow the right-turn movements to operate at LOS D or better.

Moanalua Road/Kaonohi Street

Overall this intersection operates at LOS C(D)[D] during the AM(PM)[Sat MD] peak hours of traffic. The intersection provides the only access for the Pearlridge Estates Subdivision and the south legs provide access to multiple driveways into the Pearlridge Center and Westridge Shopping Centers. Field observations indicate that during the AM peak hour of traffic, a heavy eastbound flow of traffic occasionally spills as far back as the Pearlridge Elementary School Driveway. All vehicles typically clear the intersection after one (1) signal cycle. During the weekday PM peak hour of traffic, westbound traffic occasionally queue to the Sizzler Restaurant, approximately 1,400 feet east of the intersection. The majority of vehicles clear the intersection after one (1) signal cycle. During the Sat MD peak hour of traffic, the westbound left-turn movement would occasionally queue beyond the length of the left-turn storage lane and spill back beyond the Moanalua Road/Ualo Street intersection into the inside westbound through lane. Approximately ten (10) to 12 vehicles in the left-turn storage lane would clear the intersection in one (1) signal cycle length while the remaining vehicles required two (2) signal cycle lengths. Spillback into the through lane was not frequent and did not appear to affect throughput progression along Moanalua Road.

Due to preference given to the major thoroughfare, the minor approach movements and mainline left-turn movements operate at LOS E or worse during the peak hours of traffic.

Kaonohi Street/RIRO Driveway – as noted earlier the following description is of the observed conditions prior to the driveway reconfiguration

This intersection is a right-in/right-out (RIRO) access into the Swap Meet. A median with a fence separates the northbound and southbound approaches, restricting left-turn movements at the intersection. The RIRO access is restricted except on Wednesdays, Fridays, Saturdays and Sundays when the Swap Meet takes place. A single shared southbound right-turn/through lane provides access into the Swap Meet. Field observations indicate that during the Sat MD peak

hour of traffic, vehicles entering the Swap Meet progressed slowly, forming queues further north. The intersection overall operates at LOS D or better during the Sat MD peak hour of traffic.

Kaonohi Street/Pearlridge Center Driveway 1

This intersection currently operates satisfactorily, LOS B or better during the peak hours of traffic. However, due to higher through traffic along Kaonohi Street and left-turners going into the Pearlridge Center during the Sat MD peak hour of traffic, the westbound left-turn movement out of the Pearlridge Center Driveway 1 operates at LOS F. Since the intersection is located near the south end of the median fencing along Kaonohi Street, the southbound approach of the intersection does not have a designated left-turn storage lane. Buffer space in the median provides storage for one (1) or two (2) vehicles without impeding traffic flow. Field observations indicate that due to internal congestion within the Pearlridge Center parking lot, the southbound left-turn movement is restricted from turning and results in occasional queues of approximately four (4) to five (5) vehicles that spill back into the southbound through lane, impeding traffic flow.

Kaonohi Street/Pearlridge Center Driveway 2

This intersection currently operates at LOS D or better during the weekday AM(PM) peak hours of traffic. The eastbound approach provides an outlet for vehicles exiting the KFC Restaurant Drive-Thru. In addition, during the Sat MD peak hour of traffic, the eastbound approach provides the only exit for vehicles leaving the Swap Meet. As a result of the traffic volume conflicting with the heavy eastbound volume during the Saturday MD peak hour of traffic, the eastbound and westbound approaches operate at LOS F and overcapacity conditions.

Kaonohi Street/Westridge (north) Driveway

This intersections currently operates at LOS D or better during the AM(PM)[Sat MD] peak hours of traffic.

Kaonohi Street/Westridge (south) Driveway

This intersections currently operates at LOS D or better during the AM(PM)[Sat MD] peak hours of traffic.

Kaonohi Street/Anna Miller's Driveway

This intersections currently operates at LOS D or better during the AM(PM)[Sat MD] peak hours of traffic.

Kaonohi Street/Moanalua Loop

This intersections currently operates at LOS D or better during the weekday AM(PM) peak hours of traffic. The eastbound approach operates at LOS E due to high delays during the Sat MD peak hour of traffic. Since the intersection is only 200 feet north of the congested Kamehameha Highway/Kaonohi Street intersection, vehicles typically spill back along the southbound approach at the Kaonohi Street/Moanalua Loop intersection during the peak hours of traffic. These queued southbound vehicles typically leave gaps for eastbound left-turners, thus reducing the delay for this movement.

Intersections along Kamehameha Highway

Intersections along Kamehameha Highway generally operate with heavier volume in the eastbound direction during the AM peak hour of traffic, westbound direction during the weekday PM peak hour of traffic and in both directions during the Sat MD peak hour of traffic.

Along the approximate mile stretch of highway that is within the study area there are four (4) bus stops provided in either direction which service approximately seven (7) different bus routes. Therefore, bus stops along Kamehameha Highway are frequent and sometimes affect vehicular operations.

All the study intersections along Kamehameha Highway are also signalized and operating on a coordinated system where the mainline, Kamehameha Highway, is given preference. Therefore, the minor approaches experience longer delays as a result.

During the AM peak hour of traffic, although traffic volume was observed to be heavier in the eastbound direction, queues were able to clear after each cycle length.

During the weekday PM peak hour of traffic, the queue in the westbound direction was observed to extend near the Moanalua Freeway off-ramp. The right-most lane in general had longer queues due to bus stops and heavy right-

turns onto the various streets and driveways. The study intersections were observed to operate at overcapacity condition. Therefore, the traffic volume collected is the roadway capacity in the westbound direction and not the actual demand. In order to provide more accurate analyses inside the model the westbound traffic volume was increased during the weekday PM peak hour to match observed conditions.

During the Sat MD peak hour, the traffic volume in either direction was similar with queues occasionally extending into the adjacent intersections. However, congestion was observed to ebb and flow and was generally observed to operate satisfactorily.

Kamehameha Highway/Kaonohi Street

Overall this intersection operates at LOS C(F*[2])[C] during the AM(PM)[Sat MD] peak hours of traffic.

During the AM peak hour of traffic, eastbound through vehicles extend to the length of the approximately 500-foot left-turn storage lane. The traffic signal at the Kamehameha Highway/Lipoa Street intersection, located approximately 530 feet east of the intersection, occasionally form queues along the eastbound approach that spill back beyond the Kamehameha Highway/Kaonohi Street intersection. As a result, the eastbound approach experiences on average a 10 -15 second period where no vehicles progress through the intersection followed by slow throughput progression. However, due to recent signal coordination, all vehicles clear the intersection after one (1) cycle Length.

During the weekday PM peak hour of traffic, Kamehameha Highway becomes congested in the westbound direction. After 5:00 PM, westbound vehicles along Kamehameha Highway typically queue beyond McGrew Point. Progression is slow with frequent stop-and-go type travel.

During the Sat MD peak hour of traffic, a heavy southbound left-turn movement occasionally queues beyond the Kaonohi Street/Westridge (north) intersection. Eastbound vehicles also experience an occasional 10-12 second stoppage due to spillback caused by the Kamehameha Highway/Lipoa Street

[2] * denotes overcapacity conditions.

intersection. Most vehicles at each movement typically clear after one (1) cycle length. The eastbound right-most left-turn lane was observed to queue approximately the length of the pocket while the left-most lane had only three (3) to four (4) vehicles. This is due to the fact that access to the Pearlridge Center is located on the east side of Kaonohi Street.

Generally, the eastbound left-turn movement along Kamehameha Highway (mainline) and southbound approach along Kaonohi Street (minor street) operate at LOS E conditions during the weekday PM and Sat MD peak hours of traffic. In addition, due to increased traffic generated by the Swap Meet and the Pearlridge Center, the southbound approach operates with a v/c[3] ratio > 1.0 and LOS F conditions during the Sat MD peak hour of traffic.

Kamehameha Highway/Kanuku Street

No problems were observed at this intersection during the AM peak hour of traffic.

During the PM peak hour of traffic, the westbound direction operated with long delays due to the heavy volumes. In general, the two (2) right-most lanes were more heavily utilized than the left-most lane.

During the Sat MD peak hour of traffic, traffic was observed to operate relatively smoothly at LOS D or better except the .westbound left-turn at LOS E.

Kamehameha Highway/Hekaha Street

No problems were observed at this intersection during the weekday AM peak hour of traffic.

During the weekday PM peak hour of traffic, the westbound direction was observed to be congested due to the heavy demand as described earlier.

During the Sat MD peak hour of traffic, the intersection was observed to operate satisfactorily at LOS C. However, some of the left-turn movements experience longer delays, LOS E or F the other movement operates at LOS D or better.

[3] Volume to capacity ratio (v/c) is a measure of the traffic demand over the roadway/intersection capacity within one hour. v/c greater than 1 indicate that the traffic volume demand is greater than what the roadway/intersection can handle during one hour.

Kamehameha Highway/Lipoa Street

As mentioned earlier, although the intersection was observed to queue in the eastbound direction during the weekday AM peak hour of traffic, the queue was observed to clear after one (1) cycle length.

During the weekday PM and Sat MD peak hours of traffic the westbound movement was often observed to queue into the intersection and the rightmost lane more heavily utilized then the two (2) leftmost lanes because the rightmost lane provides access to Kaonohi Street which provides access to the commercial areas as well as Moanalua Road. However, during the Sat MD peak hour of traffic, the queue was observed to ebb and flow.

Kamehameha Highway/Pali Momi Inbound and Outbound

These intersections mostly provide ingress and egress to and from the Pearl Ridge Center onto Kamehameha Highway while also providing access to Moanalua Road. The delay experienced along the minor approaches and major approaches left-turn movements are mostly due to the long cycle length with preference given to the major through movements.

These intersections operate similar to the previous intersections along Kamehameha Highway during the peak hours of traffic.

See Figure 3 for the existing intersection lane configuration and existing traffic volumes and overall LOS. Table 1 shows the Existing Level of Service Summary for individual turning movements.

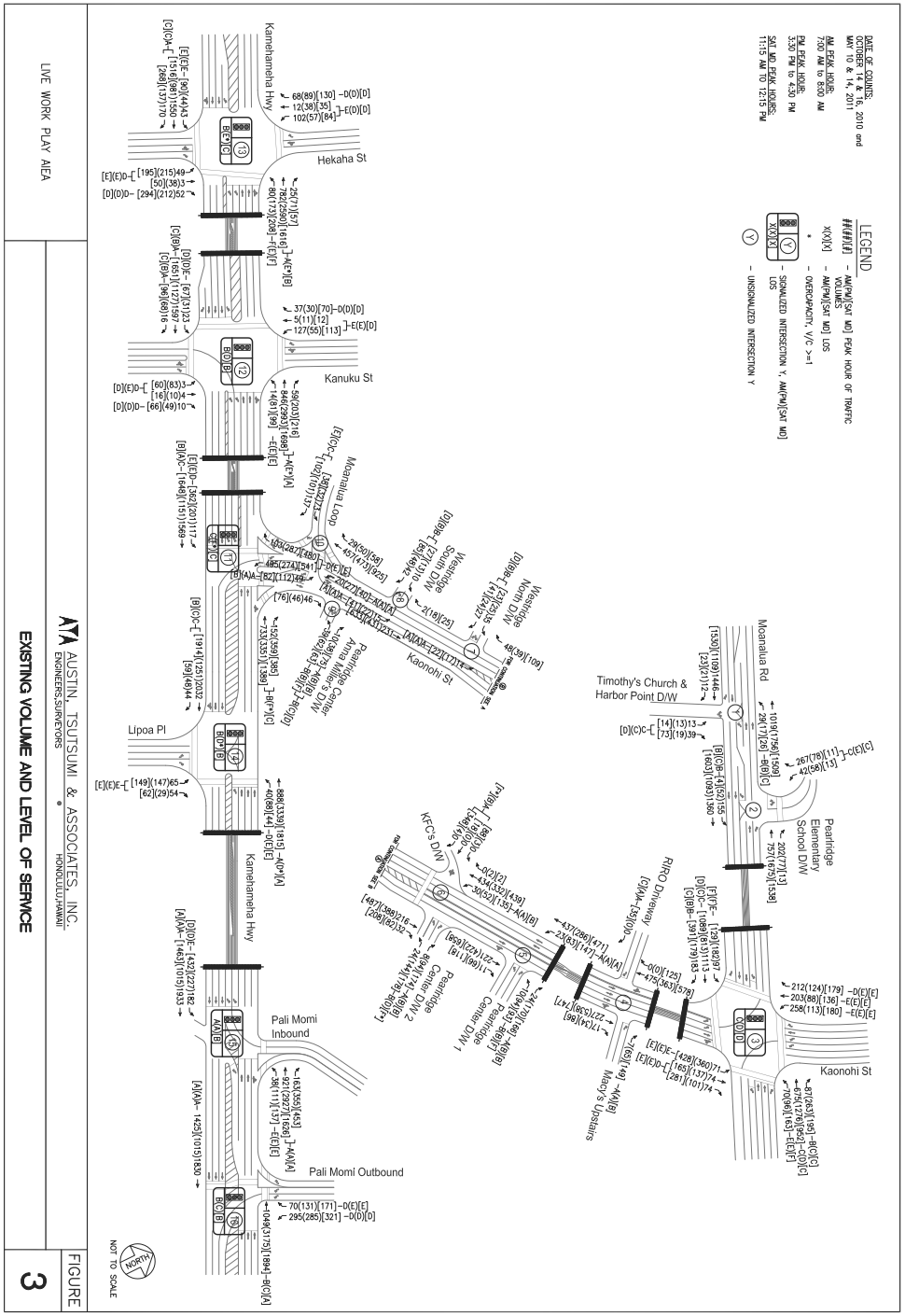

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FIGURE 3

EXISTING VOLUME AND LEVEL OF SERVICE

Table 1: Existing Level of Service Summary

INTERSECTION	Existing Conditions								
	AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Moanalua Road & Harbor Pointe									
WB LT	15	0.08	B	12	0.03	B	15	0.08	C
NB LT/RT	23	0.22	C	18	0.11	C	28	0.38	D
2: Moanalua Road & Pearlridge Elementary School									
EB LT	11	0.22	B	18	0.17	C	14	0.01	B
SB LT/RT	21	0.61	C	38	0.59	E	23	0.11	C
3: Moanalua Road & Kaonohi Street									
EB LT	58	0.56	E	85	0.81	F	80	0.71	F
EB TH	28	0.71	C	24	0.47	C	41	0.77	D
EB RT	18	0.13	B	19	0.12	B	30	0.31	C
WB LT	58	0.47	E	78	0.64	E	80	0.76	F
WB TH	23	0.44	C	38	0.81	D	34	0.64	C
WB RT	19	0.06	B	24	0.22	C	25	0.13	C
NB LT	58	0.34	E	77	0.82	E	73	0.82	E
NB TH/RT	52	0.25	D	60	0.33	E	58	0.48	E
SB LT	56	0.63	E	76	0.56	E	75	0.65	E
SB TH	56	0.69	E	76	0.60	E	77	0.69	E
SB RT	45	0.15	D	68	0.09	E	64	0.12	E
Overall	35	0.67	C	45	0.79	D	49	0.81	D
4: Kahonohi Street & RIRO Driveway									
EB RT	0	0.00	A	0	0.00	A	15	0.10	C
WB RT	9	0.01	A	10	0.08	A	11	0.22	B
5: Kaonohi Street & Pearlridge Driveway 1									
WB LT	13	0.02	B	14	0.21	B	131	0.90	F
WB RT	9	0.03	A	12	0.25	B	14	0.31	B
SB LT/TH	1	0.02	A	5	0.09	A	6	0.20	A
6: Kaonohi Street & Pearlridge Driveway 2									
EB LT/TH/RT	0	0.00	A	14	0.02	B	441	1.88	F*
WB LT	14	0.06	B	33	0.56	D	n/a	6.91	F*
WB TH/RT	9	0.01	A	11	0.14	B	13	0.31	B
SB LT	8	0.03	A	9	0.05	A	10	0.17	B
7: Kaonohi Street & Westridge (north)									
EB LT/RT	13	0.13	B	14	0.12	B	25	0.28	D
NB LT/TH	1	0.01	A	1	0.02	A	1	0.04	A
8: Kaonohi Street & Westridge (south)									
EB LT/RT	11	0.08	B	12	0.11	B	27	0.43	D
NB LT/TH	2	0.01	A	1	0.02	A	2	0.06	A
9: Kaonohi Street & Anna Miller's Driveway									
WB LT/RT	12	0.10	B	16	0.25	C	28	0.49	D
SB LT/TH	2	0.02	A	2	0.03	A	2	0.05	A
10: Kaonohi Street & Moanalua Loop									
EB LT/RT	16	0.41	C	16	0.31	C	45	0.65	E
NB LT	9	0.05	A	9	0.12	A	11	0.13	B

Note:
* = overcapacity conditions, v/c > 1
n/a = applies to unsignalized intersection and usually operates better than shown in the analysis

Table 1: Existing Level of Service Summary cont'd

INTERSECTION	Existing Conditions								
	AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
11: Kamehameha Highway & Kaonohi Street									
EB LT	48	0.49	D	68	0.61	E	63	0.86	E
EB TH	27	0.58	C	7	0.32	A	16	0.58	B
WB TH/RT	14	0.40	B	189	1.36	F*	25	0.87	C
SB LT/RT	40	0.53	D	57	0.72	E	57	0.86	E
SB RT	33	0.08	C	48	0.13	D	45	0.45	D
Overall	26	0.57	C	134	1.16	F*	31	0.86	C
12: Kamehameha Highway & Kanuku Street									
EB LT	62	0.38	E	51	0.47	D	54	0.65	D
EB TH	7	0.52	A	11	0.38	B	22	0.65	C
EB RT	7	0.01	A	15	0.06	B	24	0.09	C
WB LT	75	0.22	E	62	0.40	E	67	0.45	E
WB TH/RT	7	0.31	A	57	1.04	E*	9	0.76	A
NB LT/TH	47	0.03	D	65	0.67	E	45	0.30	D
NB RT	47	0.01	D	50	0.03	D	40	0.05	D
SB LT/TH	65	0.73	E	58	0.55	E	53	0.53	D
SB RT	47	0.03	D	50	0.02	D	41	0.05	D
Overall	12	0.53	B	46	0.97	D	20	0.66	B
13: Kamehameha Highway & Hekaha Street									
EB LT	56	0.46	E	66	0.47	E	66	0.74	E
EB TH/RT	10	0.60	A	29	0.51	C	27	0.87	C
WB LT	87	0.40	F	66	0.59	E	91	0.78	F
WB TH/RT	1	0.28	A	73	1.12	E*	11	0.79	B
NB LT/TH	52	0.40	D	63	0.84	E	55	0.76	E
NB RT	48	0.04	D	37	0.16	D	39	0.43	D
SB LT/TH	66	0.72	E	40	0.42	D	43	0.48	D
SB RT	48	0.05	D	35	0.07	D	33	0.10	C
Overall	15	0.61	B	58	1.01	E*	28	0.82	C
14: Kamehameha Highway & Lipoa Street									
EB TH/RT	21	0.65	C	21	0.44	C	12	0.69	B
WB LT	51	0.44	D	60	0.57	E	80	0.55	E
WB TH	3	0.25	A	40	1.06	D*	4	0.56	A
NB LT/RT	62	0.60	E	62	0.72	E	63	0.76	E
Overall	18	0.63	B	36	1.00	D*	12	0.72	B
15: Kamehameha Highway & Pali Momi Inbound									
EB LT	76	0.60	E	51	0.65	D	39	0.78	D
EB TH/RT	1	0.52	A	2	0.30	A	5	0.44	A
WB LT	71	0.43	E	64	0.64	E	68	0.70	E
WB TH/RT	0	0.31	A	6	0.97	A	5	0.68	A
Overall	6	0.51	A	9	0.93	A	11	0.70	B
16: Kamehameha Highway & Pali Momi Outbound									
EB TH	6	0.66	A	3	0.31	A	3	0.44	A
WB TH	12	0.38	B	21	0.96	C	9	0.59	A
SB LT	41	0.37	D	53	0.60	D	50	0.58	D
SB RT	36	0.06	D	62	0.70	E	65	0.77	E
Overall	12	0.58	B	20	0.91	C	13	0.63	B

Note:
* = overcapacity conditions, v/c > 1

III. BASE YEAR SCENARIOS

The Years 2015, 2017, 2019 and 2021 were selected as the Base Years to reflect the completion year of Phase 1, 2, 3 and 4 respectively. Base Years 2015, 2017, 2019 and 2021 projections were formulated by applying a defacto growth rate and trips generated by other known developments as described in the following sections.

A. Defacto Growth Rate

A defacto growth rate was estimated based on population data obtained from the Oahu Regional Transportation Plan (ORTP) 2030. The ORTP forecasts population and employment growth within designated regions around Oahu from year 2005 to a baseline year of 2030. Most of the Pearl City-Aiea region has already been built out to full development, thus future traffic growth will be minimal. However, due to frequent travel between the Ewa, Pearl City, Aiea and Honolulu regions, an average population growth was taken from these regions and forecasted to conservatively yield an annual growth rate of about 1.04 percent growth per year.

B. Traffic Forecasts for Other Known Developments

The only known project in the area is the Aiea Town Center, which was initially proposed in 2001. Since this project is still in the planning stages and has no current phasing plan, it was not included in the analysis of the study for any of the Base Years.

C. Transit Project

The Honolulu High-Capacity transit Corridor Project (HHCTCP) or Rail Transit (RT) is a planned rail transit system that is anticipated to reduce vehicular traffic in the surrounding Proposed Project area.

According to the Honolulu High-Capacity Transit Corridor Project (HHCTCP), Final Environmental Impact Statement (EIS), dated June 2010, the RT will be a fixed guideway rail system that is projected to span 20 miles between East Kapolei and Honolulu when completed in 2019. Twenty-one transit stations will be placed throughout the length of the rail line for boarding and de-boarding of transit passengers at major destinations of travel.

Impacts:

Chapter 3 of the HHCTCP EIS analyzed transportation conditions for three (3) scenarios; Existing Year 2005 conditions, Future Year 2030 without the HHCTCP (No Build Alternative) and Future Year 2030 with the HHCTCP. The HHCTCP study analyzes the major roadways on a system-wide basis, accounting for reductions made to vehicular trips at select locations or screenlines. The HHCTCP Final EIS also looks at vehicular traffic reductions based on trip purposes (ie. trips to and from work, trips to and from shopping, etc.).

Due to the fact that the EIS does not breakdown the HHCTCP impact by phases and due to changing construction schedule the transit trip reduction was only applied to Base Year of 2019 and 2021.

Table 2 shows the calculated percent reductions that were applied to Base Year 2019 and 2021 traffic volume projections.

Although the RT is anticipated to provide vehicular traffic reductions, the RT could potentially attract upwards of 145 new vehicles during the weekday AM or PM peak hours of traffic, due to increased demand for kiss-and-ride vehicles, added bus operations and spillover parking at the Pearlridge transit station. Based on Addendum 02 to the Transportation Technical Report HHCTCP, these trips were assigned to the roadway networks and assumed to be accounted for in the projected screenline reductions.

Table 2: HHCTCP Trip Reduction

Vehicle Trip Reductions Due to HHCTCP [1]			
Affected Roadways	**Direction**	**% Reduction AM (PM) [Sat MD [2]]**	**Description**
Vehicle Reductions Based on Screenline Impacts[3]			
Moanalua Road	Westbound	16% (16%) [16%]	As shown in Table 3-9 & 3-10 of the HHCTCP Final EIS, vehicular traffic volume projections were taken at various screenline locations near the proposed rail line. These percentages reflect the vehicular volume reduction at the Kalauao screenline as a result of the rail. These reductions were applied to the eastbound/westbound through movement along Moanalua Road and Kamehameha Highway.
	Eastbound	25% (6%) [10%]	
Kamehameha Highway	Westbound	3% (10%) [8%]	
	Eastbound	16% (3%) [8%]	
Vehicle Reductions Based on Transit Trip Purposes[4]			
Affected Roadways	**Trip Purpose**	**% Reduction AM (PM) [Sat MD]**	**Description**
Moanalua Road, Kamehameha Highway & Kaonohi Street	To and from work	12% (12%) [N/A]	A 12% vehicle reduction reflects residents who will use the rail for work purposes. To account for these potential transit users, the 12% vehicle reduction was applied to weekday AM peak hour movements exiting a residential subdivision and weekday PM peak hour movements entering a residential subdivision.
	To and from shopping/other	N/A (4.5%) [4.5%]	A 4.5% vehicle reduction reflects residents who will use the rail for shopping purposes.

Source: Honolulu High-Capacity Transit Corridor Project Environmental Impact Statement, June 2010

Notes:

HHCTCP = Honolulu High-Capacity Transit Corridor Project
[1] Percent reductions based on projected daily vehicular and transit usage and calculated peak hour factors.
[2] Percent reduction rates for Saturday were not accounted for in the HHCTCP EIS. These rates were estimated based on projected weekday AM and PM peak hour reductions
[3] Percent reduction applied to Base Year traffic along the existing roadways. Screenlines are imaginary lines crossing major corridors at strategic locations and are used to determine the amount of traffic crossing the screenlines
[4] Percent reduction applied to the Proposed Project generated trips

D. Base Year Analysis

The roadways in the Proposed Project vicinity are fully buildout and therefore, no right-of-way (ROW) exists for recommended geometric improvements. In order to simplify the analysis discussion, the Base Year analyses were combined into two (2) sections:

1. Base Year 2015 to 2021
2. Base Year with RT 2019 and 2021

Base Year 2015 to 2021

Weekday AM peak hour of traffic:

During the AM peak hour of traffic, the existing prevailing traffic operating conditions would continue. In general, Kamehameha Highway and Moanalua Road are expected to operate at LOS D or better along the through movement while some of the minor approaches would operate with delays of LOS E or F due to preference given to the major approach.

Weekday PM peak hour of traffic:

The weekday PM peak hour of traffic is the most congested peak period. Existing conditions along Kamehameha Highway are at overcapacity in the westbound direction. The limited ROW available would not allow major roadway improvements required to improve traffic operations along Kamehameha Highway and Moanalua Road. Therefore, with each Base Year, traffic conditions would worsen as a result of the increased traffic demand.

Sat MD peak hour of traffic:

The Sat MD peak hour of traffic generally operates with delays worse than the weekday AM peak but better than the weekday PM peak hour of traffic. Overall, traffic operation along Kamehameha Highway and Moanalua Road would be satisfactory at LOS D or better while some of the minor street approach as well as major approach left-turn movements would experience delays of LOS E and F.

The intersections of Moanalua Road/Kaonohi Street westbound left-turn lane and Kamehameha Highway/Pali Momi Outbound westbound left-turn lane do not provide sufficient storage. However, not enough space is available to extend the pocket. Although it appears that there is space in the median to extend the westbound left-turn at the Pali Momi Outbound intersection, it may not be desirable because the left-turn could potentially block the southbound left-turn movements.

See Figures 4 to 7 for Base Year 2015, 2017, 2019 and 2021 without Proposed Project volumes and LOS.

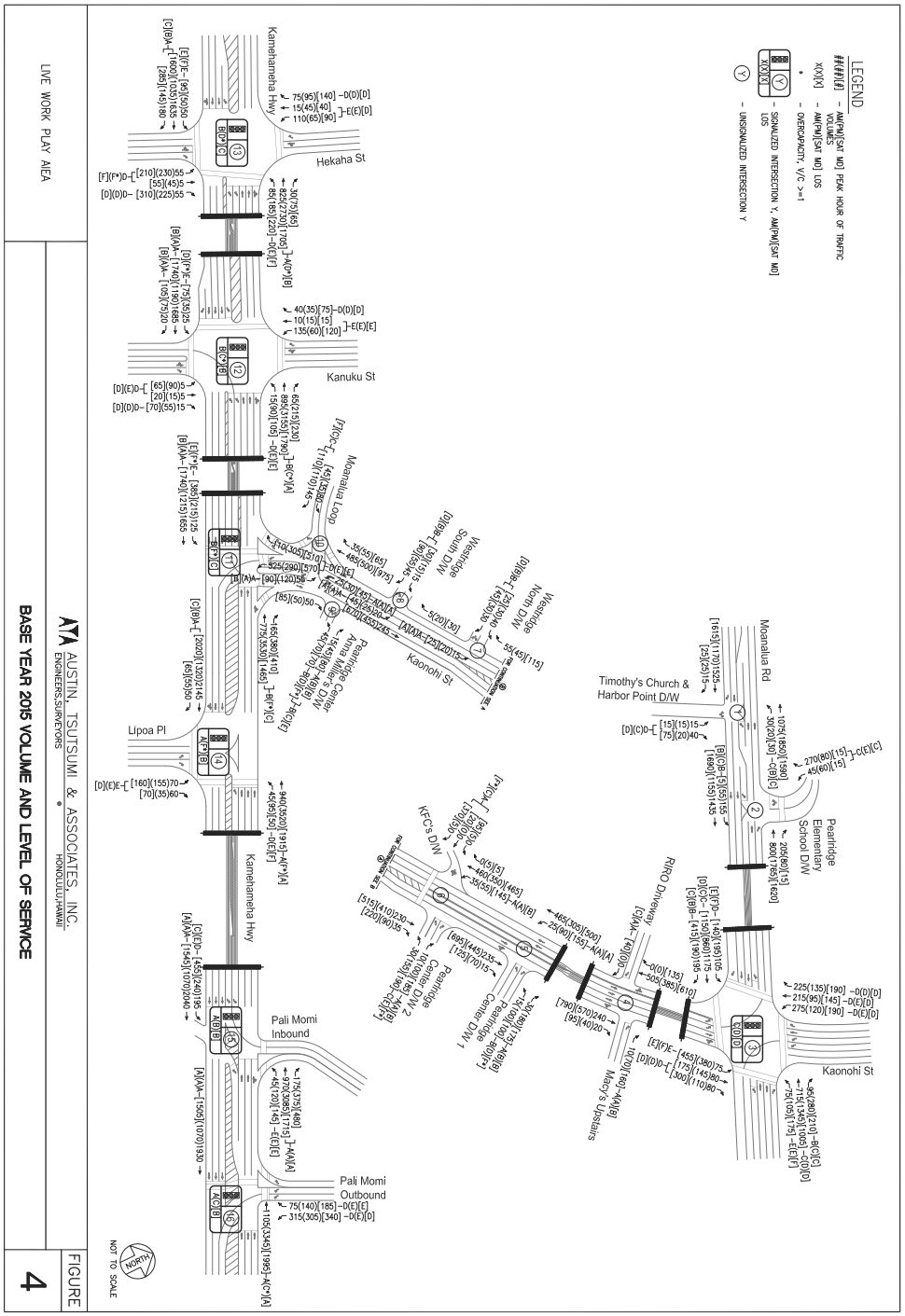

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FIGURE 4

BASE YEAR 2015 VOLUME AND LEVEL OF SERVICE

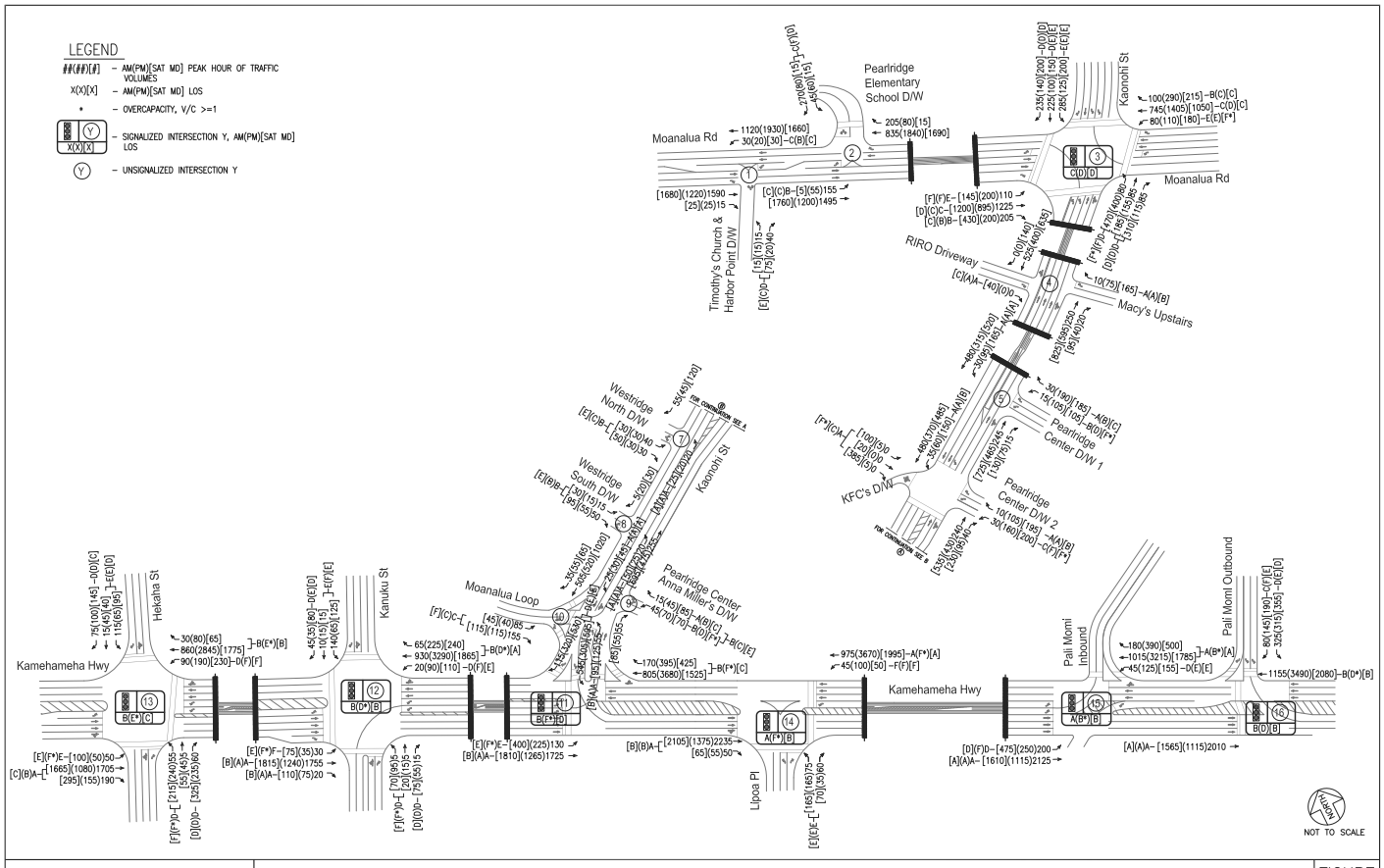

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FIGURE 6

BASE YEAR 2019 VOLUME AND LEVEL OF SERVICE

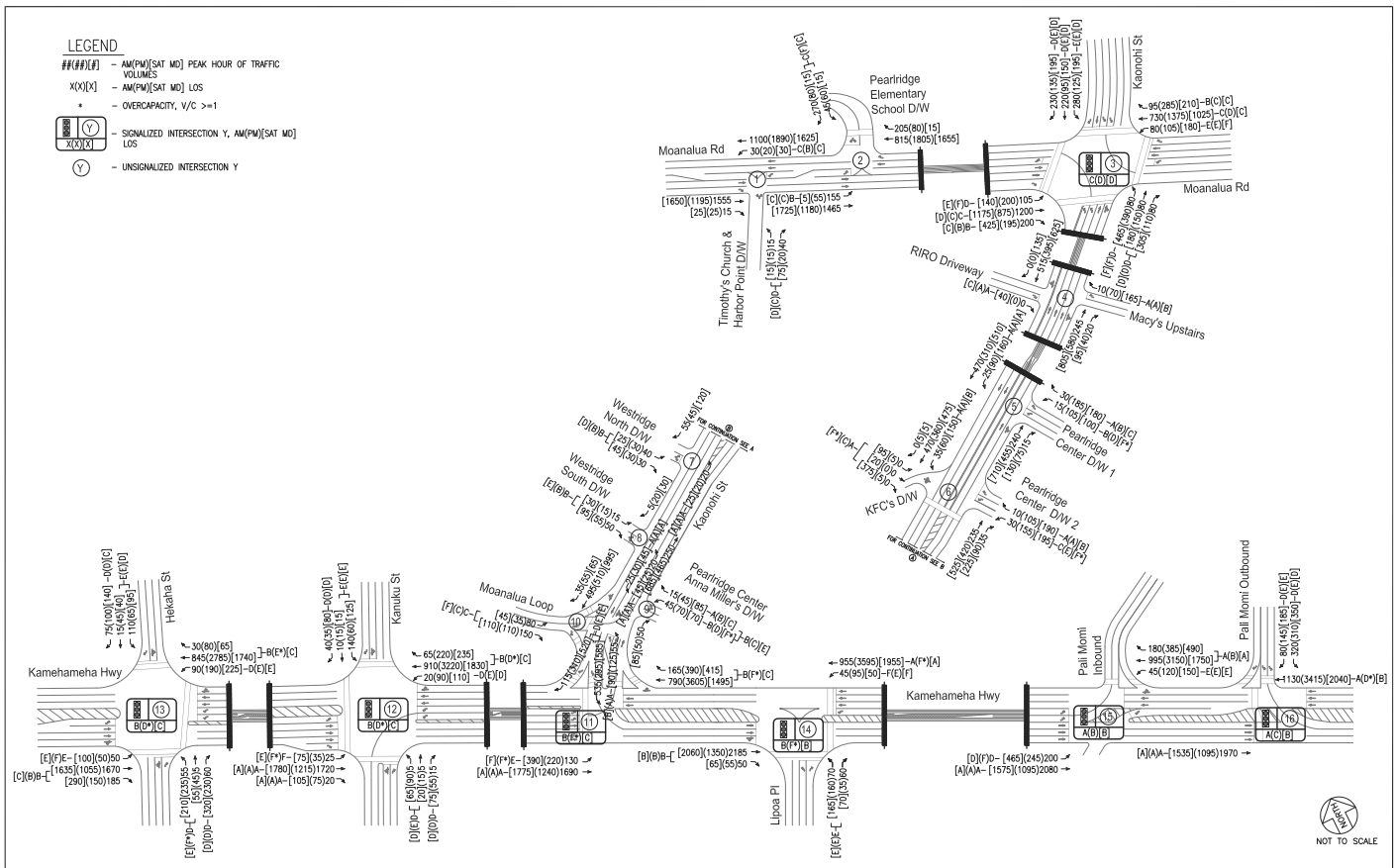

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FIGURE 5

BASE YEAR 2017 VOLUME AND LEVEL OF SERVICE

Base Year with RT 2019 and 2021

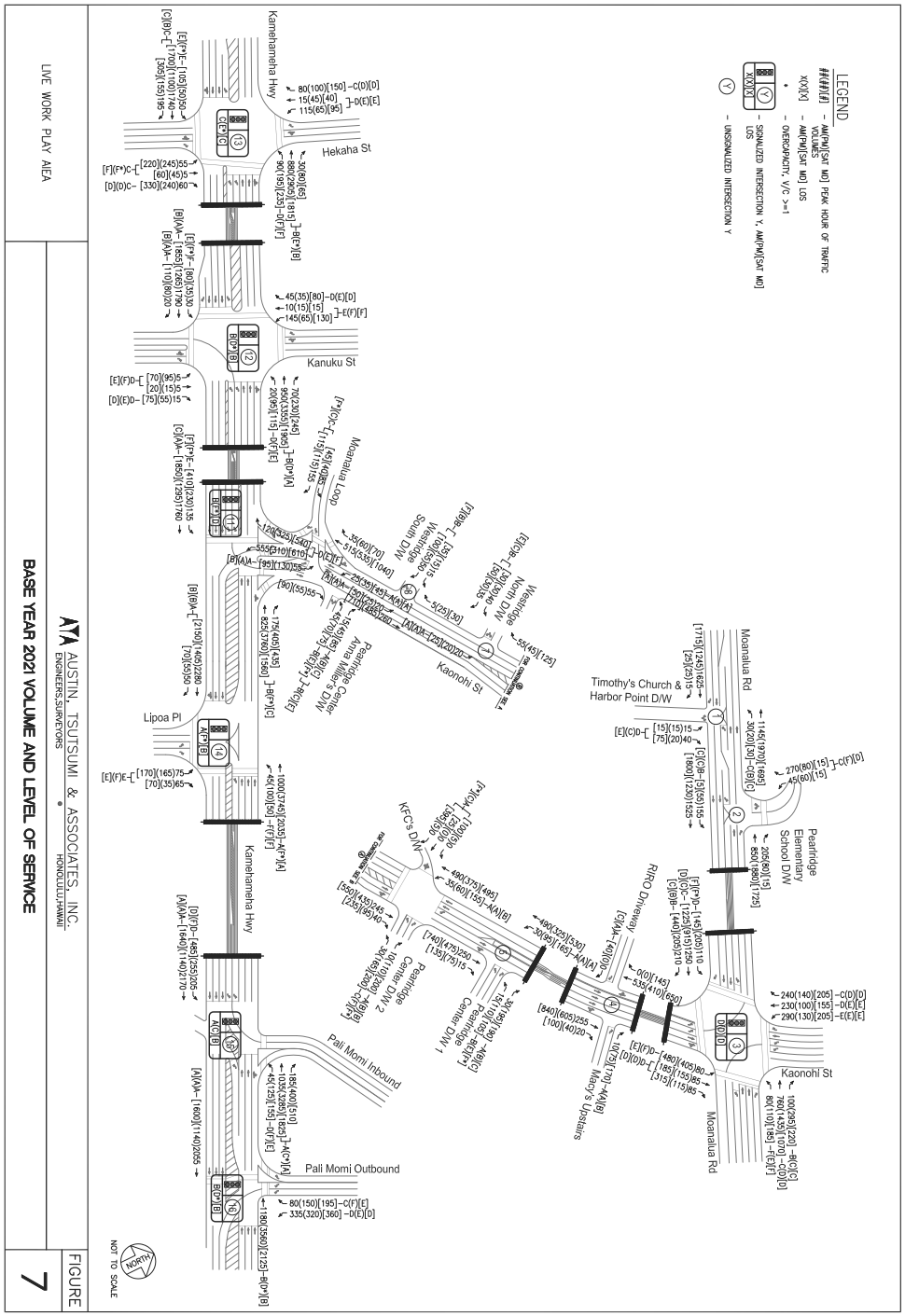
With the RT anticipated completion by year 2019, traffic volume along Moanalua Road and Kamehameha Highway will decrease – see Table 2 for the percent reduction applied – and will slightly improve traffic operations. Overall, the traffic volume in the westbound direction is reduced by 3%(10%)[8] and in the eastbound direction by 16%(3%)[8%] during the AM(PM)[Sat MD] peak hour of traffic respectively.

The most noticeable improvement is during the weekday PM peak hour of traffic with approximately 10 to 20 second overall delay reduction along Kamehameha Highway. Although the congested intersections along Kamehameha Highway would continue to operate at overcapacity conditions, the overall delays would improve as well as the westbound through movement delay.

Note that although the Kanuku Street/Kamehameha Highway intersection westbound approach is shown to operate at LOS A during the weekday PM peak hour of traffic during Base Year 2019, the v/c ratio is at capacity. Therefore, the approach would effectively operate at LOS F.

Therefore, although the RT reduces traffic volume, prevailing conditions will continue.

See Figures 8 and 9 for the Base Year 2019 and 2021 with RT volumes and LOS and Tables 3a and 3b for the scenarios LOS summary.



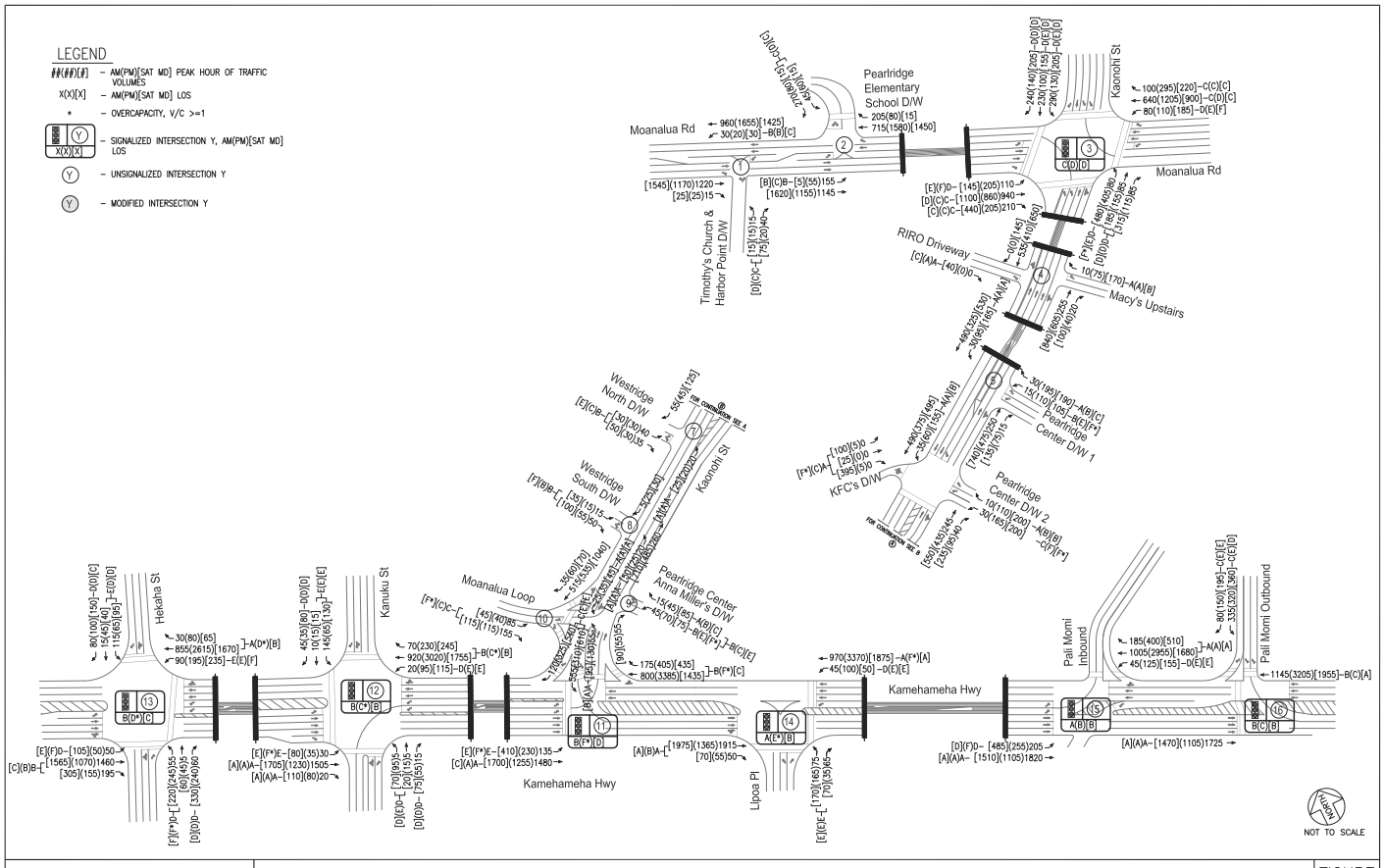


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FIGURE 9

BASE YEAR 2021 WITH RAIL TRANSIT VOLUME AND LEVEL OF SERVICE

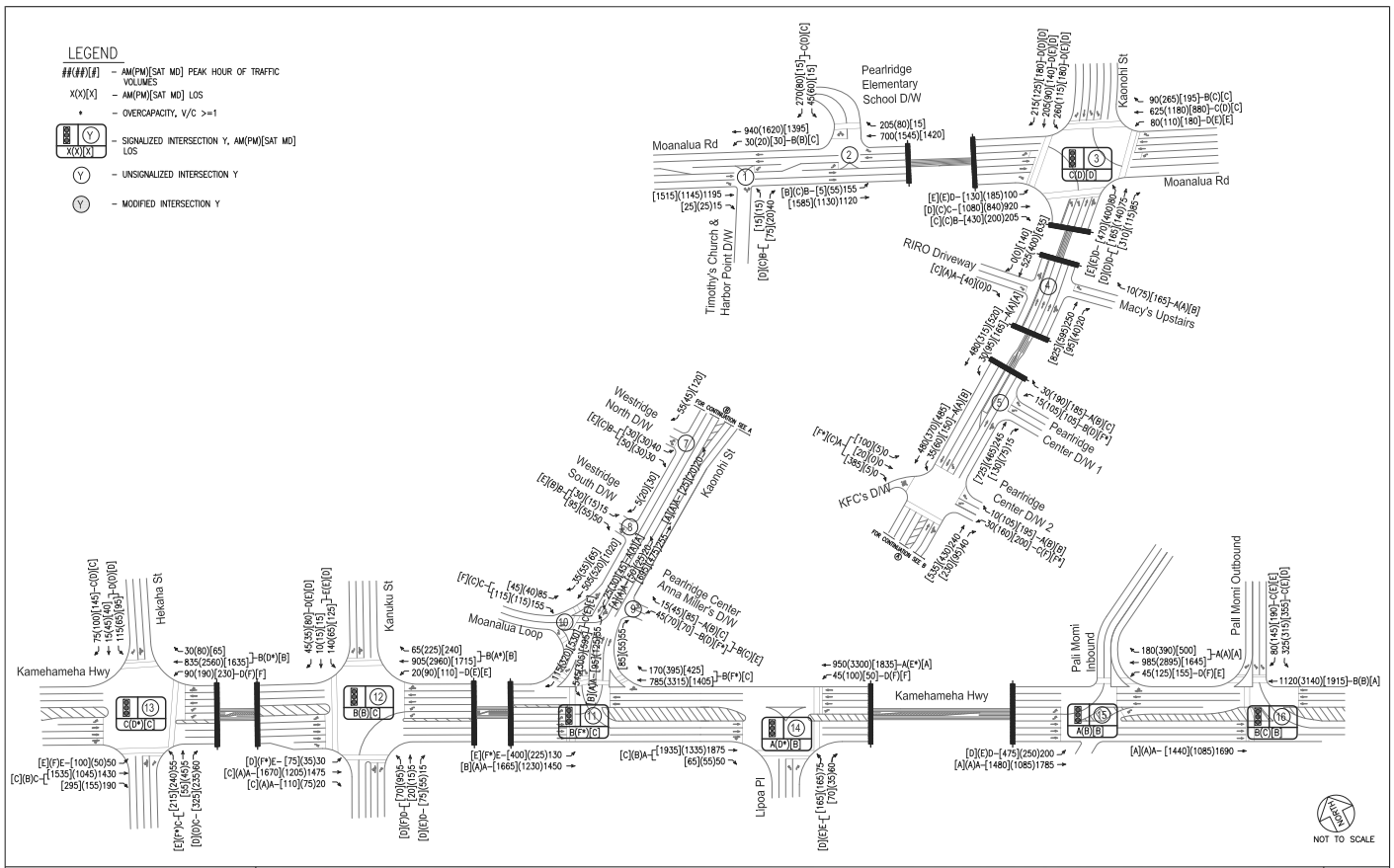

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FIGURE 8

BASE YEAR 2019 WITH RAIL TRANSIT VOLUME AND LEVEL OF SERVICE

Table 3a: Existing, Base Year 2015, Base Year 2017 and Base Year 2019 Level of Service Summary cont'd

INTERSECTION	Existing Conditions 2010									Base Year 2015									Base Year 2017									Base Year 2019								
	AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
12: Kamehameha Highway & Kanuku Street																																				
EB LT	62	0.38	E	51	0.47	D	54	0.65	D	73	0.54	E	235	1.09	F*	55	0.68	D	82	0.54	F	235	1.09	F*	79	0.74	E	94	0.66	F	296	1.23	F*	60	0.74	E
EB TH	7	0.52	A	11	0.38	B	22	0.65	C	6	0.57	A	5	0.39	A	19	0.63	B	3	0.58	A	5	0.40	A	6	0.64	A	5	0.60	A	5	0.40	A	20	0.67	B
EB RT	7	0.01	A	15	0.06	B	24	0.09	C	3	0.02	A	2	0.06	A	18	0.10	B	0	0.02	A	1	0.06	A	2	0.09	A	1	0.02	A	1	0.06	A	18	0.10	B
WB LT	75	0.22	E	62	0.40	E	67	0.45	E	48	0.30	D	77	0.50	E	63	0.46	E	52	0.46	D	76	0.50	E	50	0.56	D	44	0.28	D	82	0.56	F	61	0.48	E
WB TH/RT	7	0.31	A	57	1.04	E*	9	0.76	A	14	0.33	B	31	1.06	C*	7	0.74	A	14	0.34	B	42	1.08	D*	24	0.76	C	15	0.35	B	46	1.09	D*	9	0.77	A
NB LT/TH	47	0.03	D	65	0.67	E	45	0.30	D	42	0.04	D	75	0.74	E	52	0.52	D	41	0.04	D	75	0.74	E	51	0.52	D	41	0.04	D	92	0.80	F	52	0.54	D
NB RT	47	0.01	D	50	0.03	D	40	0.05	D	42	0.01	D	53	0.04	D	45	0.05	D	41	0.01	D	53	0.04	D	45	0.05	D	41	0.01	D	60	0.04	E	44	0.05	D
SB LT/TH	65	0.73	E	58	0.55	E	53	0.53	D	60	0.73	E	67	0.63	E	70	0.78	E	60	0.74	E	67	0.63	E	71	0.79	E	60	0.74	E	83	0.70	F	72	0.80	E
SB RT	47	0.03	D	50	0.02	D	41	0.05	D	42	0.03	D	53	0.03	D	46	0.06	D	41	0.03	D	53	0.03	D	45	0.06	D	41	0.03	D	61	0.05	E	45	0.06	D
Overall	12	0.53	B	46	0.97	D	20	0.66	B	13	0.57	B	29	1.01	C*	19	0.71	B	11	0.59	B	36	1.03	D*	20	0.76	C	13	0.60	B	40	1.05	D*	19	0.74	B
13: Kamehameha Highway & Hekaha Street																																				
EB LT	56	0.46	E	66	0.47	E	66	0.74	E	57	0.56	E	158	0.92	F	57	0.73	E	55	0.56	E	157	0.92	F	64	0.75	E	60	0.56	E	221	1.04	F*	62	0.75	E
EB TH/RT	10	0.60	A	29	0.51	C	27	0.87	C	10	0.65	A	14	0.50	B	27	0.86	C	12	0.66	B	14	0.51	B	31	0.89	C	10	0.68	A	18	0.52	B	28	0.90	C
WB LT	87	0.40	F	66	0.59	E	91	0.78	F	51	0.50	D	74	0.68	E	84	0.82	F	43	0.53	D	72	0.67	E	74	0.84	E	37	0.53	D	85	0.71	F	100	0.92	F
WB TH/RT	1	0.28	A	73	1.12	E*	11	0.79	B	9	0.30	A	55	1.08	D*	11	0.79	B	16	0.31	B	59	1.09	E*	25	0.82	C	13	0.32	B	60	1.10	E*	13	0.84	B
NB LT/TH	52	0.40	D	63	0.84	E	55	0.76	E	48	0.43	D	121	1.05	F*	83	0.94	F	48	0.43	D	139	1.11	F*	78	0.93	E	47	0.42	D	137	1.08	F*	82	0.95	F
NB RT	48	0.04	D	37	0.16	D	39	0.43	D	43	0.04	D	43	0.32	D	40	0.49	D	43	0.04	D	44	0.32	D	40	0.50	D	43	0.04	D	49	0.34	D	40	0.53	D
SB LT/TH	66	0.72	E	40	0.42	D	43	0.48	D	60	0.72	E	57	0.68	E	54	0.71	D	60	0.72	E	66	0.75	E	53	0.72	D	61	0.73	E	67	0.71	E	54	0.73	D
SB RT	48	0.05	D	35	0.07	D	33	0.10	C	43	0.06	D	41	0.14	D	35	0.11	D	43	0.06	D	42	0.17	D	35	0.11	C	43	0.06	D	47	0.18	D	34	0.11	C
Overall	15	0.61	B	58	1.01	E*	28	0.82	C	15	0.62	B	50	1.07	D*	29	0.88	C	19	0.63	B	53	1.09	D*	35	0.90	C	16	0.64	B	56	1.09	E*	31	0.87	C
14: Kamehameha Highway & Lipoa Street																																				
EB TH/RT	21	0.65	C	21	0.44	C	12	0.69	B	5	0.73	A	14	0.46	B	21	0.85	C	12	0.72	B	14	0.48	B	14	0.76	B	5	0.71	A	18	0.47	B	13	0.77	B
WB LT	51	0.44	D	60	0.57	E	80	0.55	E	52	0.52	D	72	0.64	E	93	0.67	F	84	0.74	F	73	0.63	E	86	0.67	F	91	0.78	F	82	0.68	F	110	0.76	F
WB TH	3	0.25	A	40	1.06	D*	4	0.56	A	3	0.27	A	182	1.38	F*	7	0.67	A	3	0.27	A	199	1.42	F*	5	0.61	A	3	0.28	A	114	1.23	F*	3	0.63	A
NB LT/RT	62	0.60	E	62	0.72	E	63	0.76	E	56	0.60	E	68	0.75	E	46	0.55	D	56	0.60	E	68	0.76	E	63	0.78	E	57	0.62	E	79	0.78	E	63	0.78	E
Overall	18	0.63	B	36	1.00	D*	12	0.72	B	7	0.70	A	136	1.28	F*	17	0.77	B	12	0.71	B	148	1.31	F*	13	0.78	B	8	0.70	A	87	1.16	F*	12	0.79	B
15: Kamehameha Highway & Pali Momi Inbound																																				
EB LT	76	0.60	E	51	0.65	D	39	0.78	D	50	0.60	D	80	0.88	E	33	0.80	C	50	0.61	D	105	0.97	F	40	0.80	D	40	0.61	D	93	0.91	F	37	0.80	D
EB TH/RT	1	0.52	A	2	0.30	A	5	0.44	A	2	0.56	A	3	0.31	A	8	0.47	A	2	0.57	A	3	0.32	A	6	0.48	A	3	0.58	A	1	0.32	A	8	0.49	A
WB LT	71	0.43	E	64	0.64	E	68	0.70	E	59	0.46	E	69	0.71	E	68	0.71	E	59	0.46	E	68	0.71	E	67	0.72	E	53	0.46	D	78	0.74	E	68	0.74	E
WB TH/RT	0	0.31	A	6	0.97	A	5	0.68	A	2	0.33	A	9	0.98	A	6	0.73	A	2	0.34	A	11	0.99	B	6	0.74	A	2	0.35	A	16	1.01	B*	7	0.76	A
Overall	6	0.51	A	9	0.93	A	11	0.70	B	5	0.55	A	13	0.97	B	11	0.74	B	5	0.56	A	15	0.99	B	12	0.76	B	5	0.57	A	18	1.00	B*	12	0.77	B
16: Kamehameha Highway & Pali Momi Outbound																																				
EB TH	6	0.66	A	3	0.31	A	3	0.44	A	2	0.60	A	3	0.32	A	3	0.47	A	2	0.61	A	4	0.33	A	2	0.48	A	8	0.77	A	4	0.33	A	4	0.50	A
WB TH	12	0.38	B	21	0.96	C	9	0.59	A	6	0.34	A	31	1.00	C*	10	0.63	A	6	0.35	A	38	1.03	D*	10	0.64	B	14	0.44	B	40	1.03	D*	11	0.66	B
SB LT	41	0.37	D	53	0.60	E	50	0.58	D	53	0.70	D	59	0.65	E	50	0.59	D	53	0.70	D	58	0.64	E	50	0.61	D	36	0.38	D	67	0.67	E	49	0.60	D
SB RT	36	0.06	D	62	0.70	E	65	0.77	E	44	0.09	D	69	0.73	E	64	0.78	E	45	0.12	D	70	0.75	E	64	0.78	E	32	0.10	C	82	0.78	F	65	0.79	E
Overall	12	0.58	B	20	0.91	C	13	0.63	B	9	0.62	A	28	0.95	C	13	0.66	B	9	0.63	A	33	0.98	C	13	0.67	B	13	0.64	B	35	0.99	D	14	0.69	B

Note:
* = overcapacity conditions, v/c >1

Table 3a: Existing, Base Year 2015, Base Year 2017 and Base Year 2019 Level of Service Summary

INTERSECTION	Existing Conditions 2010									Base Year 2015									Base Year 2017									Base Year 2019								
	AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Moanalua Road & Harbor Pointe																																				
WB LT	15	0.08	B	12	0.03	B	15	0.08	C	15	0.09	C	12	0.04	B	17	0.09	C	16	0.09	C	12	0.04	B	17	0.10	C	16	0.09	C	13	0.04	B	17	0.10	C
NB LT/RT	23	0.22	C	18	0.11	C	28	0.38	D	27	0.26	D	20	0.13	C	32	0.43	D	28	0.27	D	20	0.14	C	34	0.44	D	29	0.28	D	21	0.14	C	35	0.46	E
2: Moanalua Road & Pearlridge Elementary School																																				
EB LT	11	0.22	B	18	0.17	C	14	0.01	B	11	0.23	B	20	0.20	C	15	0.01	B	12	0.24	B	21	0.21	C	15	0.01	C	12	0.24	B	22	0.22	C	16	0.02	C
SB LT/RT	21	0.61	C	38	0.59	E	23	0.11	C	22	0.63	C	48	0.67	E	23	0.14	C	23	0.64	C	54	0.71	F	24	0.15	C	24	0.65	C	61	0.74	F	26	0.16	D
3: Moanalua Road & Kaonohi Street																																				
EB LT	58	0.56	E	85	0.81	F	80	0.71	F	54	0.60	D	97	0.94	F	64	0.76	E	54	0.59	D	97	0.93	F	71	0.79	E	55	0.62	E	104	0.96	F	81	0.83	F
EB TH	28	0.71	C	24	0.47	C	41	0.77	D	28	0.77	C	24	0.55	C	45	0.93	D	27	0.76	C	25	0.54	C	44	0.91	D	28	0.78	C	26	0.59	C	40	0.86	D
EB RT	18	0.13	B	19	0.12	B	30	0.31	C	17	0.13	B	19	0.13	B	25	0.30	C	17	0.14	B	19	0.13	B	26	0.32	C	17	0.14	B	20	0.14	B	25	0.29	C
WB LT	58	0.47	E	78	0.64	E	80	0.76	F	59	0.60	E	59	0.60	E	95	0.94	F	70	0.70	E	65	0.62	E	99	0.94	F	72	0.72	E	60	0.62	E	130	1.03	F*
WB TH	23	0.44	C	38	0.81	D	34	0.64	C	24	0.50	C	40	0.91	D	35	0.81	D	24	0.50	C	42	0.91	D	34	0.78	C	24	0.52	C	50	0.97	D	35	0.75	C
WB RT	19	0.06	B	24	0.22	C	25	0.13	C	19	0.07	B	21	0.23	C	23	0.14	C	19	0.07	B	22	0.25	C	23	0.14	C	19	0.07	B	22	0.26	C	23	0.15	C
NB LT	58	0.34	E	77	0.82	E	73	0.82	E	56	0.51	E	83	0.94	F	66	0.91	E	54	0.43	D	84	0.93	F	83	0.97	F	55	0.43	D	80	0.94	F	100	1.02	F*
NB TH/RT	52	0.25	D	60	0.33	E	58	0.48	E	46	0.25	D	48	0.35	D	42	0.54	D	46	0.24	D	53	0.39	D	47	0.61	D	46	0.25	D	48	0.37	D	51	0.60	D
SB LT	56	0.63	E	76	0.56	E	75	0.65	E	54	0.71	D	57	0.51	E	52	0.62	D	60	0.78	E	62	0.50	E	54	0.61	D	62	0.81	E	57	0.48	E	63	0.67	E
SB TH	56	0.69	E	76	0.60	E	77	0.69	E	46	0.64	D	58	0.57	E	52	0.63	D	52	0.72	D	64	0.59	E	55	0.65	D	53	0.72	D	58	0.58	E	61	0.67	E
SB RT	45	0.15	D	68	0.09	E	64	0.12	E	39	0.22	D	52	0.09	D	44	0.13	D	41	0.22	D	57	0.09	E	46	0.18	D	41	0.24	D	52	0.10	D	50	0.14	D
Overall	35	0.67	C	45	0.79	D	49	0.81	D	33	0.77	C	43	0.93	D	45	0.87	D	34	0.79	C	45	0.93	D	47	0.89	D	35	0.81	C	47	0.91	D	50	0.83	D
4: RIRO Driveway & Kaonohi Street																																				
EB RT	0	0.00	A	0	0.00	A	15	0.10	C	0	0.00	A	0	0.00	A	16	0.12	C	0	0.00	A	0	0.00	A	16	0.12	C	0	0.00	A	0	0.00	A	17	0.12	C
WB RT	9	0.01	A	10	0.08	A	11	0.22	B	9	0.01	A	10	0.09	A	11	0.24	B	9	0.01	A	10	0.09	A	12	0.25	B	9	0.01	A	10	0.10	A	12	0.25	B
5: Pearlridge Center D/W 1 & Kaonohi Street																																				
WB LT	13	0.02	B	14	0.21	B	131	0.90	F	14	0.04	B	29	0.42	D	208	1.12	F*	14	0.04	B	31	0.45	D	242	1.20	F*	14	0.04	B	33	0.47	D	301	1.34	F*
WB RT	9	0.03	A	12	0.25	B	14	0.31	B	9	0.04	A	12	0.27	B	15	0.34	B	9	0.04	A	12	0.28	B	15	0.36	C	9	0.04	A	12	0.29	B	15	0.37	C
SB LT/TH	1	0.02	A	5	0.09	A	6	0.20	A	1	0.02	A	5	0.10	A	7	0.22	A	1	0.02	A	5	0.10	A	7	0.23	A	1	0.03	A	5	0.10	A	7	0.25	A
6: Pearlridge Center D/W 2 & Kaonohi Street																																				
EB LT/TH/RT	0	0.00	A	14	0.02	B	441	1.88	F*	0	0.00	A	16	0.03	C	656	2.35	F*	0	0.00	A	17	0.03	C	732	2.52	F*	0	0.00	A	17	0.03	C	838	2.75	F*
WB LT	14	0.06	B	33	0.56	D	n/a	6.91	F*	15	0.09	C	42	0.65	E	n/a	10.30	F*	16	0.09	C	47	0.69	E	n/a	11.83	F*	16	0.09	C	52	0.73	F	n/a	13.56	F*
WB TH/RT	9	0.01	A	11	0.14	B	13	0.31	B	8	0.03	A	9	0.06	A	14	0.34	B	8	0.03	A	9	0.06	A	14	0.35	B	8	0.03	A	9	0.07	A	15	0.36	B
SB LT	8	0.03	A	9	0.05	A	10	0.17	B	8	0.03	A	9	0.06	A	10	0.19	B	8	0.03	A	9	0.06	A	11	0.20	B	8	0.03	A	9	0.07	A	11	0.20	B
7: Westridge (north) & Kaonohi Street																																				
EB LT/RT	13	0.13	B	14	0.12	B	25	0.28	D	14	0.15	B	15	0.15	B	30	0.34	D	14	0.16	B	15	0.15	B	31	0.36	D	14	0.16	B	15	0.16	C	36	0.44	E
NB LT/TH	1	0.01	A	1	0.02	A	1	0.04	A	2	0.02	A	1	0.02	A	2	0.04	A	2	0.02	A	1	0.02	A	2	0.04	A	2	0.02	A	1	0.02	A	2	0.04	A
8: Westridge (south) & Kaonohi Street																																				
EB LT/RT	11	0.08	B	12	0.11	B	27	0.43	D	12	0.11	B	12	0.14	B	34	0.52	D	12	0.11	B	13	0.14	B	36	0.55	E	12	0.12	B	13	0.14	B	40	0.58	E
NB LT/TH	2	0.01	A	1	0.02	A	2	0.06	A	2	0.02	A	1	0.03	A	3	0.07	A	2	0.02	A	1	0.03	A	3	0.08	A	2	0.02	A	1	0.03	A	3	0.09	A
9: Pearlridge Center - Anna Miller's D/W & Kaonohi Street																																				
WB LT/RT	12	0.10	B	16	0.25	C	28	0.49	D	13	0.12	B	17	0.30	C	36	0.60	E	13	0.12	B	18	0.30	C	39	0.63	E	13	0.12	B	18	0.31	C	40	0.64	E
SB LT/TH	2	0.02	A	2	0.03	A	2	0.05	A	2	0.02	A	2	0.03	A	3	0.06	A	2	0.02	A	2	0.03	A	3	0.06	A	2	0.02	A	2	0.03	A	3	0.06	A
10: Moanalua Loop & Kaonohi Street																																				
EB LT/RT	16	0.41	C	16	0.31	C	45	0.65	E	18	0.47	C	18	0.36	C	82	0.86	F	18	0.49	C	18	0.37	C	92	0.90	F	20	0.52	C	20	0.42	C	113	0.97	F
NB LT	9	0.05	A	9	0.12	A	11	0.13	B	9	0.06	A	9	0.13	A	12	0.15	B	9	0.06	A	9	0.13	A	12	0.15	B	9	0.06	A	9	0.14	A	12	0.17	B
11: Kamehameha Highway & Kaonohi Street																																				
EB LT	48	0.49	D	68	0.61	E	63	0.86	E	68	0.50	E	249	1.36	F*	67	0.87	E	65	0.51	E	261	1.39	F*	97	0.95	F	70	0.51	E	218	1.27	F*	76	0.93	E
EB TH	27	0.58	C	7	0.32	A	16	0.58	B	5	0.55	A	5	0.34	A	16	0.60	B	3	0.56	A	5	0.35	A	4	0.62	A	9	0.68	A	7	0.35	A	18	0.63	B
WB TH/RT	14	0.40	B	189	1.36	F*	25	0.87	C	11	0.37	B	206	1.43	F*	25	0.92	C	11	0.38	B	222	1.46	F*	27	0.92	C	16	0.48	B	179	1.36	F*	33	0.96	C
SB LT/RT	40	0.53	D	57	0.72	E	57	0.86	E	49	0.78	D	62	0.76	E	63	0.93	E	49	0.78	D	62	0.76	E	66	0.94	E	35	0.54	D	72	0.79	E	68	0.95	E
SB RT	33	0.08	C	48	0.13	D	45	0.45	D	38	0.08	D	57	0.57	E	42	0.50	D	37	0.08	D	58	0.58	E	44	0.58	D	29	0.08	C	66	0.60	E	44	0.57	D
Overall	26	0.57	C	134	1.16	F*	31	0.86	C	17	0.60	B	155	1.30	F*	32	0.91	C	16	0.62	B	166	1.33	F*	31	0.93	C	18	0.63	B	134	1.25	F*	37	0.95	D

Note:
* = overcapacity conditions, v/c >1
n/a = applies to unsignalized intersection and usually operates better than shown in the analysis

Table 3b: Base Year 2019 with RT, Base Year 2021 and Base Year 2021 with RT Level of Service Summary cont'd

INTERSECTION	Base Year 2019 with RT									Base Year 2021									Base Year 2021 with RT								
	AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
12: Kamehameha Highway & Kanuku Street																											
EB LT	77	0.51	E	235	1.09	F*	52	0.62	D	101	0.66	F	340	1.31	F*	64	0.72	E	70	0.57	E	213	1.03	F*	76	0.76	E
EB TH	4	0.50	A	5	0.39	A	29	0.72	C	3	0.60	A	5	0.40	A	18	0.66	B	8	0.51	A	4	0.41	A	6	0.62	A
EB RT	2	0.02	A	1	0.06	A	29	0.11	C	1	0.02	A	1	0.06	A	17	0.10	B	5	0.02	A	2	0.06	A	3	0.10	A
WB LT	45	0.28	D	78	0.59	E	70	0.49	E	46	0.46	D	93	0.59	F	69	0.59	E	51	0.46	D	73	0.52	E	75	0.57	E
WB TH/RT	17	0.34	B	7	1.00	A*	13	0.86	B	11	0.35	B	46	1.09	D*	9	0.78	A	18	0.34	B	20	1.04	C*	11	0.74	B
NB LT/TH	42	0.04	D	89	0.80	F	40	0.30	D	42	0.04	D	105	0.84	F	59	0.59	E	42	0.04	D	77	0.77	E	51	0.56	D
NB RT	42	0.01	D	57	0.04	E	36	0.05	D	42	0.01	D	65	0.04	E	48	0.05	D	42	0.01	D	51	0.04	D	43	0.05	D
SB LT/TH	64	0.78	E	79	0.71	E	47	0.50	D	65	0.79	E	93	0.74	F	90	0.87	F	64	0.78	E	68	0.67	E	77	0.84	E
SB RT	42	0.03	D	57	0.03	E	36	0.06	D	42	0.03	D	65	0.07	E	49	0.06	D	42	0.03	D	51	0.03	D	44	0.06	D
Overall	14	0.53	B	14	0.97	B	24	0.73	C	11	0.61	B	41	1.06	D*	20	0.79	B	16	0.54	B	21	1.00	C*	16	0.76	B
13: Kamehameha Highway & Hekaha Street																											
EB LT	61	0.54	E	195	0.98	F	69	0.81	E	69	0.57	E	246	1.10	F*	72	0.79	E	53	0.57	D	145	0.89	F	61	0.77	E
EB TH/RT	21	0.74	C	18	0.52	B	33	0.94	C	21	0.84	C	20	0.52	B	29	0.91	C	10	0.59	B	15	0.54	B	26	0.88	C
WB LT	37	0.53	D	86	0.72	F	99	0.86	F	43	0.61	D	94	0.73	F	108	0.93	F	60	0.53	E	67	0.68	E	92	0.90	F
WB TH/RT	19	0.39	B	39	1.03	D*	11	0.84	B	18	0.40	B	64	1.10	E*	14	0.85	B	9	0.31	A	53	1.06	D*	16	0.81	B
NB LT/TH	32	0.17	C	104	1.00	F*	56	0.79	E	33	0.19	C	155	1.12	F*	93	0.97	F	48	0.45	D	119	1.06	F*	82	0.96	F
NB RT	30	0.04	C	44	0.33	D	37	0.46	D	31	0.04	C	53	0.34	D	43	0.54	D	43	0.04	D	41	0.34	D	38	0.52	D
SB LT/TH	36	0.39	D	52	0.60	D	43	0.54	D	39	0.41	D	79	0.77	E	61	0.76	E	65	0.76	E	53	0.66	D	53	0.73	D
SB RT	30	0.06	C	42	0.15	D	31	0.11	C	32	0.06	C	50	0.19	D	37	0.12	D	43	0.06	D	39	0.15	D	33	0.11	C
Overall	23	0.57	C	42	1.02	D*	31	0.87	C	23	0.65	C	61	1.11	E*	34	0.89	C	17	0.62	B	48	1.06	D*	32	0.86	C
14: Kamehameha Highway & Lipoa Street																											
EB TH/RT	5	0.62	A	18	0.46	B	22	0.82	C	4	0.73	A	14	0.47	B	11	0.78	B	5	0.63	A	14	0.49	B	10	0.74	A
WB LT	47	0.52	D	89	0.71	F	90	0.61	F	87	0.78	F	93	0.72	F	106	0.71	F	53	0.56	D	74	0.66	E	75	0.65	E
WB TH	3	0.27	A	64	1.12	E*	7	0.64	A	4	0.29	A	212	1.45	F*	4	0.63	A	3	0.28	A	81	1.16	F*	7	0.59	A
NB LT/RT	57	0.62	E	74	0.77	E	47	0.56	D	57	0.62	E	85	0.80	F	69	0.81	E	57	0.62	E	65	0.75	E	60	0.78	E
Overall	7	0.61	A	52	1.06	D*	18	0.75	B	7	0.72	A	159	1.34	F*	12	0.80	B	8	0.63	A	61	1.09	E*	12	0.76	B
15: Kamehameha Highway & Pali Momi Inbound																											
EB LT	42	0.63	D	77	0.81	E	36	0.84	D	49	0.64	D	111	0.93	F	45	0.86	D	44	0.64	D	84	0.91	F	54	0.84	D
EB TH/RT	3	0.49	A	2	0.31	A	7	0.45	A	2	0.59	A	2	0.33	A	6	0.49	A	2	0.50	A	4	0.32	A	3	0.46	A
WB LT	52	0.47	D	82	0.76	F	72	0.75	E	53	0.47	D	90	0.78	F	78	0.78	E	54	0.47	D	71	0.74	E	68	0.75	E
WB TH/RT	2	0.34	A	6	0.94	A	6	0.71	A	2	0.35	A	23	1.03	C*	6	0.76	A	1	0.34	A	8	0.96	A	6	0.73	A
Overall	5	0.49	A	11	0.89	B	12	0.74	B	5	0.58	A	25	0.98	C	13	0.78	B	5	0.50	A	13	0.91	B	12	0.75	B
16: Kamehameha Highway & Pali Momi Outbound																											
EB TH	8	0.68	A	3	0.32	A	3	0.45	A	8	0.78	A	5	0.33	A	3	0.50	A	7	0.68	A	4	0.33	A	1	0.47	A
WB TH	16	0.45	B	19	0.93	B	9	0.60	A	14	0.45	B	45	1.04	D*	11	0.67	B	15	0.45	B	24	0.97	C	10	0.62	A
SB LT	32	0.34	C	64	0.68	E	55	0.62	D	36	0.39	D	73	0.69	E	54	0.62	D	34	0.37	C	56	0.65	E	48	0.61	D
SB RT	29	0.10	C	79	0.79	E	67	0.80	E	32	0.10	C	94	0.83	F	74	0.83	E	31	0.10	C	68	0.75	E	65	0.80	E
Overall	14	0.56	B	20	0.90	C	14	0.64	B	13	0.66	B	39	1.01	D*	15	0.70	B	13	0.57	B	23	0.93	C	13	0.66	B

Note:
* = overcapacity conditions, v/c >1

Table 3b: Base Year 2019 with RT, Base Year 2021 and Base Year 2021 with RT Level of Service Summary

INTERSECTION	Base Year 2019 with RT									Base Year 2021									Base Year 2021 with RT								
	AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Moanalua Road & Harbor Pointe																											
WB LT	12	0.06	B	12	0.04	B	15	0.09	C	17	0.09	C	13	0.04	B	18	0.10	C	13	0.06	B	12	0.04	B	16	0.09	C
NB LT/RT	15	0.11	B	19	0.13	C	28	0.39	D	30	0.29	D	21	0.14	C	37	0.47	E	19	0.19	C	19	0.13	C	29	0.40	D
2: Moanalua Road & Pearlridge Elementary School																											
EB LT	11	0.21	B	16	0.15	C	13	0.01	B	12	0.24	B	23	0.23	C	16	0.02	C	11	0.22	B	16	0.15	C	13	0.01	B
SB LT/RT	19	0.58	C	30	0.52	D	20	0.12	C	23	0.63	C	71	0.79	F	26	0.16	D	20	0.59	C	32	0.54	D	20	0.12	C
3: Moanalua Road & Kaonohi Street																											
EB LT	51	0.55	D	74	0.83	E	63	0.72	E	54	0.69	D	133	1.06	F*	83	0.83	F	53	0.59	D	81	0.88	F	65	0.75	E
EB TH	26	0.64	C	26	0.57	C	41	0.87	D	32	0.88	C	26	0.61	C	51	0.94	D	28	0.66	C	26	0.58	C	39	0.86	D
EB RT	19	0.14	B	20	0.14	C	26	0.30	C	17	0.14	B	20	0.14	B	28	0.37	C	20	0.14	C	20	0.14	C	26	0.30	C
WB LT	51	0.49	D	59	0.61	E	80	0.87	E	83	0.81	F	60	0.62	E	98	0.93	F	53	0.49	D	59	0.61	E	88	0.91	F
WB TH	23	0.45	C	38	0.85	D	31	0.68	C	25	0.59	C	50	0.97	D	37	0.79	D	25	0.47	C	40	0.88	D	32	0.69	C
WB RT	19	0.06	B	23	0.21	C	23	0.13	C	19	0.07	B	22	0.26	C	24	0.15	C	20	0.07	C	24	0.24	C	23	0.15	C
NB LT	52	0.38	D	62	0.83	E	70	0.93	E	50	0.54	D	83	0.95	F	79	0.94	E	54	0.39	D	72	0.90	E	113	1.07	F*
NB TH/RT	47	0.25	D	45	0.30	D	44	0.54	D	36	0.20	D	48	0.36	D	50	0.61	D	48	0.27	D	47	0.34	D	48	0.63	D
SB LT	49	0.62	D	57	0.49	E	54	0.59	D	71	0.91	E	57	0.51	E	61	0.65	E	51	0.65	D	58	0.52	E	54	0.62	D
SB TH	49	0.66	D	58	0.55	E	55	0.64	D	38	0.62	D	58	0.58	E	61	0.68	E	50	0.69	D	58	0.58	E	54	0.65	D
SB RT	40	0.15	D	52	0.09	D	46	0.12	D	34	0.38	C	52	0.10	D	51	0.24	D	40	0.17	D	52	0.10	D	46	0.14	D
Overall	33	0.62	C	40	0.87	D	44	0.84	D	36	0.87	D	49	0.93	D	51	0.85	D	34	0.65	C	43	0.90	D	49	0.88	D
4: RIRO Driveway & Kaonohi Street																											
EB RT	0	0.00	A	0	0.00	A	17	0.12	C	0	0.00	A	0	0.00	A	17	0.13	C	0	0.00	A	0	0.00	A	17	0.13	C
WB RT	9	0.01	A	10	0.10	A	12	0.25	B	9	0.01	A	10	0.10	A	12	0.26	B	9	0.01	A	10	0.10	A	12	0.26	B
5: Pearlridge Center D/W 1 & Kaonohi Street																											
WB LT	14	0.04	B	33	0.47	D	301	1.34	F*	14	0.04	B	35	0.51	E	329	1.40	F*	14	0.04	B	35	0.51	E	329	1.40	F*
WB RT	9	0.04	A	12	0.29	B	15	0.37	C	9	0.04	A	12	0.30	B	16	0.39	C	9	0.04	A	12	0.30	B	16	0.39	C
SB LT/TH	1	0.03	A	5	0.10	A	7	0.25	A	1	0.03	A	5	0.11	A	7	0.25	A	1	0.03	A	5	0.11	A	7	0.25	A
6: Pearlridge Center D/W 2 & Kaonohi Street																											
EB LT/TH/RT	0	0.00	A	17	0.03	C	832	2.74	F*	0	0.00	A	17	0.04	C	Err	3.05	F*	0	0.00	A	17	0.04	C	Err	3.05	F*
WB LT	16	0.09	C	53	0.73	F	Err	13.47	F*	16	0.09	C	58	0.77	F	Err	17.26	F*	16	0.09	C	58	0.77	F	Err	17.26	F*
WB TH/RT	9	0.01	A	11	0.16	B	15	0.36	B	9	0.01	A	11	0.17	B	15	0.38	B	9	0.01	A	11	0.17	B	15	0.38	B
NB TH/RT	0	0.08	A	0	0.15	A	0	0.26	A	0	0.08	A	0	0.15	A	0	0.27	A	0	0.08	A	0	0.15	A	0	0.27	A
SB LT	8	0.03	A	9	0.07	A	11	0.20	B	8	0.03	A	9	0.07	A	11	0.22	B	8	0.03	A	9	0.07	A	11	0.22	B
SB TH	0	0.15	A	0	0.12	A	0	0.16	A	0	0.16	A	0	0.12	A	0	0.16	A	0	0.16	A	0	0.12	A	0	0.16	A
Overall	1	0.25	A	8	0.44	A	1054	0.86	E	1	0.25	A	9	0.44	A	3059	0.88	E	1	0.25	A	9	0.44	A	3059	0.88	E
7: Westridge (north) & Kaonohi Street																											
EB LT/RT	14	0.16	B	15	0.16	C	36	0.44	E	14	0.17	B	16	0.16	C	39	0.46	E	14	0.17	B	16	0.16	C	39	0.46	E
NB LT/TH	2	0.02	A	1	0.02	A	2	0.04	A	2	0.02	A	1	0.02	A	2	0.05	A	2	0.02	A	1	0.02	A	2	0.05	A
8: Westridge (south) & Kaonohi Street																											
EB LT/RT	12	0.12	B	13	0.14	B	40	0.58	E	12	0.12	B	13	0.14	B	51	0.68	F	12	0.12	B	13	0.14	B	51	0.68	F
NB LT/TH	2	0.02	A	1	0.03	A	3	0.09	A	2	0.02	A	1	0.03	A	3	0.09	A	2	0.02	A	1	0.03	A	3	0.09	A
9: Pearlridge Center - Anna Miller's D/W & Kaonohi Street																											
WB LT/RT	13	0.12	B	18	0.31	C	40	0.64	E	13	0.13	B	19	0.32	C	48	0.70	E	13	0.13	B	19	0.32	C	48	0.70	E
SB LT/TH	2	0.02	A	2	0.03	A	3	0.06	A	2	0.02	A	3	0.04	A	3	0.06	A	2	0.02	A	3	0.04	A	3	0.06	A
10: Moanalua Loop & Kaonohi Street																											
EB LT/RT	20	0.52	C	20	0.42	C	113	0.97	F	20	0.52	C	21	0.44	C	129	1.02	F*	20	0.52	C	21	0.44	C	129	1.02	F*
NB LT	9	0.06	A	9	0.14	A	12	0.17	B	9	0.06	A	9	0.14	A	12	0.17	B	9	0.06	A	9	0.14	A	12	0.17	B
11: Kamehameha Highway & Kaonohi Street																											
EB LT	73	0.52	E	243	1.34	F*	70	0.91	E	72	0.54	E	342	1.54	F*	95	0.98	F	70	0.53	E	265	1.40	F*	60	0.94	E
EB TH	7	0.60	A	7	0.35	A	17	0.60	B	3	0.59	A	9	0.36	A	21	0.64	C	9	0.60	A	5	0.36	A	23	0.60	C
WB TH/RT	18	0.51	B	130	1.25	F*	32	0.95	C	11	0.41	B	229	1.48	F*	34	0.95	C	18	0.50	B	154	1.31	F*	29	0.94	C
SB LT/RT	31	0.49	C	67	0.78	E	55	0.87	E	49	0.78	D	77	0.81	E	81	0.99	F	33	0.52	C	59	0.76	E	67	0.96	E
SB RT	26	0.08	C	62	0.60	E	43	0.49	D	37	0.09	D	74	0.67	E	50	0.62	D	27	0.09	C	55	0.58	E	42	0.55	D
Overall	18	0.56	B	101	1.17	F*	34	0.92	C	16	0.64	B	176	1.36	F*	42	0.97	D	19	0.57	B	116	1.21	F*	36	0.95	D

Note:
* = overcapacity conditions, v/c >1

IV. YEAR 2019 WITH PROPOSED PROJECT SCENARIO

A. Trip Generation

The Institute of Transportation Engineers (ITE) publishes a book based on empirical data compiled from a body of more than 4,250 trip generation studies submitted by public agencies, developers, consulting firms, and associations. This publication, titled Trip Generation, 8th Edition, provides trip rates and/or formulae based on graphs that correlate vehicular trips with independent variables. The independent variable can range from Dwelling Units (DU) for single-family attached homes to Gross Floor Area (GFA) for commercial or office development. These trip rates/formulae and their associated directional distributions were used to estimate the increase in the number of vehicular trips generated by the Proposed Project.

Table 4 shows the trip rates used and Table 6 shows the trips generated by the Proposed Project for each phase.

Table 4: Trip Generation Rates

Land Use (ITE Code)	Independent Variable	AM Peak Hour		PM Peak Hour		Saturday MD Peak Hour	
		Trip Rate	% Enter	Trip Rate	% Enter	Trip Rate	% Enter
High-Rise Residential Condominium/Townhouse (232)	Dwelling Units	[a]	19%	[b]	62%	[c]	43%
Shopping Center (820)	1,000 SF GLA	[d]	61%	[e]	49%	[f]	52%
Office Park (750)	1,000 SF GLA	[g]	89%	[h]	14%	0.14	74%

[a]. (T) = 0.29(X)+28.86 [b]. (T) = 0.34(X)+15.47 [c]. (T) = 0.30(X)+28.85
[d]. Ln(T) = 0.59Ln(X)+2.32 [e]. Ln(T) = 0.67Ln(X)+3.37 [f]. Ln(T) = 0.65Ln(X)+3.76
[g]. T = 1.37(X)+124.36 [h]. T = 1.22(X)+95.83

Where X is the independent variable and T the number of trips
SF GLA = Square Feet Gross Leasable Area

Source: Trip Generation, 8th Edition, Institute of Transportation Engineers (2008)

The Proposed Project site is currently zoned for commercial land use. However, the proposed plan for the site is to provide a mixed use type of development which requires the rezoning of the parcel. The Proposed Project

site is currently zoned for commercial land use. It allows for up to 1.5 – 2 Million square feet of commercial space. For this study two (2)"zone-ready" alternatives were considered:

Alternative 1 – commercial/office land use:

- 1,200,000 SF of office space
- 120,000 SF of commercial retail space

Alternative 2 – commercial only/mall expansion:

- 1,522,600 SF of commercial retail space

With the change is zoning, the following uses are proposed:

- 1,500 residential dwelling units
- Approximately 144,000 SF of commercial space
- 80,000 SF of office space and/or hotel – since office space generates more trips, for the purpose of this study the office land use was used as a conservative measure.

See Table 5 for a comparison of the total amount of trips generated for each type of land use.

Table 5: Proposed and Existing Land Use Trip Generation Comparison

Alternative	Total Trips generated after Project completion		
	AM Peak Hour	PM Peak Hour	Sat MD Peak Hour
Proposed Project, Residential/Commercial/Office	889	1,530	1,575
Alternative 1, Commercial/Office	1,941	2,279	1,133
Proposed Project - Alternative 1	(1,052)	(749)	442
% difference	*(118%)*	*(49%)*	*28%*
Alternative 2, Mall Expansion	285	1,818	2,198
Proposed Project - Alternative 2	604	(288)	(623)
% difference	*68%*	*(19%)*	*(40%)*

Table 6a: Project Trip Generation by Phase

LAND USE (ITE Code)	Independent Variable	AM Peak Hour Enter (VPH)	AM Peak Hour Exit (VPH)	AM Peak Hour Total (VPH)	PM Peak Hour Enter (VPH)	PM Peak Hour Exit (VPH)	PM Peak Hour Total (VPH)	Saturday MD Peak Hour Enter (VPH)	Saturday MD Peak Hour Exit (VPH)	Saturday MD Peak Hour Total (VPH)
Phase 1 - Year 2015										
Residential High Rise Condominiums (232)	320 DU	24	98	122	78	47	125	54	71	125
Shopping Center (820)	124,652 sq ft GFA	108	68	176	362	376	738	515	474	989
Office (750)	80,000 sq ft GLA	209	25	234	28	166	194	9	3	12
Total trips generated after PHASE 1B completion		*341*	*191*	*532*	*468*	*589*	*1,057*	*578*	*548*	*1,126*
Internal Capture										
Residential		--	--	--	*27*	*25*	*52*	*18*	*38*	*56*
Commercial		--	--	--	*33*	*34*	*67*	*39*	*20*	*59*
Office		--	--	--	*9*	*10*	*19*	*3*	*2*	*5*
Total Project generated trips with internal trip capture		*341*	*191*	*532*	*399*	*520*	*919*	*518*	*488*	*1,006*
Pass-By trip reduction										
Commercial		--	--	--	*33*	*34*	*67*	*48*	*45*	*93*
Swap Meet reduction										
Saturday Swap Meet Trip reduction		--	--	--	--	--	--	*125*	*478*	*603*
Total Trip reduction		--	--	--	*102*	*103*	*205*	*233*	*583*	*816*
% Reduction		--	--	--	*22%*	*18%*	*19%*	*40%*	*106%*	*72%*
Total Project Generated External Trips After Phase 1B Completion		**341**	**191**	**532**	**366**	**486**	**852**	**345**	**(35)**	**310**
Phase 2 - Year 2017										
Residential High Rise Condominiums (232)	705 DU	45	189	234	159	97	256	104	137	241
Shopping Center (820)	137,706 sq ft GFA	115	72	187	387	402	789	550	506	1,056
Office (750)	80,000 sq ft GLA	209	25	234	28	166	194	9	3	12
Total trips generated after PHASE 2 completion		*369*	*286*	*655*	*574*	*665*	*1,239*	*663*	*646*	*1,309*
Internal Capture										
Residential		--	--	--	*53*	*35*	*88*	*34*	*50*	*84*
Commercial		--	--	--	*43*	*58*	*101*	*51*	*36*	*87*
Office		--	--	--	*9*	*12*	*21*	*3*	*2*	*5*
Total Project generated trips with internal trip capture		*369*	*286*	*655*	*469*	*560*	*1,029*	*575*	*558*	*1,133*
Pass-By trip reduction										
Commercial		--	--	--	*34*	*34*	*69*	*50*	*47*	*97*
Swap Meet reduction										
Saturday Swap Meet Trip reduction		--	--	--	--	--	--	*125*	*478*	*603*
Total Trip reduction		--	--	--	*139*	*139*	*279*	*263*	*613*	*876*
% Reduction		--	--	--	*24%*	*21%*	*23%*	*40%*	*95%*	*67%*
Total Project Generated External Trips After Phase 2 Completion		**369**	**286**	**655**	**435**	**526**	**960**	**400**	**33**	**433**

Note:
1. Phase 1 combined Phase 1A and 1B.
2. The Swap Meet reduction is independent of the Project Phase therefore the reduction in traffic is the same for each Phase.

As shown in the table above, Alternative 1 would generate approximately 118 percent and 49 percent more trips than the Proposed Project during the weekday AM and PM peak hour of traffic respectively. During the Sat MD peak hour of traffic, Alternative 1 would generate approximately 28 percent fewer trips. Alternative 2 would generate approximately 19 percent and 40 percent more trips than the Proposed Project during the weekday PM and Sat MD peak hour of traffic respectively. During the weekday AM peak hour of traffic the Proposed Project would generate approximately 68% more trips.

As mentioned earlier, the weekday PM peak hour of traffic is the critical peak hour of traffic due to the fact that it operates at overcapacity conditions along Kamehameha Highway. Therefore, although the Proposed Project would generate more trips during the weekday AM and Sat MD peak hour of traffic compared to Alternative 1 and 2 respectively, the preferred option would be the land use that generates the least amount of trips during the weekday PM peak hour of traffic. In any case, the site would no longer house the Swap Meet and therefore would be subtracted from the network during the Sat MD peak hour of traffic.

B. Trip Distribution/Assignment

Trips generated by the Proposed Project were assigned onto the network based on existing trip distribution with approximately:

- 65 percent headed east towards Honolulu the urban core center
- 35 percent headed west towards Kapolei, the "second city"

The Proposed Project is planned as a mixture of housing, commercial and offices. The multi-use of the Proposed Project is aimed at providing close proximity between these land uses to reduce the amount of external trips. Trip reductions were applied through "pass-by" trips and "internal capture" rate. See below for a definition of these terms:

Pass-by Trips

As defined by the ITE Trip Generation Handbook, June 2004:

"Pass-by trips are made as intermediate stops on the way from an origin to a primary trip destination ***without a route diversion****. Pass-by trips are attracted from traffic passing the site on an adjacent street or roadway that offers direct access to the generator." Conversely, "Primary trips are trips made for the specific purpose of visiting the generator. The stop at the generator is the primary reason for the trip."*

In simple terms, a pass-by trip would be someone travelling home from work along Moanalua Road (for example) and stopping at the market (i.e. Proposed Project) on its way home. Pass-by trips are not new trips but rather trips currently in the network making an intermediate stop before reaching their final destination.

The pass-by rate was applied strictly to the Commercial land use weekday PM and Sat MD peak hours of traffic. Pass-by rate was not applied to the weekday AM peak hour of traffic as a conservative measure due to the fact that the Commercial land use does not generate a significant amount of trips during the that peak.

Table 6b: Project Trip Generation by Phase cont'd

LAND USE	Independent	AM Peak Hour			PM Peak Hour			Saturday MD Peak Hour		
(ITE Code)	Variable	Enter (VPH)	Exit (VPH)	Total (VPH)	Enter (VPH)	Exit (VPH)	Total (VPH)	Enter (VPH)	Exit (VPH)	Total (VPH)
Phase 3 - Year 2019										
Residential High Rise Condominiums (232)	1,090 DU	66	279	345	240	147	387	154	202	356
Shopping Center (820)	143,385 sq ft GFA	117	74	191	397	413	810	564	520	1,084
Office (750)	80,000 sq ft GLA	209	25	234	28	166	194	9	3	12
Total trips generated after PHASE 3 completion		*392*	*378*	*770*	*665*	*726*	*1,391*	*727*	*725*	*1,452*
Internal Capture										
Residential		--	--	--	*54*	*36*	*90*	*49*	*51*	*100*
Commercial		--	--	--	*44*	*59*	*103*	*52*	*51*	*103*
Office		--	--	--	*9*	*12*	*21*	*3*	*2*	*5*
Total Project generated trips with internal trip capture		*392*	*378*	*770*	*558*	*619*	*1,177*	*623*	*621*	*1,244*
Pass-By trip reduction										
Commercial		--	--	--	*35*	*35*	*71*	*51*	*47*	*98*
Total Project Generated External Trips WITHOUT HHCTCP		***392***	***378***	***770***	***523***	***584***	***1,106***	***572***	***574***	***1,146***
RAIL reduction										
Residential		--	33	33	22	--	22	--	--	--
Commercial		--	--	--	14	14	29	21	19	40
Swap Meet reduction										
Saturday Swap Meet Trip reduction		--	--	--	--	--	--	*125*	*478*	*603*
Total Trip reduction		--	*33*	*33*	*179*	*157*	*336*	*301*	*648*	*949*
% Reduction		--	*9%*	*4%*	*27%*	*22%*	*24%*	*41%*	*89%*	*65%*
Total Project Generated External Trips After Phase 3 Completion		**392**	**345**	**737**	**521**	**605**	**1,126**	**477**	**124**	**601**
Phase 4 - Year 2021										
Residential High Rise Condominiums (232)	1,500 DU	89	375	464	327	199	526	206	273	479
Shopping Center (820)	143,400 sq ft GFA	117	74	191	397	413	810	564	520	1,084
Office (750)	80,000 sq ft GLA	209	25	234	28	166	194	9	3	12
Total trips generated after PHASE 4 completion		*415*	*474*	*889*	*752*	*778*	*1,530*	*779*	*796*	*1,575*
Internal Capture										
Residential		--	--	--	*54*	*36*	*90*	*64*	*51*	*115*
Commercial		--	--	--	*44*	*59*	*103*	*52*	*66*	*118*
Office		--	--	--	*9*	*12*	*21*	*3*	*2*	*5*
Total Project generated trips with internal trip capture		*415*	*474*	*889*	*645*	*671*	*1,316*	*660*	*677*	*1,337*
Pass-By trip reduction										
Commercial		--	--	--	*35*	*35*	*71*	*51*	*45*	*97*
Total Project Generated External Trips WITHOUT HHCTCP		***415***	***474***	***889***	***610***	***636***	***1,245***	***609***	***632***	***1,240***
RAIL reduction										
Residential		--	45	45	33	--	33	--	--	--
Commercial		--	--	--	14	14	29	21	18	39
Swap Meet reduction										
Saturday Swap Meet Trip reduction		--	--	--	--	--	--	*125*	*478*	*603*
Total Trip reduction		--	*45*	*45*	*189*	*157*	*346*	*316*	*661*	*977*
% Reduction		--	*9%*	*5%*	*25%*	*20%*	*23%*	*41%*	*83%*	*62%*
Total Project Generated External Trips After Phase 4 Completion		**415**	**429**	**844**	**563**	**621**	**1,184**	**463**	**135**	**598**

Note:
1. The Swap Meet reduction is independent of the Project Phase therefore the reduction in traffic is the same for each Phase.

Internal Capture

As defined by the ITE Trip Generation Handbook, June 2004:

"[…] a multi-use development is typically a single real-estate project that consists of two or more ITE land use classifications between which trips can be made without using the off-site road system. Because of the nature of these land uses, the trip-making characteristics are interrelated, and some trips are made among the on-site uses. This capture of trips internal to the site has the net effect of reducing vehicle trip generation between the overall development site and the external street system (compared to the total number of trips generated by comparable, stand-alone sites)."

The internal capture rates were strictly applied to weekday PM and Sat MD peak hour of traffic. During the weekday AM peak, commercial and office space land uses are generally not open and generate small amount of trips. Therefore, although internal trips may occur there would likely not be significant and are not accounted for during the weekday AM peak hour traffic as a conservative measure.

In addition to those trip reductions, the Swap Meet trips during the Sat MD peak hour would also be discounted from the Proposed Project generated trips.

See Table 6 for the Proposed Project trip generation and pass-by and internal capture rates.

C. Future Year Analysis

All the site accesses will be constructed during the first Phase of the Proposed Project. The Proposed Project is planned with the following four (4) accesses located at existing intersections:

One along Moanalua Road at:

- Moanalua Road/Pearlridge Elementary School/Proposed Project Access 1 – The project access would be the intersection's forth leg to the south. Due to the projected volume it is anticipated that the

intersection would warrant a traffic signal and operate in coordination with the Moanalua Road/Kaonohi Street intersection. Therefore, it is likely that the eastbound queue would extend back to the Timothy's Church/Harbor Pointe driveway blocking access for the left-turn movement. As a result, it is recommended that the Moanalua Road/Timothy's Church/Harbor Pointe driveway be restricted to a right-in/right-out. Full access to the Timothy's Church and Harbor Pointe townhouses would be provided through the signalized Proposed Project Access 1. In addition to Moanalua Road, this would also provide them access to Kaonohi Street through the Proposed Project internal roadways.

Three along Kaonohi Street at:

- Kaonohi Street/RIRO driveway-Proposed Project Access 2 will be located across the RIRO Macy's upstairs driveway.
- Kaonohi Street/Pearlridge Center D/W 1/Proposed Project Access 3 – to underground garage, provides northbound and southbound left-turn lanes along Kaonohi Street and would be aligned with the Pearlridge Center D/W 1.
- Kaonohi Street/Pearlridge Center D/W 2/Proposed Project Access 4 – provides northbound and southbound left-turn lanes along Kaonohi Street and would be aligned with Pearlridge Center D/W 2.

With the Proposed Project accesses located along Moanalua Road and Kaonohi Street, it is likely that vehicles would use them to avoid congested areas. In particular, the northbound left-turn at the Moanalua Road/Kaonohi Street intersection would likely enter the Proposed Project site via the Proposed Project Access 3 or 4 and make a northbound left-turn at the Moanalua Road/Pearlridge Elementary/Proposed Project Access 1 signalized intersection. The amount of trip diversion would be based on equilibrium, until the perceived delay becomes similar for both intersections.

Similar to the base year discussion, the benchmark years with Proposed Project were combined into three (3) sections:

1. Year 2015 with Proposed Project
2. Year 2015 to 2021 with Proposed Project and Improvements[4]
3. Year 2019 and 2021 with Proposed Project, Improvements and RT

Year 2015 with Proposed Project

Base year 2015 traffic volume and Phase 1 Proposed Project traffic volume combined would increase traffic and further increase the traffic delay. See Figure 10 for Year 2015 Proposed Project distribution. See Figure 11 for Year 2015 with Proposed Project volumes and LOS. See following section for proposed improvements.

Year 2015 to 2021 with Proposed Project Improvements and without RT

By Year 2015 with Proposed Project the following improvements are recommended:

Moanalua Road/Pearlridge Elementary School

- Signalize the intersection – with the recommended lane configuration, the signal would be split phase
- Provide eastbound and westbound left-turn lanes. The eastbound left-turn lane would need to be a minimum of 155 feet to accommodate average traffic conditions during the weekday AM peak hour of traffic. Therefore, westbound access to the Timothy's Church/Harbor Pointe driveway would be prohibited. The westbound left-turn lane would require approximately 100 feet which can be accommodated
- Provide an eastbound right-turn lane - the ROW would be provided by the Proposed Project
- Stripe the northbound approach with a left-turn lane and a shared left-turn/through/right-turn lane

[4] Improvements recommended in year 2015 are assumed to be carried over to the following year.

- Stripe the southbound approach with a left-turn lane and a shared through/right-turn lane

With this intersection providing a signalized access onto Moanalua Road it is expected that some existing trips currently making a southbound right-turn at this intersection would now re-direct onto the southbound left-turn movement. Similarly, northbound left-turn movements at the Moanalua Road/Kaonohi Street intersection would also re-direct onto the northbound left-turn at this intersection.

Moanalua Road/Kaonohi Street:

- Provide an additional eastbound left-turn lane for a total of two left-turn lanes.
- Provide an additional southbound through lane on the south leg so that Kaonohi Street has at least two (2) southbound lanes between its intersection with Moanalua Road and Kamehameha Highway.

The additional through lane along Kaonohi Street would allow better traffic flow while the additional left-turn lane would allow more time for the westbound through movement especially during the weekday PM peak periods.

Kaonohi Street/Pearlridge Center D/W 1/Proposed Project Access 3

- Provide northbound and southbound left-turn lanes. The projected volume is not anticipated to warrant a traffic signal.

The eastbound and westbound shared left-turn/through movements are shown to operate at LOS F and overcapacity conditions. The delays are a result of the heavier volume along Kaonohi Street. However, it is likely that the delay would be shorter with gaps in traffic created by the signals at the Kaonohi Street/Pearlridge Center D/W 2/Proposed Project Access 4 and Moanalua Road/Kaonohi Street intersections.

Kaonohi Street/Pearlridge Center D/W 2/Proposed Project Access 4:

- Signalize the intersection – part of the Base Year 2019 mitigation.
- Provide northbound and southbound left-turn lanes

This signalized intersection would operate satisfactorily at LOS D or better during the peak hours of traffic.

As part of the Proposed Project, the median along Kaonohi Street at its intersection with Moanalua Road would be removed. The median was implemented primarily as a means to prevent left-turns into the Swap Meet. With the Swap Meet gone and the Proposed Project new accesses, the median would no longer be necessary.

Similar to Base Year scenarios, no improvements are recommended along Kamehameha Highway due to the limited ROW available besides optimizing the corridor.

By Year 2017, 2019 and 2021 with Proposed Project Phase 2, 3 and 4 respectively, no other improvements would be recommended due to the limited ROW available. Although the Proposed Project would increase traffic volume along the roadway network, the recommended improvements should minimize the Proposed Project's impacts.

Note that although the analysis shows delays of over 10 minutes for the unsignalized intersections minor approaches of Pearlridge Center D/W 1/Kaonohi Street, the signalized intersections along Kaonohi Street would provide gaps in traffic allowing the minor movements to proceed thereby reducing the delay experienced.

If the site is constructed as Alternative 1, the traffic volume along Kaonohi Street would increase by approximately 20 percent over the Proposed Project and would cause the intersection of Kaonohi Street/Pearlridge Center D/W 2/Project Access 4 to operate at LOS F and overcapacity conditions during the weekday PM peak hour of traffic. At the intersection of Kaonohi Street/Kamehameha Highway the delay would

increase by approximately 45 seconds during the weekday PM peak hour of traffic.

If the site is constructed as Alternative 2, the delay at the intersection of Kaonohi Street/Kamehameha Highway would increase by approximately 30 seconds and the intersection of Kaonohi Street/Pearlridge Center D/W 2/Project Access 4 would operate at LOS F and overcapacity conditions.

See Figures 13, 15, 17 and 19 for Year 2015 to 2021 Proposed Project only distribution, Figures 12, 14, 16 and 18 for Year 2015 to 2021 with Proposed Project volumes and LOS.

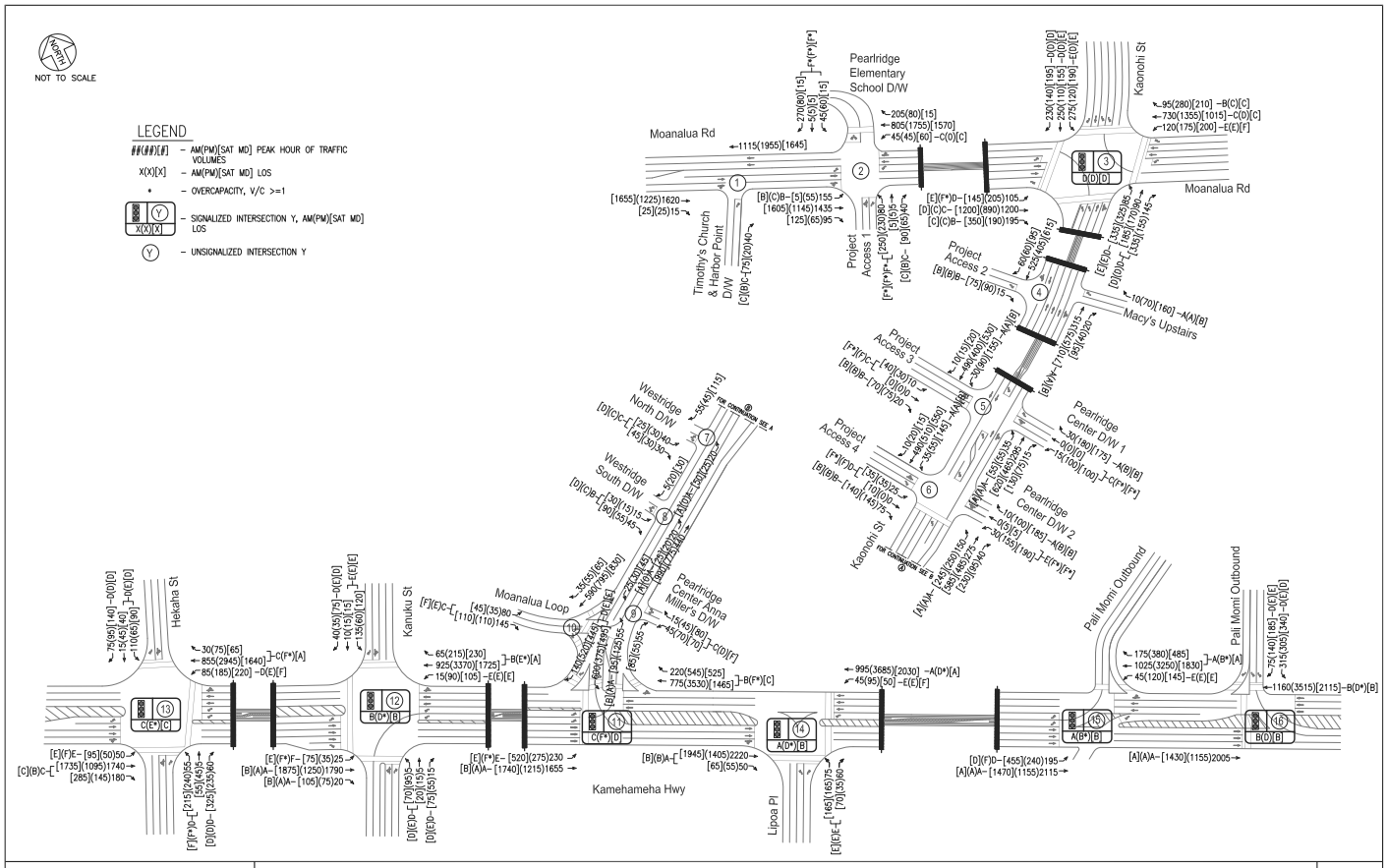

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FIGURE 11

YEAR 2015 WITH PROJECT VOLUME AND LEVEL OF SERVICE

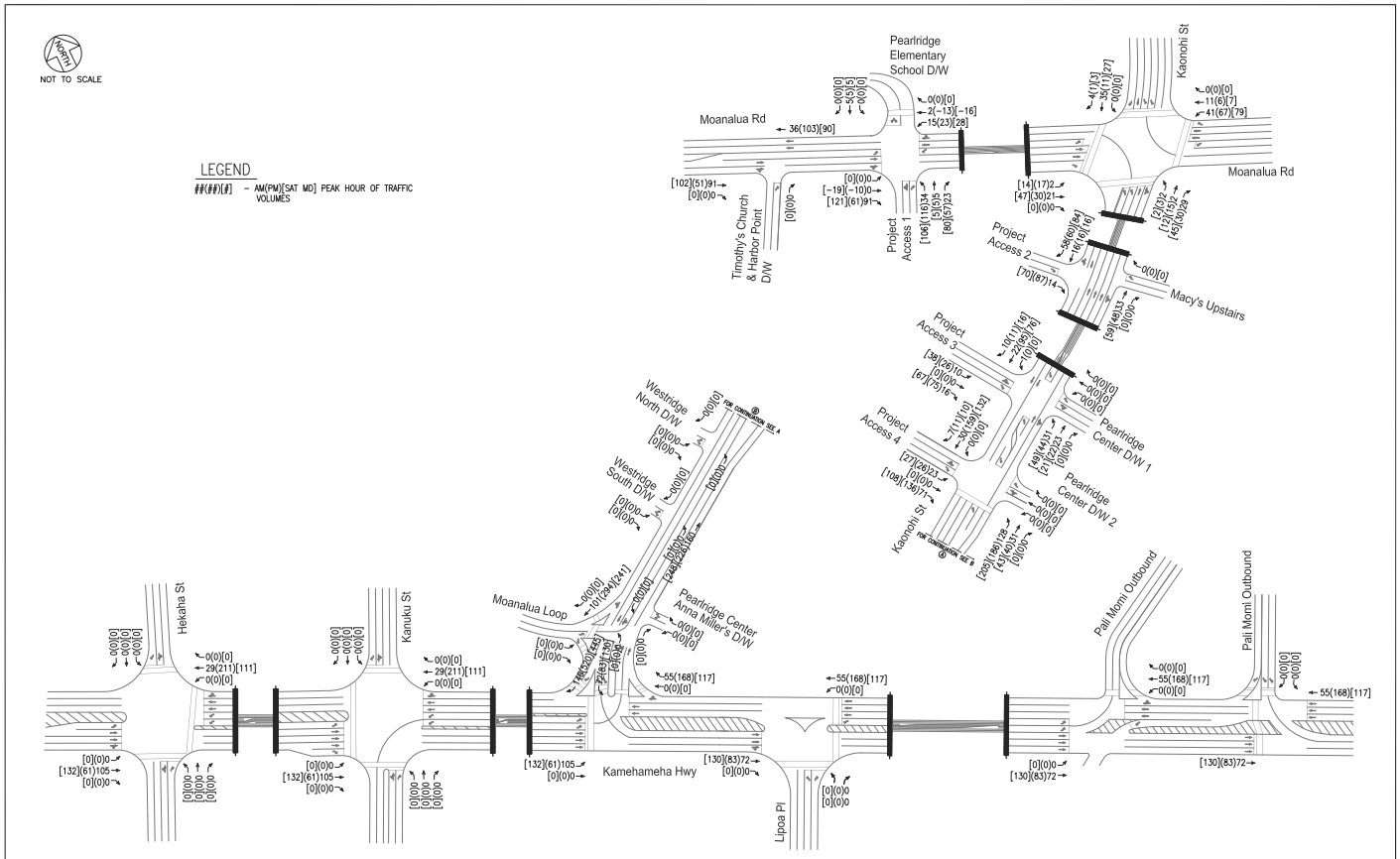

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FIGURE 10

YEAR 2015 PROJECT VOLUME DISTRIBUTION

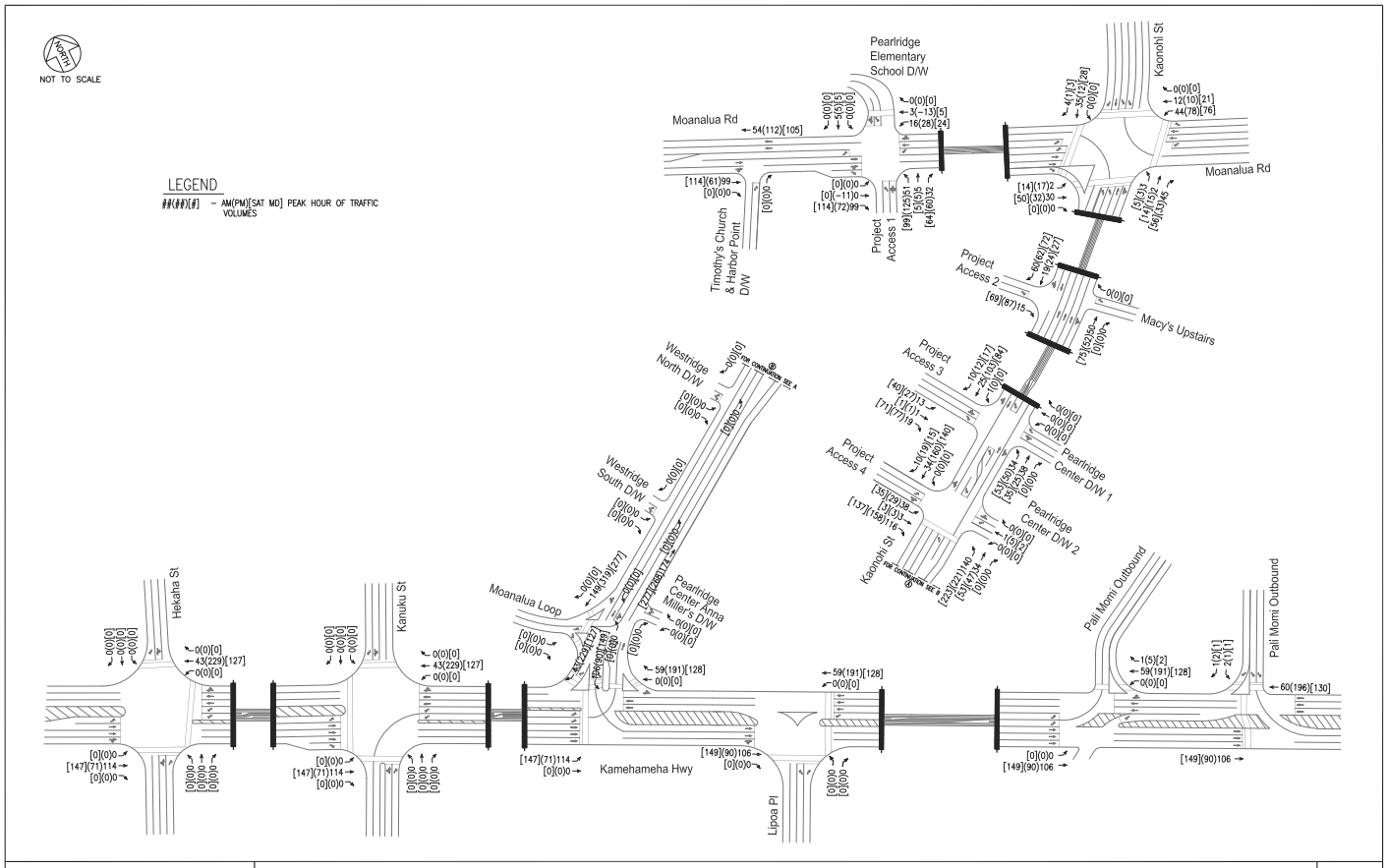

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FIGURE 13

YEAR 2017 PROJECT VOLUME DISTRIBUTION

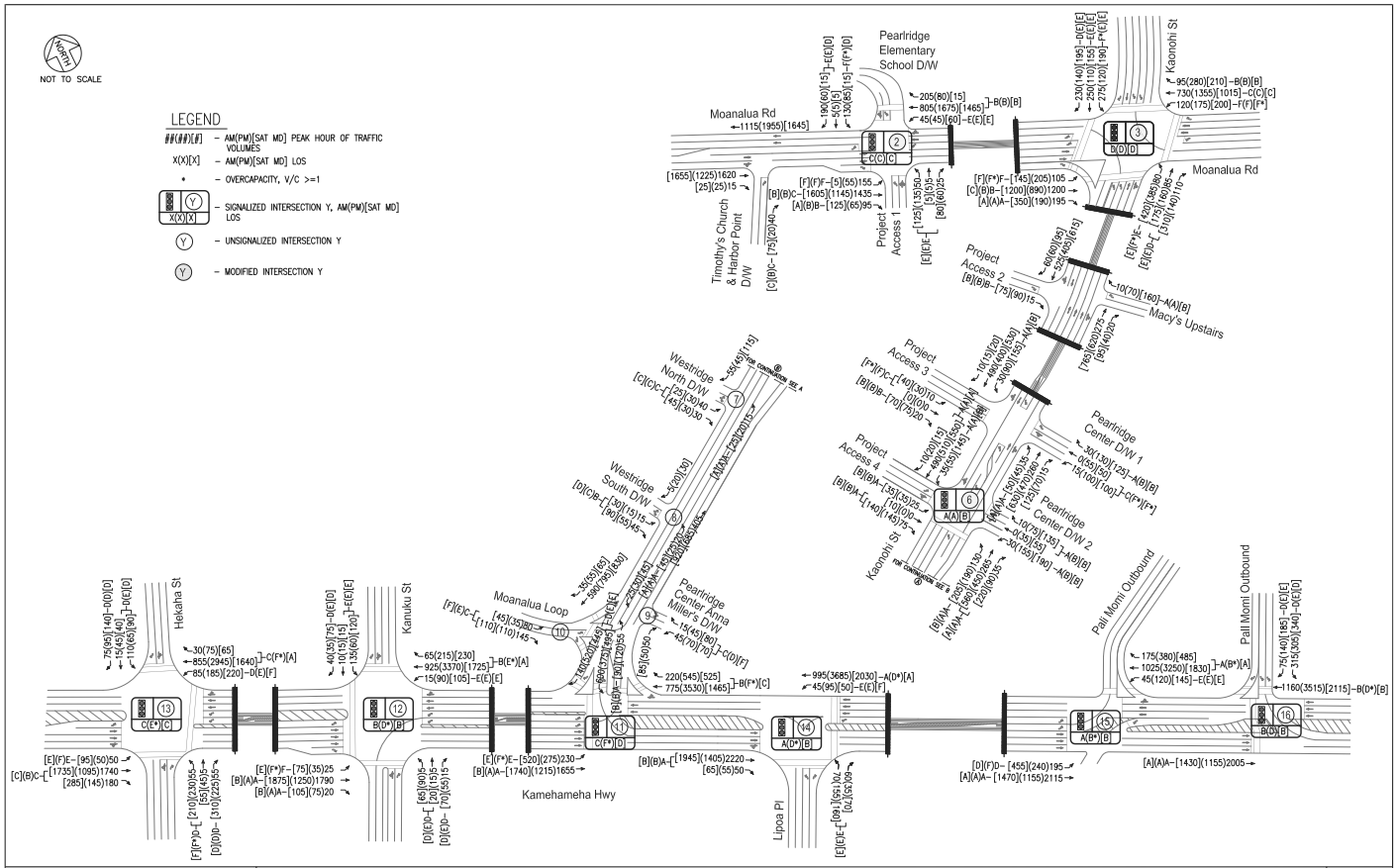

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FIGURE 12

YEAR 2015 WITH PROJECT AND IMPROVEMENTS VOLUME AND LEVEL OF SERVICE

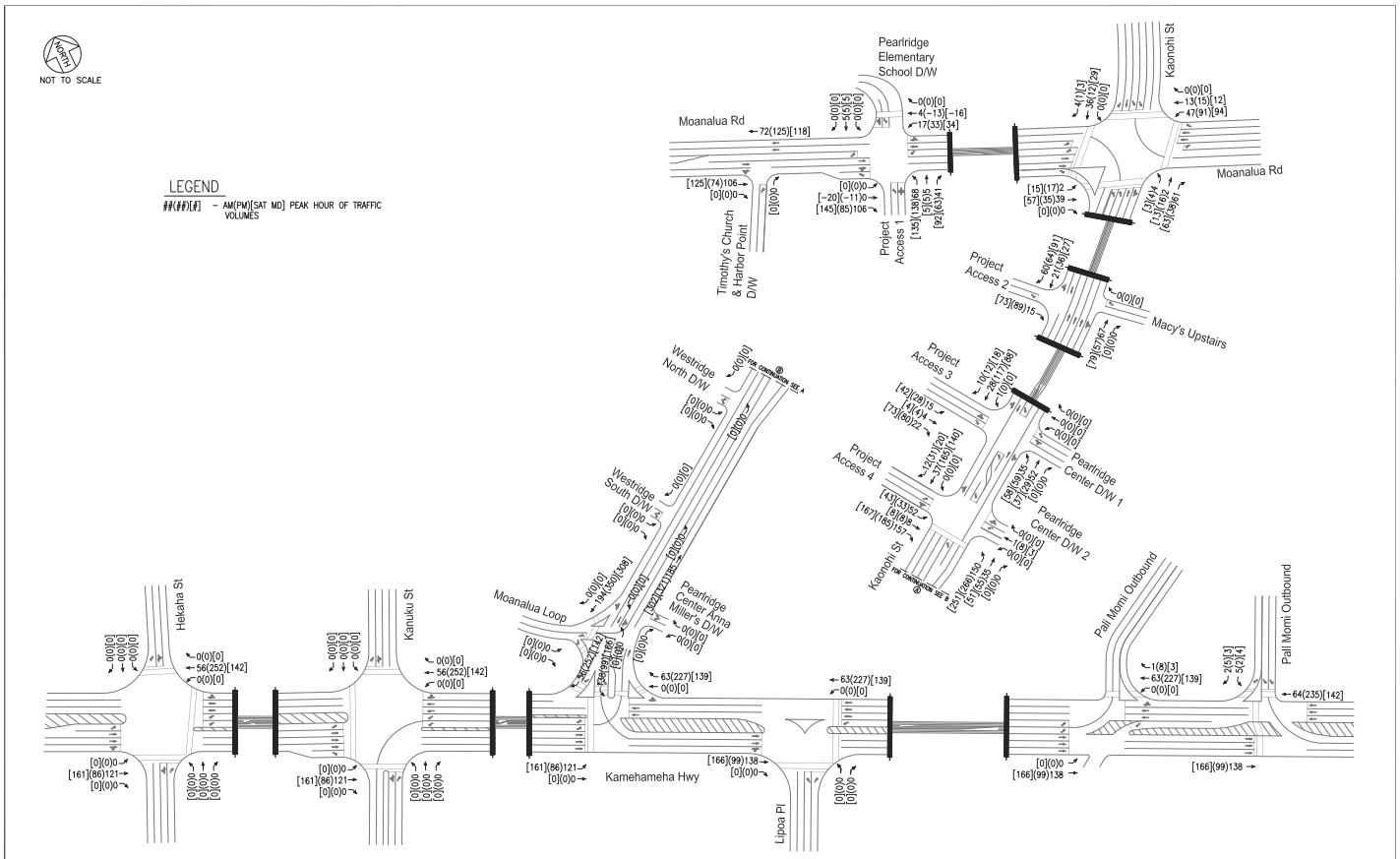

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FIGURE 15

YEAR 2019 PROJECT VOLUME DISTRIBUTION

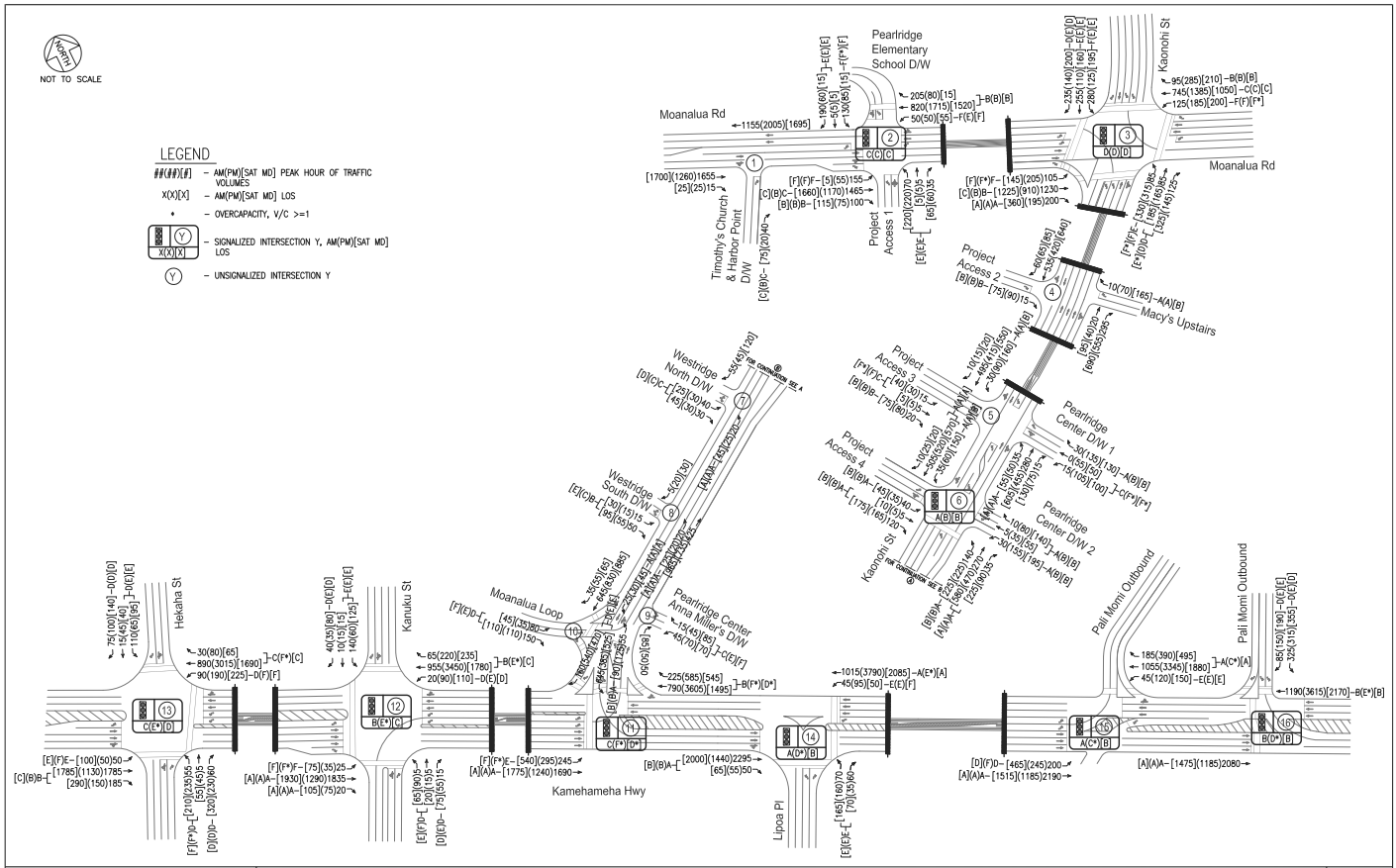

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FIGURE 14

YEAR 2017 PROJECT VOLUME AND LEVEL OF SERVICE

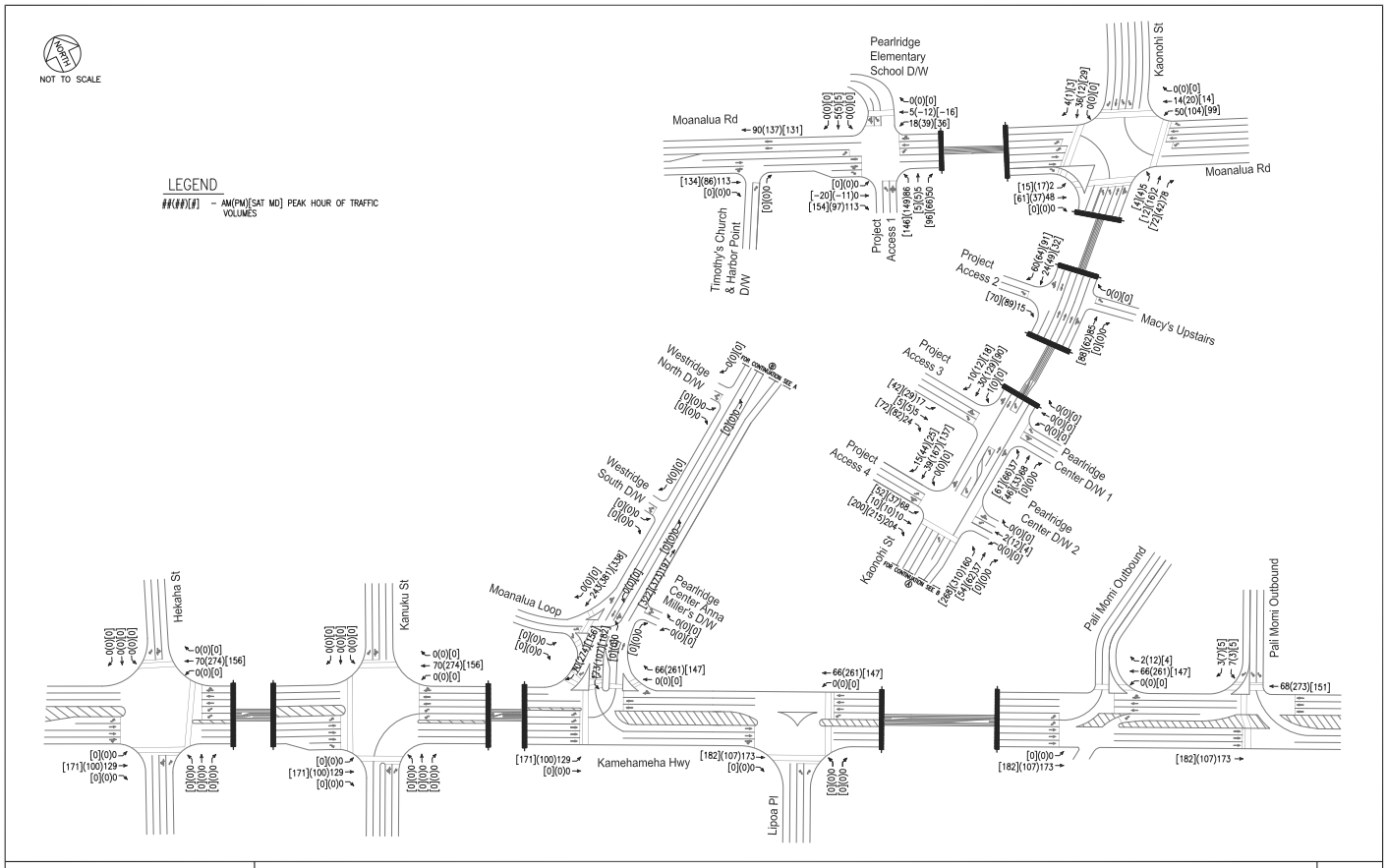

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FIGURE 17

YEAR 2021 PROJECT VOLUME DISTRIBUTION

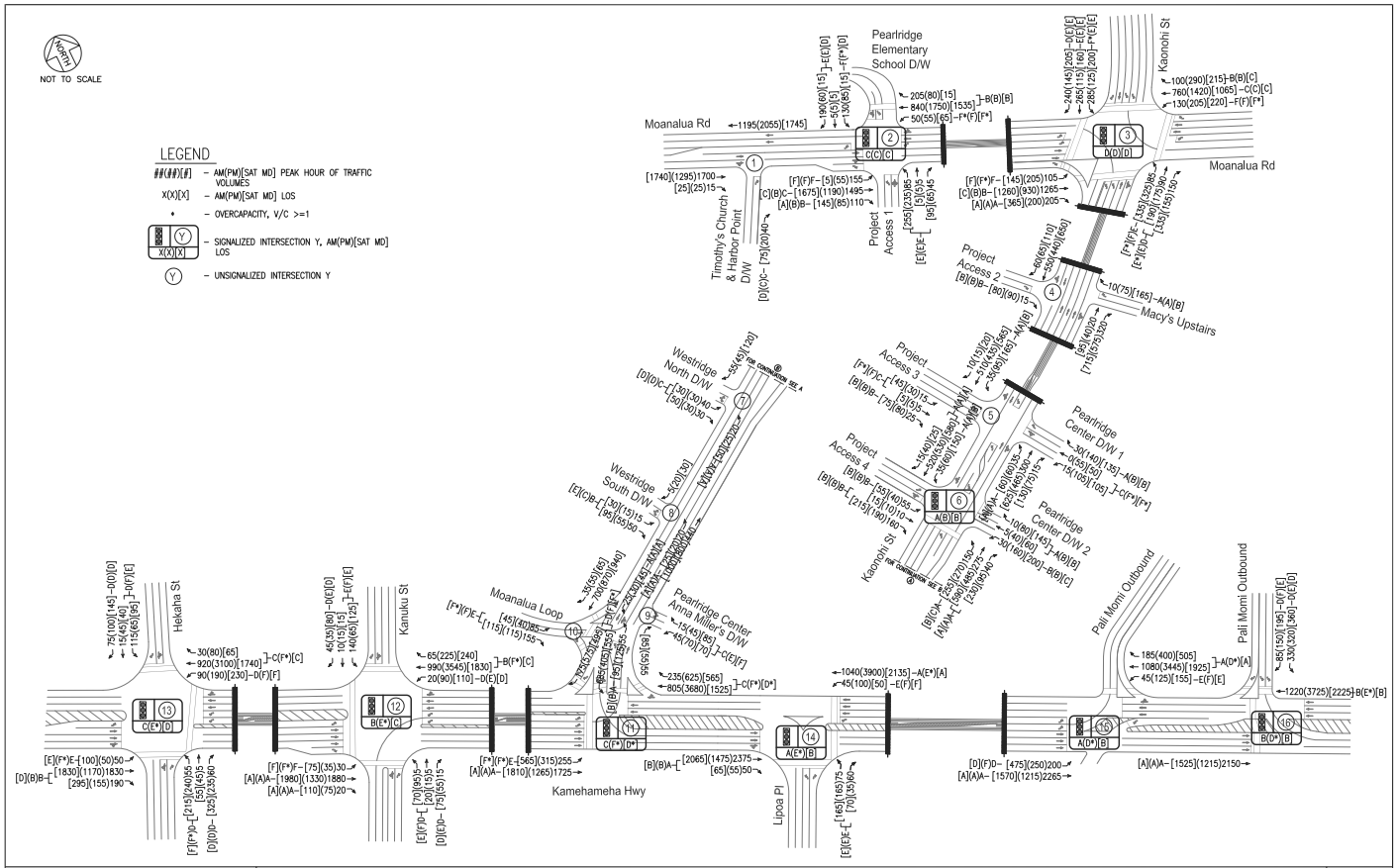

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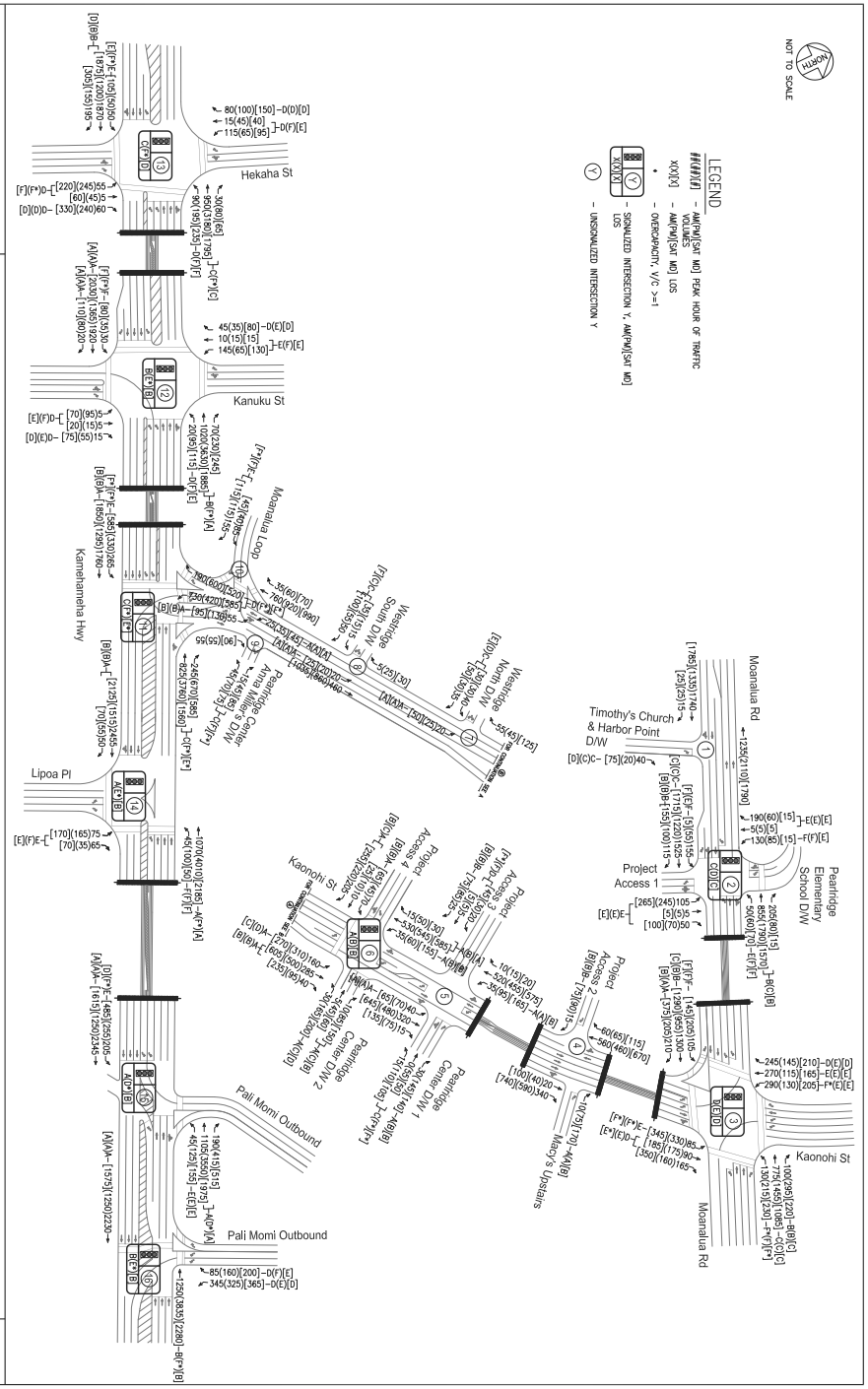
FIGURE 16

YEAR 2019 PROJECT VOLUME AND LEVEL OF SERVICE



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YEAR 2021 WITH PROJECT VOLUME AND LEVEL OF SERVICE

FIGURE 18

Year 2019 and 2021 with Proposed Project and RT

The RT is planned to generally follow the Kamehameha Highway roadway alignment median within the Proposed Project area and is anticipated to be completed by year 2019 with a station located south of the Proposed Project just west of Kaonohi Street. The station will be within walking distance approximately less than 0.5 miles from the Proposed Project. Therefore, in addition to being a multi-use development – commercial, office and residential land uses – the Project as proposed is a Transportation Oriented Development (TOD) due to its proximity to bus transportation and the proposed transit system.

A study[5] of 17 TOD in four (4) different urbanized areas with high quality rail services showed an average trip generation of approximately 48%(37%) below ITE trip generation rates during the weekday AM(PM) peak hour of traffic respectively. Therefore, it is likely that with the completed RT a higher traffic volume reduction would occur especially during the weekday PM peak hour of traffic due to overcapacity conditions currently experienced. However, due to the lack of official trip generation rates for this type of land use, this report assumed regular residential and commercial trip generation rates. **Thus, the analysis contained within, showing an approximate 20-second intersection delay reduction for intersections along Kamehameha Highway is considered conservative.**

See Figures 19 and 21 for Year 2019 and 2021 with the Proposed Project and RT Proposed Project distribution and Figures 20 and 22 for the Year 2019 and 2021 with Proposed Project and RT volume and LOS. See Table 7a-7b for a summary of the Year 2015 to 2021 with Proposed Project LOS.

[5] Transportation Research Board of the National Academies, TCRP Report 128: Effects on of TOD Housing, Parking, and Travel, 2008

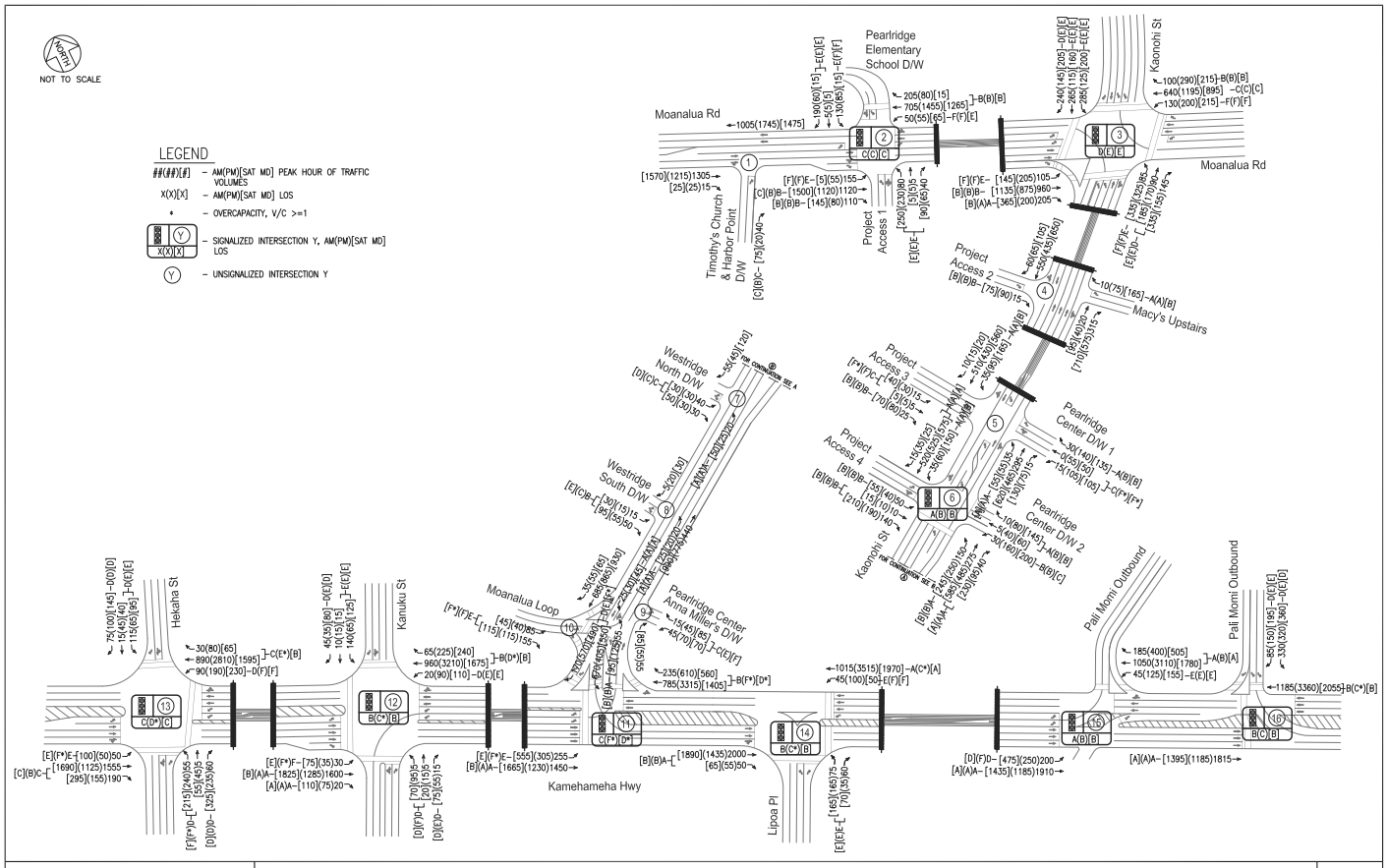

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FIGURE 20

YEAR 2019 WITH PROJECT and RAIL TRANSIT VOLUME AND LEVEL OF SERVICE

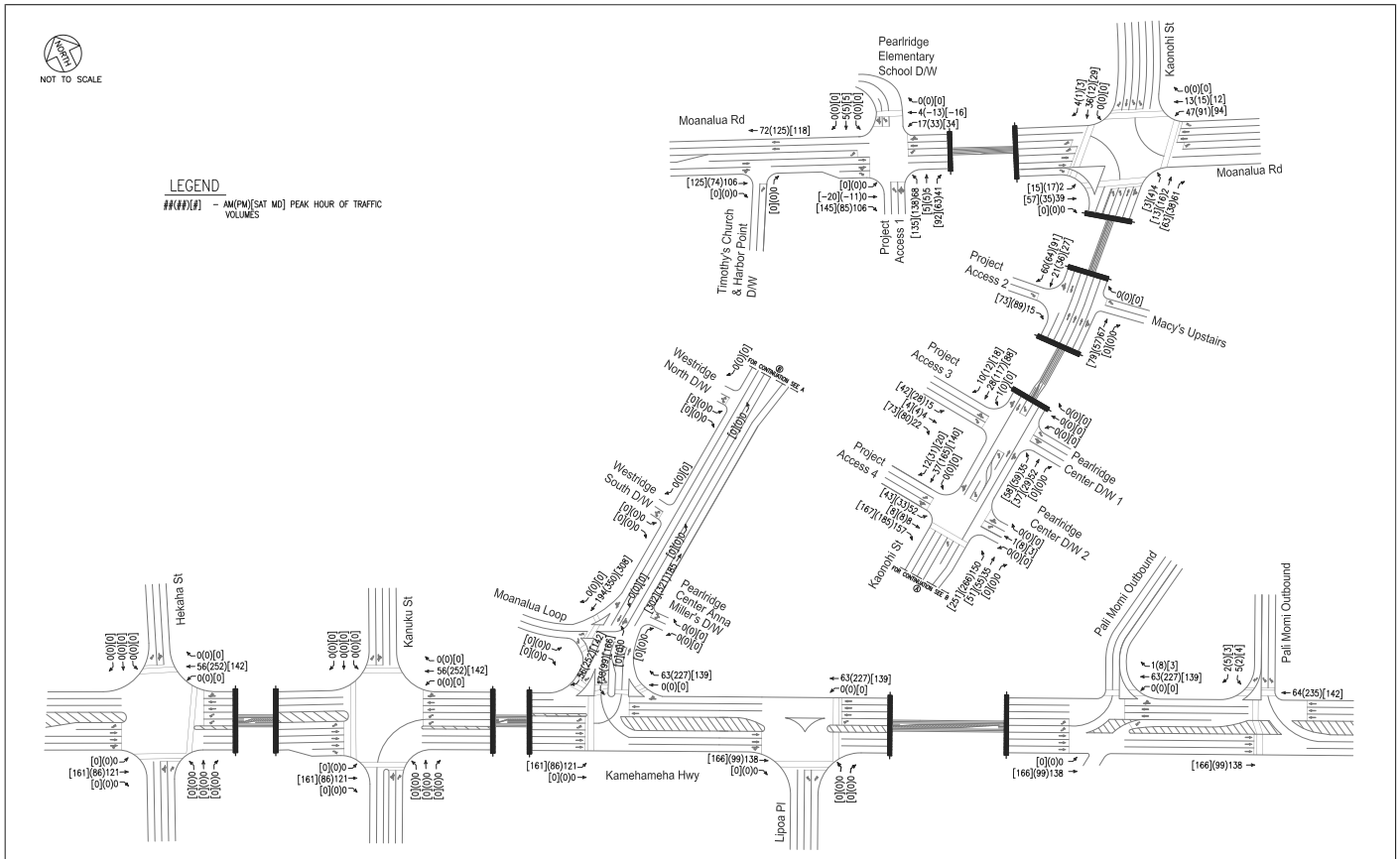

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FIGURE 19

YEAR 2019 WITH RAIL TRANSIT PROJECT VOLUME DISTRIBUTION

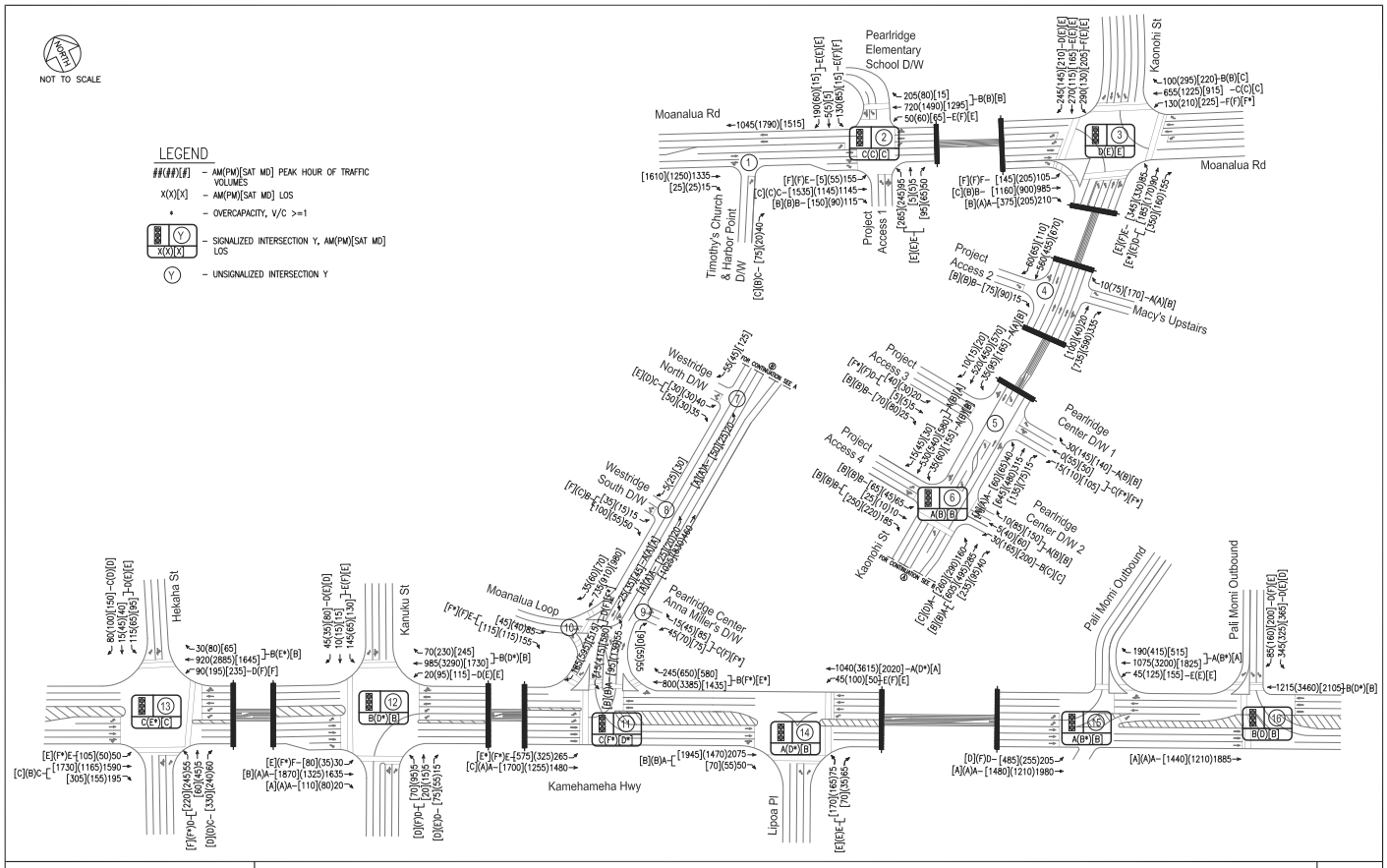

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FIGURE 22

YEAR 2021 WITH RAIL TRANSIT PROJECT VOLUME AND LEVEL OF SERVICE

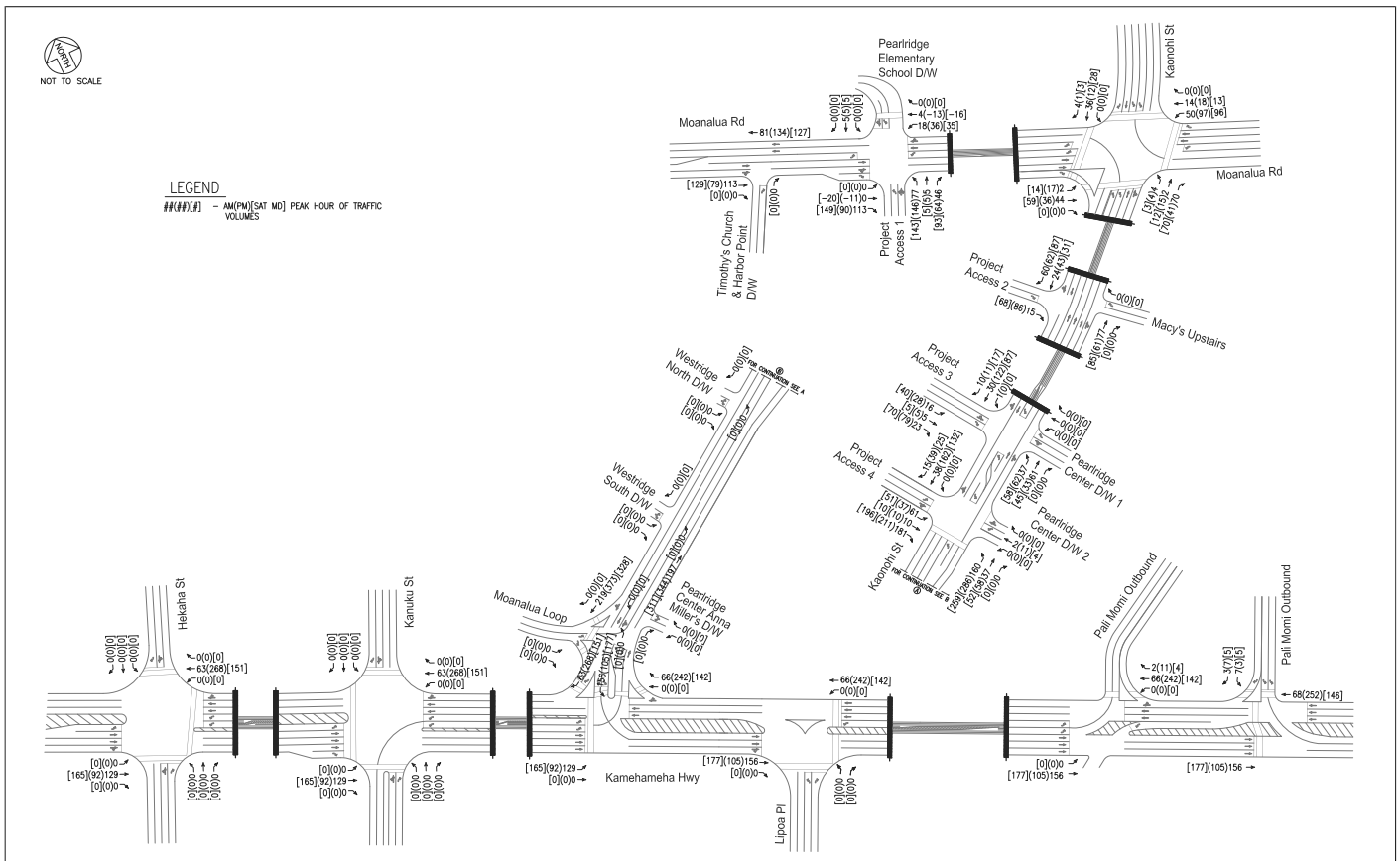

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FIGURE 21

YEAR 2021 WITH RAIL TRANSIT PROJECT VOLUME DISTRIBUTION

Table 7a: Existing, Year 2015 with Project, Year 2015 with Project and Improvements, and Year 2017 with Project Level of Service Summary Cont'd

INTERSECTION	Existing									Future Year 2015									Future Year 2015 with Improvements[1]									Future Year 2017								
	AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
8: Westridge (south) & Kaonohi Street																																				
EB LT/RT	11	0.08	B	12	0.11	B	27	0.43	D	13	0.13	B	18	0.21	C	31	0.49	D										14	0.14	B	18	0.22	C	35	0.54	E
NB LT/TH	2	0.01	A	1	0.02	A	2	0.06	A	1	0.02	A	0	0.32	0	2	0.06	A										1	0.02	A	1	0.04	A	2	0.07	A
9: Pearlridge Center - Ana Miller's D/W & Kaonohi Street																																				
WB LT/RT	12	0.10	B	16	0.25	C	28	0.49	D	16	0.16	C	31	0.48	D	74	0.82	F										16	0.17	C	36	0.52	E	97	0.91	F
SB LT/TH	2	0.02	A	2	0.03	A	2	0.05	A	2	0.03	A	2	0.04	A	3	0.08	A										2	0.03	A	2	0.04	A	3	0.08	A
10: Moanalua Loop & Kaonohi Street																																				
EB LT/RT	16	0.41	C	16	0.31	C	45	0.65	E	25	0.58	C	38	0.61	E	70	0.81	F										29	0.64	D	47	0.67	E	96	0.91	F
NB LT	9	0.05	A	9	0.12	A	11	0.13	B	9	0.06	A	0	0.23	A	11	0.13	B										9	0.07	A	11	0.18	B	11	0.14	B
11: Kamehameha Highway & Kaonohi Street																																				
EB LT	48	0.49	D	68	0.61	E	63	0.86	E	70	0.67	E	265	1.40	F*	78	0.99	E										70	0.68	E	334	1.56	F*	102	0.99	F
EB TH	27	0.58	C	7	0.32	A	16	0.58	B	8	0.63	A	7	0.36	A	17	0.57	B										6	0.66	A	8	0.37	A	3	0.59	A
WB TH/RT	14	0.40	B	189	1.36	F*	25	0.87	C	18	0.50	B	250	1.51	F*	31	0.95	C										19	0.54	B	268	1.55	F*	46	1.01	D*
SB LT/RT	40	0.53	D	57	0.72	E	57	0.86	E	43	0.60	D	66	0.86	E	79	0.97	E										41	0.63	D	69	0.87	E	78	0.97	E
SB RT	33	0.08	C	48	0.13	D	45	0.45	D	34	0.10	C	69	0.80	E	47	0.44	D										32	0.12	C	68	0.79	E	46	0.33	D
Overall	26	0.57	C	134	1.16	F*	31	0.86	C	21	0.62	C	179	1.35	F*	38	0.96	D										21	0.65	C	195	1.39	F*	42	1.00	D*
12:Kamehameha Highway & Kanuku Street																																				
EB LT	62	0.38	E	51	0.47	D	54	0.65	D	112	0.64	F	246	1.12	F*	61	0.71	E										101	0.61	F	259	1.15	F*	81	0.73	F
EB TH	7	0.52	A	11	0.38	B	22	0.65	C	3	0.58	A	5	0.41	A	16	0.68	B										3	0.61	A	5	0.42	A	6	0.70	A
EB RT	7	0.01	A	15	0.06	B	24	0.09	C	0	0.02	A	2	0.06	A	14	0.10	B										0	0.02	A	2	0.06	A	2	0.10	A
WB LT	75	0.22	E	62	0.40	E	67	0.45	E	55	0.35	E	72	0.52	E	74	0.47	E										49	0.31	D	74	0.53	E	47	0.49	D
WB TH/RT	7	0.31	A	57	1.04	E*	9	0.76	A	11	0.33	B	62	1.12	E*	8	0.71	A										15	0.34	B	71	1.14	E*	25	0.73	C
NB LT/TH	47	0.03	D	65	0.67	E	45	0.30	D	50	0.04	D	79	0.75	E	54	0.53	D										47	0.04	D	83	0.76	F	56	0.54	E
NB RT	47	0.01	D	50	0.03	D	40	0.05	D	49	0.01	D	55	0.04	E	47	0.05	D										47	0.01	D	57	0.04	E	48	0.05	D
SB LT/TH	65	0.73	E	58	0.55	E	53	0.53	D	71	0.76	E	70	0.64	E	74	0.79	E										69	0.77	E	74	0.65	E	78	0.81	E
SB RT	47	0.03	D	50	0.02	D	41	0.05	D	49	0.03	D	55	0.03	E	48	0.06	D										47	0.03	D	57	0.04	E	49	0.06	D
Overall	12	0.53	B	46	0.97	D	20	0.66	B	11	0.59	B	49	1.07	D*	18	0.69	B										12	0.61	B	55	1.09	E*	21	0.71	C
13: Kamehameha Highway & Hekaha Street																																				
EB LT	56	0.46	E	66	0.47	E	66	0.74	E	66	0.60	E	174	0.95	F	62	0.75	E										68	0.58	E	191	0.98	F	67	0.76	E
EB TH/RT	10	0.60	A	29	0.51	C	27	0.87	C	21	0.78	C	15	0.52	B	25	0.90	C										18	0.80	B	16	0.53	B	33	0.92	C
WB LT	87	0.40	F	66	0.59	E	91	0.78	F	48	0.52	D	80	0.67	E	110	0.92	F										51	0.53	D	82	0.68	F	109	0.97	F
WB TH/RT	1	0.28	A	73	1.12	E*	11	0.79	B	23	0.35	C	84	1.14	F*	10	0.76	A										21	0.37	C	83	1.15	F*	24	0.78	C
NB LT/TH	52	0.40	D	63	0.84	E	55	0.76	E	42	0.21	D	126	1.06	F*	84	0.94	F										42	0.21	D	153	1.13	F*	89	0.95	F
NB RT	48	0.04	D	37	0.16	D	39	0.43	D	39	0.04	D	45	0.33	D	42	0.52	D										38	0.04	D	48	0.34	D	44	0.55	D
SB LT/TH	66	0.72	E	40	0.42	D	43	0.48	D	48	0.44	D	62	0.70	E	54	0.70	D										47	0.45	D	78	0.79	E	60	0.75	E
SB RT	48	0.05	D	35	0.07	D	33	0.10	C	40	0.06	D	43	0.15	D	36	0.11	D										39	0.06	D	46	0.18	D	38	0.11	D
Overall	15	0.61	B	58	1.01	E*	28	0.82	C	25	0.67	C	67	1.12	E*	30	0.87	C										23	0.68	C	69	1.14	E*	38	0.89	D
14: Kamehameha Highway & Lipoa Street																																				
EB TH/RT	21	0.65	C	21	0.44	C	12	0.69	B	6	0.70	A	15	0.49	B	16	0.72	B										7	0.72	A	16	0.50	B	14	0.73	B
WB LT	51	0.44	D	60	0.57	E	80	0.55	E	70	0.62	E	74	0.66	E	86	0.58	F										70	0.64	E	77	0.67	E	89	0.60	F
WB TH	3	0.25	A	40	1.06	D*	4	0.56	A	3	0.28	A	51	1.09	D*	4	0.63	A										3	0.29	A	64	1.12	E*	4	0.65	A
NB LT/RT	62	0.60	E	62	0.72	E	63	0.76	E	68	0.65	E	71	0.76	E	66	0.79	E										65	0.64	E	73	0.77	E	68	0.80	E
Overall	18	0.63	B	36	1.00	D*	12	0.72	B	8	0.69	A	42	1.04	D*	14	0.75	B										9	0.71	A	52	1.06	D*	13	0.76	B
15: Kamehameha Highway & Pali Momi Inbound																																				
EB LT	76	0.60	E	51	0.65	D	39	0.78	D	53	0.63	D	113	0.98	F	41	0.80	D										50	0.63	D	105	0.96	F	43	0.82	D
EB TH/RT	1	0.52	A	2	0.30	A	5	0.44	A	2	0.57	A	2	0.33	A	6	0.44	A										2	0.59	A	2	0.34	A	6	0.46	A
WB LT	71	0.43	E	64	0.64	E	68	0.70	E	64	0.49	E	70	0.71	E	70	0.72	E										61	0.49	E	70	0.72	E	74	0.75	E
WB TH/RT	0	0.31	A	6	0.97	A	5	0.68	A	2	0.34	A	16	1.01	B*	6	0.76	A										2	0.35	A	27	1.04	C*	6	0.78	A
Overall	6	0.51	A	9	0.93	A	11	0.70	B	5	0.56	A	18	1.01	B*	12	0.77	B										5	0.58	A	26	1.04	C*	12	0.79	B
16: Kamehameha Highway & Pali Momi Outbound																																				
EB TH	6	0.66	A	3	0.31	A	3	0.44	A	6	0.71	A	5	0.34	A	3	0.45	A										7	0.76	A	5	0.35	A	3	0.46	A
WB TH	12	0.38	B	21	0.96	C	9	0.59	A	13	0.41	B	45	1.04	D*	11	0.66	B										13	0.43	B	59	1.08	E*	11	0.68	B
SB LT	41	0.37	D	53	0.60	D	50	0.58	D	45	0.40	D	61	0.65	E	52	0.59	D										42	0.40	D	62	0.65	E	53	0.61	D
SB RT	36	0.06	D	62	0.70	E	65	0.77	E	40	0.06	D	72	0.75	E	67	0.79	E										38	0.11	D	76	0.77	E	71	0.80	E
Overall	12	0.58	B	20	0.91	C	13	0.63	B	12	0.62	B	37	0.99	D	14	0.69	B										13	0.65	B	47	1.03	D*	15	0.71	B

Note:
* = overcapacity conditions, v/c >1
n/a = applies to unsignalized intersection and usually operates better than shown in the analysis
[1]= where intersection results are blank, the result is similar to Future Year 2015

Table 7a: Existing, Year 2015 with Project, Year 2015 with Project and Improvements, and Year 2017 with Project Level of Service Summary

INTERSECTION	Existing									Future Year 2015									Future Year 2015 with Improvements[1]									Future Year 2017								
	AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Moanalua Road & Harbor Pointe																																				
WB LT	15	0.08	B	12	0.03	B	15	0.08	C																											
NB LT/RT	23	0.22	C	18	0.11	C	28	0.38	D																											
NB RT										20	0.15	C	15	0.06	B	23	0.30	C										20	0.16	C	15	0.06	B	24	0.31	C
2: Moanalua Road & Pearlridge Elementary School & Project Access 1																																				
																			Signalized									Signalized								
EB LT	11	0.22	B	18	0.17	C	14	0.01	B	12	0.23	B	17	0.17	C	13	0.01	B	85	0.83	F	163	0.95	F	106	0.50	F	85	0.82	F	163	0.95	F	104	0.50	F
EB TH	0	0.43	0	0	0.35	0	0	0.51	0	0	0.46	0	0	0.37	0	0	0.51	0	21	0.72	C	18	0.59	B	19	0.75	B	21	0.72	C	18	0.59	B	22	0.80	C
EB RT										0	0.06	0	0	0.04	0	0	0.08	0	11	0.09	B	12	0.06	B	9	0.11	A	11	0.09	B	11	0.07	B	10	0.11	B
WB LT										16	0.13	C	0	0.37	0	19	0.21	C	65	0.47	E	77	0.60	E	64	0.64	E	114	0.79	F	80	0.61	E	102	0.85	F
WB TH/RT	0	0.29	0	0	0.41	0	0	0.34	0	0	0.30	0	0	0.41	0	0	0.32	0	14	0.56	B	18	0.89	B	12	0.64	B	14	0.59	B	16	0.89	B	12	0.70	B
NB LT																			68	0.47	E	69	0.71	E	81	0.82	F	68	0.50	E	68	0.70	E	68	0.71	E
NB LT/TH										n/a	42.45	F*	n/a	n/a	F*	n/a	n/a	F*																		
NB LT/TH/RT																			64	0.17	E	61	0.58	E	61	0.60	E	64	0.19	E	62	0.60	E	61	0.59	E
NB RT										17	0.08	C	15	0.15	B	22	0.30	C																		
SB LT																			89	0.82	F	171	1.03	F*	52	0.12	D	87	0.81	F	343	1.46	F*	85	0.53	F
SB LT/RT	21	0.61	C	38	0.59	E	23	0.11	C																											
SB TH/RT																			59	0.16	E	64	0.10	E	51	0.03	D	60	0.16	E	66	0.13	E	71	0.19	E
SB LT/TH/RT										n/a	10.66	F*	n/a	n/a	F*	n/a	n/a	F*																		
Overall																			28	0.74	C	29	0.83	C	21	0.80	C	30	0.71	C	32	0.84	C	23	0.83	C
3: Moanalua Road & Kaonohi Street																																				
																			EB: Double LT, 2 TH and RT									EB: Double LT, 2 TH and RT								
EB LT	58	0.56	E	85	0.81	F	80	0.71	F	53	0.61	D	124	1.04	F*	66	0.75	E	88	0.54	F	132	1.01	F*	90	0.56	F	89	0.55	F	127	1.01	F*	92	0.72	F
EB TH	28	0.71	C	24	0.47	C	41	0.77	D	34	0.85	C	29	0.66	C	46	0.93	D	16	0.74	B	13	0.54	B	20	0.79	C	17	0.75	B	17	0.59	B	23	0.83	C
EB RT	18	0.13	B	19	0.12	B	30	0.31	C	19	0.13	B	21	0.13	C	26	0.28	C	2	0.13	A	2	0.13	A	8	0.27	A	2	0.14	A	4	0.13	A	10	0.27	A
WB LT	58	0.47	E	78	0.64	E	80	0.76	F	79	0.82	E	57	0.73	E	84	0.89	F	99	0.86	F	82	0.83	F	138	1.04	F*	121	0.93	F	82	0.84	F	146	1.07	F*
WB TH	23	0.44	C	38	0.81	D	34	0.64	C	25	0.54	C	43	0.94	D	33	0.75	C	21	0.43	C	25	0.73	C	28	0.62	C	22	0.43	C	28	0.78	C	27	0.64	C
WB RT	19	0.06	B	24	0.22	C	25	0.13	C	20	0.07	B	21	0.23	C	23	0.14	C	17	0.07	B	15	0.21	B	20	0.14	B	17	0.07	B	17	0.22	B	19	0.14	B
NB LT	58	0.34	E	77	0.82	E	73	0.82	E	55	0.51	D	60	0.80	E	58	0.75	E	68	0.51	E	125	1.04	F*	77	0.84	E	69	0.51	E	80	0.88	F	124	1.05	F*
NB TH/RT	52	0.25	D	60	0.33	E	58	0.48	E	41	0.21	D	44	0.38	D	49	0.61	D	52	0.22	D	57	0.44	E	60	0.64	E	54	0.22	D	54	0.40	D	61	0.86dr	E*
SB LT	56	0.63	E	76	0.56	E	75	0.65	E	71	0.88	E	53	0.51	D	57	0.61	E	121	1.02	F*	69	0.61	E	70	0.68	E	113	0.99	F	70	0.63	E	69	0.70	E
SB TH	56	0.69	E	76	0.60	E	77	0.69	E	45	0.68	D	53	0.58	D	57	0.66	E	62	0.76	E	66	0.62	E	69	0.69	E	65	0.77	E	66	0.62	E	57	0.58	E
SB RT	45	0.15	D	68	0.09	E	64	0.12	E	36	0.21	D	47	0.10	D	47	0.13	D	48	0.25	D	57	0.11	E	56	0.13	E	50	0.28	D	57	0.10	E	53	0.35	D
Overall	35	0.67	C	45	0.79	D	49	0.81	D	38	0.78	D	44	0.94	D	45	0.86	D	38	0.85	D	42	0.83	D	42	0.87	D	40	0.86	D	40	0.80	D	46	0.84	D
4: Project Access 2-RIRO Driveway & Kaonohi Street																																				
EB RT	0	0.00	A	0	0.00	A	15	0.10	C	10	0.02	B	11	0.13	B	12	0.13	B	10	0.02	B	11	0.13	B	12	0.13	B	11	0.02	B	11	0.13	B	12	0.13	B
WB RT	9	0.01	A	10	0.08	A	11	0.22	B	9	0.01	A	10	0.09	A	11	0.23	B	9	0.01	A	10	0.09	A	11	0.23	B	9	0.01	A	10	0.09	A	11	0.24	B
5: Pearlridge Center D/W 1 & Project Access 3 & Kaonohi Street																																				
EB LT/TH										21	0.05	C	84	0.43	F	1203	2.61	F*	21	0.05	C	79	0.41	F	857	2.02	F*	23	0.10	C	84	0.47	F	n/a	3.54	F*
EB RT										10	0.03	B	10	0.10	B	11	0.11	B	10	0.03	B	10	0.10	B	11	0.11	B	10	0.03	B	10	0.11	B	11	0.12	B
WB LT	13	0.02	B	14	0.21	B	131	0.90	F																											
WB LT/TH										18	0.06	C	217	1.24	F*	877	2.62	F*	18	0.06	C	204	1.21	F*	784	2.43	F*	19	0.06	C	255	1.33	F*	1031	2.94	F*
WB RT	9	0.03	A	12	0.25	B	14	0.31	B	9	0.04	A	11	0.20	B	13	0.22	B	9	0.04	A	11	0.19	B	11	0.19	B	9	0.04	A	11	0.19	B	11	0.20	B
NB LT										9	0.04	A	8	0.04	A	9	0.06	A	9	0.04	A	8	0.04	A	9	0.06	A	9	0.04	A	9	0.05	A	9	0.06	A
SB LT										8	0.03	A	9	0.10	A	10	0.20	B	8	0.03	A	9	0.10	A	10	0.19	B	8	0.03	A	9	0.09	A	10	0.20	B
SB LT/TH	1	0.02	A	5	0.09	A	6	0.20	A																											
6: Pearlridge Center D/W 2 & Project Access 4 & Kaonohi Street																																				
																			Signalized									Signalized								
EB LT																			10	0.11	A	12	0.10	B	13	0.11	B	10	0.16	A	14	0.10	B	14	0.14	B
EB LT/TH										33	0.17	D	283	0.96	F	n/a	n/a	F*																		
EB TH/RT																			10	0.05	A	12	0.10	B	13	0.12	B	10	0.10	A	14	0.12	B	14	0.14	B
EB LT/TH/RT	0	0.00	A	14	0.02	B	441	1.88	F*																											
EB RT										11	0.11	B	12	0.22	B	12	0.22	B																		
WB LT	14	0.06	B	33	0.56	D	n/a	6.91	F*										10	0.14	A	14	0.47	B	17	0.55	B	10	0.12	A	16	0.46	B	19	0.59	B
WB LT/TH										36	0.22	E	n/a	3.76	F*	n/a	15.85	F*																		
WB TH/RT	9	0.01	A	11	0.14	B	13	0.31	B										10	0.01	A	12	0.13	B	13	0.21	B	9	0.02	A	14	0.13	B	15	0.21	B
WB RT										9	0.01	A	11	0.12	B	13	0.25	B																		
NB LT										9	0.14	A	10	0.21	A	10	0.23	A	5	0.36	A	9	0.53	A	11	0.59	B	6	0.41	A	12	0.61	B	14	0.65	B
NB TH/RT	0	0.07	0	0	0.14	0	0	0.24	0	0	0.08	0	0	0.15	0	0	0.26	0	4	0.19	A	7	0.34	A	9	0.47	A	5	0.20	A	8	0.33	A	9	0.47	A
SB LT	8	0.03	A	9	0.05	A	10	0.17	B	8	0.03	A	9	0.06	A	11	0.20	B	4	0.08	A	7	0.15	A	13	0.59	B	4	0.08	A	7	0.17	A	14	0.61	B
SB TH/RT	0	0.18	0	0	0.14	0	0	0.19	0	0	0.11	0	0	0.12	0	0	0.13	0	4	0.32	A	7	0.34	A	8	0.35	A	5	0.35	A	8	0.33	A	8	0.35	A
Overall																			5	0.31	A	9	0.50	A	10	0.58	B	6	0.34	A	10	0.56	B	11	0.63	B
7: Westridge (north) & Kaonohi Street																																				
EB LT/RT	13	0.13	B	14	0.12	B	25	0.28	D	16	0.19	C	25	0.26	C	27	0.32	D										16	0.19	C	23	0.24	C	25	0.30	D
NB LT/TH	1	0.01	A	1	0.02	A	1	0.04	A	1	0.02	A	0	0.32	A	1	0.04	A										1	0.02	A	1	0.03	A	1	0.04	A

Note:
* = overcapacity conditions, v/c >1
n/a = applies to unsignalized intersection and usually operates better than shown in the analysis
[1]= where intersection results are blank, the result is similar to Future Year 2015

Table 7b: Year 2019 with Project, Year 2019 with Project and RT, Year 2021 with Project and Year 2021 with Project and RT Level of Service Summary Cont'd

INTERSECTION	Future Year 2019									Future Year 2019 with RT									Future Year 2021									Future Year 2021 with RT								
	AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
10: Moanalua Loop & Kaonohi Street																																				
EB LT/RT	38	0.73	E	75	0.83	F	140	1.05	F*	36	0.71	E	71	0.81	F	131	1.03	F*	48	0.80	E	112	0.96	F	187	1.17	F*	44	0.77	E	101	0.93	F	176	1.14	F*
NB LT	10	0.07	A	11	0.19	B	11	0.15	B	10	0.07	A	11	0.19	B	11	0.15	B	10	0.07	A	12	0.21	B	12	0.16	B	10	0.07	A	12	0.20	B	12	0.16	B
11: Kamehameha Highway & Kaonohi Street																																				
EB LT	69	0.69	E	290	1.45	F*	116	1.03	F*	68	0.69	E	311	1.50	F*	66	0.98	E	72	0.72	E	287	1.44	F*	108	1.07	F*	67	0.70	E	309	1.50	F*	75	1.01	E*
EB TH	7	0.68	A	9	0.37	A	4	0.60	A	6	0.57	A	9	0.37	A	19	0.55	B	8	0.71	A	11	0.38	B	17	0.61	B	6	0.60	A	10	0.37	A	21	0.57	C
WB TH/RT	20	0.56	C	291	1.60	F*	54	1.04	D*	19	0.55	B	232	1.47	F*	43	1.00	D*	22	0.59	C	311	1.64	F*	64	1.07	E*	20	0.59	B	252	1.51	F*	55	1.05	E*
SB LT/RT	41	0.65	D	84	0.94	F	91	1.02	F*	40	0.64	D	77	0.92	E	85	1.00	F*	42	0.68	D	102	1.01	F*	108	1.07	F*	39	0.67	D	87	0.96	F	89	1.02	F*
SB RT	31	0.13	C	77	0.83	E	47	0.41	D	31	0.12	C	74	0.82	E	44	0.36	D	32	0.14	C	88	0.88	F	48	0.47	D	30	0.14	C	82	0.86	F	44	0.40	D
Overall	22	0.67	C	209	1.43	F*	48	1.03	D*	22	0.60	C	169	1.34	F*	44	1.00	D*	23	0.69	C	224	1.48	F*	58	1.07	E*	22	0.62	C	183	1.38	F*	51	1.03	D*
12:Kamehameha Highway & Kanuku Street																																				
EB LT	103	0.65	F	296	1.23	F*	81	0.73	F	90	0.52	F	276	1.19	F*	63	0.61	E	108	0.66	F	316	1.27	F*	81	0.76	F	92	0.54	F	294	1.23	F*	70	0.74	E
EB TH	3	0.62	A	5	0.43	A	6	0.72	A	3	0.53	A	5	0.42	A	11	0.67	B	3	0.63	A	5	0.44	A	7	0.74	A	3	0.55	A	5	0.43	A	11	0.69	B
EB RT	0	0.02	A	1	0.06	A	2	0.10	A	0	0.02	A	1	0.06	A	9	0.10	A	0	0.02	A	1	0.06	A	2	0.11	A	0	0.02	A	1	0.06	A	9	0.10	A
WB LT	50	0.31	D	79	0.56	E	49	0.49	D	50	0.31	D	76	0.55	E	75	0.49	E	53	0.32	D	82	0.56	F	68	0.51	E	48	0.30	D	79	0.55	E	74	0.50	E
WB TH/RT	14	0.36	B	84	1.17	F*	24	0.75	C	15	0.35	B	39	1.07	D*	12	0.71	B	14	0.37	B	94	1.19	F*	8	0.78	A	15	0.37	B	48	1.09	D*	12	0.73	B
NB LT/TH	47	0.04	D	92	0.80	F	57	0.56	E	47	0.04	D	89	0.79	F	54	0.55	D	49	0.04	D	96	0.80	F	56	0.56	E	45	0.04	D	92	0.80	F	54	0.55	D
NB RT	47	0.01	D	60	0.04	E	48	0.05	D	47	0.01	D	59	0.04	E	46	0.05	D	48	0.01	D	62	0.04	E	47	0.05	D	45	0.01	D	60	0.04	E	46	0.05	D
SB LT/TH	69	0.77	E	83	0.70	F	79	0.81	E	68	0.76	E	80	0.70	E	75	0.80	E	72	0.78	E	85	0.71	F	79	0.82	E	66	0.76	E	83	0.70	F	75	0.81	E
SB RT	47	0.03	D	61	0.06	E	49	0.06	D	47	0.03	D	59	0.05	E	47	0.06	D	49	0.03	D	63	0.06	E	48	0.06	D	45	0.03	D	61	0.05	E	47	0.06	D
Overall	12	0.62	B	65	1.11	E*	21	0.72	C	13	0.56	B	34	1.03	C*	18	0.72	B	12	0.64	B	72	1.13	E*	14	0.75	B	13	0.57	B	41	1.05	D*	18	0.71	B
13: Kamehameha Highway & Hekaha Street																																				
EB LT	66	0.58	E	220	1.04	F*	67	0.76	E	62	0.58	E	211	1.02	F*	64	0.77	E	67	0.60	E	234	1.08	F*	67	0.78	E	58	0.57	E	219	1.04	F*	62	0.77	E
EB TH/RT	19	0.82	B	17	0.54	B	39	0.96	D	22	0.73	C	17	0.54	B	26	0.90	C	20	0.82	B	19	0.56	B	35	0.99	D	24	0.77	C	18	0.56	B	31	0.94	C
WB LT	49	0.53	D	88	0.71	F	91	0.91	F	53	0.53	D	84	0.69	F	117	0.96	F	48	0.50	D	91	0.71	F	92	0.93	F	47	0.52	D	86	0.70	F	102	0.89	F
WB TH/RT	21	0.38	C	94	1.17	F*	27	0.81	C	22	0.38	C	56	1.08	E*	13	0.75	B	22	0.38	C	110	1.20	F*	29	0.84	C	20	0.40	B	69	1.11	E*	14	0.78	B
NB LT/TH	42	0.21	D	161	1.15	F*	91	0.96	F	40	0.20	D	141	1.10	F*	84	0.95	F	44	0.23	D	161	1.15	F*	96	0.98	F	37	0.19	D	143	1.10	F*	88	0.97	F
NB RT	38	0.04	D	51	0.38	D	44	0.54	D	37	0.04	D	48	0.35	D	42	0.54	D	41	0.04	D	52	0.38	D	44	0.56	D	35	0.04	C	49	0.36	D	42	0.53	D
SB LT/TH	48	0.46	D	83	0.81	F	61	0.75	E	45	0.44	D	69	0.73	E	56	0.73	E	51	0.48	D	82	0.79	F	63	0.77	E	42	0.42	D	69	0.72	E	58	0.74	E
SB RT	39	0.06	D	48	0.19	D	37	0.11	D	37	0.06	D	46	0.18	D	36	0.11	D	41	0.06	D	49	0.19	D	37	0.12	D	35	0.06	C	47	0.18	D	35	0.12	D
Overall	23	0.70	C	77	1.16	E*	41	0.91	D	26	0.63	C	53	1.09	D*	32	0.88	C	24	0.71	C	87	1.18	F*	41	0.94	D	25	0.64	C	61	1.11	E*	34	0.90	C
14: Kamehameha Highway & Lipoa Street																																				
EB TH/RT	7	0.75	A	17	0.51	B	14	0.76	B	9	0.64	A	17	0.50	B	13	0.70	B	7	0.76	A	19	0.51	B	17	0.77	B	8	0.67	A	18	0.50	B	11	0.73	B
WB LT	77	0.69	E	83	0.69	F	88	0.60	F	59	0.53	E	82	0.69	F	81	0.58	F	105	0.80	F	85	0.70	F	100	0.71	F	60	0.58	E	85	0.69	F	76	0.58	E
WB TH	3	0.30	A	77	1.15	E*	5	0.66	A	3	0.29	A	30	1.04	C*	5	0.61	A	4	0.30	A	90	1.18	F*	4	0.68	A	3	0.30	A	42	1.07	D*	6	0.63	A
NB LT/RT	65	0.65	E	79	0.78	E	68	0.80	E	65	0.65	E	76	0.78	E	66	0.79	E	69	0.67	E	82	0.79	F	69	0.81	E	63	0.65	E	79	0.78	E	66	0.80	E
Overall	9	0.73	A	62	1.09	E*	13	0.78	B	10	0.64	B	29	1.00	C*	13	0.73	B	10	0.75	A	71	1.11	E*	15	0.79	B	10	0.66	A	37	1.02	D*	13	0.75	B
15: Kamehameha Highway & Pali Momi Inbound																																				
EB LT	51	0.63	D	101	0.97	F	43	0.83	D	51	0.63	D	86	0.88	F	49	0.81	D	56	0.65	E	114	1.02	F*	44	0.82	D	48	0.63	D	85	0.92	F	52	0.82	D
EB TH/RT	2	0.61	A	7	0.35	A	7	0.48	A	2	0.51	A	3	0.34	A	4	0.44	A	2	0.63	A	7	0.36	A	6	0.49	A	2	0.54	A	6	0.35	A	4	0.45	A
WB LT	61	0.49	E	82	0.74	F	73	0.75	E	61	0.48	E	76	0.73	E	71	0.74	E	65	0.49	E	77	0.74	E	72	0.75	E	58	0.48	E	77	0.74	E	71	0.75	E
WB TH/RT	2	0.36	A	40	1.07	D*	7	0.80	A	2	0.35	A	12	0.99	B	7	0.76	A	2	0.37	A	51	1.10	D*	8	0.82	A	2	0.36	A	18	1.02	B*	7	0.78	A
Overall	5	0.60	A	36	1.06	D*	13	0.80	B	6	0.51	A	15	0.98	B	13	0.77	B	5	0.61	A	44	1.09	D*	13	0.82	B	6	0.53	A	20	1.01	B*	13	0.79	B
16: Kamehameha Highway & Pali Momi Outbound																																				
EB TH	6	0.77	A	5	0.36	A	3	0.48	A	6	0.68	A	4	0.35	A	2	0.44	A	6	0.79	A	2	0.37	A	4	0.50	A	6	0.70	A	2	0.36	A	2	0.46	A
WB TH	13	0.44	B	69	1.10	E*	12	0.70	B	14	0.44	B	32	1.00	C*	11	0.65	B	13	0.44	B	85	1.14	F*	13	0.72	B	14	0.45	B	42	1.03	D*	11	0.67	B
SB LT	43	0.42	D	67	0.67	E	53	0.61	D	40	0.38	D	65	0.66	E	51	0.60	D	46	0.45	D	68	0.66	E	53	0.60	D	40	0.41	D	66	0.65	E	51	0.60	D
SB RT	39	0.11	D	83	0.79	F	72	0.82	E	37	0.11	D	79	0.78	E	67	0.80	E	41	0.12	D	90	0.83	F	72	0.82	E	36	0.12	D	85	0.81	F	68	0.80	E
Overall	12	0.67	B	55	1.05	D*	15	0.73	B	13	0.58	B	29	0.96	C	14	0.68	B	13	0.69	B	65	1.08	E*	15	0.74	B	13	0.61	B	36	0.99	D	14	0.70	B

Note:
* = overcapacity conditions, v/c >1
n/a = applies to unsignalized intersection and usually operates better than shown in the analysis

Table 7b: Year 2019 with Project, Year 2019 with Project and RT, Year 2021 with Project and Year 2021 with Project and RT Level of Service Summary

INTERSECTION	Future Year 2019									Future Year 2019 with RT									Future Year 2021									Future Year 2021 with RT								
	AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD			AM			PM			Sat MD		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1: Moanalua Road & Harbor Pointe																																				
NB RT	21	0.16	C	15	0.06	C	25	0.32	D	16	0.12	C	15	0.05	B	22	0.28	C	22	0.17	C	16	0.06	C	27	0.33	D	16	0.12	C	15	0.06	B	23	0.28	C
2: Moanalua Road & Pearlridge Elementary School & Project Access 1																																				
					Signalized									**Signalized**									**Signalized**									**Signalized**				
EB LT	85	0.83	F	179	0.98	F	133	0.56	F	74	0.77	E	119	0.82	F	133	0.56	F	85	0.83	F	75	0.56	E	81	0.29	F	75	0.79	E	119	0.82	F	133	0.56	F
EB TH	21	0.74	C	19	0.60	B	20	0.78	C	19	0.58	B	20	0.58	B	24	0.75	C	31	0.84	C	22	0.64	C	31	0.89	C	23	0.64	C	20	0.60	C	24	0.77	C
EB RT	11	0.10	B	12	0.08	B	10	0.13	A	13	0.10	B	13	0.07	B	13	0.14	B	15	0.12	B	14	0.10	B	13	0.15	B	15	0.11	B	13	0.08	B	13	0.14	B
WB LT	209	1.06	F*	82	0.64	F	150	1.00	F*	96	0.67	F	98	0.77	F	65	0.61	E	64	0.36	E	81	0.59	F	84	0.78	F	68	0.40	E	91	0.74	F	69	0.65	E
WB TH/RT	14	0.61	B	18	0.90	B	12	0.69	B	16	0.56	B	17	0.80	B	12	0.59	B	16	0.63	B	34	0.99	C	16	0.76	B	16	0.57	B	17	0.81	B	13	0.61	B
NB LT	66	0.54	E	70	0.73	E	83	0.84	F	66	0.52	E	71	0.72	E	76	0.78	E	67	0.58	E	74	0.74	E	74	0.79	E	63	0.56	E	71	0.74	E	77	0.79	E
NB LT/TH/RT	61	0.19	E	64	0.61	E	62	0.62	E	61	0.20	E	64	0.62	E	67	0.66	E	60	0.24	E	67	0.65	E	64	0.65	E	58	0.21	E	64	0.63	E	67	0.67	E
SB LT	89	0.82	F	366	1.51	F*	52	0.11	D	71	0.71	E	107	0.84	F	99	0.57	F	89	0.82	F	156	0.98	F	73	0.32	E	73	0.75	E	139	0.94	F	99	0.57	F
SB TH/RT	59	0.16	E	69	0.13	E	51	0.03	D	57	0.16	E	65	0.09	E	77	0.20	E	59	0.16	E	68	0.10	E	70	0.12	E	55	0.16	E	66	0.10	E	77	0.20	E
Overall	31	0.72	C	34	0.90	C	24	0.84	C	29	0.60	C	29	0.75	C	25	0.78	C	34	0.84	C	37	0.88	D	29	0.89	C	30	0.68	C	30	0.78	C	26	0.81	C
3: Moanalua Road & Kaonohi Street																																				
					EB: Double LT, 2 TH and RT									**EB: Double LT, 2 TH and RT**									**EB: Double LT, 2 TH and RT**									**EB: Double LT, 2 TH and RT**				
EB LT	82	0.54	F	144	1.05	F*	97	0.62	F	76	0.54	E	119	0.94	F	98	0.62	F	85	0.54	F	123	0.97	F	90	0.63	F	80	0.58	F	118	0.94	F	97	0.62	F
EB TH	20	0.80	B	17	0.59	B	25	0.85	C	17	0.63	B	16	0.56	B	20	0.77	B	16	0.81	B	16	0.59	B	27	0.89	C	15	0.65	B	16	0.58	B	21	0.79	C
EB RT	5	0.15	A	3	0.14	A	7	0.30	A	3	0.14	A	2	0.14	A	14	0.27	B	6	0.15	A	5	0.14	A	10	0.31	B	3	0.14	A	2	0.14	A	12	0.30	B
WB LT	116	0.93	F	111	0.96	F	145	1.07	F*	81	0.78	F	84	0.85	F	121	0.99	F	145	1.01	F*	106	0.94	F	192	1.20	F*	82	0.80	F	89	0.88	F	153	1.09	F*
WB TH	23	0.46	C	29	0.79	C	29	0.64	C	22	0.39	C	25	0.67	C	26	0.54	C	23	0.47	C	28	0.78	C	31	0.68	C	21	0.40	C	25	0.68	C	27	0.56	C
WB RT	18	0.07	B	17	0.23	B	20	0.15	C	18	0.07	B	17	0.20	B	20	0.15	B	18	0.07	B	17	0.23	B	21	0.15	C	17	0.07	B	17	0.21	B	21	0.15	C
NB LT	66	0.49	E	84	0.89	F	133	1.06	F*	66	0.49	E	93	0.93	F	112	0.99	F	66	0.49	E	129	1.05	F*	128	1.06	F*	65	0.53	E	97	0.95	F	78	0.85	E
NB TH/RT	51	0.26	D	56	0.44	E	66	0.86	E*	53	0.25	D	57	0.45	E	65	0.75	E	51	0.29	D	61	0.51	E	63	0.90	E*	51	0.27	D	57	0.45	E	64	0.86	E*
SB LT	132	1.05	F*	70	0.60	E	75	0.72	E	79	0.85	E	70	0.60	E	75	0.72	E	137	1.07	F*	74	0.64	E	70	0.69	E	82	0.88	F	71	0.62	E	76	0.73	E
SB TH	62	0.77	E	69	0.64	E	62	0.59	E	62	0.76	E	70	0.64	E	65	0.64	E	62	0.77	E	72	0.65	E	58	0.56	E	59	0.76	E	70	0.64	E	71	0.71	E
SB RT	48	0.29	D	60	0.18	E	56	0.29	E	47	0.21	D	59	0.10	E	57	0.25	E	48	0.32	D	62	0.17	E	54	0.33	D	45	0.27	D	59	0.10	E	59	0.28	E
Overall	41	0.90	D	43	0.79	D	49	0.86	D	37	0.76	D	41	0.71	D	46	0.85	D	42	0.87	D	46	0.84	D	51	0.90	D	36	0.78	D	42	0.73	D	46	0.86	D
4: Project Access 2-RIRO Driveway & Kaonohi Street																																				
EB RT	11	0.02	B	11	0.14	B	12	0.15	B	11	0.02	B	11	0.13	B	12	0.14	B	11	0.02	B	11	0.14	B	12	0.14	B	11	0.02	B	11	0.14	B	12	0.14	B
WB RT	9	0.01	A	10	0.10	A	11	0.24	B	9	0.01	A	10	0.10	A	11	0.24	B	9	0.01	A	10	0.10	A	11	0.25	B	9	0.01	A	10	0.10	A	11	0.25	B
5: Pearlridge Center D/W 1 & Project Access 3 & Kaonohi Street																																				
EB LT/TH	24	0.10	C	103	0.53	F	n/a	17.34	F*	24	0.10	C	95	0.51	F	n/a	5.78	F*	26	0.14	D	129	0.61	F	n/a	n/a	F*	26	0.14	D	116	0.57	F	n/a	n/a	F*
EB RT	10	0.04	B	10	0.12	B	11	0.12	B	10	0.04	B	10	0.11	B	11	0.11	B	10	0.04	B	11	0.12	B	11	0.12	B	10	0.04	B	11	0.12	B	11	0.11	B
WB LT/TH	20	0.07	C	304	1.44	F*	n/a	3.37	F*	20	0.06	C	283	1.39	F*	n/a	3.18	F*	22	0.07	C	388	1.63	F*	n/a	3.61	F*	22	0.07	C	351	1.55	F*	n/a	3.43	F*
WB RT	9	0.04	A	10	0.19	B	11	0.20	B	9	0.04	A	10	0.18	B	11	0.20	B	10	0.04	A	10	0.19	B	11	0.20	B	10	0.04	A	10	0.18	B	11	0.20	B
NB LT	9	0.04	A	9	0.06	A	9	0.07	A	9	0.04	A	9	0.06	A	9	0.06	A	9	0.04	A	9	0.07	A	9	0.08	A	9	0.04	A	9	0.07	A	9	0.07	A
SB LT	8	0.03	A	9	0.10	A	10	0.21	B	8	0.03	A	9	0.10	A	10	0.21	B	8	0.03	A	9	0.10	A	10	0.21	B	8	0.03	A	9	0.10	A	10	0.21	B
SB TH/RT	0	0.12	0	0	0.10	0	0	0.13	0	0	0.12	0	0	0.10	0	0	0.13	0	0	0.12	0	0	0.11	0	0	0.14	0	0	0.12	0	0	0.11	0	0	0.13	0
6: Pearlridge Center D/W 2 & Project Access 4 & Kaonohi Street																																				
					Signalized									**Signalized**									**Signalized**									**Signalized**				
EB LT	11	0.23	B	17	0.10	B	16	0.18	B	10	0.21	B	15	0.10	B	16	0.18	B	10	0.22	A	20	0.12	B	17	0.21	B	11	0.27	B	18	0.11	B	17	0.21	B
EB TH/RT	10	0.15	B	17	0.15	B	16	0.19	B	10	0.13	B	15	0.15	B	15	0.17	B	10	0.17	A	20	0.17	C	18	0.29	B	11	0.16	B	18	0.17	B	17	0.28	B
WB LT	10	0.13	B	20	0.49	B	26	0.70	C	10	0.13	B	18	0.46	B	24	0.67	C	9	0.12	A	25	0.55	C	35	0.79	D	10	0.13	B	22	0.51	C	32	0.76	C
WB TH/RT	10	0.02	A	17	0.14	B	16	0.22	B	10	0.02	A	15	0.14	B	16	0.22	B	9	0.02	A	20	0.16	C	17	0.22	B	10	0.02	A	18	0.14	B	17	0.22	B
NB LT	6	0.43	A	21	0.76	C	19	0.74	B	6	0.43	A	19	0.73	B	17	0.71	B	8	0.50	A	40	0.89	D	25	0.80	C	6	0.46	A	37	0.87	D	23	0.78	C
NB TH/RT	5	0.20	A	10	0.33	A	9	0.47	A	5	0.20	A	10	0.35	A	9	0.47	A	6	0.22	A	11	0.33	B	10	0.48	B	5	0.20	A	12	0.35	B	10	0.48	B
SB LT	4	0.08	A	9	0.17	A	14	0.61	B	4	0.08	A	9	0.18	A	15	0.62	B	5	0.09	A	10	0.17	B	18	0.66	B	4	0.08	A	11	0.18	B	19	0.67	B
SB TH/RT	5	0.35	A	9	0.33	A	9	0.35	A	5	0.35	A	10	0.34	A	9	0.35	A	6	0.38	A	11	0.33	B	9	0.36	A	5	0.35	A	12	0.35	B	9	0.36	A
Overall	6	0.37	A	13	0.66	B	13	0.72	B	6	0.37	A	13	0.62	B	13	0.70	B	7	0.40	A	18	0.76	B	15	0.80	B	6	0.40	A	17	0.72	B	15	0.77	B
7: Westridge (north) & Kaonohi Street																																				
EB LT/RT	17	0.20	C	25	0.27	D	32	0.40	D	17	0.20	C	25	0.26	C	31	0.39	D	18	0.22	C	29	0.30	D	37	0.44	E	18	0.22	C	27	0.29	D	36	0.43	E
NB LT/TH	1	0.02	A	1	0.03	A	1	0.04	A	1	0.02	A	1	0.03	A	1	0.04	A	1	0.02	A	1	0.03	A	1	0.04	A	1	0.02	A	1	0.03	A	1	0.04	A
8: Westridge (south) & Kaonohi Street																																				
EB LT/RT	14	0.15	B	19	0.23	C	41	0.59	E	14	0.15	B	19	0.22	C	40	0.58	E	15	0.17	C	20	0.24	C	59	0.72	F	15	0.16	B	19	0.23	C	56	0.71	F
NB LT/TH	1	0.02	A	1	0.04	A	2	0.08	A	1	0.02	A	1	0.04	A	2	0.08	A	1	0.03	A	1	0.04	A	2	0.08	A	1	0.03	A	1	0.04	A	2	0.08	A
9: Pearlridge Center - Ana Miller's D/W & Kaonohi Street																																				
WB LT/RT	17	0.18	C	44	0.59	E	120	0.99	F	17	0.18	C	41	0.57	E	113	0.97	F	18	0.19	C	58	0.68	F	171	1.13	F*	18	0.19	C	52	0.65	F	162	1.11	F*
SB LT/TH	2	0.03	A	2	0.04	A	3	0.08	A	2	0.03	A	2	0.04	A	3	0.08	A	2	0.03	A	2	0.06	A	3	0.09	A	2	0.03	A	2	0.05	A	3	0.09	A

Note:
* = overcapacity conditions, v/c >1
n/a = applies to unsignalized intersection and usually operates better than shown in the analysis

V. CONCLUSIONS AND RECOMMENDATIONS

Existing Traffic Conditions

Currently, the majority of the congestion occurs during the weekday PM peak hour of traffic where Kamehameha Highway operates at overcapacity conditions. The weekday PM peak traffic mostly consists of regional/commuter traffic and commercial use traffic volume. During the Sat MD peak hour of traffic, some congestion occurs along Kamehameha Highway and Moanalua Road, however traffic operates relatively smoothly. No Problems were observed during the weekday AM peak hour of traffic.

Base Year Conditions

Projected Base Year Growth

Based on the Oahu Metropolitan Planning Organization the growth was found to be 1.04 percent annually.

Planned Roadway Projects

The State is planning the construction of a High Capacity Transit Corridor Project/ Rail Transit (HHCTCP/RT). This transit project is planned to be completed by year 2019 and span from west Oahu – Kapolei – to east Oahu – Manoa. One of the RT stations will be located in the vicinity of the Proposed Project along Kamehameha Highway west of Kaonohi Street.

Base Year without RT – year 2015 to 2019

Much of the congestion that currently exists within the study area will continue and expected to worsen through Base Year 2019 due to the increase in traffic volume. HCM analyses were performed to determine the type of improvements necessary. In order to improve traffic operation along Kamehameha Highway additional ROW would be necessary as well as along Moanalua Road.

Base Year with RT– year 2019 and 2021

Due to the existing overcapacity conditions and base year growth, the traffic volume reduction caused by the RT would not bring the traffic volume along Kamehameha Highway within capacity. Therefore, prevailing conditions would continue along both Kamehameha Highway and Moanalua Road.

With Proposed Project Conditions

The site is currently zoned for commercial land use. The two (2) alternatives considered for this site are:

Alternative 1, commercial land use only with approximately:

- 1,522,600 SF of commercial retail space

Alternative 2, commercial/office land use with approximately:

- 1,200,000 SF of office space
- 120,000 SF of commercial retail space

Both of these alternatives would generate more trips during the weekday PM peak hour of traffic yielding longer delays and would also not benefit as much from the transit opportunities in the area as the Proposed Project. The Proposed Project would also allow for internal trips due to its mixed use of residential, office and commercial components. The existing Swap Meet trips were also discounted from the Sat MD peak hour of traffic.

The Proposed Project would consist of approximately:

- 1,500 dwelling units
- 144,000 SF of commercial space
- 80,000 SF of office or hotel

The Proposed Project will be constructed on the existing Swap Meet site located at the corner of Moanalua Road and Kaonohi Street. Four (4) accesses would be provided:

- Moanalua Road/Pearlridge Elementary School – Proposed Project Access 1, signalized
- Kaonohi Street/RIRO driveway – Proposed Project Access 2
- Kaonohi Street/Pearlridge Center D/W1/Proposed Project Access 3
- Kaonohi Street/Pearlridge Center D/W2/KFC/Proposed Project Access 4, signalized

The signalized intersections would facilitate ingress and egress to the Proposed Project site. The signal at the Proposed Project Access 1 would likely allow some of the southbound right-turns out of the Pearlridge Elementary School to divert onto the left-turn lane. In addition to providing access to the Proposed Project it would also serve as a cut-through for the existing traffic volume.

Other roadway mitigation improvements include:

Moanalua Road/Kaonohi Street:

- Providing a second eastbound left-turn lane
- Providing an additional southbound lane on the south leg
- Removal of the median located along the Northbound approach

The Proposed Project mitigation improvements would reduce the Proposed Project impact on the surrounding intersections. However, congestion along the major arterials, Kamehameha Highway and Moanalua Road, are regional issues that cannot be addressed with Proposed Project related improvements.

With Proposed Project and Rail Transit (RT) Conditions

Although RT trips were discounted from the Proposed Project generated trips, the discounted amount is considered conservative due to the fact that the Proposed Project is located in close proximity to the RT and therefore would likely not generate as many vehicular trips as projected in this report.

Overall, the Proposed Project would be a better alternative than the alternatives considered because it would generate fewer trips during the weekday PM peak hours of traffic, provide residential land use which can benefit from the RT more than commercial/office land use and is planned as a Mixed Use Project which is also intended to minimize the amount of trips generated.

Overall, the Proposed Project would:

- Add 844(1,184)[598][6] additional trips to the roadway network during the AM(PM)[Sat MD] peak hour of traffic. However, it would generate fewer trips than what the current zoning allows for. Approximately 118 percent and 39 percent less during the weekday AM and PM peak hour of traffic respectively compared to Alternative 1 and approximately 19 percent and 40 percent less during the weekday PM and Sat MD peak hour of traffic respectively.
- Signalize two (2) of the Proposed Project's intersections by Year 2015 with the Proposed Project. Extend the eastbound left-turn lane as well as the westbound left-turn lane.
- Combine the left-turn movements at the Moanalua Road/Timothy's Church/Harbor Pointe D/W intersection with the Moanalua Road/Proposed Project Access 1 intersection. The Proposed Project would signalize the intersection and provide access to the site.
- Eliminate the Swap Meet.
- The Proposed Project would give up some ROW along Moanalua Road to allow for an additional eastbound left-turn lane at the intersection of Moanalua Road/Kaonohi Street. This would also provide for a better alignment of Moanalua Road.
- The proposed Project would give up some ROW along Kaonohi Street to allowan additional southbound lane on the south leg at the intersection of Moanalua Road/Kaonohi Street.
- Remove the raised median along Kaonohi Street between the intersection of Moanalua Road/Kaonohi Street and Kaonohi Street/Proposed Project Access 2.
- Maintain the RIRO access to the Proposed Project across the Macy's Upstairs parking structure.
- Across the Pearlridge Center D/W 1 provide the Project Access 3 with left-turn lane along Kaonohi Street.
- Across the Pearlridge Center D/W 2 provide the Project Access 4 with left-turn lanes along Kaonohi Street. The Proposed Project would also signalize the intersection when warranted.
- Create an opportunity for a Transportation Oriented Development (TOD) due to its proximity to transit systems.

[6] With RT trips discounted

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VI. RECOMMENDATIONS

It is recommended that once the Proposed Project has been approved a construction management plan (CMP) be prepared for a building plan approval. The CMP shall address issues such as how the construction vehicles would access the site, what the impacts would be to the existing traffic and provide mitigation measures to minimize those impacts.

Year 2015 with Proposed Project

Moanalua Road/Timothy's Church/Harbor Pointe Driveway

- Modify the intersection to operate as a RIRO only. Left-turn access to the Timothy's Church and Harbor Pointe will be provided via the Proposed Project Access 1 signalized intersection.

Moanalua Road/Pearlridge Elementary School/Proposed Project Access 1:

- Signalize the intersection.
- Provide eastbound and westbound left-turn lanes.
- Stripe the northbound approach with a left-turn lane and a shared left-turn/through/right-turn lane.
- Stripe the southbound approach with a left-turn lane and a shared through/right-turn lane.

Kaonohi Street/Moanalua Road

- Widen Kaonohi Street north of the Pearlridge Center D/W 1 up to its intersection with Moanalua Road to provide two (2) southbound through lanes.
- Provide an additional eastbound left-turn lane.

Kaonohi Street/Pearlridge Center D/W 1/Proposed Project Access 3

- Provide northbound and southbound left-turn lanes along Kaonohi Street.
- Stripe the minor approaches with a left-turn lane and a shared through/right-turn lane.

Kaonohi Street/Pearlridge Center D/W 2/Proposed Project Access 4

- Signalize the intersection by Year 2015.
- Provide northbound and southbound left-turn lanes along Kaonohi Street.
- Stripe the minor approaches with a left-turn lane and a shared through/right-turn lane.

VII. REFERENCES

1. Federal Transit Administration, Addendum 03 to the Transportation Technical Report, 2010
2. Federal Transit Administration, Honolulu High-Capacity Transit Corridor Project: Final Environmental Impact Statement, 2010
3. Institute of Transportation Engineers, Trip Generation, 8th Edition, 2008.
4. Institute of Transportation Engineers, Trip Generation Handbook, 2001.
5. Oahu Metropolitan Planning Organization, Oahu Regional Transportation Plan, 2006.
6. Transportation Research Board, Highway Capacity Manual, 2000.

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APPENDICES

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APPENDIX A

TRAFFIC COUNT DATA

Austin, Tsutsumi & Associates
501 Sumner Street Suite 521
Honolulu, HI 96817
(808) 533-3646

File Name : AM_Harbor Pt - Moanalua Peak
Site Code : 00000000
Start Date : 10/14/2010
Page No : 1

Groups Printed- Unshifted

	HARBOR POINT From North				MOANALUA From East				HARBOR POINT From South				MOANALUA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	0	0	0	0	0	177	2	0	6	0	2	0	1	341	0	0	529
07:15 AM	0	0	0	0	0	246	8	0	4	0	6	0	3	394	0	0	661
07:30 AM	0	0	0	0	0	308	6	0	14	0	5	1	3	363	0	0	700
07:45 AM	0	0	0	0	0	288	13	0	15	0	0	0	5	348	0	0	669
Total	0	0	0	0	0	1019	29	0	39	0	13	1	12	1446	0	0	2559
Grand Total	0	0	0	0	0	1019	29	0	39	0	13	1	12	1446	0	0	2559
Apprch %	0	0	0	0	0	97.2	2.8	0	73.6	0	24.5	1.9	0.8	99.2	0	0	
Total %	0	0	0	0	0	39.8	1.1	0	1.5	0	0.5	0	0.5	56.5	0	0	

Austin, Tsutsumi & Associates

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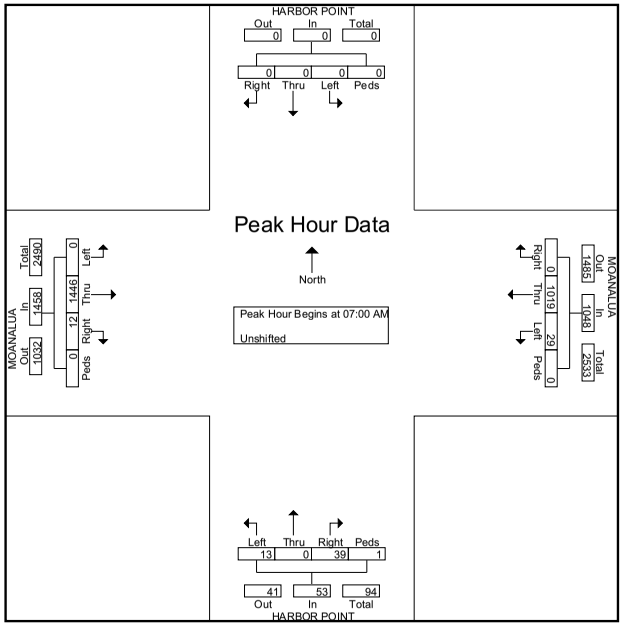
File Name : AM_Harbor Pt - Moanalua Peak
Site Code : 00000000
Start Date : 10/14/2010
Page No : 2

	HARBOR POINT From North					MOANALUA From East					HARBOR POINT From South					MOANALUA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	0	0	0	0	177	2	0	179	6	0	2	0	8	1	341	0	0	342	529
07:15 AM	0	0	0	0	0	0	246	8	0	254	4	0	**6**	0	10	3	**394**	0	0	**397**	661
07:30 AM	0	0	0	0	0	0	**308**	6	0	**314**	14	0	5	**1**	**20**	3	363	0	0	366	**700**
07:45 AM	0	0	0	0	0	0	288	**13**	0	301	**15**	0	0	0	15	**5**	348	0	0	353	669
Total Volume	0	0	0	0	0	0	1019	29	0	1048	39	0	13	1	53	12	1446	0	0	1458	2559
% App. Total	0	0	0	0		0	97.2	2.8	0		73.6	0	24.5	1.9		0.8	99.2	0	0		
PHF	.000	.000	.000	.000	.000	.000	.827	.558	.000	.834	.650	.000	.542	.250	.663	.600	.918	.000	.000	.918	.914



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File Name : AM_Pearlridge Elementary Schl - Moanalua
Site Code : 00000000
Start Date : 10/14/2010
Page No : 1

Groups Printed- Unshifted

	PEARLRIDGE ELEMENTARY SCHL From North				MOANALUA From East				PEARLRIDGE ELEMENTARY SCHL From South				MOANALUA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	5	0	9	0	9	103	0	0	0	0	0	0	0	302	16	0	444
06:45 AM	5	0	11	0	15	140	0	0	0	0	0	0	0	313	17	0	501
Total	10	0	20	0	24	243	0	0	0	0	0	0	0	615	33	0	945
07:00 AM	19	0	24	2	27	150	0	0	0	0	0	0	0	342	24	0	588
07:15 AM	47	0	12	1	51	213	0	0	0	0	0	0	0	350	38	0	712
07:30 AM	98	0	2	0	72	214	0	0	0	0	0	0	0	333	60	0	779
07:45 AM	103	0	4	0	52	180	0	0	0	0	0	0	0	335	33	0	707
Total	267	0	42	3	202	757	0	0	0	0	0	0	0	1360	155	0	2786
08:00 AM	13	0	4	0	5	155	0	0	0	0	0	0	0	318	5	0	500
08:15 AM	3	0	1	1	0	168	0	0	0	0	0	0	0	260	2	0	435
Grand Total	293	0	67	4	231	1323	0	0	0	0	0	0	0	2553	195	0	4666
Apprch %	80.5	0	18.4	1.1	14.9	85.1	0	0	0	0	0	0	0	92.9	7.1	0	
Total %	6.3	0	1.4	0.1	5	28.4	0	0	0	0	0	0	0	54.7	4.2	0	

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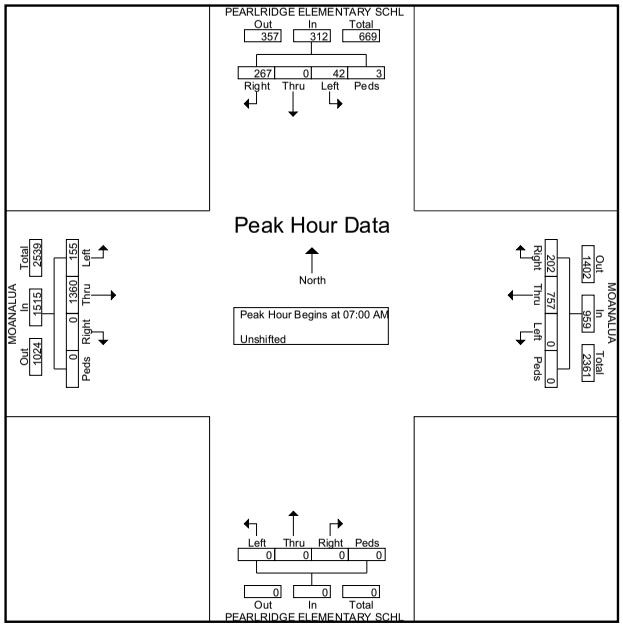
Start Date : 10/14/2010
Page No : 2

	PEARLRIDGE ELEMENTARY SCHL From North					MOANALUA From East					PEARLRIDGE ELEMENTARY SCHL From South					MOANALUA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	19	0	**24**	**2**	45	27	150	0	0	177	0	0	0	0	0	0	342	24	0	366	588
07:15 AM	47	0	12	1	60	51	213	0	0	264	0	0	0	0	0	0	**350**	38	0	388	712
07:30 AM	98	0	2	0	100	**72**	**214**	0	0	**286**	0	0	0	0	0	0	333	**60**	0	**393**	**779**
07:45 AM	**103**	0	4	0	**107**	52	180	0	0	232	0	0	0	0	0	0	335	33	0	368	707
Total Volume	267	0	42	3	312	202	757	0	0	959	0	0	0	0	0	0	1360	155	0	1515	2786
% App. Total	85.6	0	13.5	1		21.1	78.9	0	0		0	0	0	0		0	89.8	10.2	0		
PHF	.648	.000	.438	.375	.729	.701	.884	.000	.000	.838	.000	.000	.000	.000	.000	.000	.971	.646	.000	.964	.894



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File Name : AM_Kaonohi - Moanalua Peak
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	KAONOHI From North				MOANALUA From East				KAONOHI From South				MOANALUA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
07:00 AM	45	70	67	3	11	125	17	4	13	9	12	0	49	284	23	1	733
07:15 AM	48	55	91	7	12	178	15	5	14	14	27	1	50	302	18	2	839
07:30 AM	61	43	55	8	30	199	15	3	21	18	15	2	40	265	25	7	807
07:45 AM	58	35	45	7	34	173	23	2	21	28	12	4	44	262	31	6	785
Total	212	203	258	25	87	675	70	14	69	69	66	7	183	1113	97	16	3164
Grand Total	212	203	258	25	87	675	70	14	69	69	66	7	183	1113	97	16	3164
Apprch %	30.4	29.1	37	3.6	10.3	79.8	8.3	1.7	32.7	32.7	31.3	3.3	13	79	6.9	1.1	
Total %	6.7	6.4	8.2	0.8	2.7	21.3	2.2	0.4	2.2	2.2	2.1	0.2	5.8	35.2	3.1	0.5	

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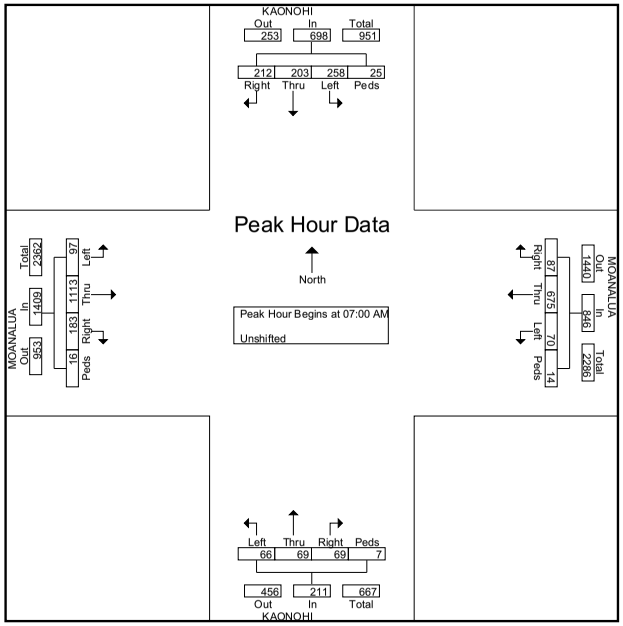
	KAONOHI From North					MOANALUA From East					KAONOHI From South					MOANALUA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	45	**70**	67	3	185	11	125	17	4	157	13	9	12	0	34	49	284	23	1	357	733
07:15 AM	48	55	**91**	7	**201**	12	178	15	**5**	210	14	14	**27**	1	56	**50**	**302**	18	2	**372**	**839**
07:30 AM	**61**	43	55	**8**	167	30	**199**	15	3	**247**	**21**	18	15	2	56	40	265	25	**7**	337	807
07:45 AM	58	35	45	7	145	**34**	173	**23**	2	232	21	**28**	12	**4**	**65**	44	262	**31**	6	343	785
Total Volume	212	203	258	25	698	87	675	70	14	846	69	69	66	7	211	183	1113	97	16	1409	3164
% App. Total	30.4	29.1	37	3.6		10.3	79.8	8.3	1.7		32.7	32.7	31.3	3.3		13	79	6.9	1.1		
PHF	.869	.725	.709	.781	.868	.640	.848	.761	.700	.856	.821	.616	.611	.438	.812	.915	.921	.782	.571	.947	.943



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File Name : AM_Kaonohi - Pearlridge Dr
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	KAONOHI From North				PEARLRIDGE DRIVEWAY From East				KAONOHI From South				PEARLRIDGE DRIVEWAY From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	0	124	0	0	1	0	0	2	4	28	0	0	0	0	0	0	159
06:45 AM	0	124	0	0	3	0	0	1	8	33	0	0	0	0	0	0	169
Total	0	248	0	0	4	0	0	3	12	61	0	0	0	0	0	0	328
07:00 AM	0	128	0	0	0	0	0	5	5	39	0	0	0	0	0	0	177
07:15 AM	0	133	0	0	2	0	0	2	1	55	0	0	0	0	0	0	193
07:30 AM	0	95	0	0	2	0	0	2	5	62	0	0	0	0	0	0	166
07:45 AM	0	119	0	0	3	0	0	0	6	71	0	0	0	0	0	0	199
Total	0	475	0	0	7	0	0	9	17	227	0	0	0	0	0	0	735
08:00 AM	0	101	0	0	3	0	0	2	7	49	0	0	0	0	0	0	162
08:15 AM	0	92	0	0	7	0	0	1	2	43	0	0	0	0	0	0	145
Grand Total	0	916	0	0	21	0	0	15	38	380	0	0	0	0	0	0	1370
Apprch %	0	100	0	0	58.3	0	0	41.7	9.1	90.9	0	0	0	0	0	0	
Total %	0	66.9	0	0	1.5	0	0	1.1	2.8	27.7	0	0	0	0	0	0	

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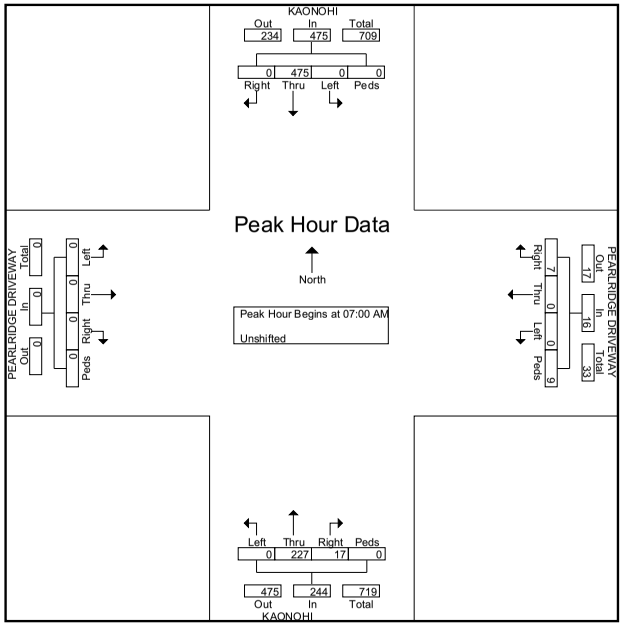
	KAONOHI From North					PEARLRIDGE DRIVEWAY From East					KAONOHI From South					PEARLRIDGE DRIVEWAY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	128	0	0	128	0	0	0	**5**	**5**	5	39	0	0	44	0	0	0	0	0	177
07:15 AM	0	**133**	0	0	**133**	2	0	0	2	4	1	55	0	0	56	0	0	0	0	0	193
07:30 AM	0	95	0	0	95	2	0	0	2	4	5	62	0	0	67	0	0	0	0	0	166
07:45 AM	0	119	0	0	119	**3**	0	0	0	3	**6**	**71**	0	0	**77**	0	0	0	0	0	**199**
Total Volume	0	475	0	0	475	7	0	0	9	16	17	227	0	0	244	0	0	0	0	0	735
% App. Total	0	100	0	0		43.8	0	0	56.2		7	93	0	0		0	0	0	0		
PHF	.000	.893	.000	.000	.893	.583	.000	.000	.450	.800	.708	.799	.000	.000	.792	.000	.000	.000	.000	.000	.923



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	KAONOHI From North				MACY'S DRIVEWAY From East				KAONOHI From South				MACY'S DRIVEWAY From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	0	109	8	0	3	0	1	2	1	31	0	0	0	0	0	0	155
06:45 AM	0	117	8	0	6	0	3	3	4	35	0	0	0	0	0	0	176
Total	0	226	16	0	9	0	4	5	5	66	0	0	0	0	0	0	331
07:00 AM	0	127	6	0	8	0	1	5	3	35	0	0	0	0	0	0	185
07:15 AM	0	119	6	0	6	0	2	2	2	49	0	0	0	0	0	0	186
07:30 AM	0	93	3	0	5	0	2	1	5	61	0	0	0	0	0	0	170
07:45 AM	0	98	8	0	5	0	5	1	1	76	0	0	0	0	0	0	194
Total	0	437	23	0	24	0	10	9	11	221	0	0	0	0	0	0	735
08:00 AM	0	65	12	0	10	0	3	2	1	33	0	0	0	0	0	0	126
08:15 AM	0	81	13	0	7	0	8	1	7	39	0	0	0	0	0	0	156
Grand Total	0	809	64	0	50	0	25	17	24	359	0	0	0	0	0	0	1348
Apprch %	0	92.7	7.3	0	54.3	0	27.2	18.5	6.3	93.7	0	0	0	0	0	0	
Total %	0	60	4.7	0	3.7	0	1.9	1.3	1.8	26.6	0	0	0	0	0	0	

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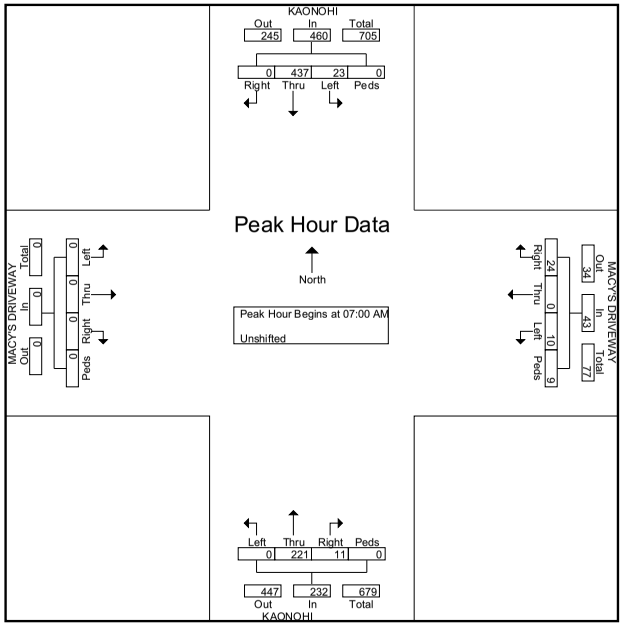
	KAONOHI From North					MACY'S DRIVEWAY From East					KAONOHI From South					MACY'S DRIVEWAY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	**127**	6	0	**133**	**8**	0	1	**5**	**14**	3	35	0	0	38	0	0	0	0	0	185
07:15 AM	0	119	6	0	125	6	0	2	2	10	2	49	0	0	51	0	0	0	0	0	186
07:30 AM	0	93	3	0	96	5	0	2	1	8	**5**	61	0	0	66	0	0	0	0	0	170
07:45 AM	0	98	**8**	0	106	5	0	**5**	1	11	1	**76**	0	0	**77**	0	0	0	0	0	**194**
Total Volume	0	437	23	0	460	24	0	10	9	43	11	221	0	0	232	0	0	0	0	0	735
% App. Total	0	95	5	0		55.8	0	23.3	20.9		4.7	95.3	0	0		0	0	0	0		
PHF	.000	.860	.719	.000	.865	.750	.000	.500	.450	.768	.550	.727	.000	.000	.753	.000	.000	.000	.000	.000	.947



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	KAONOHI From North				SWAP MEET EXIT (KFC DRIVEWAY) From East				KAONOHI From South				SWAP MEET EXIT (KFC DRIVEWAY) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	0	109	4	0	0	0	5	2	4	30	0	0	0	0	0	0	154
06:45 AM	0	113	10	0	2	0	1	5	3	37	0	0	0	0	0	5	176
Total	0	222	14	0	2	0	6	7	7	67	0	0	0	0	0	5	330
07:00 AM	0	116	10	0	0	0	3	5	7	40	1	0	0	0	1	4	187
07:15 AM	0	132	7	0	2	0	5	6	4	45	0	0	0	0	0	2	203
07:30 AM	0	89	5	0	3	0	6	3	10	61	0	0	0	0	0	3	180
07:45 AM	0	97	8	0	3	0	10	1	11	70	0	0	0	0	0	1	201
Total	0	434	30	0	8	0	24	15	32	216	1	0	0	0	1	10	771
08:00 AM	0	86	10	0	2	0	13	3	8	44	0	0	2	0	0	2	170
08:15 AM	1	82	4	0	3	0	10	3	11	40	0	0	0	0	0	1	155
Grand Total	1	824	58	0	15	0	53	28	58	367	1	0	2	0	1	18	1426
Apprch %	0.1	93.3	6.6	0	15.6	0	55.2	29.2	13.6	86.2	0.2	0	9.5	0	4.8	85.7	
Total %	0.1	57.8	4.1	0	1.1	0	3.7	2	4.1	25.7	0.1	0	0.1	0	0.1	1.3	

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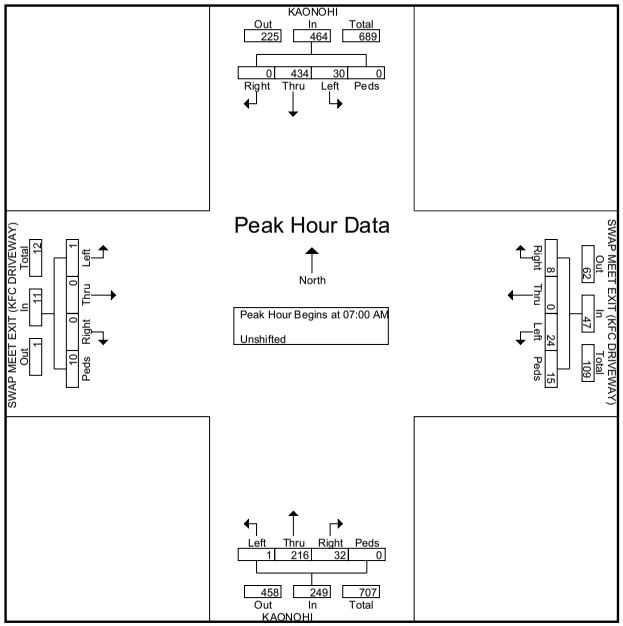
	KAONOHI From North					SWAP MEET EXIT (KFC DRIVEWAY) From East					KAONOHI From South					SWAP MEET EXIT (KFC DRIVEWAY) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	116	**10**	0	126	0	0	3	5	8	7	40	**1**	0	48	0	0	**1**	**4**	**5**	187
07:15 AM	0	**132**	7	0	**139**	2	0	5	**6**	13	4	45	0	0	49	0	0	0	2	2	**203**
07:30 AM	0	89	5	0	94	**3**	0	6	3	12	10	61	0	0	71	0	0	0	3	3	180
07:45 AM	0	97	8	0	105	3	0	**10**	1	**14**	**11**	**70**	0	0	**81**	0	0	0	1	1	201
Total Volume	0	434	30	0	464	8	0	24	15	47	32	216	1	0	249	0	0	1	10	11	771
% App. Total	0	93.5	6.5	0		17	0	51.1	31.9		12.9	86.7	0.4	0		0	0	9.1	90.9		
PHF	.000	.822	.750	.000	.835	.667	.000	.600	.625	.839	.727	.771	.250	.000	.769	.000	.000	.250	.625	.550	.950



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	KAONOHI From North				WESTRIDGE DRIVEWAY (MAUKA) From East				KAONOHI From South				WESTRIDGE DRIVEWAY (MAUKA) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	11	102	0	0	0	0	0	0	0	27	5	0	10	0	5	0	160
06:45 AM	11	101	0	0	0	0	0	0	0	35	7	0	4	0	6	0	164
Total	22	203	0	0	0	0	0	0	0	62	12	0	14	0	11	0	324
07:00 AM	6	114	0	0	0	0	0	0	0	38	4	0	6	0	10	0	178
07:15 AM	13	106	0	0	0	0	0	0	0	42	2	0	9	0	8	3	183
07:30 AM	10	83	0	0	0	0	0	0	0	66	6	0	5	0	9	1	180
07:45 AM	19	87	0	0	0	0	0	0	0	74	2	1	7	0	8	1	199
Total	48	390	0	0	0	0	0	0	0	220	14	1	27	0	35	5	740
08:00 AM	6	94	0	0	0	0	0	0	0	47	1	0	6	0	6	1	161
08:15 AM	13	78	0	0	0	0	0	0	0	46	7	0	3	0	6	2	155
Grand Total	89	765	0	0	0	0	0	0	0	375	34	1	50	0	58	8	1380
Apprch %	10.4	89.6	0	0	0	0	0	0	0	91.5	8.3	0.2	43.1	0	50	6.9	
Total %	6.4	55.4	0	0	0	0	0	0	0	27.2	2.5	0.1	3.6	0	4.2	0.6	

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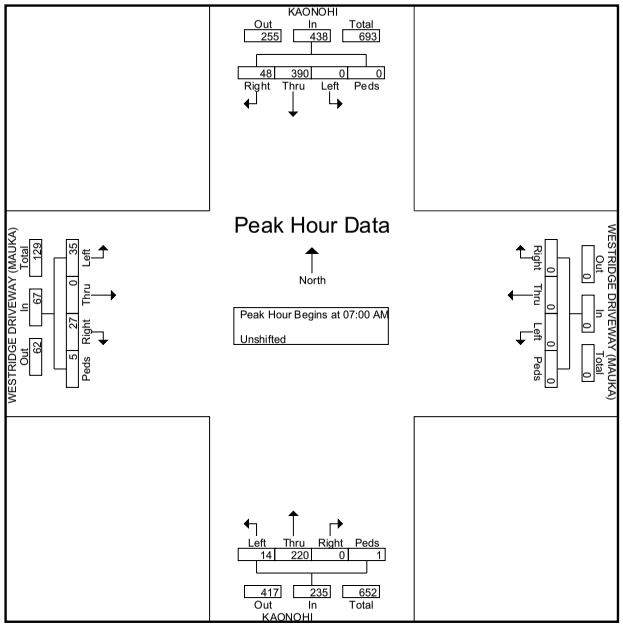
	KAONOHI From North					WESTRIDGE DRIVEWAY (MAUKA) From East					KAONOHI From South					WESTRIDGE DRIVEWAY (MAUKA) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	6	**114**	0	0	**120**	0	0	0	0	0	0	38	4	0	42	6	0	**10**	0	16	178
07:15 AM	13	106	0	0	119	0	0	0	0	0	0	42	2	0	44	**9**	0	8	**3**	**20**	183
07:30 AM	10	83	0	0	93	0	0	0	0	0	0	66	**6**	0	72	5	0	9	1	15	180
07:45 AM	**19**	87	0	0	106	0	0	0	0	0	0	**74**	2	**1**	**77**	7	0	8	1	16	**199**
Total Volume	48	390	0	0	438	0	0	0	0	0	0	220	14	1	235	27	0	35	5	67	740
% App. Total	11	89	0	0		0	0	0	0		0	93.6	6	0.4		40.3	0	52.2	7.5		
PHF	.632	.855	.000	.000	.913	.000	.000	.000	.000	.000	.000	.743	.583	.250	.763	.750	.000	.875	.417	.838	.930



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	KAONOHI From North				WESTRIDGE DRIVEWAY (MAKAI) From East				KAONOHI From South				WESTRIDGE DRIVEWAY (MAKAI) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	0	118	0	2	0	0	0	0	0	29	2	0	9	0	1	0	161
06:45 AM	0	104	0	4	0	0	0	0	0	45	9	0	16	0	0	5	183
Total	0	222	0	6	0	0	0	0	0	74	11	0	25	0	1	5	344
07:00 AM	1	118	0	0	0	0	0	0	0	36	2	2	9	0	3	1	172
07:15 AM	1	114	0	0	0	0	0	0	0	48	6	0	12	0	1	0	182
07:30 AM	0	88	0	0	0	0	0	0	0	70	4	1	7	0	1	0	171
07:45 AM	0	98	0	1	0	0	0	0	0	72	3	4	14	0	5	0	197
Total	2	418	0	1	0	0	0	0	0	226	15	7	42	0	10	1	722
08:00 AM	0	96	0	0	0	0	0	0	0	43	3	1	10	0	2	0	155
08:15 AM	2	77	0	0	0	0	0	0	0	53	6	1	6	0	0	0	145
Grand Total	4	813	0	7	0	0	0	0	0	396	35	9	83	0	13	6	1366
Apprch %	0.5	98.7	0	0.8	0	0	0	0	0	90	8	2	81.4	0	12.7	5.9	
Total %	0.3	59.5	0	0.5	0	0	0	0	0	29	2.6	0.7	6.1	0	1	0.4	

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File Name : AM_Kaonohi - Westridge Dr (Makai)
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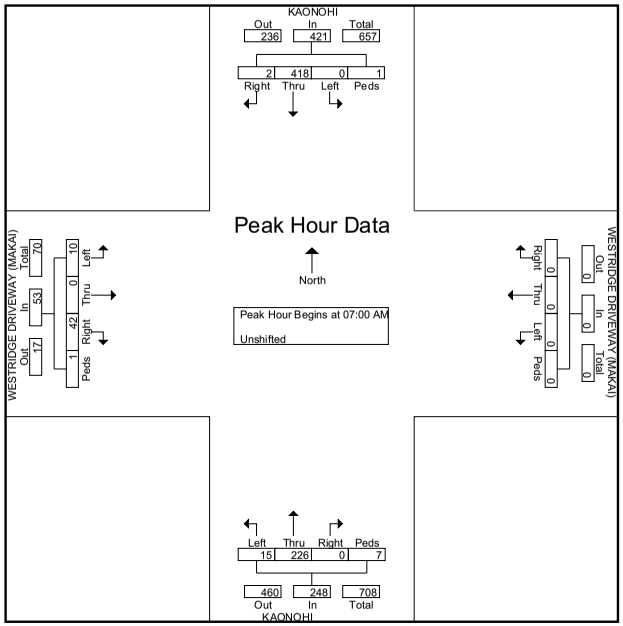
	KAONOHI From North					WESTRIDGE DRIVEWAY (MAKAI) From East					KAONOHI From South					WESTRIDGE DRIVEWAY (MAKAI) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	**1**	**118**	0	0	**119**	0	0	0	0	0	0	36	2	2	40	9	0	3	**1**	13	172
07:15 AM	1	114	0	0	115	0	0	0	0	0	0	48	**6**	0	54	12	0	1	0	13	182
07:30 AM	0	88	0	0	88	0	0	0	0	0	0	70	4	1	75	7	0	1	0	8	171
07:45 AM	0	98	0	**1**	99	0	0	0	0	0	0	**72**	3	**4**	**79**	**14**	0	**5**	0	**19**	**197**
Total Volume	2	418	0	1	421	0	0	0	0	0	0	226	15	7	248	42	0	10	1	53	722
% App. Total	0.5	99.3	0	0.2		0	0	0	0		0	91.1	6	2.8		79.2	0	18.9	1.9		
PHF	.500	.886	.000	.250	.884	.000	.000	.000	.000	.000	.000	.785	.625	.438	.785	.750	.000	.500	.250	.697	.916



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File Name : AM_Kaonohi - Anna Miller's Dr
Site Code : 00000000
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Groups Printed- Unshifted

	KAONOHI From North				ANA MILLER'S DRIVEWAY From East				KAONOHI From South				ANA MILLER'S DRIVEWAY From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:45 AM	0	80	4	0	4	0	11	0	5	30	0	0	0	0	0	0	134
Total	0	80	4	0	4	0	11	0	5	30	0	0	0	0	0	0	134
07:00 AM	0	120	6	0	4	0	8	4	4	35	0	0	0	0	0	0	181
07:15 AM	0	121	4	0	0	0	12	7	12	49	0	0	0	0	0	0	205
07:30 AM	0	94	2	0	5	0	6	2	11	74	0	0	0	0	0	0	194
07:45 AM	0	104	8	0	1	0	13	2	19	73	0	0	0	0	0	0	220
Total	0	439	20	0	10	0	39	15	46	231	0	0	0	0	0	0	800
08:00 AM	0	96	9	0	1	0	13	2	6	46	0	0	0	0	0	0	173
08:15 AM	0	77	7	0	5	0	18	1	7	58	0	0	0	0	0	0	173
Grand Total	0	692	40	0	20	0	81	18	64	365	0	0	0	0	0	0	1280
Apprch %	0	94.5	5.5	0	16.8	0	68.1	15.1	14.9	85.1	0	0	0	0	0	0	
Total %	0	54.1	3.1	0	1.6	0	6.3	1.4	5	28.5	0	0	0	0	0	0	

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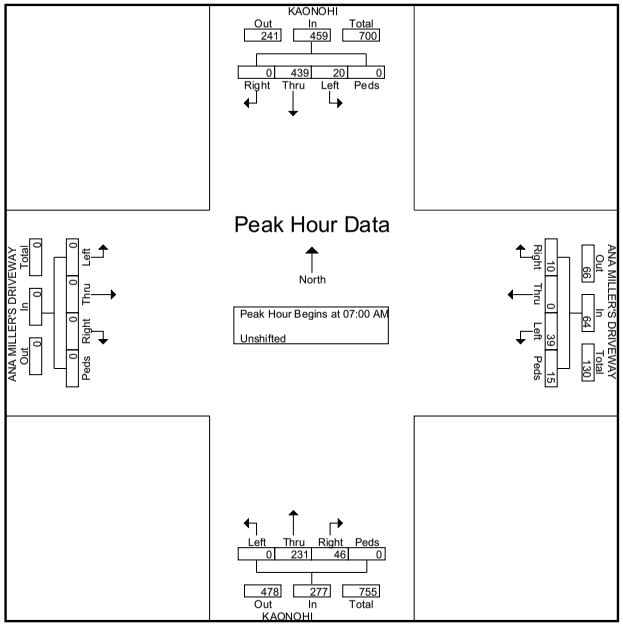
	KAONOHI From North					ANA MILLER'S DRIVEWAY From East					KAONOHI From South					ANA MILLER'S DRIVEWAY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:45 AM to 08:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	120	6	0	**126**	4	0	8	4	16	4	35	0	0	39	0	0	0	0	0	181
07:15 AM	0	**121**	4	0	125	0	0	12	**7**	**19**	12	49	0	0	61	0	0	0	0	0	205
07:30 AM	0	94	2	0	96	**5**	0	6	2	13	11	**74**	0	0	85	0	0	0	0	0	194
07:45 AM	0	104	**8**	0	112	1	0	**13**	2	16	**19**	73	0	0	**92**	0	0	0	0	0	**220**
Total Volume	0	439	20	0	459	10	0	39	15	64	46	231	0	0	277	0	0	0	0	0	800
% App. Total	0	95.6	4.4	0		15.6	0	60.9	23.4		16.6	83.4	0	0		0	0	0	0		
PHF	.000	.907	.625	.000	.911	.500	.000	.750	.536	.842	.605	.780	.000	.000	.753	.000	.000	.000	.000	.000	.909



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File Name : AM_Kaonohi - Moanalua Loop
Site Code : 00000000
Start Date : 10/14/2010
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Groups Printed- Unshifted

	KAONOHI From North				MOANALUA LOOP From East				KAONOHI From South				MOANALUA LOOP From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	3	135	0	0	0	0	0	0	0	24	8	0	28	0	6	1	205
06:45 AM	2	120	0	0	0	0	0	0	0	52	10	0	39	0	3	3	229
Total	5	255	0	0	0	0	0	0	0	76	18	0	67	0	9	4	434
07:00 AM	11	121	0	0	0	0	0	0	0	31	5	0	34	0	7	6	215
07:15 AM	6	130	0	0	0	0	0	0	0	54	9	0	31	0	10	2	242
07:30 AM	4	96	0	0	0	0	0	0	0	57	13	0	40	0	21	1	232
07:45 AM	8	110	0	0	0	0	0	0	0	56	22	0	32	0	35	7	270
Total	29	457	0	0	0	0	0	0	0	198	49	0	137	0	73	16	959
08:00 AM	6	97	0	0	0	0	0	0	0	42	15	0	37	0	7	1	205
08:15 AM	9	89	0	0	0	0	0	0	0	59	15	0	21	0	5	3	201
Grand Total	49	898	0	0	0	0	0	0	0	375	97	0	262	0	94	24	1799
Apprch %	5.2	94.8	0	0	0	0	0	0	0	79.4	20.6	0	68.9	0	24.7	6.3	
Total %	2.7	49.9	0	0	0	0	0	0	0	20.8	5.4	0	14.6	0	5.2	1.3	

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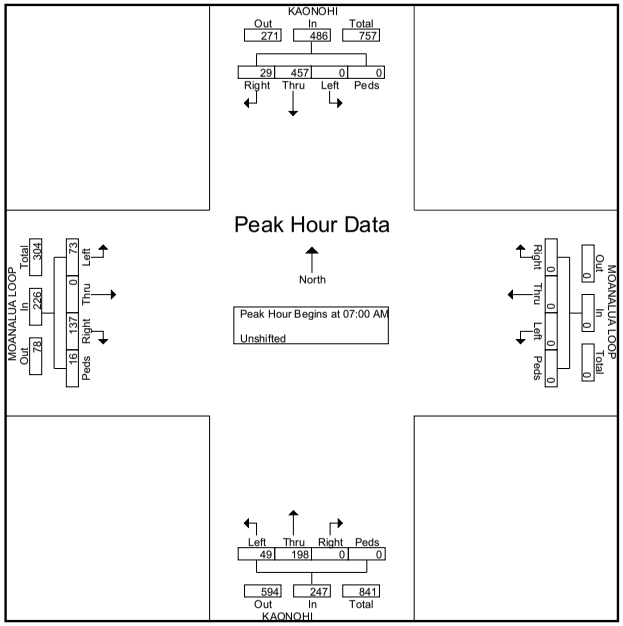
	KAONOHI From North					MOANALUA LOOP From East					KAONOHI From South					MOANALUA LOOP From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	**11**	121	0	0	132	0	0	0	0	0	0	31	5	0	36	34	0	7	6	47	215
07:15 AM	6	**130**	0	0	**136**	0	0	0	0	0	0	54	9	0	63	31	0	10	2	43	242
07:30 AM	4	96	0	0	100	0	0	0	0	0	0	**57**	13	0	70	**40**	0	21	1	62	232
07:45 AM	8	110	0	0	118	0	0	0	0	0	0	56	**22**	0	**78**	32	0	**35**	**7**	**74**	**270**
Total Volume	29	457	0	0	486	0	0	0	0	0	0	198	49	0	247	137	0	73	16	226	959
% App. Total	6	94	0	0		0	0	0	0		0	80.2	19.8	0		60.6	0	32.3	7.1		
PHF	.659	.879	.000	.000	.893	.000	.000	.000	.000	.000	.000	.868	.557	.000	.792	.856	.000	.521	.571	.764	.888



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File Name : AM_Kaonohi - Kamehameha
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Groups Printed- Unshifted

	KAONOHI From North				KAMEHAMEHA From East				KAONOHI From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	14	0	122	14	18	118	0	0	0	0	0	0	0	583	20	15	904
06:45 AM	18	0	157	11	27	142	0	0	0	0	0	0	0	514	37	9	915
Total	32	0	279	25	45	260	0	0	0	0	0	0	0	1097	57	24	1819
07:00 AM	27	0	125	11	27	161	0	0	0	0	0	0	0	434	16	17	818
07:15 AM	22	0	145	12	35	155	0	0	0	0	0	0	0	422	29	18	838
07:30 AM	22	0	111	3	36	212	0	0	0	0	0	0	0	397	37	4	822
07:45 AM	32	0	114	12	54	190	0	0	0	0	0	0	0	316	35	15	768
Total	103	0	495	38	152	718	0	0	0	0	0	0	0	1569	117	54	3246
08:00 AM	40	0	95	9	33	221	0	0	0	0	0	0	0	337	23	9	767
08:15 AM	28	0	79	17	47	184	0	0	0	0	0	0	0	253	26	14	648
Grand Total	203	0	948	89	277	1383	0	0	0	0	0	0	0	3256	223	101	6480
Apprch %	16.4	0	76.5	7.2	16.7	83.3	0	0	0	0	0	0	0	90.9	6.2	2.8	
Total %	3.1	0	14.6	1.4	4.3	21.3	0	0	0	0	0	0	0	50.2	3.4	1.6	

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File Name : AM_Kaonohi - Kamehameha
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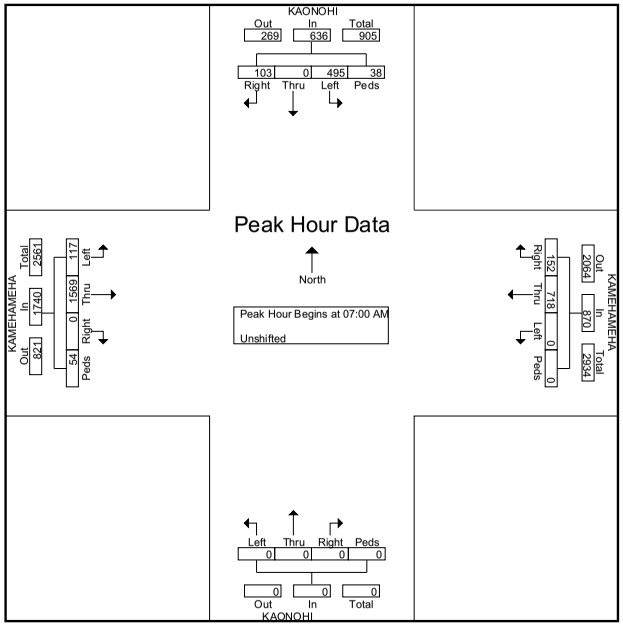
	KAONOHI From North					KAMEHAMEHA From East					KAONOHI From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	27	0	125	11	163	27	161	0	0	188	0	0	0	0	0	0	**434**	16	17	467	818
07:15 AM	22	0	**145**	**12**	**179**	35	155	0	0	190	0	0	0	0	0	0	422	29	**18**	**469**	**838**
07:30 AM	22	0	111	3	136	36	**212**	0	0	**248**	0	0	0	0	0	0	397	**37**	4	438	822
07:45 AM	**32**	0	114	12	158	**54**	190	0	0	244	0	0	0	0	0	0	316	35	15	366	768
Total Volume	103	0	495	38	636	152	718	0	0	870	0	0	0	0	0	0	1569	117	54	1740	3246
% App. Total	16.2	0	77.8	6		17.5	82.5	0	0		0	0	0	0		0	90.2	6.7	3.1		
PHF	.805	.000	.853	.792	.888	.704	.847	.000	.000	.877	.000	.000	.000	.000	.000	.000	.904	.791	.750	.928	.968



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File Name : AM_Hekaha - Kamehameha - new
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Groups Printed- Unshifted

	HEKAHA From North				KAMEHAMEHA From East					HEKAHA From South				KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	U-Turn	Peds	Right	Thru	Left	Peds	Right	Thru	Left	U-Turn	Peds	Int. Total
06:30 AM	13	6	6	0	7	118	6	0	4	9	1	6	2	11	484	5	0	0	678
06:45 AM	16	9	10	1	3	156	23	0	5	2	0	4	0	24	461	3	1	0	718
Total	29	15	16	1	10	274	29	0	9	11	1	10	2	35	945	8	1	0	1396
07:00 AM	10	2	15	0	7	148	13	0	0	6	0	9	2	29	445	9	0	0	695
07:15 AM	18	3	25	2	9	198	21	0	3	12	0	6	2	35	423	5	0	0	762
07:30 AM	23	5	31	0	3	205	24	0	3	13	1	18	4	52	369	15	0	0	766
07:45 AM	17	2	31	0	6	231	22	0	9	21	2	16	1	54	313	14	1	0	740
Total	68	12	102	2	25	782	80	0	15	52	3	49	9	170	1550	43	1	0	2963
08:00 AM	13	6	15	1	6	144	33	0	3	15	3	15	0	51	264	14	0	0	583
08:15 AM	7	1	13	0	9	159	30	0	4	24	1	12	2	45	212	13	0	0	532
Grand Total	117	34	146	4	50	1359	172	0	31	102	8	86	13	301	2971	78	2	0	5474
Apprch %	38.9	11.3	48.5	1.3	3.1	84.3	10.7	0	1.9	48.8	3.8	41.1	6.2	9	88.6	2.3	0.1	0	
Total %	2.1	0.6	2.7	0.1	0.9	24.8	3.1	0	0.6	1.9	0.1	1.6	0.2	5.5	54.3	1.4	0	0	

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File Name : AM_Hekaha - Kamehameha - new
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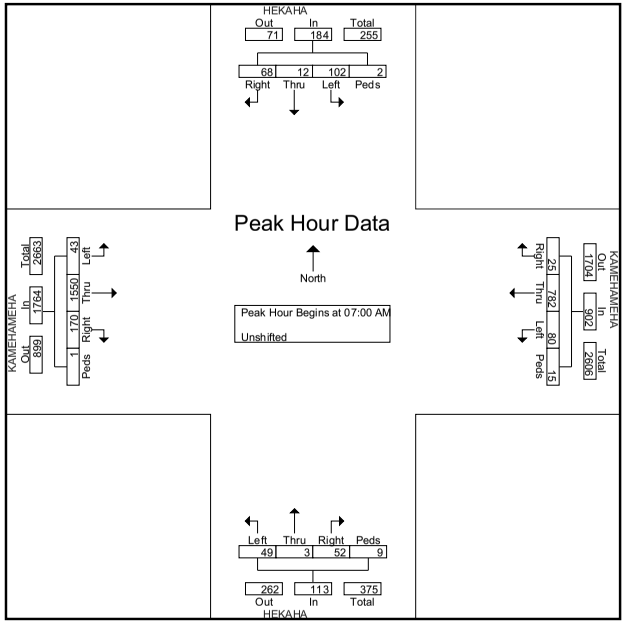
	HEKAHA From North					KAMEHAMEHA From East						HEKAHA From South					KAMEHAMEHA From West						
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																							
Peak Hour for Entire Intersection Begins at 07:00 AM																							
07:00 AM	10	2	15	0	27	7	148	13	0	0	168	6	0	9	2	17	29	445	9	0	0	483	695
07:15 AM	18	3	25	2	48	9	198	21	0	3	231	12	0	6	2	20	35	423	5	0	0	463	762
07:30 AM	23	5	31	0	59	3	205	24	0	3	235	13	1	18	4	36	52	369	15	0	0	436	766
07:45 AM	17	2	31	0	50	6	231	22	0	9	268	21	2	16	1	40	54	313	14	1	0	382	740
Total Volume	68	12	102	2	184	25	782	80	0	15	902	52	3	49	9	113	170	1550	43	1	0	1764	2963
% App. Total			55.4	1.1		2.8	86.7	8.9	0	1.7		46	2.7	43.4				87.9	2.4	0.1	0		
PHF	.739	.600	.823	.250	.780	.694	.846	.833	.000	.417	.841	.619	.375	.681	.563	.706	.787	.871	.717	.250	.000	.913	.967



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File Name : AM_Kanuku - Kamehameha new
Site Code : 00000000
Start Date : 5/10/2011
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Groups Printed- Unshifted

	KANUKU From North				KAM From East				KANUKU From South				KAM From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	2	1	28	1	12	86	2	0	2	2	1	0	3	352	2	1	495
06:45 AM	5	2	36	3	14	175	2	0	3	1	1	1	1	466	2	4	716
Total	7	3	64	4	26	261	4	0	5	3	2	1	4	818	4	5	1211
07:00 AM	6	1	40	1	14	163	3	0	0	0	1	1	3	444	4	3	684
07:15 AM	7	2	41	0	17	219	2	0	4	3	0	1	3	418	10	1	728
07:30 AM	13	0	23	2	16	217	4	0	2	1	1	1	5	408	3	0	696
07:45 AM	11	2	23	0	12	247	5	0	4	0	1	1	5	327	6	0	644
Total	37	5	127	3	59	846	14	0	10	4	3	4	16	1597	23	4	2752
08:00 AM	5	3	23	0	14	186	2	0	5	0	0	2	8	257	4	7	516
08:15 AM	5	1	13	1	17	201	3	0	4	1	1	2	3	232	5	0	489
Grand Total	54	12	227	8	116	1494	23	0	24	8	6	9	31	2904	36	16	4968
Apprch %	17.9	4	75.4	2.7	7.1	91.5	1.4	0	51.1	17	12.8	19.1	1	97.2	1.2	0.5	
Total %	1.1	0.2	4.6	0.2	2.3	30.1	0.5	0	0.5	0.2	0.1	0.2	0.6	58.5	0.7	0.3	

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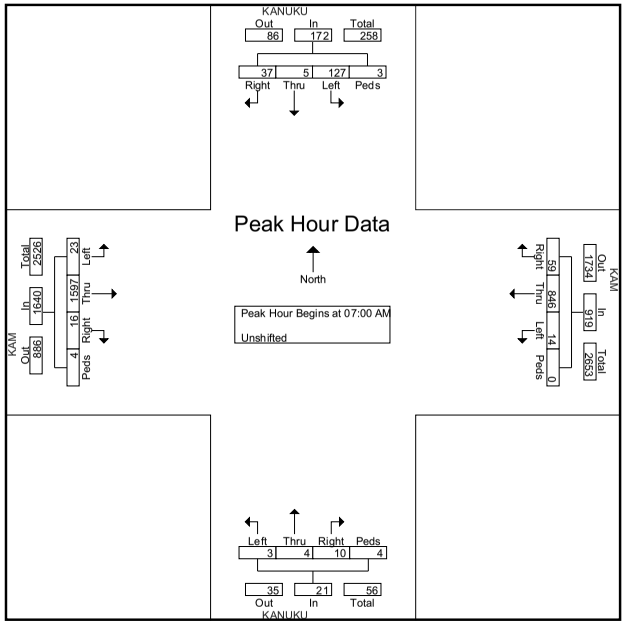
	KANUKU From North					KAM From East					KANUKU From South					KAM From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	6	1	40	1	48	14	163	3	0	180	0	0	1	1	2	3	444	4	3	454	684
07:15 AM	7	2	41	0	50	17	219	2	0	238	4	3	0	1	8	3	418	10	1	432	728
07:30 AM	13	0	23	2	38	16	217	4	0	237	2	1	1	1	5	5	408	3	0	416	696
07:45 AM	11	2	23	0	36	12	247	5	0	264	4	0	1	1	6	5	327	6	0	338	644
Total Volume	37	5	127	3	172	59	846	14	0	919	10	4	3	4	21	16	1597	23	4	1640	2752
% App. Total	21.5	2.9	73.8	1.7		6.4	92.1	1.5	0		47.6	19	14.3	19		1	97.4	1.4	0.2		
PHF	.712	.625	.774	.375	.860	.868	.856	.700	.000	.870	.625	.333	.750	1.00	.656	.800	.899	.575	.333	.903	.945



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Default Comments
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File Name : AM_Lipoa - Kamehameha new
Site Code : 00000000
Start Date : 5/10/2011
Page No : 1

Groups Printed- Unshifted

	LIPOA From North				KAM From East					LIPOA From South				KAM From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	U-Turn	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	0	0	0	0	0	145	7	0	3	17	0	9	0	11	617	0	0	809
06:45 AM	0	0	0	0	0	165	5	7	8	11	0	20	2	7	616	0	0	841
Total	0	0	0	0	0	310	12	7	11	28	0	29	2	18	1233	0	0	1650
07:00 AM	0	0	0	0	0	182	8	13	5	12	0	11	0	9	582	0	0	822
07:15 AM	0	0	0	0	0	240	13	7	2	11	0	20	1	7	517	0	0	818
07:30 AM	0	0	0	0	0	218	13	6	1	19	0	16	1	13	521	0	0	808
07:45 AM	0	0	0	0	0	248	6	6	10	12	0	18	0	15	412	0	0	727
Total	0	0	0	0	0	888	40	32	18	54	0	65	2	44	2032	0	0	3175
08:00 AM	0	0	0	0	0	217	15	6	1	13	0	17	1	7	337	1	0	615
08:15 AM	0	0	0	0	0	204	10	10	1	8	0	21	2	7	327	0	0	590
Grand Total	0	0	0	0	0	1619	77	55	31	103	0	132	7	76	3929	1	0	6030
Apprch %	0	0	0	0	0	90.9	4.3	3.1	1.7	42.6	0	54.5	2.9	1.9	98.1	0	0	
Total %	0	0	0	0	0	26.8	1.3	0.9	0.5	1.7	0	2.2	0.1	1.3	65.2	0	0	

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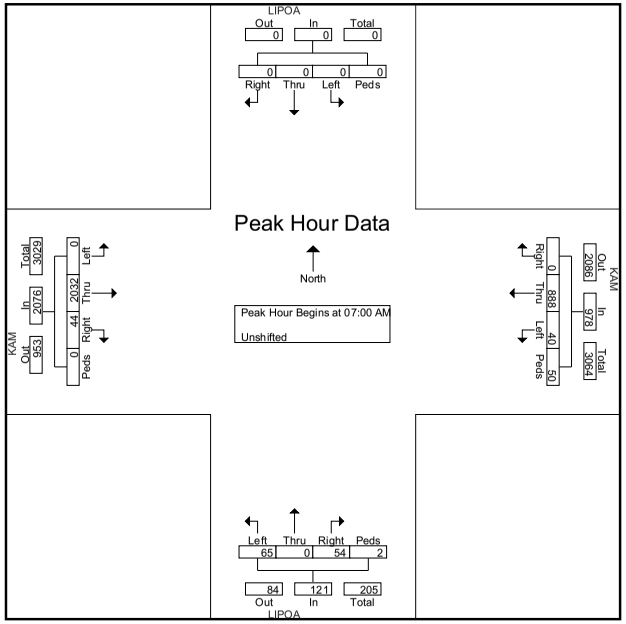
File Name : AM_Lipoa - Kamehameha new
Site Code : 00000000
Start Date : 5/10/2011
Page No : 2

	LIPOA From North					KAM From East						LIPOA From South					KAM From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	U-Turn	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																						
Peak Hour for Entire Intersection Begins at 07:00 AM																						
07:00 AM	0	0	0	0	0	0	182	8	13	5	208	12	0	11	0	23	9	582	0	0	591	822
07:15 AM	0	0	0	0	0	0	240	13	7	2	262	11	0	20	1	32	7	517	0	0	524	818
07:30 AM	0	0	0	0	0	0	218	13	6	1	238	19	0	16	1	36	13	521	0	0	534	808
07:45 AM	0	0	0	0	0	0	248	6	6	10	270	12	0	18	0	30	15	412	0	0	427	727
Total Volume	0	0	0	0	0	0	888	40	32	18	978	54	0	65	2	121	44	2032	0	0	2076	3175
% App. Total							90.8					44.6		53.7				97.9				
PHF	.000	.000	.000	.000		.000	.895	.769	.615	.450	.906	.711	.000	.813	.500		.733	.873	.000	.000		



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File Name : AM_PaliMomi (In) - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 1

Groups Printed- Class 1

	PALIMOI (IN) From North				KAMEHAMEHA From East				PALIMOI (IN) From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	0	0	0	0	23	147	3	0	0	0	0	0	3	626	16	0	818
06:45 AM	0	0	0	0	34	184	7	0	0	0	0	0	1	630	25	0	881
Total	0	0	0	0	57	331	10	0	0	0	0	0	4	1256	41	0	1699
07:00 AM	0	0	0	0	27	201	1	0	0	0	0	2	2	560	31	0	824
07:15 AM	0	0	0	1	33	259	10	0	0	0	0	3	6	525	43	0	880
07:30 AM	0	0	0	1	54	215	16	0	0	0	0	0	2	482	46	0	816
07:45 AM	0	0	0	0	49	246	11	0	0	0	0	1	1	366	62	0	736
Total	0	0	0	2	163	921	38	0	0	0	0	6	11	1933	182	0	3256
08:00 AM	0	0	0	0	49	225	7	0	0	0	0	0	3	299	53	0	636
08:15 AM	0	0	0	0	58	206	16	0	0	0	0	1	3	288	50	0	622
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	107	431	23	0	0	0	0	1	6	587	103	0	1258
Grand Total	0	0	0	2	327	1683	71	0	0	0	0	7	21	3776	326	0	6213
Apprch %	0	0	0	100	15.7	80.9	3.4	0	0	0	0	100	0.5	91.6	7.9	0	
Total %	0	0	0	0	5.3	27.1	1.1	0	0	0	0	0.1	0.3	60.8	5.2	0	

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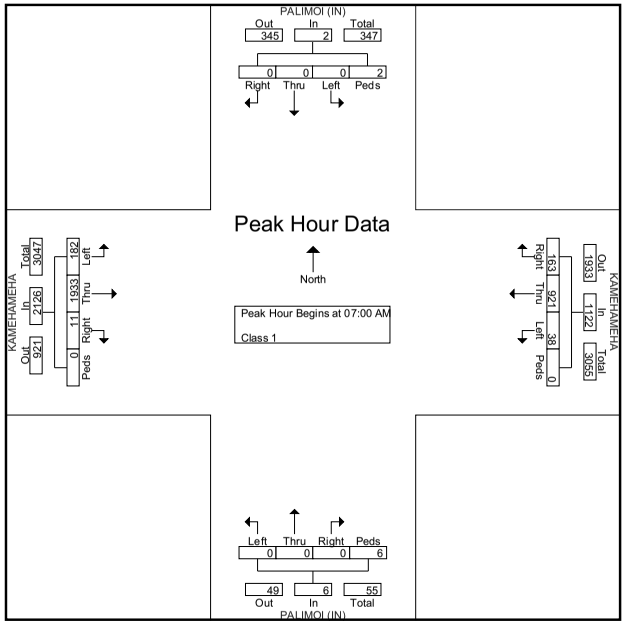
File Name : AM_PaliMomi (In) - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 2

	PALIMOI (IN) From North					KAMEHAMEHA From East					PALIMOI (IN) From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	0	0	0	27	201	1	0	229	0	0	0	2	2	2	560	31	0	593	824
07:15 AM	0	0	0	1	1	33	259	10	0	302	0	0	0	3	3	6	525	43	0	574	880
07:30 AM	0	0	0	1	1	54	215	16	0	285	0	0	0	0	0	2	482	46	0	530	816
07:45 AM	0	0	0	0	0	49	246	11	0	306	0	0	0	1	1	1	366	62	0	429	736
Total Volume	0	0	0	2	2	163	921	38	0	1122	0	0	0	6	6	11	1933	182	0	2126	3256
% App. Total	0	0	0	100		14.5	82.1	3.4	0		0	0	0	100		0.5	90.9	8.6	0		
PHF	.000	.000	.000	.500	.500	.755	.889	.594	.000	.917	.000	.000	.000	.500	.500	.458	.863	.734	.000	.896	.925



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File Name : AM_PaliMomi (Out) - Kamehameha - new
Site Code : 00000000
Start Date : 5/10/2011
Page No : 1

Groups Printed- Class 1

	PALIMOI (OUT) From North				KAMEHAMEHA From East				PALIMOI (OUT) From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
06:30 AM	7	0	93	0	0	170	0	0	0	0	0	0	0	574	0	6	850
06:45 AM	6	0	67	0	0	217	0	0	0	0	0	0	0	581	0	23	894
Total	13	0	160	0	0	387	0	0	0	0	0	0	0	1155	0	29	1744
07:00 AM	10	0	72	0	0	229	0	0	0	0	0	0	0	510	0	7	828
07:15 AM	18	0	83	0	0	290	0	0	0	0	0	0	0	501	0	18	910
07:30 AM	25	0	78	0	0	254	0	0	0	0	0	0	0	465	0	8	830
07:45 AM	17	0	62	0	0	276	0	0	0	0	0	0	0	354	0	16	725
Total	70	0	295	0	0	1049	0	0	0	0	0	0	0	1830	0	49	3293
08:00 AM	12	0	41	0	0	264	0	0	0	0	0	0	0	303	0	11	631
08:15 AM	14	0	45	0	0	274	0	0	0	0	0	0	0	264	0	12	609
08:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	26	0	86	0	0	538	0	0	0	0	0	0	0	567	0	23	1240
Grand Total	109	0	541	0	0	1974	0	0	0	0	0	0	0	3552	0	101	6277
Apprch %	16.8	0	83.2	0	0	100	0	0	0	0	0	0	0	97.2	0	2.8	
Total %	1.7	0	8.6	0	0	31.4	0	0	0	0	0	0	0	56.6	0	1.6	

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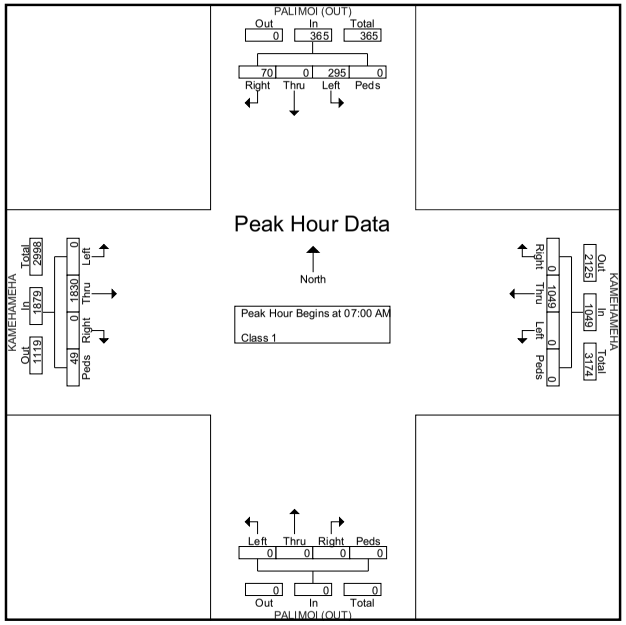
File Name : AM_PaliMomi (Out) - Kamehameha - new
Site Code : 00000000
Start Date : 5/10/2011
Page No : 2

	PALIMOI (OUT) From North					KAMEHAMEHA From East					PALIMOI (OUT) From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 07:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	10	0	72	0	82	0	229	0	0	229	0	0	0	0	0	0	510	0	7	517	828
07:15 AM	18	0	83	0	101	0	290	0	0	290	0	0	0	0	0	0	501	0	18	519	910
07:30 AM	25	0	78	0	103	0	254	0	0	254	0	0	0	0	0	0	465	0	8	473	830
07:45 AM	17	0	62	0	79	0	276	0	0	276	0	0	0	0	0	0	354	0	16	370	725
Total Volume	70	0	295	0	365	0	1049	0	0	1049	0	0	0	0	0	0	1830	0	49	1879	3293
% App. Total	19.2	0	80.8	0		0	100	0	0		0	0	0	0		0	97.4	0	2.6		
PHF	.700	.000	.889	.000	.886	.000	.904	.000	.000	.904	.000	.000	.000	.000	.000	.000	.897	.000	.681	.905	.905



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File Name : PM_Harbor Pt - Moanalua Peak
Site Code : 00000000
Start Date : 10/14/2010
Page No : 1

Groups Printed- Unshifted

	HARBOR POINT From North				MOANALUA From East				HARBOR POINT From South				MOANALUA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	0	0	0	0	0	364	4	0	6	0	3	0	8	289	0	0	674
03:45 PM	0	0	0	0	0	453	4	0	6	0	4	0	8	287	0	0	762
Total	0	0	0	0	0	817	8	0	12	0	7	0	16	576	0	0	1436
04:00 PM	0	0	0	0	0	482	2	0	5	0	4	0	2	229	0	0	724
04:15 PM	0	0	0	0	0	457	7	0	2	0	2	0	3	304	0	0	775
Grand Total	0	0	0	0	0	1756	17	0	19	0	13	0	21	1109	0	0	2935
Apprch %	0	0	0	0	0	99	1	0	59.4	0	40.6	0	1.9	98.1	0	0	
Total %	0	0	0	0	0	59.8	0.6	0	0.6	0	0.4	0	0.7	37.8	0	0	

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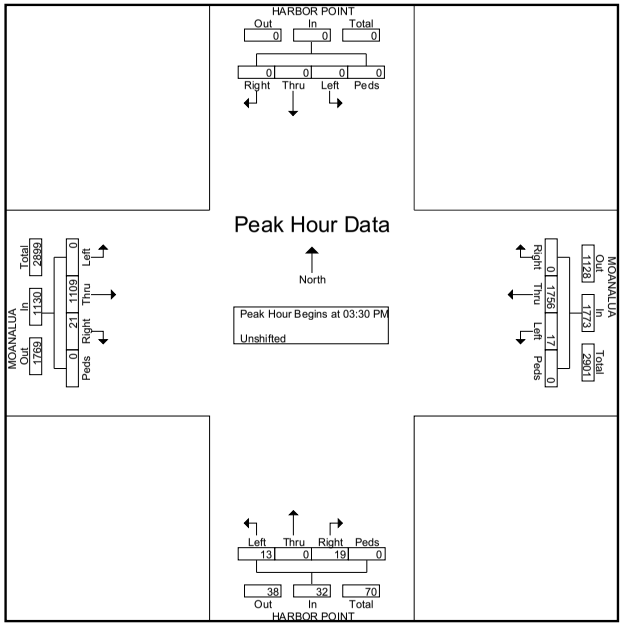
File Name : PM_Harbor Pt - Moanalua Peak
Site Code : 00000000
Start Date : 10/14/2010
Page No : 2

	HARBOR POINT From North					MOANALUA From East					HARBOR POINT From South					MOANALUA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	0	0	0	364	4	0	368	**6**	0	3	0	9	**8**	289	0	0	297	674
03:45 PM	0	0	0	0	0	0	453	4	0	457	6	0	**4**	0	**10**	8	287	0	0	295	762
04:00 PM	0	0	0	0	0	0	**482**	2	0	**484**	5	0	4	0	9	2	229	0	0	231	724
04:15 PM	0	0	0	0	0	0	457	**7**	0	464	2	0	2	0	4	3	**304**	0	0	**307**	**775**
Total Volume	0	0	0	0	0	0	1756	17	0	1773	19	0	13	0	32	21	1109	0	0	1130	2935
% App. Total	0	0	0	0		0	99	1	0		59.4	0	40.6	0		1.9	98.1	0	0		
PHF	.000	.000	.000	.000	.000	.000	.911	.607	.000	.916	.792	.000	.813	.000	.800	.656	.912	.000	.000	.920	.947



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File Name : PM_Pearlridge Elementary Schl - Moanalua
Site Code : 00000000
Start Date : 10/14/2010
Page No : 1

Groups Printed- Unshifted

	PEARLRIDGE ELEMENTARY SCHL From North				MOANALUA From East				PEARLRIDGE ELEMENTARY SCHL From South				MOANALUA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	8	0	8	0	18	339	0	0	0	0	0	0	0	248	5	0	626
03:15 PM	22	0	13	1	13	389	0	0	0	0	0	0	0	266	14	0	718
03:30 PM	17	0	9	0	13	389	0	0	0	0	0	0	0	295	21	0	744
03:45 PM	18	0	16	2	23	434	0	0	0	0	0	0	0	274	10	0	777
Total	65	0	46	3	67	1551	0	0	0	0	0	0	0	1083	50	0	2865
04:00 PM	26	0	22	1	19	436	0	0	0	0	0	0	0	239	9	0	752
04:15 PM	17	0	11	0	22	416	0	0	0	0	0	0	0	285	12	0	763
04:30 PM	19	0	11	2	21	448	0	0	0	0	0	0	0	269	14	0	784
04:45 PM	19	0	13	0	23	465	0	0	0	0	0	0	0	291	7	0	818
Total	81	0	57	3	85	1765	0	0	0	0	0	0	0	1084	42	0	3117
05:00 PM	15	0	10	1	15	440	0	0	0	0	0	0	0	227	12	0	720
05:15 PM	7	0	13	2	12	478	0	0	0	0	0	0	0	296	6	0	814
Grand Total	168	0	126	9	179	4234	0	0	0	0	0	0	0	2690	110	0	7516
Apprch %	55.4	0	41.6	3	4.1	95.9	0	0	0	0	0	0	0	96.1	3.9	0	
Total %	2.2	0	1.7	0.1	2.4	56.3	0	0	0	0	0	0	0	35.8	1.5	0	

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File Name : PM_Pearlridge Elementary Schl - Moanalua
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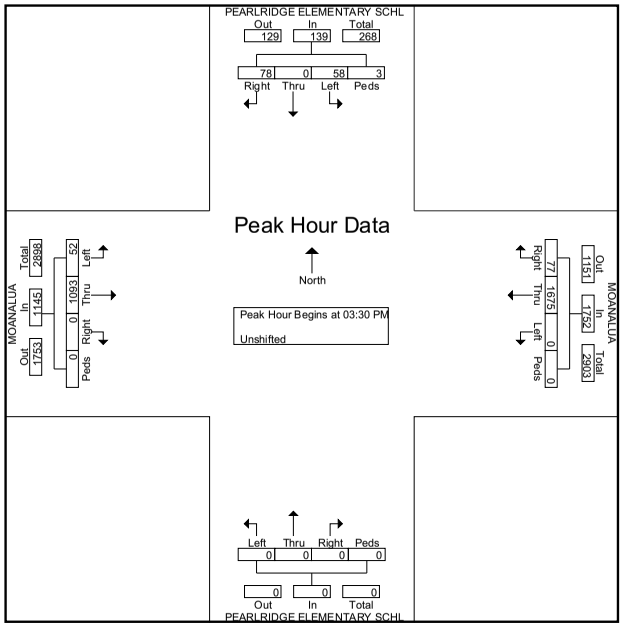
	PEARLRIDGE ELEMENTARY SCHL From North					MOANALUA From East					PEARLRIDGE ELEMENTARY SCHL From South					MOANALUA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	17	0	9	0	26	13	389	0	0	402	0	0	0	0	0	0	**295**	**21**	0	**316**	744
03:45 PM	18	0	16	**2**	36	**23**	434	0	0	**457**	0	0	0	0	0	0	274	10	0	284	**777**
04:00 PM	**26**	0	**22**	1	**49**	19	**436**	0	0	455	0	0	0	0	0	0	239	9	0	248	752
04:15 PM	17	0	11	0	28	22	416	0	0	438	0	0	0	0	0	0	285	12	0	297	763
Total Volume	78	0	58	3	139	77	1675	0	0	1752	0	0	0	0	0	0	1093	52	0	1145	3036
% App. Total	56.1	0	41.7	2.2		4.4	95.6	0	0		0	0	0	0		0	95.5	4.5	0		
PHF	.750	.000	.659	.375	.709	.837	.960	.000	.000	.958	.000	.000	.000	.000	.000	.000	.926	.619	.000	.906	.977



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File Name : PM_Kaonohi - Moanalua
Site Code : 00000000
Start Date : 10/14/2010
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Groups Printed- Unshifted

	KAONOHI From North				MOANALUA From East				KAONOHI From South				MOANALUA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	29	25	23	5	53	266	23	2	25	38	92	0	31	181	56	0	849
03:15 PM	30	15	37	6	69	284	18	1	32	44	89	1	34	179	47	0	886
03:30 PM	43	26	30	3	65	296	31	5	27	30	74	9	51	229	36	3	958
03:45 PM	27	15	28	3	61	345	20	1	28	27	85	6	34	217	52	3	952
Total	129	81	118	17	248	1191	92	9	112	139	340	16	150	806	191	6	3645
04:00 PM	30	28	31	4	67	306	19	4	25	44	123	4	47	168	40	3	943
04:15 PM	24	19	24	3	70	329	26	4	21	36	78	1	47	199	54	1	936
04:30 PM	35	29	59	3	72	337	18	7	18	39	105	5	34	173	62	3	999
04:45 PM	39	31	38	0	90	341	14	3	27	37	93	4	44	210	77	0	1048
Total	128	107	152	10	299	1313	77	18	91	156	399	14	172	750	233	7	3926
05:00 PM	39	26	51	3	71	320	22	2	25	52	99	2	50	149	32	3	946
05:15 PM	29	24	31	2	52	303	20	4	15	30	110	2	49	140	53	0	864
Grand Total	325	238	352	32	670	3127	211	33	243	377	948	34	421	1845	509	16	9381
Apprch %	34.3	25.1	37.2	3.4	16.6	77.4	5.2	0.8	15.2	23.5	59.2	2.1	15.1	66.1	18.2	0.6	
Total %	3.5	2.5	3.8	0.3	7.1	33.3	2.2	0.4	2.6	4	10.1	0.4	4.5	19.7	5.4	0.2	

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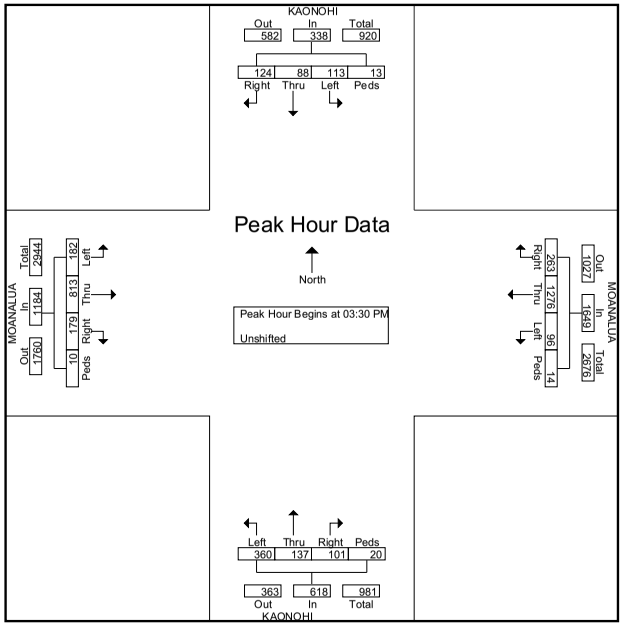
	KAONOHI From North					MOANALUA From East					KAONOHI From South					MOANALUA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**43**	26	30	3	**102**	65	296	**31**	**5**	397	27	30	74	**9**	140	**51**	**229**	36	**3**	**319**	**958**
03:45 PM	27	15	28	3	73	61	**345**	20	1	427	**28**	27	85	6	146	34	217	52	3	306	952
04:00 PM	30	**28**	**31**	**4**	93	67	306	19	4	396	25	**44**	**123**	4	**196**	47	168	40	3	258	943
04:15 PM	24	19	24	3	70	**70**	329	26	4	**429**	21	36	78	1	136	47	199	**54**	1	301	936
Total Volume	124	88	113	13	338	263	1276	96	14	1649	101	137	360	20	618	179	813	182	10	1184	3789
% App. Total	36.7	26	33.4	3.8		15.9	77.4	5.8	0.8		16.3	22.2	58.3	3.2		15.1	68.7	15.4	0.8		
PHF	.721	.786	.911	.813	.828	.939	.925	.774	.700	.961	.902	.778	.732	.556	.788	.877	.888	.843	.833	.928	.989



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File Name : PM_Kaonohi - Pearlridge Dr
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Groups Printed- Unshifted

	KAONOHI From North				PEARLRIDGE DRIVEWAY From East				KAONOHI From South				PEARLRIDGE DRIVEWAY From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
*** BREAK ***																	
03:15 PM	0	0	0	0	25	0	0	4	8	114	0	0	0	0	0	0	151
03:30 PM	0	0	0	0	15	0	0	6	10	111	0	0	0	0	0	0	142
03:45 PM	0	0	0	0	21	0	0	3	6	115	0	0	0	0	0	0	145
Total	0	0	0	0	61	0	0	13	24	340	0	0	0	0	0	0	438
04:00 PM	0	0	0	0	22	0	0	1	12	131	0	0	0	0	0	0	166
04:15 PM	0	0	0	0	7	0	0	1	6	121	0	0	0	0	0	0	135
04:30 PM	0	0	0	0	19	0	0	1	13	125	0	0	0	0	0	0	158
04:45 PM	0	0	0	0	11	0	0	3	7	147	0	0	0	0	0	0	168
Total	0	0	0	0	59	0	0	6	38	524	0	0	0	0	0	0	627
05:00 PM	0	0	0	0	36	0	0	4	4	138	0	0	0	0	0	0	182
05:15 PM	0	0	0	0	16	0	0	2	2	105	0	0	0	0	0	0	125
Grand Total	0	0	0	0	172	0	0	25	68	1107	0	0	0	0	0	0	1372
Apprch %	0	0	0	0	87.3	0	0	12.7	5.8	94.2	0	0	0	0	0	0	
Total %	0	0	0	0	12.5	0	0	1.8	5	80.7	0	0	0	0	0	0	

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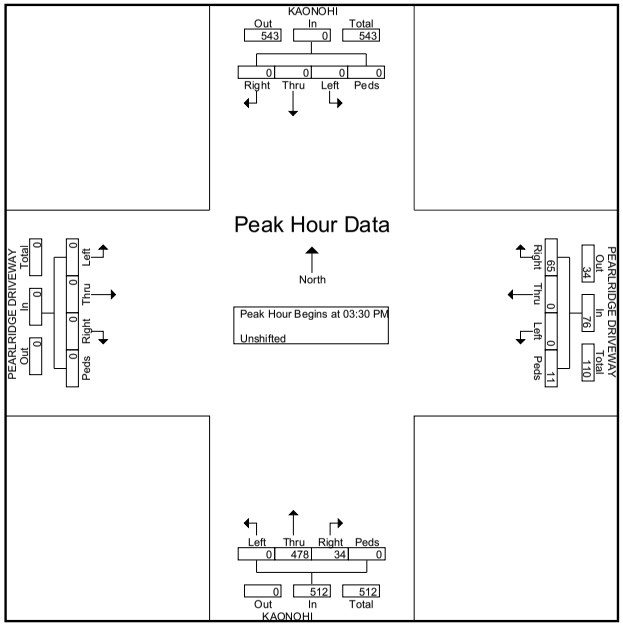
	KAONOHI From North					PEARLRIDGE DRIVEWAY From East					KAONOHI From South					PEARLRIDGE DRIVEWAY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	0	0	15	0	0	**6**	21	10	111	0	0	121	0	0	0	0	0	142
03:45 PM	0	0	0	0	0	21	0	0	3	**24**	6	115	0	0	121	0	0	0	0	0	145
04:00 PM	0	0	0	0	0	**22**	0	0	1	23	**12**	**131**	0	0	**143**	0	0	0	0	0	**166**
04:15 PM	0	0	0	0	0	7	0	0	1	8	6	121	0	0	127	0	0	0	0	0	135
Total Volume	0	0	0	0	0	65	0	0	11	76	34	478	0	0	512	0	0	0	0	0	588
% App. Total	0	0	0	0		85.5	0	0	14.5		6.6	93.4	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.739	.000	.000	.458	.792	.708	.912	.000	.000	.895	.000	.000	.000	.000	.000	.886



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Groups Printed- Unshifted

	KAONOHI From North				MACY'S DRIVEWAY From East				KAONOHI From South				MACY'S DRIVEWAY From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
*** BREAK ***																	
03:15 PM	0	54	27	0	40	0	24	2	11	100	0	0	0	0	0	0	258
03:30 PM	0	74	21	0	44	0	32	8	15	101	0	0	0	0	0	0	295
03:45 PM	0	66	27	0	41	0	18	3	13	91	0	0	0	0	0	0	259
Total	0	194	75	0	125	0	74	13	39	292	0	0	0	0	0	0	812
04:00 PM	0	75	15	0	42	0	23	2	25	118	0	0	0	0	0	0	300
04:15 PM	0	71	20	0	43	0	21	1	13	112	0	0	0	0	0	0	281
04:30 PM	0	89	31	0	48	0	29	2	14	100	0	0	0	0	0	0	313
04:45 PM	0	84	32	0	52	0	20	5	24	108	0	0	0	0	0	0	325
Total	0	319	98	0	185	0	93	10	76	438	0	0	0	0	0	0	1219
05:00 PM	0	79	14	0	43	0	25	3	13	109	0	0	0	0	0	0	286
05:15 PM	0	77	27	0	46	0	14	4	16	89	0	0	0	0	0	0	273
Grand Total	0	669	214	0	399	0	206	30	144	928	0	0	0	0	0	0	2590
Apprch %	0	75.8	24.2	0	62.8	0	32.4	4.7	13.4	86.6	0	0	0	0	0	0	
Total %	0	25.8	8.3	0	15.4	0	8	1.2	5.6	35.8	0	0	0	0	0	0	

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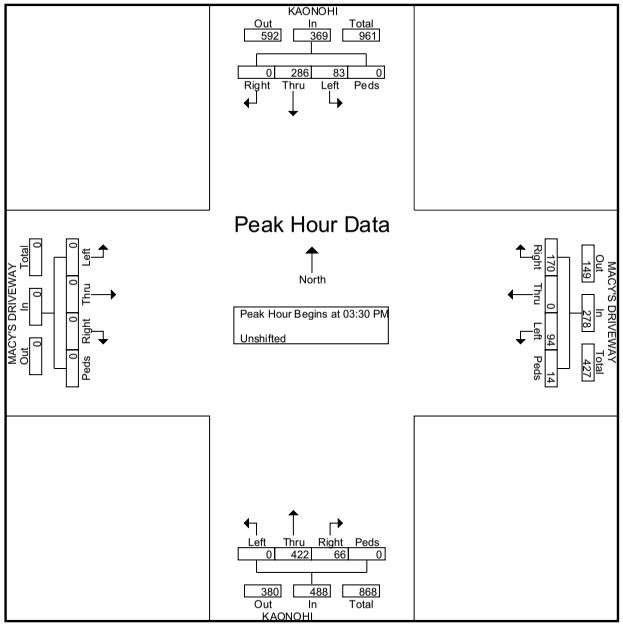
	KAONOHI From North					MACY'S DRIVEWAY From East					KAONOHI From South					MACY'S DRIVEWAY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	74	21	0	**95**	**44**	0	**32**	**8**	**84**	15	101	0	0	116	0	0	0	0	0	295
03:45 PM	0	66	**27**	0	93	41	0	18	3	62	13	91	0	0	104	0	0	0	0	0	259
04:00 PM	0	**75**	15	0	90	42	0	23	2	67	**25**	**118**	0	0	**143**	0	0	0	0	0	**300**
04:15 PM	0	71	20	0	91	43	0	21	1	65	13	112	0	0	125	0	0	0	0	0	281
Total Volume	0	286	83	0	369	170	0	94	14	278	66	422	0	0	488	0	0	0	0	0	1135
% App. Total	0	77.5	22.5	0		61.2	0	33.8	5		13.5	86.5	0	0		0	0	0	0		
PHF	.000	.953	.769	.000	.971	.966	.000	.734	.438	.827	.660	.894	.000	.000	.853	.000	.000	.000	.000	.000	.946



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Groups Printed- Unshifted

	KAONOHI From North				SWAP MEET EXIT (KFC DRIVEWAY) From East				KAONOHI From South				SWAP MEET EXIT (KFC DRIVEWAY) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	1	98	11	0	21	1	42	1	23	100	1	0	6	0	2	2	309
03:15 PM	0	67	11	0	24	0	30	2	13	82	2	0	3	0	1	3	238
03:30 PM	1	94	17	0	27	0	31	8	25	90	0	0	2	0	0	2	297
03:45 PM	0	70	9	0	23	0	33	9	22	83	0	0	1	0	2	2	254
Total	2	329	48	0	95	1	136	20	83	355	3	0	12	0	5	9	1098
04:00 PM	1	86	12	0	24	0	42	9	16	111	0	0	0	0	1	1	303
04:15 PM	0	82	14	0	20	0	38	0	19	104	0	0	1	0	0	2	280
04:30 PM	0	100	17	0	22	0	41	4	28	82	1	0	1	0	0	1	297
04:45 PM	0	86	16	0	25	0	37	6	24	109	1	0	1	1	0	2	308
Total	1	354	59	0	91	0	158	19	87	406	2	0	3	1	1	6	1188
05:00 PM	0	89	11	0	30	1	42	2	18	85	0	0	0	0	1	2	281
05:15 PM	0	85	14	0	23	0	41	3	15	77	0	0	0	0	3	4	265
Grand Total	3	857	132	0	239	2	377	44	203	923	5	0	15	1	10	21	2832
Apprch %	0.3	86.4	13.3	0	36.1	0.3	56.9	6.6	17.9	81.6	0.4	0	31.9	2.1	21.3	44.7	
Total %	0.1	30.3	4.7	0	8.4	0.1	13.3	1.6	7.2	32.6	0.2	0	0.5	0	0.4	0.7	

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File Name : PM_Kaonohi - Swap Meet Exit (KFC Dr)
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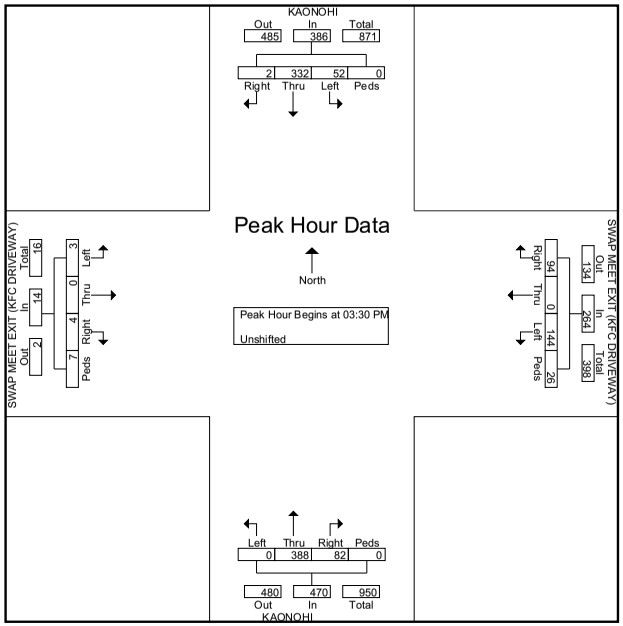
	KAONOHI From North					SWAP MEET EXIT (KFC DRIVEWAY) From East					KAONOHI From South					SWAP MEET EXIT (KFC DRIVEWAY) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**1**	**94**	**17**	0	**112**	**27**	0	31	8	66	**25**	90	0	0	115	**2**	0	0	**2**	4	297
03:45 PM	0	70	9	0	79	23	0	33	**9**	65	22	83	0	0	105	1	0	**2**	2	**5**	254
04:00 PM	1	86	12	0	99	24	0	**42**	9	**75**	16	**111**	0	0	**127**	0	0	1	1	2	**303**
04:15 PM	0	82	14	0	96	20	0	38	0	58	19	104	0	0	123	1	0	0	2	3	280
Total Volume	2	332	52	0	386	94	0	144	26	264	82	388	0	0	470	4	0	3	7	14	1134
% App. Total	0.5	86	13.5	0		35.6	0	54.5	9.8		17.4	82.6	0	0		28.6	0	21.4	50		
PHF	.500	.883	.765	.000	.862	.870	.000	.857	.722	.880	.820	.874	.000	.000	.925	.500	.000	.375	.875	.700	.936



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Groups Printed- Unshifted

	KAONOHI From North				WESTRIDGE DRIVEWAY (MAUKA) From East				KAONOHI From South				WESTRIDGE DRIVEWAY (MAUKA) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	8	85	0	0	0	0	0	0	0	66	1	0	3	0	10	0	173
03:15 PM	11	91	0	0	0	0	0	0	0	91	5	1	1	0	5	2	207
03:30 PM	9	109	0	0	0	0	0	0	0	108	3	0	8	0	7	1	245
03:45 PM	14	94	0	0	0	0	0	0	0	96	5	0	5	0	7	3	224
Total	42	379	0	0	0	0	0	0	0	361	14	1	17	0	29	6	849
04:00 PM	11	114	0	0	0	0	0	0	0	131	3	0	5	0	3	0	267
04:15 PM	5	110	0	0	0	0	0	0	0	113	6	0	6	0	8	0	248
04:30 PM	19	128	0	3	0	0	0	0	0	109	4	0	5	0	4	0	272
04:45 PM	15	104	0	0	0	0	0	0	0	123	10	1	9	0	8	5	275
Total	50	456	0	3	0	0	0	0	0	476	23	1	25	0	23	5	1062
05:00 PM	13	117	0	1	0	0	0	0	0	99	5	0	7	0	9	1	252
05:15 PM	7	116	0	0	0	0	0	0	0	81	9	0	5	0	10	4	232
Grand Total	112	1068	0	4	0	0	0	0	0	1017	51	2	54	0	71	16	2395
Apprch %	9.5	90.2	0	0.3	0	0	0	0	0	95	4.8	0.2	38.3	0	50.4	11.3	
Total %	4.7	44.6	0	0.2	0	0	0	0	0	42.5	2.1	0.1	2.3	0	3	0.7	

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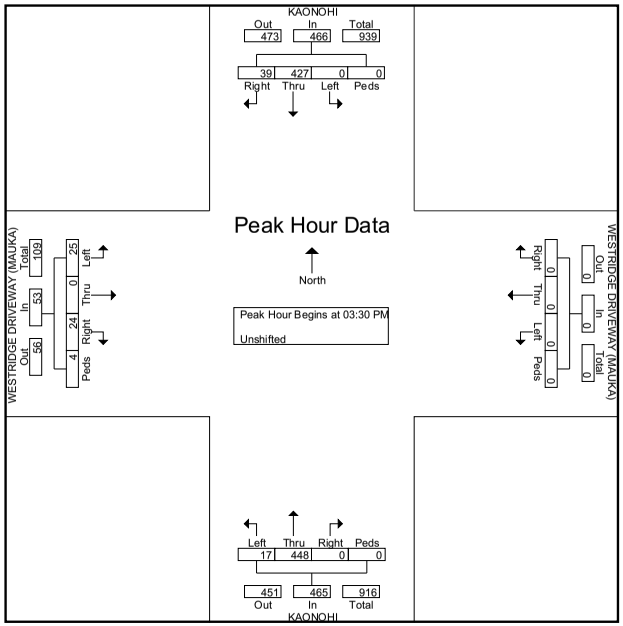
	KAONOHI From North					WESTRIDGE DRIVEWAY (MAUKA) From East					KAONOHI From South					WESTRIDGE DRIVEWAY (MAUKA) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	9	109	0	0	118	0	0	0	0	0	0	108	3	0	111	**8**	0	7	1	**16**	245
03:45 PM	**14**	94	0	0	108	0	0	0	0	0	0	96	5	0	101	5	0	7	**3**	15	224
04:00 PM	11	**114**	0	0	**125**	0	0	0	0	0	0	**131**	3	0	**134**	5	0	3	0	8	**267**
04:15 PM	5	110	0	0	115	0	0	0	0	0	0	113	**6**	0	119	6	0	**8**	0	14	248
Total Volume	39	427	0	0	466	0	0	0	0	0	0	448	17	0	465	24	0	25	4	53	984
% App. Total	8.4	91.6	0	0		0	0	0	0		0	96.3	3.7	0		45.3	0	47.2	7.5		
PHF	.696	.936	.000	.000	.932	.000	.000	.000	.000	.000	.000	.855	.708	.000	.868	.750	.000	.781	.333	.828	.921



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Groups Printed- Unshifted

	KAONOHI From North				WESTRIDGE DRIVEWAY (MAKAI) From East				KAONOHI From South				WESTRIDGE DRIVEWAY (MAKAI) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	2	97	0	0	0	0	0	0	0	76	7	0	8	0	0	1	191
03:15 PM	4	88	0	0	0	0	0	0	0	93	5	0	14	0	5	0	209
03:30 PM	6	117	0	0	0	0	0	0	0	111	3	1	13	0	2	0	253
03:45 PM	4	94	0	0	0	0	0	0	0	98	8	1	14	0	2	2	223
Total	16	396	0	0	0	0	0	0	0	378	23	2	49	0	9	3	876
04:00 PM	4	115	0	3	0	0	0	0	0	126	5	0	12	0	5	2	272
04:15 PM	4	112	0	1	0	0	0	0	0	116	6	0	9	0	4	1	253
04:30 PM	0	133	0	0	0	0	0	0	0	114	4	0	10	0	1	5	267
04:45 PM	1	112	0	0	0	0	0	0	0	135	8	1	15	0	4	3	279
Total	9	472	0	4	0	0	0	0	0	491	23	1	46	0	14	11	1071
05:00 PM	3	120	0	0	0	0	0	0	0	94	2	0	6	0	4	1	230
05:15 PM	7	115	0	0	0	0	0	0	0	90	7	0	10	0	2	3	234
Grand Total	35	1103	0	4	0	0	0	0	0	1053	55	3	111	0	29	18	2411
Apprch %	3.1	96.6	0	0.4	0	0	0	0	0	94.8	5	0.3	70.3	0	18.4	11.4	
Total %	1.5	45.7	0	0.2	0	0	0	0	0	43.7	2.3	0.1	4.6	0	1.2	0.7	

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File Name : PM_Kaonohi - Westridge Dr (Makai)
Site Code : 00000000
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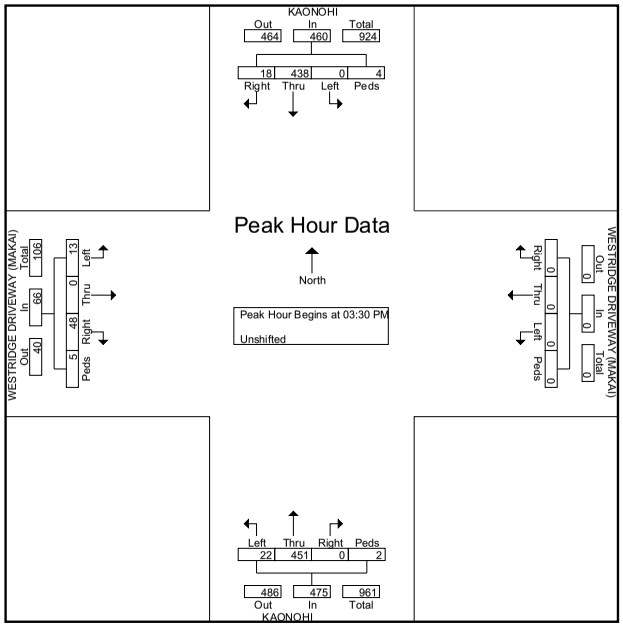
	KAONOHI From North					WESTRIDGE DRIVEWAY (MAKAI) From East					KAONOHI From South					WESTRIDGE DRIVEWAY (MAKAI) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**6**	**117**	0	0	**123**	0	0	0	0	0	0	111	3	**1**	115	13	0	2	0	15	253
03:45 PM	4	94	0	0	98	0	0	0	0	0	0	98	**8**	1	107	**14**	0	2	**2**	18	223
04:00 PM	4	115	0	**3**	122	0	0	0	0	0	0	**126**	5	0	**131**	12	0	**5**	2	**19**	**272**
04:15 PM	4	112	0	1	117	0	0	0	0	0	0	116	6	0	122	9	0	4	1	14	253
Total Volume	18	438	0	4	460	0	0	0	0	0	0	451	22	2	475	48	0	13	5	66	1001
% App. Total	3.9	95.2	0	0.9		0	0	0	0		0	94.9	4.6	0.4		72.7	0	19.7	7.6		
PHF	.750	.936	.000	.333	.935	.000	.000	.000	.000	.000	.000	.895	.688	.500	.906	.857	.000	.650	.625	.868	.920



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File Name : PM_Kaonohi - Anna Miller's Dr
Site Code : 00000000
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Page No : 1

Groups Printed- Unshifted

	KAONOHI From North				ANA MILLER'S DRIVEWAY From East				KAONOHI From South				ANA MILLER'S DRIVEWAY From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	0	140	4	0	13	0	19	4	17	119	0	0	0	0	0	0	316
03:15 PM	0	99	3	0	12	0	13	6	7	91	0	0	0	0	0	0	231
03:30 PM	0	114	9	0	2	0	14	7	12	105	0	0	0	0	0	0	263
03:45 PM	0	103	9	0	10	0	15	2	12	103	0	0	0	0	0	0	254
Total	0	456	25	0	37	0	61	19	48	418	0	0	0	0	0	0	1064
04:00 PM	0	122	3	0	10	0	18	9	12	120	0	0	0	0	0	0	294
04:15 PM	0	126	6	0	16	0	15	2	10	103	0	0	0	0	0	0	278
04:30 PM	0	127	7	0	10	0	16	4	18	111	0	0	0	0	0	0	293
04:45 PM	0	122	8	0	8	0	14	3	6	135	0	0	0	0	0	0	296
Total	0	497	24	0	44	0	63	18	46	469	0	0	0	0	0	0	1161
05:00 PM	0	113	3	0	8	0	16	0	10	77	0	0	0	0	0	0	227
05:15 PM	0	114	9	0	12	0	13	4	22	90	0	0	0	0	0	0	264
Grand Total	0	1180	61	0	101	0	153	41	126	1054	0	0	0	0	0	0	2716
Apprch %	0	95.1	4.9	0	34.2	0	51.9	13.9	10.7	89.3	0	0	0	0	0	0	
Total %	0	43.4	2.2	0	3.7	0	5.6	1.5	4.6	38.8	0	0	0	0	0	0	

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File Name : PM_Kaonohi - Anna Miller's Dr
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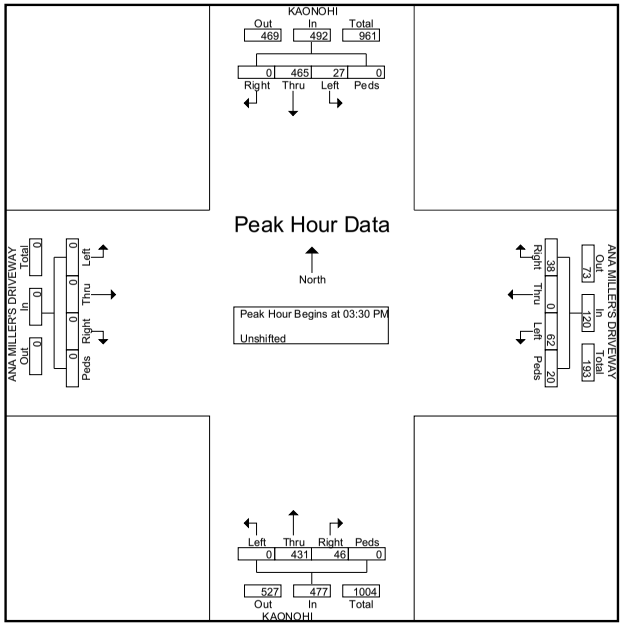
	KAONOHI From North					ANA MILLER'S DRIVEWAY From East					KAONOHI From South					ANA MILLER'S DRIVEWAY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	114	**9**	0	123	2	0	14	7	23	**12**	105	0	0	117	0	0	0	0	0	263
03:45 PM	0	103	9	0	112	10	0	15	2	27	12	103	0	0	115	0	0	0	0	0	254
04:00 PM	0	122	3	0	125	10	0	**18**	**9**	**37**	12	**120**	0	0	**132**	0	0	0	0	0	**294**
04:15 PM	0	**126**	6	0	**132**	**16**	0	15	2	33	10	103	0	0	113	0	0	0	0	0	278
Total Volume	0	465	27	0	492	38	0	62	20	120	46	431	0	0	477	0	0	0	0	0	1089
% App. Total	0	94.5	5.5	0		31.7	0	51.7	16.7		9.6	90.4	0	0		0	0	0	0		
PHF	.000	.923	.750	.000	.932	.594	.000	.861	.556	.811	.958	.898	.000	.000	.903	.000	.000	.000	.000	.000	.926



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File Name : PM_Kaonohi - Moanalua Loop
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	KAONOHI From North				MOANALUA LOOP From East				KAONOHI From South				MOANALUA LOOP From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	12	147	0	0	0	0	0	0	0	127	22	0	28	0	5	0	341
03:15 PM	12	105	0	0	0	0	0	0	0	88	21	0	21	0	8	8	263
03:30 PM	12	118	0	0	0	0	0	0	0	109	29	0	16	0	9	2	295
03:45 PM	11	111	0	0	0	0	0	0	0	100	24	0	24	0	14	2	286
Total	47	481	0	0	0	0	0	0	0	424	96	0	89	0	36	12	1185
04:00 PM	13	124	0	0	0	0	0	0	0	129	25	0	30	0	4	2	327
04:15 PM	14	120	0	0	0	0	0	0	0	114	34	0	31	0	5	2	320
04:30 PM	15	135	0	0	0	0	0	0	0	117	31	0	27	0	15	4	344
04:45 PM	12	122	0	0	0	0	0	0	0	125	23	0	20	0	9	0	311
Total	54	501	0	0	0	0	0	0	0	485	113	0	108	0	33	8	1302
05:00 PM	17	120	0	0	0	0	0	0	0	94	22	0	28	0	3	2	286
05:15 PM	14	117	0	0	0	0	0	0	0	100	32	0	39	0	7	3	312
Grand Total	132	1219	0	0	0	0	0	0	0	1103	263	0	264	0	79	25	3085
Apprch %	9.8	90.2	0	0	0	0	0	0	0	80.7	19.3	0	71.7	0	21.5	6.8	
Total %	4.3	39.5	0	0	0	0	0	0	0	35.8	8.5	0	8.6	0	2.6	0.8	

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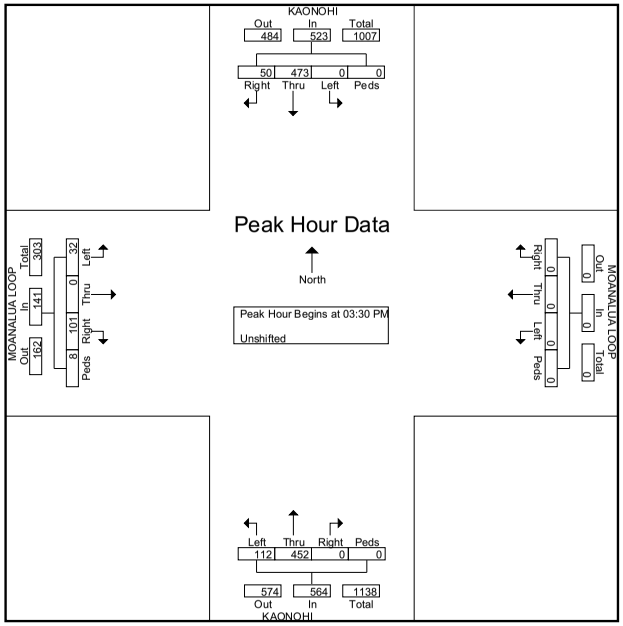
	KAONOHI From North					MOANALUA LOOP From East					KAONOHI From South					MOANALUA LOOP From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	12	118	0	0	130	0	0	0	0	0	0	109	29	0	138	16	0	9	**2**	27	295
03:45 PM	11	111	0	0	122	0	0	0	0	0	0	100	24	0	124	24	0	**14**	2	**40**	286
04:00 PM	13	**124**	0	0	**137**	0	0	0	0	0	0	**129**	25	0	**154**	30	0	4	2	36	**327**
04:15 PM	**14**	120	0	0	134	0	0	0	0	0	0	114	**34**	0	148	**31**	0	5	2	38	320
Total Volume	50	473	0	0	523	0	0	0	0	0	0	452	112	0	564	101	0	32	8	141	1228
% App. Total	9.6	90.4	0	0		0	0	0	0		0	80.1	19.9	0		71.6	0	22.7	5.7		
PHF	.893	.954	.000	.000	.954	.000	.000	.000	.000	.000	.000	.876	.824	.000	.916	.815	.000	.571	1.000		



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File Name : PM_Kaonohi - Kamehameha
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Groups Printed- Unshifted

	KAONOHI From North				KAMEHAMEHA From East				KAONOHI From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	70	0	86	14	89	409	0	0	0	0	0	0	0	262	50	8	988
03:15 PM	76	0	58	20	83	445	0	0	0	0	0	0	0	278	35	21	1016
03:30 PM	68	0	58	20	70	536	0	0	0	0	0	0	0	288	63	10	1113
03:45 PM	70	0	71	14	81	519	0	0	0	0	0	0	0	284	43	14	1096
Total	284	0	273	68	323	1909	0	0	0	0	0	0	0	1112	191	53	4213
04:00 PM	74	0	83	21	107	527	0	0	0	0	0	0	0	300	44	17	1173
04:15 PM	75	0	62	11	101	580	0	0	0	0	0	0	0	279	51	12	1171
04:30 PM	81	0	83	18	76	507	0	0	0	0	0	0	0	269	65	20	1119
04:45 PM	72	0	73	10	98	575	0	0	0	0	0	0	0	255	48	7	1138
Total	302	0	301	60	382	2189	0	0	0	0	0	0	0	1103	208	56	4601
05:00 PM	74	0	69	13	58	454	0	0	0	0	0	0	0	233	52	7	960
05:15 PM	87	0	76	8	77	470	0	0	0	0	0	0	0	242	52	8	1020
Grand Total	747	0	719	149	840	5022	0	0	0	0	0	0	0	2690	503	124	10794
Apprch %	46.3	0	44.5	9.2	14.3	85.7	0	0	0	0	0	0	0	81.1	15.2	3.7	
Total %	6.9	0	6.7	1.4	7.8	46.5	0	0	0	0	0	0	0	24.9	4.7	1.1	

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File Name : PM_Kaonohi - Kamehameha
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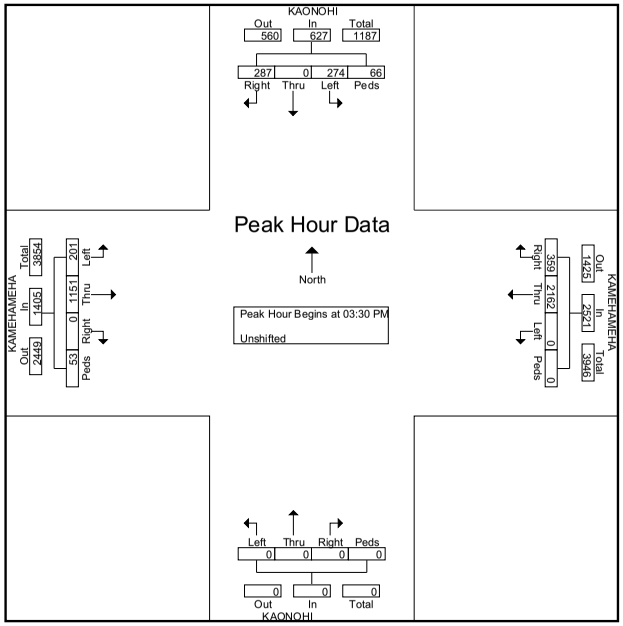
	KAONOHI From North					KAMEHAMEHA From East					KAONOHI From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	68	0	58	20	146	70	536	0	0	606	0	0	0	0	0	0	288	**63**	10	**361**	1113
03:45 PM	70	0	71	14	155	81	519	0	0	600	0	0	0	0	0	0	284	43	14	341	1096
04:00 PM	74	0	**83**	**21**	**178**	**107**	527	0	0	634	0	0	0	0	0	0	**300**	44	**17**	361	**1173**
04:15 PM	**75**	0	62	11	148	101	**580**	0	0	**681**	0	0	0	0	0	0	279	51	12	342	1171
Total Volume	287	0	274	66	627	359	2162	0	0	2521	0	0	0	0	0	0	1151	201	53	1405	4553
% App. Total	45.8	0	43.7	10.5		14.2	85.8	0	0		0	0	0	0		0	81.9	14.3	3.8		
PHF	.957	.000	.825	.786	.881	.839	.932	.000	.000	.925	.000	.000	.000	.000	.000	.000	.959	.798	.779	.973	.970



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File Name : PM_Hekaha - Kamehameha
Site Code : 00000000
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Groups Printed- Unshifted

	HEKAHA From North				KAMEHAMEHA From East				HEKAHA From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	24	11	12	1	21	398	41	11	50	8	58	2	30	256	20	0	943
03:45 PM	21	9	11	1	12	436	50	10	61	9	48	5	31	253	8	0	965
Total	45	20	23	2	33	834	91	21	111	17	106	7	61	509	28	0	1908
04:00 PM	17	8	16	0	17	403	46	8	53	9	55	0	40	222	8	0	902
04:15 PM	27	11	18	0	21	434	36	9	48	12	54	3	36	250	8	0	967
04:30 PM	20	8	11	0	18	398	25	9	64	14	65	4	47	247	8	0	938
04:45 PM	27	17	21	0	18	389	33	7	41	14	39	4	46	245	17	0	918
Total	91	44	66	0	74	1624	140	33	206	49	213	11	169	964	41	0	3725
05:00 PM	20	8	13	0	22	432	23	14	62	24	53	1	39	200	6	0	917
05:15 PM	27	3	9	3	17	427	27	6	32	6	38	1	22	213	13	0	844
05:30 PM	25	10	4	0	27	450	30	4	38	3	38	2	29	193	3	0	856
05:45 PM	17	11	12	0	26	482	33	5	29	9	30	1	36	199	14	0	904
Total	89	32	38	3	92	1791	113	29	161	42	159	5	126	805	36	0	3521
Grand Total	225	96	127	5	199	4249	344	83	478	108	478	23	356	2278	105	0	9154
Apprch %	49.7	21.2	28	1.1	4.1	87.2	7.1	1.7	44	9.9	44	2.1	13	83.2	3.8	0	
Total %	2.5	1	1.4	0.1	2.2	46.4	3.8	0.9	5.2	1.2	5.2	0.3	3.9	24.9	1.1	0	

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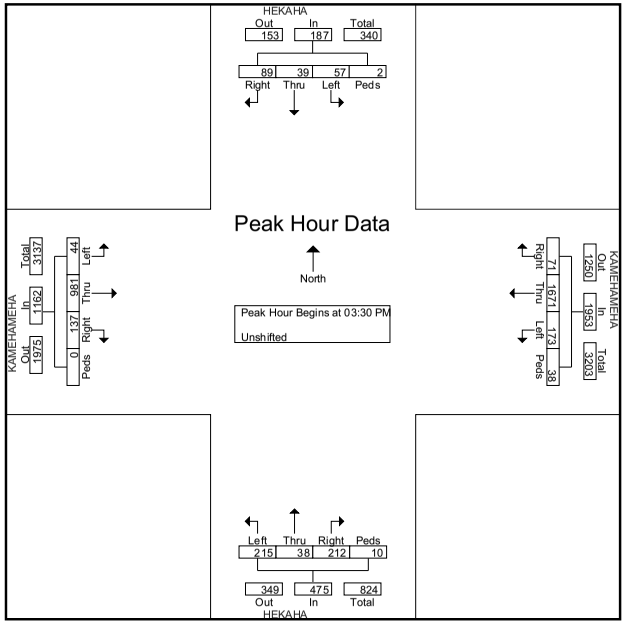
	HEKAHA From North					KAMEHAMEHA From East					HEKAHA From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	24	11	12	1	48	21	398	41	11	471	50	8	58	2	118	30	256	20	0	306	943
03:45 PM	21	9	11	1	42	12	436	50	10	508	61	9	48	5	123	31	253	8	0	292	965
04:00 PM	17	8	16	0	41	17	403	46	8	474	53	9	55	0	117	40	222	8	0	270	902
04:15 PM	27	11	18	0	56	21	434	36	9	500	48	12	54	3	117	36	250	8	0	294	967
Total Volume	89	39	57	2	187	71	1671	173	38	1953	212	38	215	10	475	137	981	44	0	1162	3777
% App. Total																					
PHF	.824	.886	.792	.500	.835	.845	.958	.865	.864	.961	.869	.792	.927	.500	.965	.856	.958	.550	.000	.949	.976



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File Name : PM_Kanuku - Kamehameha
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Groups Printed- Unshifted

	KANUKU From North				KAM From East				KANUKU From South				KAM From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	0	4	13	1	43	470	20	0	13	3	24	2	19	268	14	6	900
03:45 PM	0	4	18	3	61	456	25	0	12	3	23	4	15	275	4	3	906
Total	0	8	31	4	104	926	45	0	25	6	47	6	34	543	18	9	1806
04:00 PM	0	2	7	1	43	492	15	0	12	2	15	2	14	242	10	7	864
04:15 PM	0	1	17	0	56	473	21	0	12	2	21	2	20	262	3	1	891
04:30 PM	0	1	14	3	58	448	12	0	9	4	19	1	7	284	11	1	872
04:45 PM	0	3	15	3	53	486	17	0	9	2	23	1	16	252	3	3	886
Total	0	7	53	7	210	1899	65	0	42	10	78	6	57	1040	27	12	3513
05:00 PM	0	3	16	1	45	427	24	0	14	2	13	8	16	249	4	2	824
05:15 PM	0	2	15	4	64	493	16	0	9	4	16	3	7	226	6	10	875
05:30 PM	0	3	14	0	61	524	17	0	8	3	13	1	11	179	4	4	842
05:45 PM	0	4	17	3	43	446	28	0	12	5	15	2	8	199	8	2	792
Total	0	12	62	8	213	1890	85	0	43	14	57	14	42	853	22	18	3333
Grand Total	0	27	146	19	527	4715	195	0	110	30	182	26	133	2436	67	39	8652
Apprch %	0	14.1	76	9.9	9.7	86.7	3.6	0	31.6	8.6	52.3	7.5	5	91.1	2.5	1.5	
Total %	0	0.3	1.7	0.2	6.1	54.5	2.3	0	1.3	0.3	2.1	0.3	1.5	28.2	0.8	0.5	

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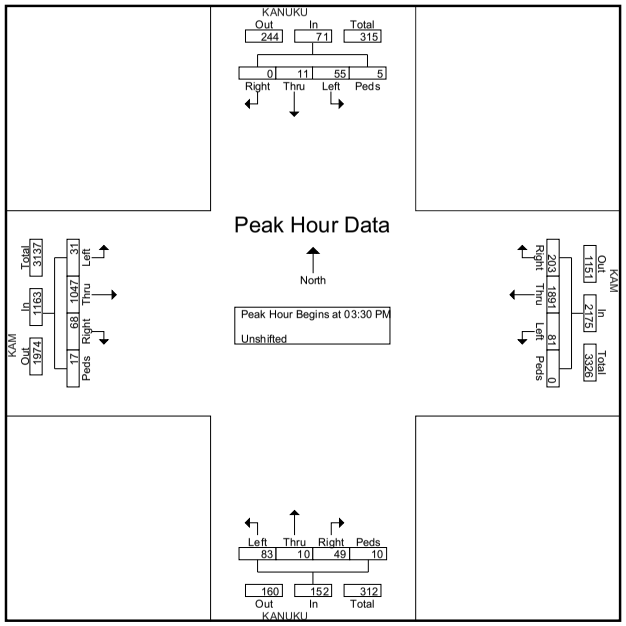
File Name : PM_Kanuku - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 2

	KANUKU From North					KAM From East					KANUKU From South					KAM From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	4	13	1	18	43	470	20	0	533	13	3	24	2	42	19	268	14	6	307	900
03:45 PM	0	4	18	3	25	61	456	25	0	542	12	3	23	4	42	15	275	4	3	297	906
04:00 PM	0	2	7	1	10	43	492	15	0	550	12	2	15	2	31	14	242	10	7	273	864
04:15 PM	0	1	17	0	18	56	473	21	0	550	12	2	21	2	37	20	262	3	1	286	891
Total Volume	0	11	55	5	71	203	1891	81	0	2175	49	10	83	10	152	68	1047	31	17	1163	3561
% App. Total	0	15.5	77.5	7		9.3	86.9	3.7	0		32.2	6.6	54.6	6.6		5.8	90	2.7	1.5		
PHF	.000	.688	.764	.417	.710	.832	.961	.810	.000	.989	.942	.833	.865	.625	.905	.850	.952	.554	.607	.947	.983



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File Name : PM_Lipoa - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 1

Groups Printed- Unshifted

	LIOPA From North				KAM From East				LIOPA From South				KAM From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	0	0	0	0	0	539	18	1	10	0	38	1	11	328	0	0	946
03:45 PM	0	0	0	0	0	544	22	4	7	0	31	1	11	324	0	0	944
Total	0	0	0	0	0	1083	40	5	17	0	69	2	22	652	0	0	1890
04:00 PM	0	0	0	0	0	483	31	5	3	0	41	2	9	256	0	0	830
04:15 PM	0	0	0	0	0	528	17	4	9	0	37	0	17	298	0	0	910
04:30 PM	0	0	0	0	0	525	10	5	5	0	36	0	7	299	0	0	887
04:45 PM	0	0	0	0	0	520	16	3	9	0	35	0	16	297	0	0	896
Total	0	0	0	0	0	2056	74	17	26	0	149	2	49	1150	0	0	3523
05:00 PM	0	0	0	0	0	497	15	3	8	0	54	0	14	268	0	0	859
05:15 PM	0	0	0	0	0	509	11	3	9	0	35	0	9	261	0	0	837
05:30 PM	0	0	0	0	0	565	16	4	8	0	31	0	11	233	0	0	868
05:45 PM	0	0	0	0	0	586	24	4	14	0	30	0	7	225	0	0	890
Total	0	0	0	0	0	2157	66	14	39	0	150	0	41	987	0	0	3454
Grand Total	0	0	0	0	0	5296	180	36	82	0	368	4	112	2789	0	0	8867
Apprch %	0	0	0	0	0	96.1	3.3	0.7	18.1	0	81.1	0.9	3.9	96.1	0	0	
Total %	0	0	0	0	0	59.7	2	0.4	0.9	0	4.2	0	1.3	31.5	0	0	

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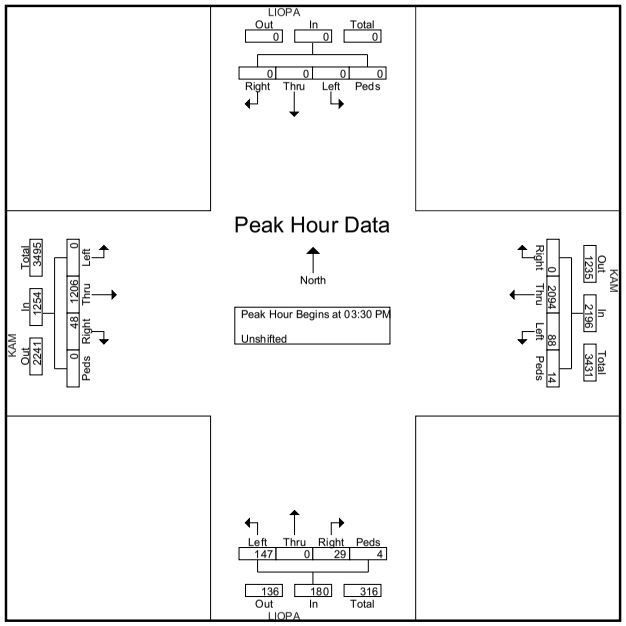
File Name : PM_Lipoa - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 2

	LIOPA From North					KAM From East					LIOPA From South					KAM From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	0	0	0	539	18	1	558	10	0	38	1	49	11	328	0	0	339	946
03:45 PM	0	0	0	0	0	0	544	22	4	570	7	0	31	1	39	11	324	0	0	335	944
04:00 PM	0	0	0	0	0	0	483	31	5	519	3	0	41	2	46	9	256	0	0	265	830
04:15 PM	0	0	0	0	0	0	528	17	4	549	9	0	37	0	46	17	298	0	0	315	910
Total Volume	0	0	0	0	0	0	2094	88	14	2196	29	0	147	4	180	48	1206	0	0	1254	3630
% App. Total	0	0	0	0		0	95.4	4	0.6		16.1	0	81.7	2.2		3.8	96.2	0	0		
PHF	.000	.000	.000	.000	.000	.000	.962	.710	.700	.963	.725	.000	.896	.500	.918	.706	.919	.000	.000	.925	.959



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File Name : PM_PaliMomi (In) - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 1

Groups Printed- Class 1

	PALIMOI (IN) From North				KAMEHAMEHA From East				PALIMOI (IN) From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	0	0	0	12	107	475	29	0	0	0	0	2	9	261	53	0	948
03:45 PM	0	0	0	4	89	511	22	0	0	0	0	5	8	293	57	0	989
Total	0	0	0	16	196	986	51	0	0	0	0	7	17	554	110	0	1937
04:00 PM	0	0	0	10	67	469	38	0	0	0	0	1	5	209	56	0	855
04:15 PM	0	0	0	7	92	496	22	0	0	0	0	1	6	252	61	0	937
04:30 PM	0	0	0	12	86	513	29	0	0	0	0	0	14	272	38	0	964
04:45 PM	0	0	0	2	88	518	33	0	0	0	0	0	5	244	65	0	955
Total	0	0	0	31	333	1996	122	0	0	0	0	2	30	977	220	0	3711
05:00 PM	0	0	0	1	86	469	30	0	0	0	0	0	9	244	51	0	890
05:15 PM	0	0	0	15	74	446	30	0	0	0	0	1	6	190	51	0	813
05:30 PM	0	0	0	9	92	547	39	0	0	0	0	2	13	195	49	0	946
05:45 PM	0	0	0	7	98	543	48	0	0	0	0	1	10	178	59	0	944
Total	0	0	0	32	350	2005	147	0	0	0	0	4	38	807	210	0	3593
Grand Total	0	0	0	79	879	4987	320	0	0	0	0	13	85	2338	540	0	9241
Apprch %	0	0	0	100	14.2	80.6	5.2	0	0	0	0	100	2.9	78.9	18.2	0	
Total %	0	0	0	0.9	9.5	54	3.5	0	0	0	0	0.1	0.9	25.3	5.8	0	

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Default Comments
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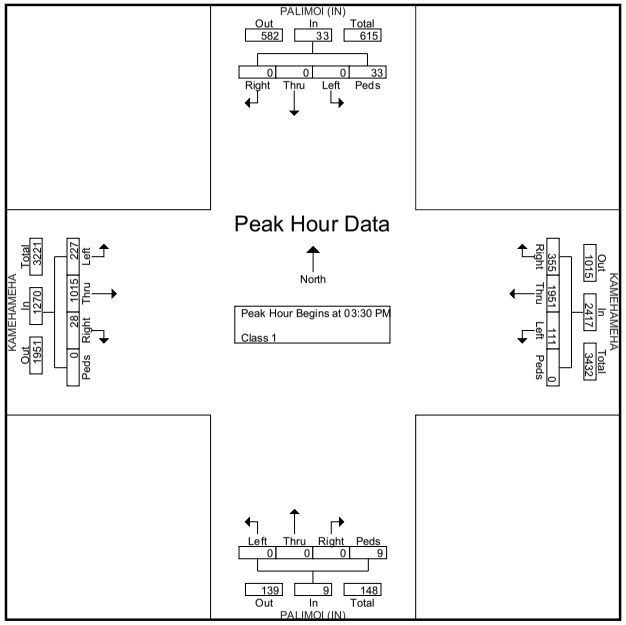
File Name : PM_PaliMomi (In) - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 2

	PALIMOI (IN) From North					KAMEHAMEHA From East					PALIMOI (IN) From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	12	12	107	475	29	0	611	0	0	0	2	2	9	261	53	0	323	948
03:45 PM	0	0	0	4	4	89	511	22	0	622	0	0	0	5	5	8	293	57	0	358	989
04:00 PM	0	0	0	10	10	67	469	38	0	574	0	0	0	1	1	5	209	56	0	270	855
04:15 PM	0	0	0	7	7	92	496	22	0	610	0	0	0	1	1	6	252	61	0	319	937
Total Volume	0	0	0	33	33	355	1951	111	0	2417	0	0	0	9	9	28	1015	227	0	1270	3729
% App. Total	0	0	0	100		14.7	80.7	4.6	0		0	0	0	100		2.2	79.9	17.9	0		
PHF	.000	.000	.000	.688	.688	.829	.955	.730	.000	.971	.000	.000	.000	.450	.450	.778	.866	.930	.000	.887	.943



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File Name : PM_PaliMomi (Out) - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 1

Groups Printed- Class 1

	PALIMOI (OUT) From North				KAMEHAMEHA From East				PALIMOI (OUT) From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	38	0	79	0	0	560	0	0	0	0	0	0	0	0	0	26	703
03:45 PM	33	0	71	0	0	581	0	0	0	0	0	0	0	0	0	22	707
Total	71	0	150	0	0	1141	0	0	0	0	0	0	0	0	0	48	1410
04:00 PM	25	0	59	0	0	547	0	0	0	0	0	0	0	0	0	20	651
04:15 PM	35	0	76	0	0	580	0	0	0	0	0	0	0	0	0	27	718
04:30 PM	36	0	67	0	0	592	0	0	0	0	0	0	0	0	0	34	729
04:45 PM	31	0	65	0	0	588	0	0	0	0	0	0	0	0	0	13	697
Total	127	0	267	0	0	2307	0	0	0	0	0	0	0	0	0	94	2795
05:00 PM	27	0	67	0	0	543	0	0	0	0	0	0	0	0	0	14	651
05:15 PM	29	0	76	0	0	521	0	0	0	0	0	0	0	0	0	15	641
05:30 PM	30	0	60	0	0	614	0	0	0	0	0	0	0	0	0	10	714
05:45 PM	32	0	46	0	0	615	0	0	0	0	0	0	0	0	0	5	698
Total	118	0	249	0	0	2293	0	0	0	0	0	0	0	0	0	44	2704
Grand Total	316	0	666	0	0	5741	0	0	0	0	0	0	0	0	0	186	6909
Apprch %	32.2	0	67.8	0	0	100	0	0	0	0	0	0	0	0	0	100	
Total %	4.6	0	9.6	0	0	83.1	0	0	0	0	0	0	0	0	0	2.7	

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Default Comments
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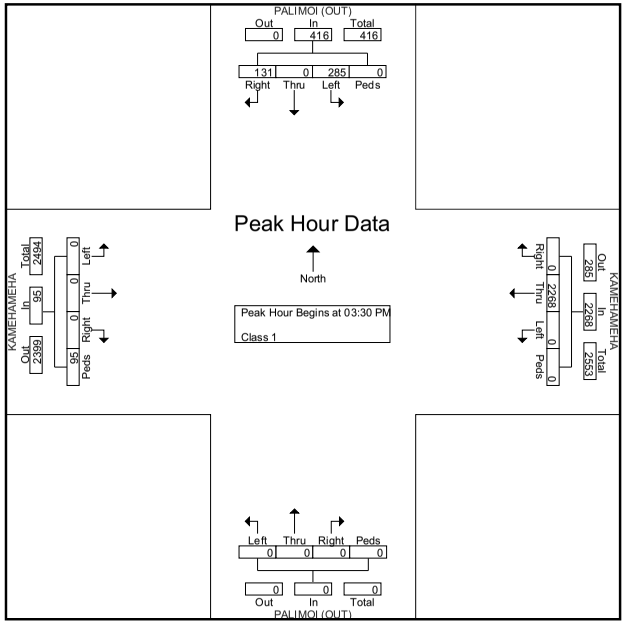
File Name : PM_PaliMomi (Out) - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 2

	PALIMOI (OUT) From North					KAMEHAMEHA From East					PALIMOI (OUT) From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	38	0	79	0	117	0	560	0	0	560	0	0	0	0	0	0	0	0	26	26	703
03:45 PM	33	0	71	0	104	0	581	0	0	581	0	0	0	0	0	0	0	0	22	22	707
04:00 PM	25	0	59	0	84	0	547	0	0	547	0	0	0	0	0	0	0	0	20	20	651
04:15 PM	35	0	76	0	111	0	580	0	0	580	0	0	0	0	0	0	0	0	27	27	718
Total Volume	131	0	285	0	416	0	2268	0	0	2268	0	0	0	0	0	0	0	0	95	95	2779
% App. Total																					
PHF	.862	.000	.902	.000	.889	.000	.976	.000	.000	.976	.000	.000	.000	.000	.000	.000	.000	.000	.880	.880	.968



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File Name : PM_Harbor Pt - Moanalua Peak
Site Code : 00000000
Start Date : 10/14/2010
Page No : 1

Groups Printed- Unshifted

	HARBOR POINT From North				MOANALUA From East				HARBOR POINT From South				MOANALUA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	0	0	0	0	0	364	4	0	6	0	3	0	8	289	0	0	674
03:45 PM	0	0	0	0	0	453	4	0	6	0	4	0	8	287	0	0	762
Total	0	0	0	0	0	817	8	0	12	0	7	0	16	576	0	0	1436
04:00 PM	0	0	0	0	0	482	2	0	5	0	4	0	2	229	0	0	724
04:15 PM	0	0	0	0	0	457	7	0	2	0	2	0	3	304	0	0	775
Grand Total	0	0	0	0	0	1756	17	0	19	0	13	0	21	1109	0	0	2935
Apprch %	0	0	0	0	0	99	1	0	59.4	0	40.6	0	1.9	98.1	0	0	
Total %	0	0	0	0	0	59.8	0.6	0	0.6	0	0.4	0	0.7	37.8	0	0	

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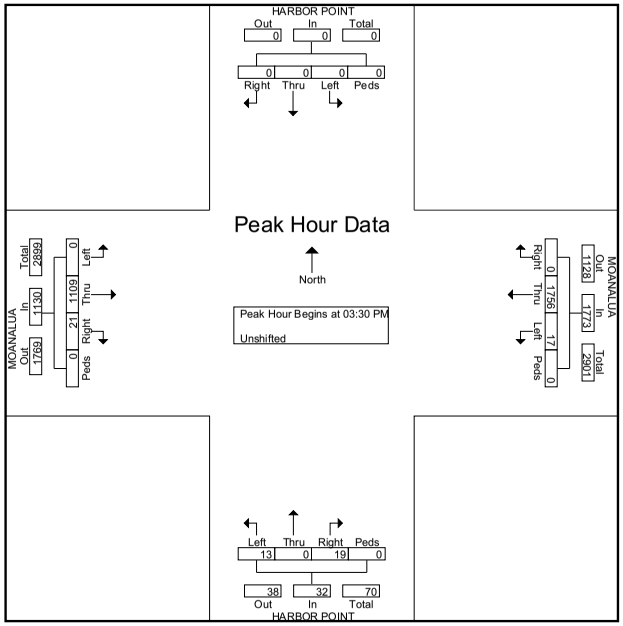
File Name : PM_Harbor Pt - Moanalua Peak
Site Code : 00000000
Start Date : 10/14/2010
Page No : 2

	HARBOR POINT From North					MOANALUA From East					HARBOR POINT From South					MOANALUA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	0	0	0	364	4	0	368	**6**	0	3	0	9	**8**	289	0	0	297	674
03:45 PM	0	0	0	0	0	0	453	4	0	457	6	0	**4**	0	**10**	8	287	0	0	295	762
04:00 PM	0	0	0	0	0	0	**482**	2	0	**484**	5	0	4	0	9	2	229	0	0	231	724
04:15 PM	0	0	0	0	0	0	457	**7**	0	464	2	0	2	0	4	3	**304**	0	0	**307**	**775**
Total Volume	0	0	0	0	0	0	1756	17	0	1773	19	0	13	0	32	21	1109	0	0	1130	2935
% App. Total	0	0	0	0		0	99	1	0		59.4	0	40.6	0		1.9	98.1	0	0		
PHF	.000	.000	.000	.000	.000	.000	.911	.607	.000	.916	.792	.000	.813	.000	.800	.656	.912	.000	.000	.920	.947



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File Name : PM_Pearlridge Elementary Schl - Moanalua
Site Code : 00000000
Start Date : 10/14/2010
Page No : 1

Groups Printed- Unshifted

	PEARLRIDGE ELEMENTARY SCHL From North				MOANALUA From East				PEARLRIDGE ELEMENTARY SCHL From South				MOANALUA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	8	0	8	0	18	339	0	0	0	0	0	0	0	248	5	0	626
03:15 PM	22	0	13	1	13	389	0	0	0	0	0	0	0	266	14	0	718
03:30 PM	17	0	9	0	13	389	0	0	0	0	0	0	0	295	21	0	744
03:45 PM	18	0	16	2	23	434	0	0	0	0	0	0	0	274	10	0	777
Total	65	0	46	3	67	1551	0	0	0	0	0	0	0	1083	50	0	2865
04:00 PM	26	0	22	1	19	436	0	0	0	0	0	0	0	239	9	0	752
04:15 PM	17	0	11	0	22	416	0	0	0	0	0	0	0	285	12	0	763
04:30 PM	19	0	11	2	21	448	0	0	0	0	0	0	0	269	14	0	784
04:45 PM	19	0	13	0	23	465	0	0	0	0	0	0	0	291	7	0	818
Total	81	0	57	3	85	1765	0	0	0	0	0	0	0	1084	42	0	3117
05:00 PM	15	0	10	1	15	440	0	0	0	0	0	0	0	227	12	0	720
05:15 PM	7	0	13	2	12	478	0	0	0	0	0	0	0	296	6	0	814
Grand Total	168	0	126	9	179	4234	0	0	0	0	0	0	0	2690	110	0	7516
Apprch %	55.4	0	41.6	3	4.1	95.9	0	0	0	0	0	0	0	96.1	3.9	0	
Total %	2.2	0	1.7	0.1	2.4	56.3	0	0	0	0	0	0	0	35.8	1.5	0	

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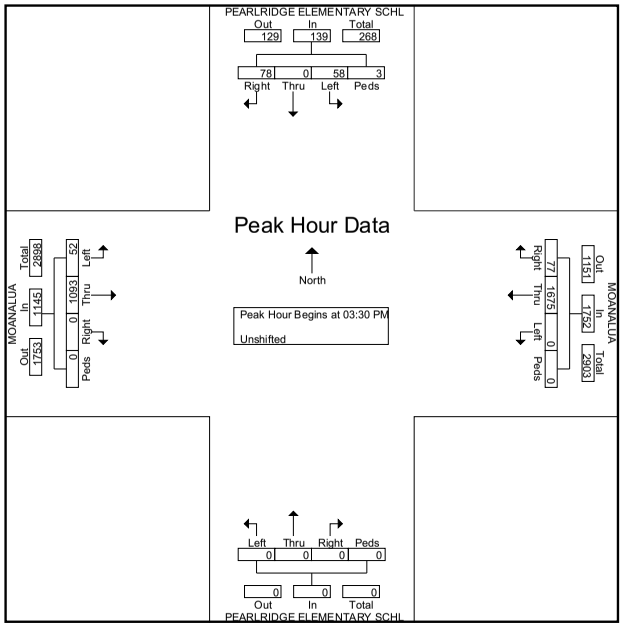
File Name : PM_Pearlridge Elementary Schl - Moanalua
Site Code : 00000000
Start Date : 10/14/2010
Page No : 2

	PEARLRIDGE ELEMENTARY SCHL From North					MOANALUA From East					PEARLRIDGE ELEMENTARY SCHL From South					MOANALUA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	17	0	9	0	26	13	389	0	0	402	0	0	0	0	0	0	**295**	**21**	0	**316**	744
03:45 PM	18	0	16	**2**	36	**23**	434	0	0	**457**	0	0	0	0	0	0	274	10	0	284	**777**
04:00 PM	**26**	0	**22**	1	**49**	19	**436**	0	0	455	0	0	0	0	0	0	239	9	0	248	752
04:15 PM	17	0	11	0	28	22	416	0	0	438	0	0	0	0	0	0	285	12	0	297	763
Total Volume	78	0	58	3	139	77	1675	0	0	1752	0	0	0	0	0	0	1093	52	0	1145	3036
% App. Total	56.1	0	41.7	2.2		4.4	95.6	0	0		0	0	0	0		0	95.5	4.5	0		
PHF	.750	.000	.659	.375	.709	.837	.960	.000	.000	.958	.000	.000	.000	.000	.000	.000	.926	.619	.000	.906	.977



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File Name : PM_Kaonohi - Moanalua
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Groups Printed- Unshifted

	KAONOHI From North				MOANALUA From East				KAONOHI From South				MOANALUA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	29	25	23	5	53	266	23	2	25	38	92	0	31	181	56	0	849
03:15 PM	30	15	37	6	69	284	18	1	32	44	89	1	34	179	47	0	886
03:30 PM	43	26	30	3	65	296	31	5	27	30	74	9	51	229	36	3	958
03:45 PM	27	15	28	3	61	345	20	1	28	27	85	6	34	217	52	3	952
Total	129	81	118	17	248	1191	92	9	112	139	340	16	150	806	191	6	3645
04:00 PM	30	28	31	4	67	306	19	4	25	44	123	4	47	168	40	3	943
04:15 PM	24	19	24	3	70	329	26	4	21	36	78	1	47	199	54	1	936
04:30 PM	35	29	59	3	72	337	18	7	18	39	105	5	34	173	62	3	999
04:45 PM	39	31	38	0	90	341	14	3	27	37	93	4	44	210	77	0	1048
Total	128	107	152	10	299	1313	77	18	91	156	399	14	172	750	233	7	3926
05:00 PM	39	26	51	3	71	320	22	2	25	52	99	2	50	149	32	3	946
05:15 PM	29	24	31	2	52	303	20	4	15	30	110	2	49	140	53	0	864
Grand Total	325	238	352	32	670	3127	211	33	243	377	948	34	421	1845	509	16	9381
Apprch %	34.3	25.1	37.2	3.4	16.6	77.4	5.2	0.8	15.2	23.5	59.2	2.1	15.1	66.1	18.2	0.6	
Total %	3.5	2.5	3.8	0.3	7.1	33.3	2.2	0.4	2.6	4	10.1	0.4	4.5	19.7	5.4	0.2	

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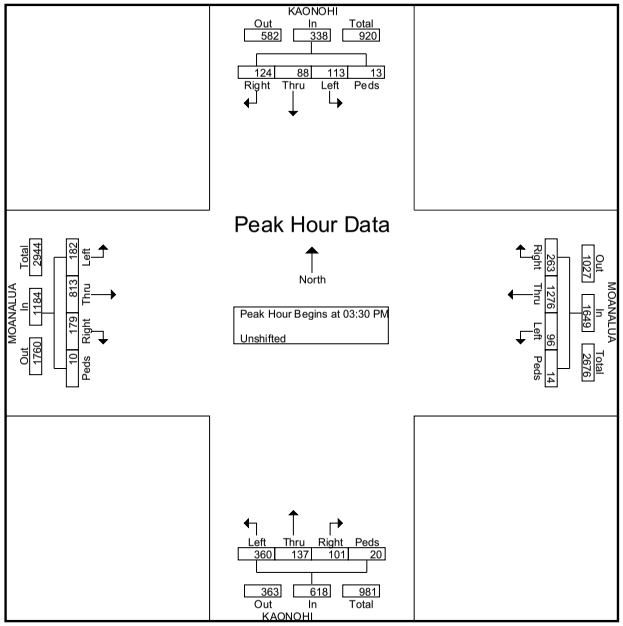
	KAONOHI From North					MOANALUA From East					KAONOHI From South					MOANALUA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**43**	26	30	3	**102**	65	296	**31**	**5**	397	27	30	74	**9**	140	**51**	**229**	36	**3**	**319**	**958**
03:45 PM	27	15	28	3	73	61	**345**	20	1	427	**28**	27	85	6	146	34	217	52	3	306	952
04:00 PM	30	**28**	**31**	**4**	93	67	306	19	4	396	25	**44**	**123**	4	**196**	47	168	40	3	258	943
04:15 PM	24	19	24	3	70	**70**	329	26	4	**429**	21	36	78	1	136	47	199	**54**	1	301	936
Total Volume	124	88	113	13	338	263	1276	96	14	1649	101	137	360	20	618	179	813	182	10	1184	3789
% App. Total	36.7	26	33.4	3.8		15.9	77.4	5.8	0.8		16.3	22.2	58.3	3.2		15.1	68.7	15.4	0.8		
PHF	.721	.786	.911	.813	.828	.939	.925	.774	.700	.961	.902	.778	.732	.556	.788	.877	.888	.843	.833	.928	.989



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File Name : PM_Kaonohi - Pearlridge Dr
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Groups Printed- Unshifted

	KAONOHI From North				PEARLRIDGE DRIVEWAY From East				KAONOHI From South				PEARLRIDGE DRIVEWAY From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
*** BREAK ***																	
03:15 PM	0	0	0	0	25	0	0	4	8	114	0	0	0	0	0	0	151
03:30 PM	0	0	0	0	15	0	0	6	10	111	0	0	0	0	0	0	142
03:45 PM	0	0	0	0	21	0	0	3	6	115	0	0	0	0	0	0	145
Total	0	0	0	0	61	0	0	13	24	340	0	0	0	0	0	0	438
04:00 PM	0	0	0	0	22	0	0	1	12	131	0	0	0	0	0	0	166
04:15 PM	0	0	0	0	7	0	0	1	6	121	0	0	0	0	0	0	135
04:30 PM	0	0	0	0	19	0	0	1	13	125	0	0	0	0	0	0	158
04:45 PM	0	0	0	0	11	0	0	3	7	147	0	0	0	0	0	0	168
Total	0	0	0	0	59	0	0	6	38	524	0	0	0	0	0	0	627
05:00 PM	0	0	0	0	36	0	0	4	4	138	0	0	0	0	0	0	182
05:15 PM	0	0	0	0	16	0	0	2	2	105	0	0	0	0	0	0	125
Grand Total	0	0	0	0	172	0	0	25	68	1107	0	0	0	0	0	0	1372
Apprch %	0	0	0	0	87.3	0	0	12.7	5.8	94.2	0	0	0	0	0	0	
Total %	0	0	0	0	12.5	0	0	1.8	5	80.7	0	0	0	0	0	0	

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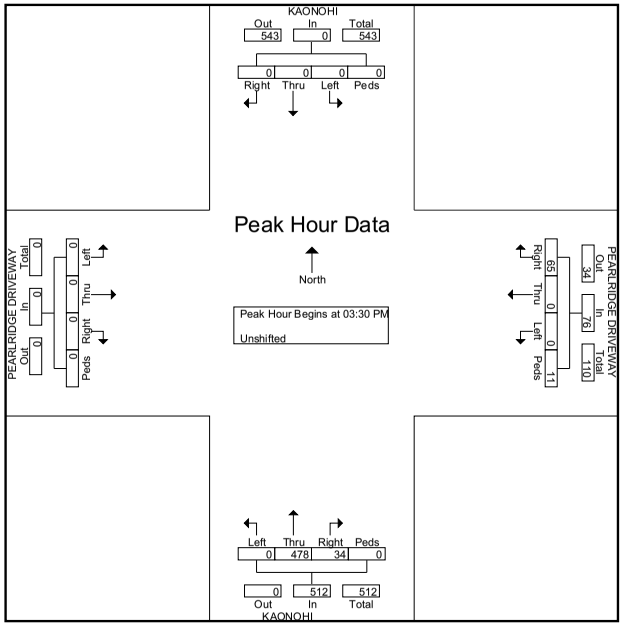
	KAONOHI From North					PEARLRIDGE DRIVEWAY From East					KAONOHI From South					PEARLRIDGE DRIVEWAY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	0	0	15	0	0	**6**	21	10	111	0	0	121	0	0	0	0	0	142
03:45 PM	0	0	0	0	0	21	0	0	3	**24**	6	115	0	0	121	0	0	0	0	0	145
04:00 PM	0	0	0	0	0	**22**	0	0	1	23	**12**	**131**	0	0	**143**	0	0	0	0	0	**166**
04:15 PM	0	0	0	0	0	7	0	0	1	8	6	121	0	0	127	0	0	0	0	0	135
Total Volume	0	0	0	0	0	65	0	0	11	76	34	478	0	0	512	0	0	0	0	0	588
% App. Total	0	0	0	0		85.5	0	0	14.5		6.6	93.4	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.739	.000	.000	.458	.792	.708	.912	.000	.000	.895	.000	.000	.000	.000	.000	.886



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Groups Printed- Unshifted

	KAONOHI From North				MACY'S DRIVEWAY From East				KAONOHI From South				MACY'S DRIVEWAY From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
*** BREAK ***																	
03:15 PM	0	54	27	0	40	0	24	2	11	100	0	0	0	0	0	0	258
03:30 PM	0	74	21	0	44	0	32	8	15	101	0	0	0	0	0	0	295
03:45 PM	0	66	27	0	41	0	18	3	13	91	0	0	0	0	0	0	259
Total	0	194	75	0	125	0	74	13	39	292	0	0	0	0	0	0	812
04:00 PM	0	75	15	0	42	0	23	2	25	118	0	0	0	0	0	0	300
04:15 PM	0	71	20	0	43	0	21	1	13	112	0	0	0	0	0	0	281
04:30 PM	0	89	31	0	48	0	29	2	14	100	0	0	0	0	0	0	313
04:45 PM	0	84	32	0	52	0	20	5	24	108	0	0	0	0	0	0	325
Total	0	319	98	0	185	0	93	10	76	438	0	0	0	0	0	0	1219
05:00 PM	0	79	14	0	43	0	25	3	13	109	0	0	0	0	0	0	286
05:15 PM	0	77	27	0	46	0	14	4	16	89	0	0	0	0	0	0	273
Grand Total	0	669	214	0	399	0	206	30	144	928	0	0	0	0	0	0	2590
Apprch %	0	75.8	24.2	0	62.8	0	32.4	4.7	13.4	86.6	0	0	0	0	0	0	
Total %	0	25.8	8.3	0	15.4	0	8	1.2	5.6	35.8	0	0	0	0	0	0	

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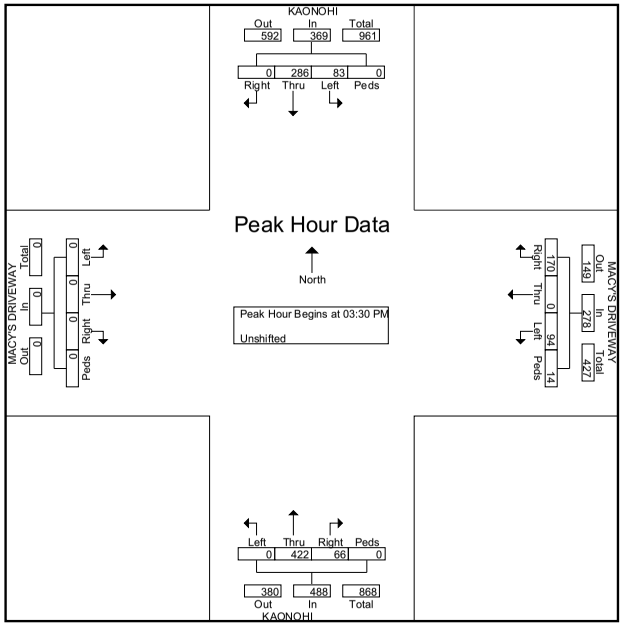
	KAONOHI From North					MACY'S DRIVEWAY From East					KAONOHI From South					MACY'S DRIVEWAY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	74	21	0	**95**	**44**	0	**32**	**8**	**84**	15	101	0	0	116	0	0	0	0	0	295
03:45 PM	0	66	**27**	0	93	41	0	18	3	62	13	91	0	0	104	0	0	0	0	0	259
04:00 PM	0	**75**	15	0	90	42	0	23	2	67	**25**	**118**	0	0	**143**	0	0	0	0	0	**300**
04:15 PM	0	71	20	0	91	43	0	21	1	65	13	112	0	0	125	0	0	0	0	0	281
Total Volume	0	286	83	0	369	170	0	94	14	278	66	422	0	0	488	0	0	0	0	0	1135
% App. Total	0	77.5	22.5	0		61.2	0	33.8	5		13.5	86.5	0	0		0	0	0	0		
PHF	.000	.953	.769	.000	.971	.966	.000	.734	.438	.827	.660	.894	.000	.000	.853	.000	.000	.000	.000	.000	.946



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File Name : PM_Kaonohi - Swap Meet Exit (KFC Dr)
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	KAONOHI From North				SWAP MEET EXIT (KFC DRIVEWAY) From East				KAONOHI From South				SWAP MEET EXIT (KFC DRIVEWAY) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	1	98	11	0	21	1	42	1	23	100	1	0	6	0	2	2	309
03:15 PM	0	67	11	0	24	0	30	2	13	82	2	0	3	0	1	3	238
03:30 PM	1	94	17	0	27	0	31	8	25	90	0	0	2	0	0	2	297
03:45 PM	0	70	9	0	23	0	33	9	22	83	0	0	1	0	2	2	254
Total	2	329	48	0	95	1	136	20	83	355	3	0	12	0	5	9	1098
04:00 PM	1	86	12	0	24	0	42	9	16	111	0	0	0	0	1	1	303
04:15 PM	0	82	14	0	20	0	38	0	19	104	0	0	1	0	0	2	280
04:30 PM	0	100	17	0	22	0	41	4	28	82	1	0	1	0	0	1	297
04:45 PM	0	86	16	0	25	0	37	6	24	109	1	0	1	1	0	2	308
Total	1	354	59	0	91	0	158	19	87	406	2	0	3	1	1	6	1188
05:00 PM	0	89	11	0	30	1	42	2	18	85	0	0	0	0	1	2	281
05:15 PM	0	85	14	0	23	0	41	3	15	77	0	0	0	0	3	4	265
Grand Total	3	857	132	0	239	2	377	44	203	923	5	0	15	1	10	21	2832
Apprch %	0.3	86.4	13.3	0	36.1	0.3	56.9	6.6	17.9	81.6	0.4	0	31.9	2.1	21.3	44.7	
Total %	0.1	30.3	4.7	0	8.4	0.1	13.3	1.6	7.2	32.6	0.2	0	0.5	0	0.4	0.7	

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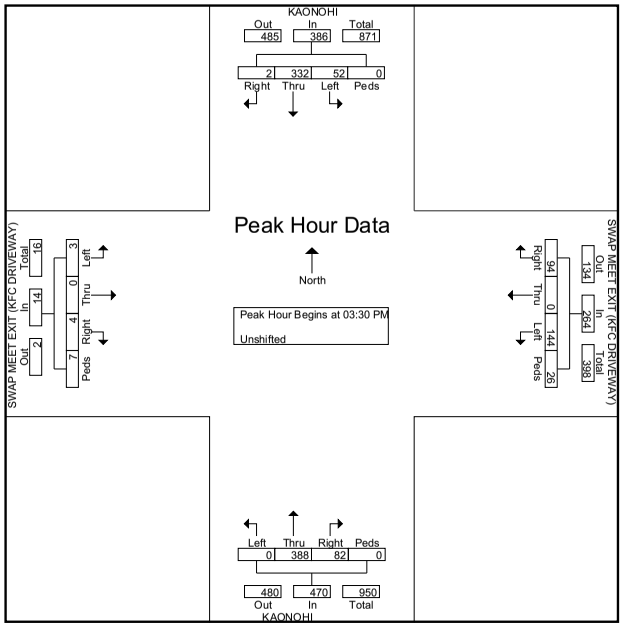
	KAONOHI From North					SWAP MEET EXIT (KFC DRIVEWAY) From East					KAONOHI From South					SWAP MEET EXIT (KFC DRIVEWAY) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**1**	**94**	**17**	0	**112**	**27**	0	31	8	66	**25**	90	0	0	115	**2**	0	0	**2**	4	297
03:45 PM	0	70	9	0	79	23	0	33	**9**	65	22	83	0	0	105	1	0	**2**	2	**5**	254
04:00 PM	1	86	12	0	99	24	0	**42**	9	**75**	16	**111**	0	0	**127**	0	0	1	1	2	**303**
04:15 PM	0	82	14	0	96	20	0	38	0	58	19	104	0	0	123	1	0	0	2	3	280
Total Volume	2	332	52	0	386	94	0	144	26	264	82	388	0	0	470	4	0	3	7	14	1134
% App. Total	0.5	86	13.5	0		35.6	0	54.5	9.8		17.4	82.6	0	0		28.6	0	21.4	50		
PHF	.500	.883	.765	.000	.862	.870	.000	.857	.722	.880	.820	.874	.000	.000	.925	.500	.000	.375	.875	.700	.936



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Groups Printed- Unshifted

	KAONOHI From North				WESTRIDGE DRIVEWAY (MAUKA) From East				KAONOHI From South				WESTRIDGE DRIVEWAY (MAUKA) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	8	85	0	0	0	0	0	0	0	66	1	0	3	0	10	0	173
03:15 PM	11	91	0	0	0	0	0	0	0	91	5	1	1	0	5	2	207
03:30 PM	9	109	0	0	0	0	0	0	0	108	3	0	8	0	7	1	245
03:45 PM	14	94	0	0	0	0	0	0	0	96	5	0	5	0	7	3	224
Total	42	379	0	0	0	0	0	0	0	361	14	1	17	0	29	6	849
04:00 PM	11	114	0	0	0	0	0	0	0	131	3	0	5	0	3	0	267
04:15 PM	5	110	0	0	0	0	0	0	0	113	6	0	6	0	8	0	248
04:30 PM	19	128	0	3	0	0	0	0	0	109	4	0	5	0	4	0	272
04:45 PM	15	104	0	0	0	0	0	0	0	123	10	1	9	0	8	5	275
Total	50	456	0	3	0	0	0	0	0	476	23	1	25	0	23	5	1062
05:00 PM	13	117	0	1	0	0	0	0	0	99	5	0	7	0	9	1	252
05:15 PM	7	116	0	0	0	0	0	0	0	81	9	0	5	0	10	4	232
Grand Total	112	1068	0	4	0	0	0	0	0	1017	51	2	54	0	71	16	2395
Apprch %	9.5	90.2	0	0.3	0	0	0	0	0	95	4.8	0.2	38.3	0	50.4	11.3	
Total %	4.7	44.6	0	0.2	0	0	0	0	0	42.5	2.1	0.1	2.3	0	3	0.7	

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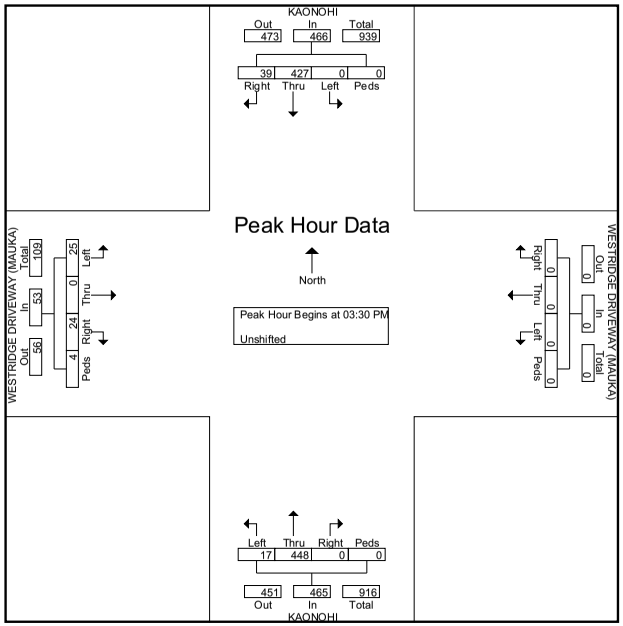
	KAONOHI From North					WESTRIDGE DRIVEWAY (MAUKA) From East					KAONOHI From South					WESTRIDGE DRIVEWAY (MAUKA) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	9	109	0	0	118	0	0	0	0	0	0	108	3	0	111	**8**	0	7	1	**16**	245
03:45 PM	**14**	94	0	0	108	0	0	0	0	0	0	96	5	0	101	5	0	7	**3**	15	224
04:00 PM	11	**114**	0	0	**125**	0	0	0	0	0	0	**131**	3	0	**134**	5	0	3	0	8	**267**
04:15 PM	5	110	0	0	115	0	0	0	0	0	0	113	**6**	0	119	6	0	**8**	0	14	248
Total Volume	39	427	0	0	466	0	0	0	0	0	0	448	17	0	465	24	0	25	4	53	984
% App. Total	8.4	91.6	0	0		0	0	0	0		0	96.3	3.7	0		45.3	0	47.2	7.5		
PHF	.696	.936	.000	.000	.932	.000	.000	.000	.000	.000	.000	.855	.708	.000	.868	.750	.000	.781	.333	.828	.921



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Groups Printed- Unshifted

	KAONOHI From North				WESTRIDGE DRIVEWAY (MAKAI) From East				KAONOHI From South				WESTRIDGE DRIVEWAY (MAKAI) From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	2	97	0	0	0	0	0	0	0	76	7	0	8	0	0	1	191
03:15 PM	4	88	0	0	0	0	0	0	0	93	5	0	14	0	5	0	209
03:30 PM	6	117	0	0	0	0	0	0	0	111	3	1	13	0	2	0	253
03:45 PM	4	94	0	0	0	0	0	0	0	98	8	1	14	0	2	2	223
Total	16	396	0	0	0	0	0	0	0	378	23	2	49	0	9	3	876
04:00 PM	4	115	0	3	0	0	0	0	0	126	5	0	12	0	5	2	272
04:15 PM	4	112	0	1	0	0	0	0	0	116	6	0	9	0	4	1	253
04:30 PM	0	133	0	0	0	0	0	0	0	114	4	0	10	0	1	5	267
04:45 PM	1	112	0	0	0	0	0	0	0	135	8	1	15	0	4	3	279
Total	9	472	0	4	0	0	0	0	0	491	23	1	46	0	14	11	1071
05:00 PM	3	120	0	0	0	0	0	0	0	94	2	0	6	0	4	1	230
05:15 PM	7	115	0	0	0	0	0	0	0	90	7	0	10	0	2	3	234
Grand Total	35	1103	0	4	0	0	0	0	0	1053	55	3	111	0	29	18	2411
Apprch %	3.1	96.6	0	0.4	0	0	0	0	0	94.8	5	0.3	70.3	0	18.4	11.4	
Total %	1.5	45.7	0	0.2	0	0	0	0	0	43.7	2.3	0.1	4.6	0	1.2	0.7	

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File Name : PM_Kaonohi - Westridge Dr (Makai)
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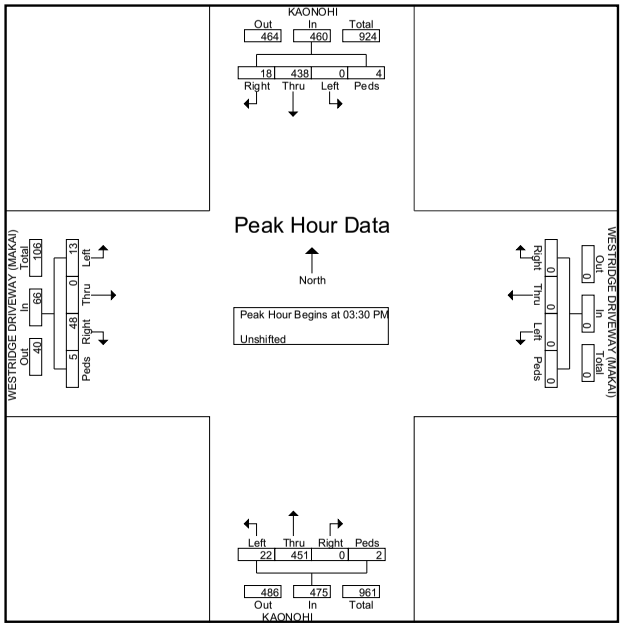
	KAONOHI From North					WESTRIDGE DRIVEWAY (MAKAI) From East					KAONOHI From South					WESTRIDGE DRIVEWAY (MAKAI) From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	**6**	**117**	0	0	**123**	0	0	0	0	0	0	111	3	**1**	115	13	0	2	0	15	253
03:45 PM	4	94	0	0	98	0	0	0	0	0	0	98	**8**	1	107	**14**	0	2	**2**	18	223
04:00 PM	4	115	0	**3**	122	0	0	0	0	0	0	**126**	5	0	**131**	12	0	**5**	2	**19**	**272**
04:15 PM	4	112	0	1	117	0	0	0	0	0	0	116	6	0	122	9	0	4	1	14	253
Total Volume	18	438	0	4	460	0	0	0	0	0	0	451	22	2	475	48	0	13	5	66	1001
% App. Total	3.9	95.2	0	0.9		0	0	0	0		0	94.9	4.6	0.4		72.7	0	19.7	7.6		
PHF	.750	.936	.000	.333	.935	.000	.000	.000	.000	.000	.000	.895	.688	.500	.906	.857	.000	.650	.625	.868	.920



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	KAONOHI From North				ANA MILLER'S DRIVEWAY From East				KAONOHI From South				ANA MILLER'S DRIVEWAY From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	0	140	4	0	13	0	19	4	17	119	0	0	0	0	0	0	316
03:15 PM	0	99	3	0	12	0	13	6	7	91	0	0	0	0	0	0	231
03:30 PM	0	114	9	0	2	0	14	7	12	105	0	0	0	0	0	0	263
03:45 PM	0	103	9	0	10	0	15	2	12	103	0	0	0	0	0	0	254
Total	0	456	25	0	37	0	61	19	48	418	0	0	0	0	0	0	1064
04:00 PM	0	122	3	0	10	0	18	9	12	120	0	0	0	0	0	0	294
04:15 PM	0	126	6	0	16	0	15	2	10	103	0	0	0	0	0	0	278
04:30 PM	0	127	7	0	10	0	16	4	18	111	0	0	0	0	0	0	293
04:45 PM	0	122	8	0	8	0	14	3	6	135	0	0	0	0	0	0	296
Total	0	497	24	0	44	0	63	18	46	469	0	0	0	0	0	0	1161
05:00 PM	0	113	3	0	8	0	16	0	10	77	0	0	0	0	0	0	227
05:15 PM	0	114	9	0	12	0	13	4	22	90	0	0	0	0	0	0	264
Grand Total	0	1180	61	0	101	0	153	41	126	1054	0	0	0	0	0	0	2716
Apprch %	0	95.1	4.9	0	34.2	0	51.9	13.9	10.7	89.3	0	0	0	0	0	0	
Total %	0	43.4	2.2	0	3.7	0	5.6	1.5	4.6	38.8	0	0	0	0	0	0	

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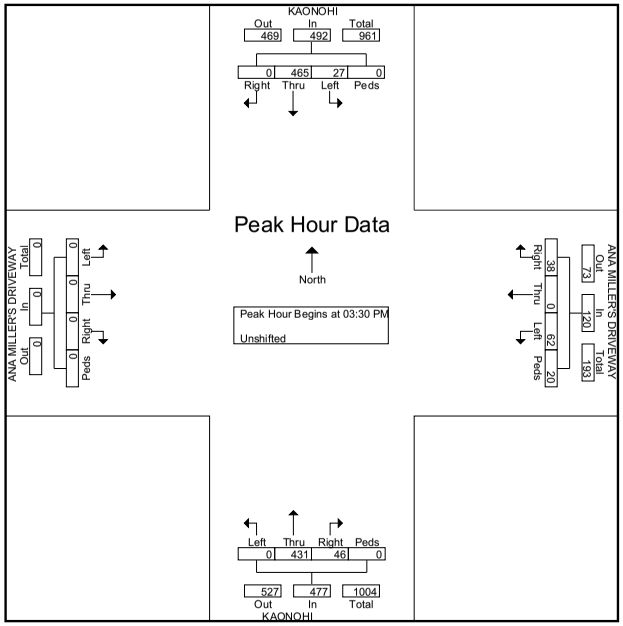
	KAONOHI From North					ANA MILLER'S DRIVEWAY From East					KAONOHI From South					ANA MILLER'S DRIVEWAY From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	114	**9**	0	123	2	0	14	7	23	**12**	105	0	0	117	0	0	0	0	0	263
03:45 PM	0	103	9	0	112	10	0	15	2	27	12	103	0	0	115	0	0	0	0	0	254
04:00 PM	0	122	3	0	125	10	0	**18**	**9**	**37**	12	**120**	0	0	**132**	0	0	0	0	0	**294**
04:15 PM	0	**126**	6	0	**132**	**16**	0	15	2	33	10	103	0	0	113	0	0	0	0	0	278
Total Volume	0	465	27	0	492	38	0	62	20	120	46	431	0	0	477	0	0	0	0	0	1089
% App. Total	0	94.5	5.5	0		31.7	0	51.7	16.7		9.6	90.4	0	0		0	0	0	0		
PHF	.000	.923	.750	.000	.932	.594	.000	.861	.556	.811	.958	.898	.000	.000	.903	.000	.000	.000	.000	.000	.926



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	KAONOHI From North				MOANALUA LOOP From East				KAONOHI From South				MOANALUA LOOP From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	12	147	0	0	0	0	0	0	0	127	22	0	28	0	5	0	341
03:15 PM	12	105	0	0	0	0	0	0	0	88	21	0	21	0	8	8	263
03:30 PM	12	118	0	0	0	0	0	0	0	109	29	0	16	0	9	2	295
03:45 PM	11	111	0	0	0	0	0	0	0	100	24	0	24	0	14	2	286
Total	47	481	0	0	0	0	0	0	0	424	96	0	89	0	36	12	1185
04:00 PM	13	124	0	0	0	0	0	0	0	129	25	0	30	0	4	2	327
04:15 PM	14	120	0	0	0	0	0	0	0	114	34	0	31	0	5	2	320
04:30 PM	15	135	0	0	0	0	0	0	0	117	31	0	27	0	15	4	344
04:45 PM	12	122	0	0	0	0	0	0	0	125	23	0	20	0	9	0	311
Total	54	501	0	0	0	0	0	0	0	485	113	0	108	0	33	8	1302
05:00 PM	17	120	0	0	0	0	0	0	0	94	22	0	28	0	3	2	286
05:15 PM	14	117	0	0	0	0	0	0	0	100	32	0	39	0	7	3	312
Grand Total	132	1219	0	0	0	0	0	0	0	1103	263	0	264	0	79	25	3085
Apprch %	9.8	90.2	0	0	0	0	0	0	0	80.7	19.3	0	71.7	0	21.5	6.8	
Total %	4.3	39.5	0	0	0	0	0	0	0	35.8	8.5	0	8.6	0	2.6	0.8	

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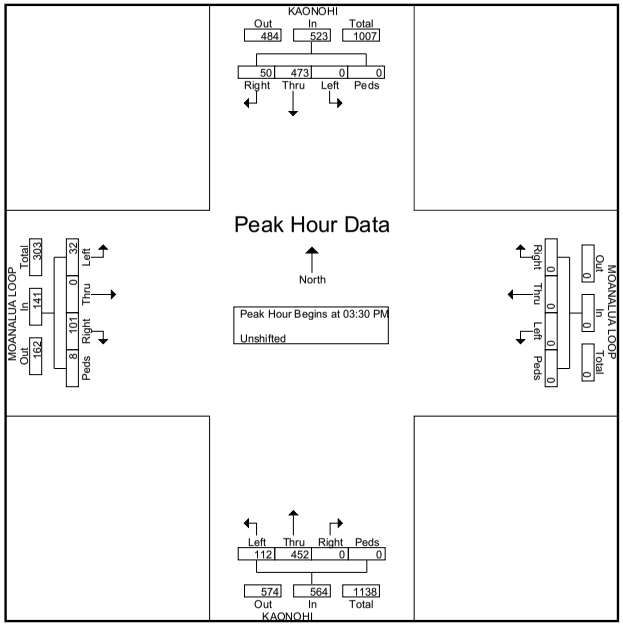
	KAONOHI From North					MOANALUA LOOP From East					KAONOHI From South					MOANALUA LOOP From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	12	118	0	0	130	0	0	0	0	0	0	109	29	0	138	16	0	9	**2**	27	295
03:45 PM	11	111	0	0	122	0	0	0	0	0	0	100	24	0	124	24	0	**14**	2	**40**	286
04:00 PM	13	**124**	0	0	**137**	0	0	0	0	0	0	**129**	25	0	**154**	30	0	4	2	36	**327**
04:15 PM	**14**	120	0	0	134	0	0	0	0	0	0	114	**34**	0	148	**31**	0	5	2	38	320
Total Volume	50	473	0	0	523	0	0	0	0	0	0	452	112	0	564	101	0	32	8	141	1228
% App. Total	9.6	90.4	0	0		0	0	0	0		0	80.1	19.9	0		71.6	0	22.7	5.7		
PHF	.893	.954	.000	.000	.954	.000	.000	.000	.000	.000	.000	.876	.824	.000	.916	.815	.000	.571	1.000		



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Groups Printed- Unshifted

	KAONOHI From North				KAMEHAMEHA From East				KAONOHI From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:00 PM	70	0	86	14	89	409	0	0	0	0	0	0	0	262	50	8	988
03:15 PM	76	0	58	20	83	445	0	0	0	0	0	0	0	278	35	21	1016
03:30 PM	68	0	58	20	70	536	0	0	0	0	0	0	0	288	63	10	1113
03:45 PM	70	0	71	14	81	519	0	0	0	0	0	0	0	284	43	14	1096
Total	284	0	273	68	323	1909	0	0	0	0	0	0	0	1112	191	53	4213
04:00 PM	74	0	83	21	107	527	0	0	0	0	0	0	0	300	44	17	1173
04:15 PM	75	0	62	11	101	580	0	0	0	0	0	0	0	279	51	12	1171
04:30 PM	81	0	83	18	76	507	0	0	0	0	0	0	0	269	65	20	1119
04:45 PM	72	0	73	10	98	575	0	0	0	0	0	0	0	255	48	7	1138
Total	302	0	301	60	382	2189	0	0	0	0	0	0	0	1103	208	56	4601
05:00 PM	74	0	69	13	58	454	0	0	0	0	0	0	0	233	52	7	960
05:15 PM	87	0	76	8	77	470	0	0	0	0	0	0	0	242	52	8	1020
Grand Total	747	0	719	149	840	5022	0	0	0	0	0	0	0	2690	503	124	10794
Apprch %	46.3	0	44.5	9.2	14.3	85.7	0	0	0	0	0	0	0	81.1	15.2	3.7	
Total %	6.9	0	6.7	1.4	7.8	46.5	0	0	0	0	0	0	0	24.9	4.7	1.1	

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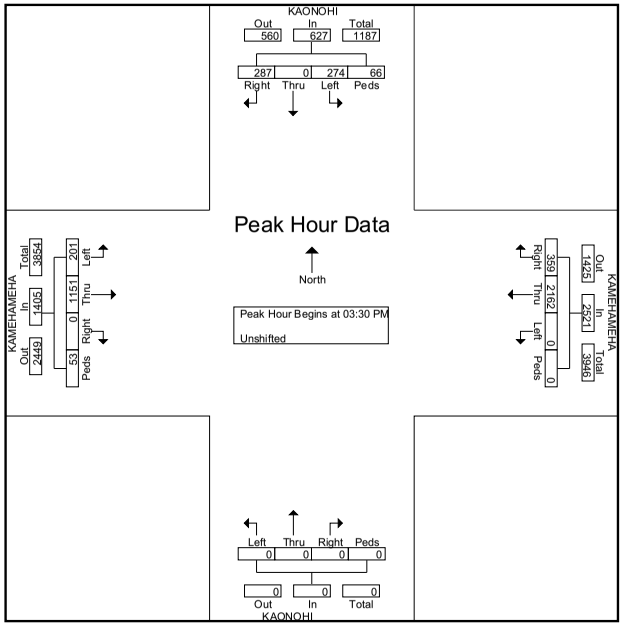
	KAONOHI From North					KAMEHAMEHA From East					KAONOHI From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	68	0	58	20	146	70	536	0	0	606	0	0	0	0	0	0	288	**63**	10	**361**	1113
03:45 PM	70	0	71	14	155	81	519	0	0	600	0	0	0	0	0	0	284	43	14	341	1096
04:00 PM	74	0	**83**	**21**	**178**	**107**	527	0	0	634	0	0	0	0	0	0	**300**	44	**17**	361	**1173**
04:15 PM	**75**	0	62	11	148	101	**580**	0	0	**681**	0	0	0	0	0	0	279	51	12	342	1171
Total Volume	287	0	274	66	627	359	2162	0	0	2521	0	0	0	0	0	0	1151	201	53	1405	4553
% App. Total	45.8	0	43.7	10.5		14.2	85.8	0	0		0	0	0	0		0	81.9	14.3	3.8		
PHF	.957	.000	.825	.786	.881	.839	.932	.000	.000	.925	.000	.000	.000	.000	.000	.000	.959	.798	.779	.973	.970



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Groups Printed- Unshifted

	HEKAHA From North				KAMEHAMEHA From East				HEKAHA From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	24	11	12	1	21	398	41	11	50	8	58	2	30	256	20	0	943
03:45 PM	21	9	11	1	12	436	50	10	61	9	48	5	31	253	8	0	965
Total	45	20	23	2	33	834	91	21	111	17	106	7	61	509	28	0	1908
04:00 PM	17	8	16	0	17	403	46	8	53	9	55	0	40	222	8	0	902
04:15 PM	27	11	18	0	21	434	36	9	48	12	54	3	36	250	8	0	967
04:30 PM	20	8	11	0	18	398	25	9	64	14	65	4	47	247	8	0	938
04:45 PM	27	17	21	0	18	389	33	7	41	14	39	4	46	245	17	0	918
Total	91	44	66	0	74	1624	140	33	206	49	213	11	169	964	41	0	3725
05:00 PM	20	8	13	0	22	432	23	14	62	24	53	1	39	200	6	0	917
05:15 PM	27	3	9	3	17	427	27	6	32	6	38	1	22	213	13	0	844
05:30 PM	25	10	4	0	27	450	30	4	38	3	38	2	29	193	3	0	856
05:45 PM	17	11	12	0	26	482	33	5	29	9	30	1	36	199	14	0	904
Total	89	32	38	3	92	1791	113	29	161	42	159	5	126	805	36	0	3521
Grand Total	225	96	127	5	199	4249	344	83	478	108	478	23	356	2278	105	0	9154
Apprch %	49.7	21.2	28	1.1	4.1	87.2	7.1	1.7	44	9.9	44	2.1	13	83.2	3.8	0	
Total %	2.5	1	1.4	0.1	2.2	46.4	3.8	0.9	5.2	1.2	5.2	0.3	3.9	24.9	1.1	0	

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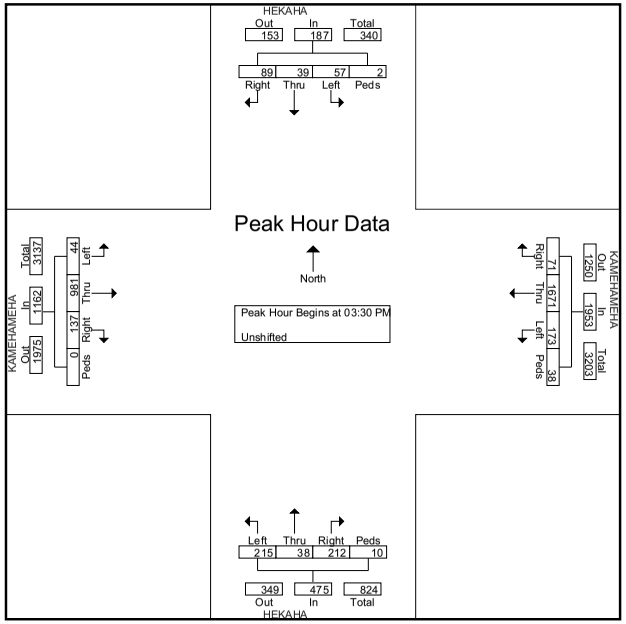
	HEKAHA From North					KAMEHAMEHA From East					HEKAHA From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	24	11	12	1	48	21	398	41	11	471	50	8	58	2	118	30	256	20	0	306	943
03:45 PM	21	9	11	1	42	12	436	50	10	508	61	9	48	5	123	31	253	8	0	292	965
04:00 PM	17	8	16	0	41	17	403	46	8	474	53	9	55	0	117	40	222	8	0	270	902
04:15 PM	27	11	18	0	56	21	434	36	9	500	48	12	54	3	117	36	250	8	0	294	967
Total Volume	89	39	57	2	187	71	1671	173	38	1953	212	38	215	10	475	137	981	44	0	1162	3777
% App. Total																					
PHF	.824	.886	.792	.500	.835	.845	.958	.865	.864	.961	.869	.792	.927	.500	.965	.856	.958	.550	.000	.949	.976



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	KANUKU From North				KAM From East				KANUKU From South				KAM From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	0	4	13	1	43	470	20	0	13	3	24	2	19	268	14	6	900
03:45 PM	0	4	18	3	61	456	25	0	12	3	23	4	15	275	4	3	906
Total	0	8	31	4	104	926	45	0	25	6	47	6	34	543	18	9	1806
04:00 PM	0	2	7	1	43	492	15	0	12	2	15	2	14	242	10	7	864
04:15 PM	0	1	17	0	56	473	21	0	12	2	21	2	20	262	3	1	891
04:30 PM	0	1	14	3	58	448	12	0	9	4	19	1	7	284	11	1	872
04:45 PM	0	3	15	3	53	486	17	0	9	2	23	1	16	252	3	3	886
Total	0	7	53	7	210	1899	65	0	42	10	78	6	57	1040	27	12	3513
05:00 PM	0	3	16	1	45	427	24	0	14	2	13	8	16	249	4	2	824
05:15 PM	0	2	15	4	64	493	16	0	9	4	16	3	7	226	6	10	875
05:30 PM	0	3	14	0	61	524	17	0	8	3	13	1	11	179	4	4	842
05:45 PM	0	4	17	3	43	446	28	0	12	5	15	2	8	199	8	2	792
Total	0	12	62	8	213	1890	85	0	43	14	57	14	42	853	22	18	3333
Grand Total	0	27	146	19	527	4715	195	0	110	30	182	26	133	2436	67	39	8652
Apprch %	0	14.1	76	9.9	9.7	86.7	3.6	0	31.6	8.6	52.3	7.5	5	91.1	2.5	1.5	
Total %	0	0.3	1.7	0.2	6.1	54.5	2.3	0	1.3	0.3	2.1	0.3	1.5	28.2	0.8	0.5	

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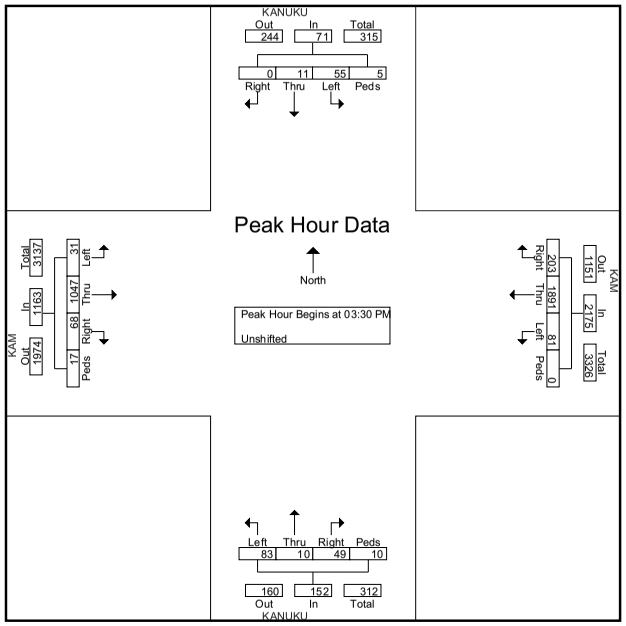
	KANUKU From North					KAM From East					KANUKU From South					KAM From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	4	13	1	18	43	470	20	0	533	13	3	24	2	42	19	268	14	6	307	900
03:45 PM	0	4	18	3	25	61	456	25	0	542	12	3	23	4	42	15	275	4	3	297	906
04:00 PM	0	2	7	1	10	43	492	15	0	550	12	2	15	2	31	14	242	10	7	273	864
04:15 PM	0	1	17	0	18	56	473	21	0	550	12	2	21	2	37	20	262	3	1	286	891
Total Volume	0	11	55	5	71	203	1891	81	0	2175	49	10	83	10	152	68	1047	31	17	1163	3561
% App. Total	0	15.5	77.5	7		9.3	86.9	3.7	0		32.2	6.6	54.6	6.6		5.8	90	2.7	1.5		
PHF	.000	.688	.764	.417	.710	.832	.961	.810	.000	.989	.942	.833	.865	.625	.905	.850	.952	.554	.607	.947	.983



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Groups Printed- Unshifted

	LIOPA From North				KAM From East				LIOPA From South				KAM From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	0	0	0	0	0	539	18	1	10	0	38	1	11	328	0	0	946
03:45 PM	0	0	0	0	0	544	22	4	7	0	31	1	11	324	0	0	944
Total	0	0	0	0	0	1083	40	5	17	0	69	2	22	652	0	0	1890
04:00 PM	0	0	0	0	0	483	31	5	3	0	41	2	9	256	0	0	830
04:15 PM	0	0	0	0	0	528	17	4	9	0	37	0	17	298	0	0	910
04:30 PM	0	0	0	0	0	525	10	5	5	0	36	0	7	299	0	0	887
04:45 PM	0	0	0	0	0	520	16	3	9	0	35	0	16	297	0	0	896
Total	0	0	0	0	0	2056	74	17	26	0	149	2	49	1150	0	0	3523
05:00 PM	0	0	0	0	0	497	15	3	8	0	54	0	14	268	0	0	859
05:15 PM	0	0	0	0	0	509	11	3	9	0	35	0	9	261	0	0	837
05:30 PM	0	0	0	0	0	565	16	4	8	0	31	0	11	233	0	0	868
05:45 PM	0	0	0	0	0	586	24	4	14	0	30	0	7	225	0	0	890
Total	0	0	0	0	0	2157	66	14	39	0	150	0	41	987	0	0	3454
Grand Total	0	0	0	0	0	5296	180	36	82	0	368	4	112	2789	0	0	8867
Apprch %	0	0	0	0	0	96.1	3.3	0.7	18.1	0	81.1	0.9	3.9	96.1	0	0	
Total %	0	0	0	0	0	59.7	2	0.4	0.9	0	4.2	0	1.3	31.5	0	0	

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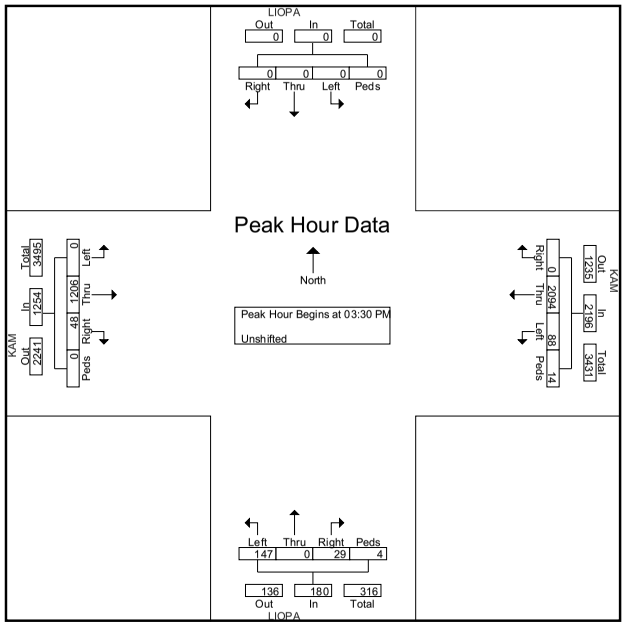
	LIOPA From North					KAM From East					LIOPA From South					KAM From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	0	0	0	539	18	1	558	10	0	38	1	49	11	328	0	0	339	946
03:45 PM	0	0	0	0	0	0	544	22	4	570	7	0	31	1	39	11	324	0	0	335	944
04:00 PM	0	0	0	0	0	0	483	31	5	519	3	0	41	2	46	9	256	0	0	265	830
04:15 PM	0	0	0	0	0	0	528	17	4	549	9	0	37	0	46	17	298	0	0	315	910
Total Volume	0	0	0	0	0	0	2094	88	14	2196	29	0	147	4	180	48	1206	0	0	1254	3630
% App. Total	0	0	0	0		0	95.4	4	0.6		16.1	0	81.7	2.2		3.8	96.2	0	0		
PHF	.000	.000	.000	.000	.000	.000	.962	.710	.700	.963	.725	.000	.896	.500	.918	.706	.919	.000	.000	.925	.959



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Groups Printed- Class 1

	PALIMOI (IN) From North				KAMEHAMEHA From East				PALIMOI (IN) From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	0	0	0	12	107	475	29	0	0	0	0	2	9	261	53	0	948
03:45 PM	0	0	0	4	89	511	22	0	0	0	0	5	8	293	57	0	989
Total	0	0	0	16	196	986	51	0	0	0	0	7	17	554	110	0	1937
04:00 PM	0	0	0	10	67	469	38	0	0	0	0	1	5	209	56	0	855
04:15 PM	0	0	0	7	92	496	22	0	0	0	0	1	6	252	61	0	937
04:30 PM	0	0	0	12	86	513	29	0	0	0	0	0	14	272	38	0	964
04:45 PM	0	0	0	2	88	518	33	0	0	0	0	0	5	244	65	0	955
Total	0	0	0	31	333	1996	122	0	0	0	0	2	30	977	220	0	3711
05:00 PM	0	0	0	1	86	469	30	0	0	0	0	0	9	244	51	0	890
05:15 PM	0	0	0	15	74	446	30	0	0	0	0	1	6	190	51	0	813
05:30 PM	0	0	0	9	92	547	39	0	0	0	0	2	13	195	49	0	946
05:45 PM	0	0	0	7	98	543	48	0	0	0	0	1	10	178	59	0	944
Total	0	0	0	32	350	2005	147	0	0	0	0	4	38	807	210	0	3593
Grand Total	0	0	0	79	879	4987	320	0	0	0	0	13	85	2338	540	0	9241
Apprch %	0	0	0	100	14.2	80.6	5.2	0	0	0	0	100	2.9	78.9	18.2	0	
Total %	0	0	0	0.9	9.5	54	3.5	0	0	0	0	0.1	0.9	25.3	5.8	0	

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Site Code : 00000000
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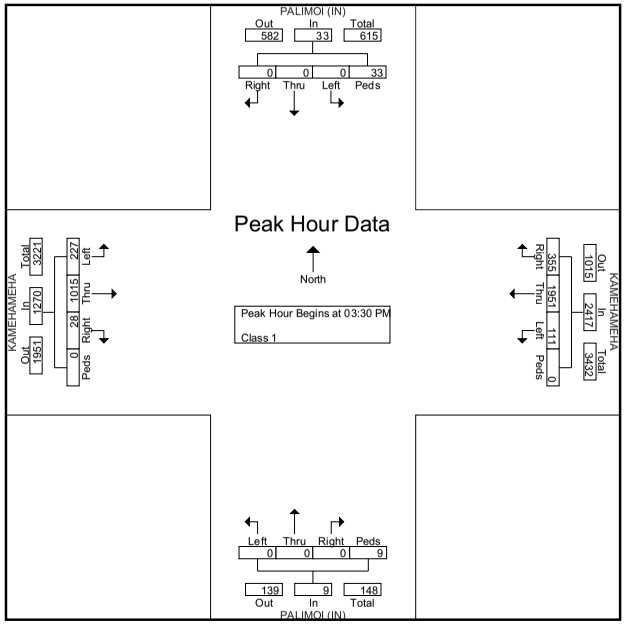
	PALIMOI (IN) From North					KAMEHAMEHA From East					PALIMOI (IN) From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	0	0	0	12	12	107	475	29	0	611	0	0	0	2	2	9	261	53	0	323	948
03:45 PM	0	0	0	4	4	89	511	22	0	622	0	0	0	5	5	8	293	57	0	358	989
04:00 PM	0	0	0	10	10	67	469	38	0	574	0	0	0	1	1	5	209	56	0	270	855
04:15 PM	0	0	0	7	7	92	496	22	0	610	0	0	0	1	1	6	252	61	0	319	937
Total Volume	0	0	0	33	33	355	1951	111	0	2417	0	0	0	9	9	28	1015	227	0	1270	3729
% App. Total	0	0	0	100		14.7	80.7	4.6	0		0	0	0	100		2.2	79.9	17.9	0		
PHF	.000	.000	.000	.688	.688	.829	.955	.730	.000	.971	.000	.000	.000	.450	.450	.778	.866	.930	.000	.887	.943



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Groups Printed- Class 1

	PALIMOI (OUT) From North				KAMEHAMEHA From East				PALIMOI (OUT) From South				KAMEHAMEHA From West				
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total
03:30 PM	38	0	79	0	0	560	0	0	0	0	0	0	0	0	0	26	703
03:45 PM	33	0	71	0	0	581	0	0	0	0	0	0	0	0	0	22	707
Total	71	0	150	0	0	1141	0	0	0	0	0	0	0	0	0	48	1410
04:00 PM	25	0	59	0	0	547	0	0	0	0	0	0	0	0	0	20	651
04:15 PM	35	0	76	0	0	580	0	0	0	0	0	0	0	0	0	27	718
04:30 PM	36	0	67	0	0	592	0	0	0	0	0	0	0	0	0	34	729
04:45 PM	31	0	65	0	0	588	0	0	0	0	0	0	0	0	0	13	697
Total	127	0	267	0	0	2307	0	0	0	0	0	0	0	0	0	94	2795
05:00 PM	27	0	67	0	0	543	0	0	0	0	0	0	0	0	0	14	651
05:15 PM	29	0	76	0	0	521	0	0	0	0	0	0	0	0	0	15	641
05:30 PM	30	0	60	0	0	614	0	0	0	0	0	0	0	0	0	10	714
05:45 PM	32	0	46	0	0	615	0	0	0	0	0	0	0	0	0	5	698
Total	118	0	249	0	0	2293	0	0	0	0	0	0	0	0	0	44	2704
Grand Total	316	0	666	0	0	5741	0	0	0	0	0	0	0	0	0	186	6909
Apprch %	32.2	0	67.8	0	0	100	0	0	0	0	0	0	0	0	0	100	
Total %	4.6	0	9.6	0	0	83.1	0	0	0	0	0	0	0	0	0	2.7	

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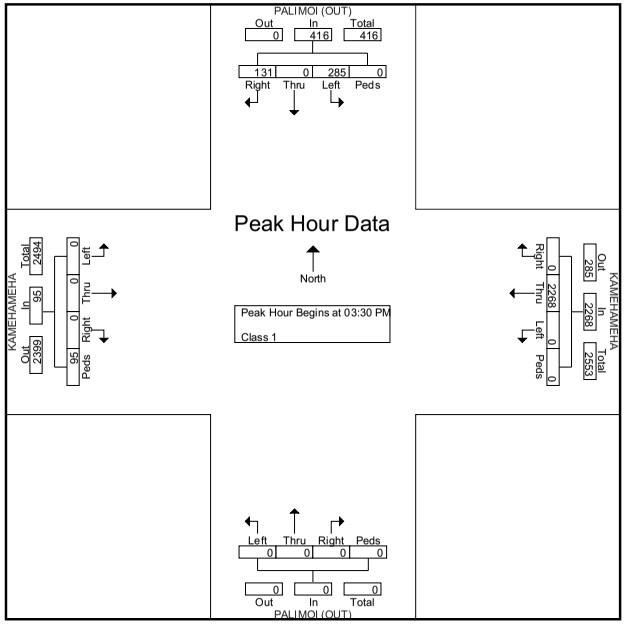
File Name : PM_PaliMomi (Out) - Kamehameha
Site Code : 00000000
Start Date : 5/10/2011
Page No : 2

	PALIMOI (OUT) From North					KAMEHAMEHA From East					PALIMOI (OUT) From South					KAMEHAMEHA From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	38	0	79	0	117	0	560	0	0	560	0	0	0	0	0	0	0	0	26	26	703
03:45 PM	33	0	71	0	104	0	581	0	0	581	0	0	0	0	0	0	0	0	22	22	707
04:00 PM	25	0	59	0	84	0	547	0	0	547	0	0	0	0	0	0	0	0	20	20	651
04:15 PM	35	0	76	0	111	0	580	0	0	580	0	0	0	0	0	0	0	0	27	27	718
Total Volume	131	0	285	0	416	0	2268	0	0	2268	0	0	0	0	0	0	0	0	95	95	2779
% App. Total																					
PHF	.862	.000	.902	.000	.889	.000	.976	.000	.000	.976	.000	.000	.000	.000	.000	.000	.000	.000	.880	.880	.968



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APPENDIX B

LEVEL OF SERVICE CRITERIA

APPENDIX B – LEVEL OF SERVICE (LOS) CRITERIA

LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS (HCM 2000)

Level of service for signalized intersections is directly related to delay values and is assigned on that basis. Level of Service is a measure of the acceptability of delay values to motorists at a given intersection. The criteria are given in table below.

Level-of Service Criteria for Signalized Intersections

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

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

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS (HCM 2000)

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

LOS delay threshold values are lower for two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections than those of signalized intersections. This is because more vehicles pass through signalized intersections, and therefore, drivers expect and tolerate greater delays. While the criteria for level of service for TWSC and AWSC intersections are the same, procedures to calculate the average total delay may differ.

Level of Service Criteria for Two-Way Stop-Controlled Intersections

Level of Service	Average Control Delay (sec/veh)
A	≤ 10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	> 50

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

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APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing Conditions

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1446	12	29	1019	13	39
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1572	13	32	1108	14	42
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.91	
vC, conflicting volume			1585		2195	792
vC1, stage 1 conf vol					1578	
vC2, stage 2 conf vol					617	
vCu, unblocked vol			1585		2117	792
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			92		90	87
cM capacity (veh/h)			411		147	332

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1048	537	32	554	554	57
Volume Left	0	0	32	0	0	14
Volume Right	0	13	0	0	0	42
cSH	1700	1700	411	1700	1700	252
Volume to Capacity	0.62	0.32	0.08	0.33	0.33	0.22
Queue Length 95th (ft)	0	0	6	0	0	21
Control Delay (s)	0.0	0.0	14.5	0.0	0.0	23.4
Lane LOS			B			C
Approach Delay (s)	0.0		0.4			23.4
Approach LOS						C

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	155	1360	757	202	42	267
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	168	1478	823	220	46	290
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.86				0.86	0.86
vC, conflicting volume	1042				2009	521
vC1, stage 1 conf vol					933	
vC2, stage 2 conf vol					1076	
vCu, unblocked vol	734				1852	130
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	78				77	62
cM capacity (veh/h)	749				196	773

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	168	739	739	549	494	336
Volume Left	168	0	0	0	0	46
Volume Right	0	0	0	0	220	290
cSH	749	1700	1700	1700	1700	553
Volume to Capacity	0.22	0.43	0.43	0.32	0.29	0.61
Queue Length 95th (ft)	22	0	0	0	0	101
Control Delay (s)	11.2	0.0	0.0	0.0	0.0	21.1
Lane LOS	B					C
Approach Delay (s)	1.1			0.0		21.1
Approach LOS						C

Intersection Summary			
Average Delay		3.0	
Intersection Capacity Utilization		64.8%	ICU Level of Service C
Analysis Period (min)		15	

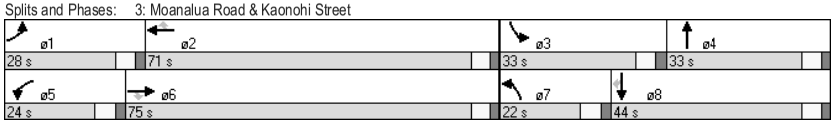
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	97	1113	183	70	675	87	71	74	258	203	212
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	33.0	11.0	33.0	33.0
Total Split (s)	28.0	75.0	75.0	24.0	71.0	71.0	22.0	33.0	33.0	44.0	44.0
Total Split (%)	17.0%	45.5%	45.5%	14.5%	43.0%	43.0%	13.3%	20.0%	20.0%	26.7%	26.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 165
Actuated Cycle Length: 128.4
Natural Cycle: 90
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	97	1113	183	70	675	87	71	74	74	258	203	212
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	105	1210	199	76	734	95	77	80	80	280	221	230
RTOR Reduction (vph)	0	0	98	0	0	50	0	71	0	0	0	191
Lane Group Flow (vph)	105	1210	101	76	734	45	77	89	0	280	221	39
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	13.4	61.7	61.7	11.7	60.0	60.0	8.5	14.0		16.4	21.9	21.9
Effective Green, g (s)	13.4	61.7	61.7	11.7	60.0	60.0	8.5	14.0		16.4	21.9	21.9
Actuated g/C Ratio	0.10	0.48	0.48	0.09	0.47	0.47	0.07	0.11		0.13	0.17	0.17
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	186	1709	764	162	1662	743	228	359		441	319	271
v/s Ratio Prot	c0.06	c0.34		0.04	0.21		0.02	0.03		c0.08	c0.12	
v/s Ratio Perm			0.06			0.03						0.02
v/c Ratio	0.56	0.71	0.13	0.47	0.44	0.06	0.34	0.25		0.63	0.69	0.15
Uniform Delay, d1	54.4	26.0	18.3	55.1	22.7	18.5	57.0	52.1		52.9	49.8	45.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.9	1.7	0.2	2.5	0.4	0.1	0.9	0.4		3.0	6.4	0.2
Delay (s)	58.3	27.7	18.4	57.6	23.1	18.6	57.8	52.4		55.8	56.2	45.2
Level of Service	E	C	B	E	C	B	E	D		E	E	D
Approach Delay (s)		28.6			25.5			54.2			52.6	
Approach LOS		C			C			D			D	

Intersection Summary				
HCM Average Control Delay	34.7	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.67			
Actuated Cycle Length (s)	127.8	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	69.8%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	7	0	227	17	0	475	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	8	0	247	18	0	516	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.89	0.89	0.89	0.89	0.89		0.89					
vC, conflicting volume	586	782	516	772	772	71	516			265		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	471	692	393	681	681	71	393			265		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	99	100			100		
cM capacity (veh/h)	419	325	538	299	330	977	1033			1296		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	8	70	70	70	54	516
Volume Left	0	0	0	0	0	0	0
Volume Right	0	8	0	0	0	18	0
cSH	1700	977	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.01	0.04	0.04	0.04	0.03	0.30
Queue Length 95th (ft)	0	1	0	0	0	0	0
Control Delay (s)	0.0	8.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	8.7	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	28.3%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	10	24	221	11	23	437
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	26	240	12	25	475
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	534	126			252	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	534	126			252	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	97			98	
cM capacity (veh/h)	467	901			1310	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	11	26	160	92	183	317
Volume Left	11	0	0	0	25	0
Volume Right	0	26	0	12	0	0
cSH	467	901	1700	1700	1310	1700
Volume to Capacity	0.02	0.03	0.09	0.05	0.02	0.19
Queue Length 95th (ft)	2	2	0	0	1	0
Control Delay (s)	12.9	9.1	0.0	0.0	1.2	0.0
Lane LOS	B	A			A	
Approach Delay (s)	10.2		0.0		0.4	
Approach LOS	B					

Intersection Summary				
Average Delay		0.8		
Intersection Capacity Utilization		32.5%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	24	0	8	0	216	32	30	434	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	26	0	9	0	235	35	33	472	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	663	807	236	553	789	135	472			270		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	663	807	236	553	789	135	472			270		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	94	100	99	100			97		
cM capacity (veh/h)	337	306	766	408	313	889	1086			1291		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	0	26	9	157	113	33	314	157
Volume Left	0	26	0	0	0	33	0	0
Volume Right	0	0	9	0	35	0	0	0
cSH	1700	408	889	1700	1700	1291	1700	1700
Volume to Capacity	0.00	0.06	0.01	0.09	0.07	0.03	0.18	0.09
Queue Length 95th (ft)	0	5	1	0	0	2	0	0
Control Delay (s)	0.0	14.4	9.1	0.0	0.0	7.9	0.0	0.0
Lane LOS	A	B	A			A		
Approach Delay (s)	0.0	13.1		0.0		0.5		
Approach LOS	A	B						

Intersection Summary				
Average Delay		0.9		
Intersection Capacity Utilization		23.7%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	27	14	220	390	48
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	29	15	239	424	52
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	600	238	476			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	600	238	476			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	91	96	99			
cM capacity (veh/h)	426	763	1082			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	67	95	159	283	193
Volume Left	38	15	0	0	0
Volume Right	29	0	0	0	52
cSH	528	1082	1700	1700	1700
Volume to Capacity	0.13	0.01	0.09	0.17	0.11
Queue Length 95th (ft)	11	1	0	0	0
Control Delay (s)	12.8	1.4	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	12.8	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.3		
Intersection Capacity Utilization		26.9%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	10	42	15	226	418	2
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	46	16	246	454	2
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	611	228	457			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	611	228	457			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	94	99			
cM capacity (veh/h)	419	774	1101			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	57	98	164	303	154
Volume Left	11	16	0	0	0
Volume Right	46	0	0	0	2
cSH	666	1101	1700	1700	1700
Volume to Capacity	0.08	0.01	0.10	0.18	0.09
Queue Length 95th (ft)	7	1	0	0	0
Control Delay (s)	10.9	1.5	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	10.9	0.6		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		27.6%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	39	10	231	46	20	439
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	42	11	251	50	22	477
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	479	151			301	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	479	151			301	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	92	99			98	
cM capacity (veh/h)	507	869			1257	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	53	167	134	117	191	191
Volume Left	42	0	0	22	0	0
Volume Right	11	0	50	0	0	0
cSH	554	1700	1700	1257	1700	1700
Volume to Capacity	0.10	0.10	0.08	0.02	0.11	0.11
Queue Length 95th (ft)	8	0	0	1	0	0
Control Delay (s)	12.2	0.0	0.0	1.6	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	12.2	0.0		0.4		
Approach LOS	B					

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		30.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	73	137	49	198	457	29
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	79	149	53	215	497	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	727	181	497			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	727	181	497			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	77	82	95			
cM capacity (veh/h)	341	830	1063			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	228	53	108	108	199	199	131
Volume Left	79	53	0	0	0	0	0
Volume Right	149	0	0	0	0	0	32
cSH	554	1063	1700	1700	1700	1700	1700
Volume to Capacity	0.41	0.05	0.06	0.06	0.12	0.12	0.08
Queue Length 95th (ft)	50	4	0	0	0	0	0
Control Delay (s)	16.0	8.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	16.0	1.7			0.0		
Approach LOS	C						

Intersection Summary				
Average Delay		4.0		
Intersection Capacity Utilization		35.3%	ICU Level of Service	A
Analysis Period (min)		15		

Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	117	1569	733	495	103
Turn Type	Prot				Perm
Protected Phases	1	6	2	3	
Permitted Phases					3
Detector Phase	1	6	2	3	3
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	26.0	27.0	32.0	32.0
Total Split (s)	19.0	86.0	67.0	44.0	44.0
Total Split (%)	14.6%	66.2%	51.5%	33.8%	33.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow
Natural Cycle: 70
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street

ø1	ø2	ø3
19 s	67 s	44 s

ø6
86 s

HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	117	1569	733	152	495	103
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	0.91
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4723		3428	1313
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4723		3428	1313
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	127	1705	797	165	538	112
RTOR Reduction (vph)	0	0	23	0	1	71
Lane Group Flow (vph)	127	1705	939	0	548	30
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	1	6	2		3	
Permitted Phases						3
Actuated Green, G (s)	10.5	80.0	64.5		39.0	39.0
Effective Green, g (s)	10.5	80.0	64.5		39.0	39.0
Actuated g/C Ratio	0.08	0.62	0.50		0.30	0.30
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	259	2921	2343		1028	394
v/s Ratio Prot	0.04	c0.36	0.20		c0.16	
v/s Ratio Perm						0.02
v/c Ratio	0.49	0.58	0.40		0.53	0.08
Uniform Delay, d1	57.2	15.0	20.6		37.9	32.6
Progression Factor	0.81	1.74	0.63		1.00	1.00
Incremental Delay, d2	1.3	0.8	0.5		2.0	0.4
Delay (s)	47.9	26.8	13.5		39.9	33.0
Level of Service	D	C	B		D	C
Approach Delay (s)		28.3	13.5		38.8	
Approach LOS		C	B		D	

Intersection Summary			
HCM Average Control Delay	26.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	62.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	43	1550	80	782	49	3	52	102	12	68
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	32.0	32.0	32.0
Total Split (s)	25.0	66.0	25.0	66.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	19.2%	50.8%	19.2%	50.8%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street

ø1	ø2	ø4
25 s	66 s	39 s
ø5	ø6	ø8
25 s	66 s	39 s

HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	43	1550	170	80	782	25	49	3	52	102	12	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.96		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.98	1.00
Frt	1.00	0.99		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.95	1.00		0.96	1.00
Satd. Flow (prot)	1652	4663		3204	4721			1717	1472		1627	1458
Flt Permitted	0.95	1.00		0.95	1.00			0.54	1.00		0.71	1.00
Satd. Flow (perm)	1652	4663		3204	4721			979	1472		1204	1458
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	1685	185	87	850	27	53	3	57	111	13	74
RTOR Reduction (vph)	0	6	0	0	2	0	0	0	49	0	0	63
Lane Group Flow (vph)	47	1864	0	87	875	0	0	56	8	0	124	11
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	8.0	86.4		8.9	87.3			18.7	18.7		18.7	18.7
Effective Green, g (s)	8.0	86.4		8.9	87.3			18.7	18.7		18.7	18.7
Actuated g/C Ratio	0.06	0.66		0.07	0.67			0.14	0.14		0.14	0.14
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	102	3099		219	3170			141	212		173	210
v/s Ratio Prot	c0.03	c0.40		0.03	0.19							
v/s Ratio Perm								0.06	0.01		c0.10	0.01
v/c Ratio	0.46	0.60		0.40	0.28			0.40	0.04		0.72	0.05
Uniform Delay, d1	58.9	12.2		58.0	8.6			50.5	47.9		53.1	48.0
Progression Factor	0.90	0.73		1.49	0.14			1.00	1.00		1.00	1.00
Incremental Delay, d2	2.8	0.7		1.2	0.2			1.8	0.1		13.2	0.1
Delay (s)	55.5	9.6		87.4	1.4			52.4	48.0		66.3	48.1
Level of Service	E	A		F	A			D	D		E	D
Approach Delay (s)		10.7			9.2			50.2			59.5	
Approach LOS		B			A			D			E	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	23	1597	16	14	846	3	4	10	127	5	37
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	34.0	34.0	34.0
Total Split (s)	25.0	60.0	60.0	25.0	60.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	19.2%	46.2%	46.2%	19.2%	46.2%	34.6%	34.6%	34.6%	34.6%	34.6%	34.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &

ø1	ø2	ø4
25 s	60 s	45 s
ø5	ø6	ø8
25 s	60 s	45 s

HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	23	1597	16	14	846	59	3	4	10	127	5	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.95	1.00
Satd. Flow (prot)	1652	4746	1450	3204	4695			1760	1531		1659	1452
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.91	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1450	3204	4695			1635	1531		1267	1452
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	25	1736	17	15	920	64	3	4	11	138	5	40
RTOR Reduction (vph)	0	0	3	0	3	0	0	0	9	0	0	34
Lane Group Flow (vph)	25	1736	14	15	981	0	0	7	2	0	143	6
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	5.2	91.2	91.2	2.7	88.7			20.1	20.1		20.1	20.1
Effective Green, g (s)	5.2	91.2	91.2	2.7	88.7			20.1	20.1		20.1	20.1
Actuated g/C Ratio	0.04	0.70	0.70	0.02	0.68			0.15	0.15		0.15	0.15
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	66	3330	1017	67	3203			253	237		196	225
v/s Ratio Prot	c0.02	c0.37		0.00	0.21							
v/s Ratio Perm			0.01					0.00	0.00		c0.11	0.00
v/c Ratio	0.38	0.52	0.01	0.22	0.31			0.03	0.01		0.73	0.03
Uniform Delay, d1	60.8	9.1	5.8	62.6	8.3			46.7	46.5		52.4	46.7
Progression Factor	0.97	0.75	1.12	1.17	0.82			1.00	1.00		1.00	1.00
Incremental Delay, d2	3.0	0.5	0.0	1.6	0.2			0.0	0.0		12.7	0.0
Delay (s)	62.0	7.3	6.6	74.6	7.1			46.7	46.5		65.1	46.7
Level of Service	E	A	A	E	A			D	D		E	D
Approach Delay (s)		8.1			8.1			46.6			61.1	
Approach LOS		A			A			D			E	

Intersection Summary				
HCM Average Control Delay	11.6	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.53			
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	57.7%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

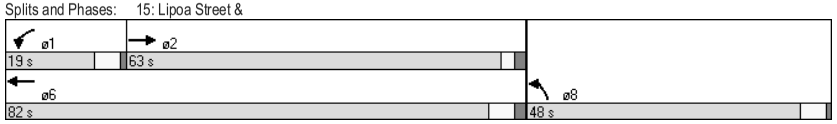
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2032	40	888	65
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	10.0	33.0	40.0
Total Split (s)	63.0	19.0	82.0	48.0
Total Split (%)	48.5%	14.6%	63.1%	36.9%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2032	44	40	888	65	54
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4731		1652	4746	1649	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4731		1652	4746	1649	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2209	48	43	965	71	59
RTOR Reduction (vph)	1	0	0	0	31	0
Lane Group Flow (vph)	2256	0	43	965	99	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	95.2		7.7	105.9	13.1	
Effective Green, g (s)	95.2		7.7	105.9	13.1	
Actuated g/C Ratio	0.73		0.06	0.81	0.10	
Clearance Time (s)	4.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3465		98	3866	166	
v/s Ratio Prot	c0.48		c0.03	0.20	c0.06	
v/s Ratio Perm						
v/c Ratio	0.65		0.44	0.25	0.60	
Uniform Delay, d1	8.9		59.1	2.8	55.9	
Progression Factor	2.29		0.81	0.99	1.00	
Incremental Delay, d2	0.8		3.0	0.1	5.7	
Delay (s)	21.2		50.7	2.9	61.6	
Level of Service	C		D	A	E	
Approach Delay (s)	21.2			5.0	61.6	
Approach LOS	C			A	E	

Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	182	1933	38	921
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	32.0	102.0	28.0	98.0
Total Split (%)	24.6%	78.5%	21.5%	75.4%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &

ø1	ø2
28 s	102 s
ø5	ø6
32 s	98 s

HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	182	1933	11	38	921	163	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4742		1652	4639							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4742		1652	4639							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	198	2101	12	41	1001	177	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	0	0	0	0
Lane Group Flow (vph)	198	2113	0	41	1166	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	13.4	111.5		7.5	105.6							
Effective Green, g (s)	13.4	111.5		7.5	105.6							
Actuated g/C Ratio	0.10	0.86		0.06	0.81							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	330	4067		95	3768							
v/s Ratio Prot	c0.06	c0.45		0.02	0.25							
v/s Ratio Perm												
v/c Ratio	0.60	0.52		0.43	0.31							
Uniform Delay, d1	55.7	2.4		59.2	3.1							
Progression Factor	1.33	0.08		1.15	0.07							
Incremental Delay, d2	2.3	0.4		3.0	0.2							
Delay (s)	76.3	0.6		70.9	0.4							
Level of Service	E	A		E	A							
Approach Delay (s)		7.1			2.8			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	50.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

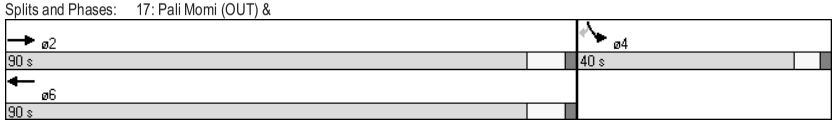
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1830	1049	295	70
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	28.0	28.0
Total Split (s)	90.0	90.0	40.0	40.0
Total Split (%)	69.2%	69.2%	30.8%	30.8%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1830	1049	0	295	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.90
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1382
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1382
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1989	1140	0	321	76
RTOR Reduction (vph)	0	0	0	0	0	56
Lane Group Flow (vph)	0	1989	1140	0	321	20
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		82.0	82.0		34.0	34.0
Effective Green, g (s)		82.0	82.0		34.0	34.0
Actuated g/C Ratio		0.63	0.63		0.26	0.26
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2994	2994		868	361
v/s Ratio Prot		c0.42	0.24		c0.10	
v/s Ratio Perm						0.01
v/c Ratio		0.66	0.38		0.37	0.06
Uniform Delay, d1		15.3	11.7		39.2	36.0
Progression Factor		0.32	1.00		1.00	1.00
Incremental Delay, d2		1.0	0.4		1.2	0.3
Delay (s)		5.9	12.0		40.5	36.3
Level of Service		A	B		D	D
Approach Delay (s)		5.9	12.0		39.6	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/1/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1109	21	17	1756	13	19
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1205	23	18	1909	14	21
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.66	
vC, conflicting volume			1228		2208	614
vC1, stage 1 conf vol					1217	
vC2, stage 2 conf vol					991	
vCu, unblocked vol			1228		1805	614
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			97		94	95
cM capacity (veh/h)			563		223	435

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	804	425	18	954	954	35
Volume Left	0	0	18	0	0	14
Volume Right	0	23	0	0	0	21
cSH	1700	1700	563	1700	1700	314
Volume to Capacity	0.47	0.25	0.03	0.56	0.56	0.11
Queue Length 95th (ft)	0	0	3	0	0	9
Control Delay (s)	0.0	0.0	11.6	0.0	0.0	17.9
Lane LOS			B			C
Approach Delay (s)	0.0		0.1			17.9
Approach LOS						C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/1/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	52	1093	1675	77	58	78
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	57	1188	1821	84	63	85
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.66				0.66	0.66
vC, conflicting volume	1904				2570	952
vC1, stage 1 conf vol					1862	
vC2, stage 2 conf vol					707	
vCu, unblocked vol	1332				2345	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	83				53	88
cM capacity (veh/h)	338				134	712

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	57	594	594	1214	691	148
Volume Left	57	0	0	0	0	63
Volume Right	0	0	0	0	84	85
cSH	338	1700	1700	1700	1700	251
Volume to Capacity	0.17	0.35	0.35	0.71	0.41	0.59
Queue Length 95th (ft)	15	0	0	0	0	85
Control Delay (s)	17.8	0.0	0.0	0.0	0.0	37.9
Lane LOS	C					E
Approach Delay (s)	0.8			0.0		37.9
Approach LOS						E

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

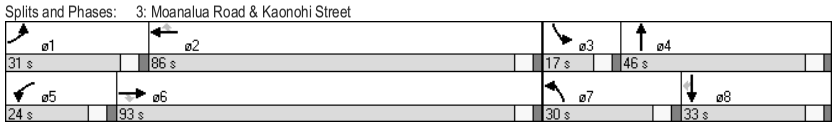
Timings
3: Moanalua Road & Kaonohi Street

7/1/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	182	813	179	96	1276	263	360	137	113	88	124
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	33.0	11.0	33.0	33.0
Total Split (s)	31.0	93.0	93.0	24.0	86.0	86.0	30.0	46.0	17.0	33.0	33.0
Total Split (%)	17.2%	51.7%	51.7%	13.3%	47.8%	47.8%	16.7%	25.6%	9.4%	18.3%	18.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 180
Actuated Cycle Length: 160.2
Natural Cycle: 130
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	182	813	179	96	1276	263	360	137	101	113	88	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3314		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3314		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	198	884	195	104	1387	286	391	149	110	123	96	135
RTOR Reduction (vph)	0	0	91	0	0	117	0	82	0	0	0	123
Lane Group Flow (vph)	198	884	104	104	1387	169	391	177	0	123	96	12
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	22.1	85.3	85.3	14.7	77.9	77.9	22.3	25.9		10.2	13.8	13.8
Effective Green, g (s)	22.1	85.3	85.3	14.7	77.9	77.9	22.3	25.9		10.2	13.8	13.8
Actuated g/C Ratio	0.14	0.53	0.53	0.09	0.49	0.49	0.14	0.16		0.06	0.09	0.09
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	244	1886	843	163	1722	770	478	536		219	161	136
v/s Ratio Prot	c0.11	0.25		0.06	c0.39		c0.11	0.05		0.04	c0.05	
v/s Ratio Perm			0.07			0.11						0.01
v/c Ratio	0.81	0.47	0.12	0.64	0.81	0.22	0.82	0.33		0.56	0.60	0.09
Uniform Delay, d1	67.0	23.3	18.7	70.1	34.7	23.6	66.9	59.4		72.8	70.5	67.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	18.2	0.4	0.1	8.3	3.3	0.3	10.4	0.4		3.3	5.8	0.3
Delay (s)	85.2	23.7	18.8	78.4	38.0	23.9	77.4	59.8		76.1	76.3	67.6
Level of Service	F	C	B	E	D	C	E	E		E	E	E
Approach Delay (s)		32.5			38.1			70.4			72.9	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM Average Control Delay	44.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	160.1	Sum of lost time (s)	24.0
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	65	0	538	34	0	363	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	71	0	585	37	0	395	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	611	1016	395	998	998	165	395			622		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	567	992	339	973	973	165	339			622		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	92	100			100		
cM capacity (veh/h)	355	233	625	197	239	851	1159			955		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	71	167	167	167	120	395
Volume Left	0	0	0	0	0	0	0
Volume Right	0	71	0	0	0	37	0
cSH	1700	851	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.08	0.10	0.10	0.10	0.07	0.23
Queue Length 95th (ft)	0	7	0	0	0	0	0
Control Delay (s)	0.0	9.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	9.6	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay		0.6		
Intersection Capacity Utilization		22.4%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/1/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	94	170	422	66	83	286
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	102	185	459	72	90	311
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			TWLTL
Median storage veh)						2
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	830	265			530	
vC1, stage 1 conf vol	495					
vC2, stage 2 conf vol	336					
vCu, unblocked vol	830	265			530	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)	5.8					
tF (s)	3.5	3.3			2.2	
p0 queue free %	79	75			91	
cM capacity (veh/h)	484	733			1033	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	102	185	306	225	194	207
Volume Left	102	0	0	0	90	0
Volume Right	0	185	0	72	0	0
cSH	484	733	1700	1700	1033	1700
Volume to Capacity	0.21	0.25	0.18	0.13	0.09	0.12
Queue Length 95th (ft)	20	25	0	0	7	0
Control Delay (s)	14.4	11.6	0.0	0.0	4.5	0.0
Lane LOS	B	B			A	
Approach Delay (s)	12.6		0.0		2.2	
Approach LOS	B					

Intersection Summary				
Average Delay		3.7		
Intersection Capacity Utilization		39.3%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	0	4	144	0	94	0	388	82	52	332	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	4	157	0	102	0	422	89	57	361	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	788	986	182	764	942	255	363			511		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	788	986	182	764	942	255	363			511		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	99	44	100	86	100			95		
cM capacity (veh/h)	233	233	830	279	247	744	1192			1051		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	8	157	102	281	230	57	241	122
Volume Left	3	157	0	0	0	57	0	0
Volume Right	4	0	102	0	89	0	0	2
cSH	395	279	744	1700	1700	1051	1700	1700
Volume to Capacity	0.02	0.56	0.14	0.17	0.14	0.05	0.14	0.07
Queue Length 95th (ft)	1	79	12	0	0	4	0	0
Control Delay (s)	14.3	33.1	10.6	0.0	0.0	8.6	0.0	0.0
Lane LOS	B	D	B			A		
Approach Delay (s)	14.3	24.2		0.0		1.2		
Approach LOS	B	C						

Intersection Summary				
Average Delay	5.7			
Intersection Capacity Utilization	41.3%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/1/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	25	24	17	448	427	39
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	26	18	487	464	42
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	1135	
pX, platoon unblocked						
vC, conflicting volume	766	253	507			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	766	253	507			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	92	97	98			
cM capacity (veh/h)	333	746	1054			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	53	181	325	309	197
Volume Left	27	18	0	0	0
Volume Right	26	0	0	0	42
cSH	457	1054	1700	1700	1700
Volume to Capacity	0.12	0.02	0.19	0.18	0.12
Queue Length 95th (ft)	10	1	0	0	0
Control Delay (s)	13.9	1.0	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	13.9	0.4		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	34.8%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/1/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	13	48	22	451	438	18
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	14	52	24	490	476	20
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	779	248	496			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	779	248	496			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	93	98			
cM capacity (veh/h)	325	752	1064			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	66	187	327	317	178
Volume Left	14	24	0	0	0
Volume Right	52	0	0	0	20
cSH	588	1064	1700	1700	1700
Volume to Capacity	0.11	0.02	0.19	0.19	0.10
Queue Length 95th (ft)	9	2	0	0	0
Control Delay (s)	11.9	1.3	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.9	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		39.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/1/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	62	38	431	46	27	465
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	67	41	468	50	29	505
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	721	259			518	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	721	259			518	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	94			97	
cM capacity (veh/h)	352	740			1044	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	109	312	206	130	202	202
Volume Left	67	0	0	29	0	0
Volume Right	41	0	50	0	0	0
cSH	440	1700	1700	1044	1700	1700
Volume to Capacity	0.25	0.18	0.12	0.03	0.12	0.12
Queue Length 95th (ft)	24	0	0	2	0	0
Control Delay (s)	15.9	0.0	0.0	2.1	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	15.9	0.0		0.5		
Approach LOS	C					

Intersection Summary				
Average Delay		1.7		
Intersection Capacity Utilization		38.7%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/1/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	32	101	112	452	473	50
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	110	122	491	514	54
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1030	199	514			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1030	199	514			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	83	86	88			
cM capacity (veh/h)	202	809	1048			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	145	122	246	246	206	206	157
Volume Left	35	122	0	0	0	0	0
Volume Right	110	0	0	0	0	0	54
cSH	470	1048	1700	1700	1700	1700	1700
Volume to Capacity	0.31	0.12	0.14	0.14	0.12	0.12	0.09
Queue Length 95th (ft)	32	10	0	0	0	0	0
Control Delay (s)	16.0	8.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	16.0	1.8			0.0		
Approach LOS	C						

Intersection Summary				
Average Delay		2.6		
Intersection Capacity Utilization		34.5%	ICU Level of Service	A
Analysis Period (min)		15		

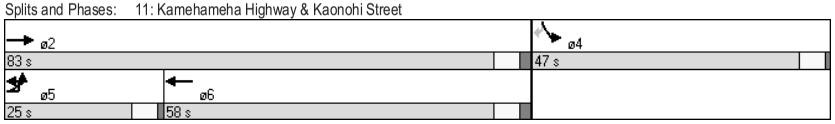
Timings
11: Kamehameha Highway & Kaonohi Street

7/1/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	201	1151	3351	274	287
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	26.0	28.0	33.0	33.0
Total Split (s)	25.0	83.0	58.0	47.0	47.0
Total Split (%)	19.2%	63.8%	44.6%	36.2%	36.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 64 (49%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/1/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	201	1151	3351	359	274	287
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		0.96	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4785		3340	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4785		3340	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	218	1251	3642	390	298	312
RTOR Reduction (vph)	0	0	6	0	43	163
Lane Group Flow (vph)	218	1251	4026	0	374	30
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	13.5	98.9	80.4		20.1	20.1
Effective Green, g (s)	13.5	98.9	80.4		20.1	20.1
Actuated g/C Ratio	0.10	0.76	0.62		0.15	0.15
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	357	3869	2959		516	223
v/s Ratio Prot	c0.06	0.25	c0.84		c0.11	
v/s Ratio Perm						0.02
v/c Ratio	0.61	0.32	1.36		0.72	0.13
Uniform Delay, d1	55.7	4.9	24.8		52.3	47.4
Progression Factor	1.17	1.43	1.06		1.00	1.00
Incremental Delay, d2	3.0	0.2	162.9		5.0	0.3
Delay (s)	68.2	7.3	189.1		57.3	47.7
Level of Service	E	A	F		E	D
Approach Delay (s)		16.3	189.1		54.3	
Approach LOS		B	F		D	

Intersection Summary			
HCM Average Control Delay	134.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	104.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Timings
13: Kamehameha Highway & Hekaha Street

7/1/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	44	981	173	2590	215	38	212	57	38	89
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	10.0	28.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	25.0	54.0	25.0	54.0	51.0	51.0	51.0	51.0	51.0	51.0
Total Split (%)	19.2%	41.5%	19.2%	41.5%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 100 (77%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 130
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street

ø1	ø2	ø4
25 s	54 s	51 s
ø5	ø6	ø8
25 s	54 s	51 s

HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	44	981	137	173	2590	71	215	38	212	57	38	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.95		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.98	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4642		3204	4724			1727	1449		1658	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.67	1.00		0.53	1.00
Satd. Flow (perm)	1652	4642		3204	4724			1211	1449		909	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	1066	149	188	2815	77	234	41	230	62	41	97
RTOR Reduction (vph)	0	11	0	0	1	0	0	0	168	0	0	71
Lane Group Flow (vph)	48	1204	0	188	2891	0	0	275	62	0	103	26
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	8.1	66.1		12.9	70.9			35.0	35.0		35.0	35.0
Effective Green, g (s)	8.1	66.1		12.9	70.9			35.0	35.0		35.0	35.0
Actuated g/C Ratio	0.06	0.51		0.10	0.55			0.27	0.27		0.27	0.27
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	103	2360		318	2576			326	390		245	398
v/s Ratio Prot	0.03	0.26		c0.06	c0.61							
v/s Ratio Perm								c0.23	0.04		0.11	0.02
v/c Ratio	0.47	0.51		0.59	1.12			0.84	0.16		0.42	0.07
Uniform Delay, d1	58.9	21.2		56.0	29.5			44.9	36.3		39.1	35.3
Progression Factor	1.06	1.33		1.16	0.55			1.00	1.00		1.00	1.00
Incremental Delay, d2	3.1	0.7		0.7	56.5			17.7	0.2		1.2	0.1
Delay (s)	65.6	29.0		66.0	72.7			62.6	36.5		40.3	35.4
Level of Service	E	C		E	E			E	D		D	D
Approach Delay (s)		30.3			72.3			50.7			37.9	
Approach LOS		C			E			D			D	

Intersection Summary			
HCM Average Control Delay	58.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	91.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

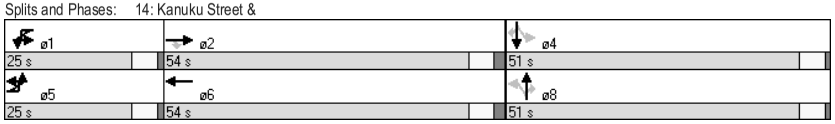
Timings
14: Kanuku Street &

7/1/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	31	1127	68	81	2993	83	10	49	55	11	30
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	33.0	33.0	33.0
Total Split (s)	25.0	54.0	54.0	25.0	54.0	51.0	51.0	51.0	51.0	51.0	51.0
Total Split (%)	19.2%	41.5%	41.5%	19.2%	41.5%	39.2%	39.2%	39.2%	39.2%	39.2%	39.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 83 (64%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	31	1127	68	81	2993	203	83	10	49	55	11	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1434	3204	4695			1691	1531		1669	1426
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.70	1.00		0.62	1.00
Satd. Flow (perm)	1652	4746	1434	3204	4695			1233	1531		1070	1426
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	34	1225	74	88	3253	221	90	11	53	60	12	33
RTOR Reduction (vph)	0	0	18	0	3	0	0	0	47	0	0	29
Lane Group Flow (vph)	34	1225	56	88	3471	0	0	101	6	0	72	4
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	5.7	89.2	89.2	8.9	92.4			15.9	15.9		15.9	15.9
Effective Green, g (s)	5.7	89.2	89.2	8.9	92.4			15.9	15.9		15.9	15.9
Actuated g/C Ratio	0.04	0.69	0.69	0.07	0.71			0.12	0.12		0.12	0.12
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	72	3256	984	219	3337			151	187		131	174
v/s Ratio Prot	0.02	0.26		c0.03	c0.74							
v/s Ratio Perm			0.04					c0.08	0.00		0.07	0.00
v/c Ratio	0.47	0.38	0.06	0.40	1.04			0.67	0.03		0.55	0.02
Uniform Delay, d1	60.7	8.6	6.7	58.0	18.8			54.5	50.3		53.7	50.2
Progression Factor	0.77	1.24	2.27	1.06	2.01			1.00	1.00		1.00	1.00
Incremental Delay, d2	4.3	0.3	0.1	0.1	19.3			10.7	0.1		4.7	0.1
Delay (s)	51.1	11.0	15.2	61.6	57.2			65.2	50.4		58.3	50.3
Level of Service	D	B	B	E	E			E	D		E	D
Approach Delay (s)		12.3			57.3			60.1			55.8	
Approach LOS		B			E			E			E	

Intersection Summary			
HCM Average Control Delay	45.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

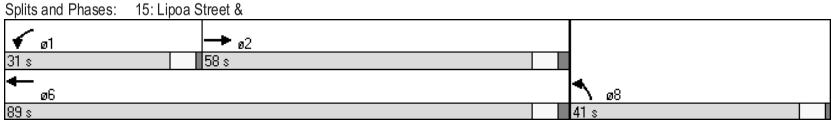
Timings
15: Lipoa Street &

7/1/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1251	88	3339	147
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	58.0	31.0	89.0	41.0
Total Split (%)	44.6%	23.8%	68.5%	31.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 55 (42%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/1/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1251	48	88	3339	147	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	*0.80	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5057		1770	4471	1748	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5057		1770	4471	1748	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1360	52	96	3629	160	32
RTOR Reduction (vph)	2	0	0	0	7	0
Lane Group Flow (vph)	1410	0	96	3629	185	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	82.5		12.4	99.9	19.1	
Effective Green, g (s)	82.5		12.4	99.9	19.1	
Actuated g/C Ratio	0.63		0.10	0.77	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3209		169	3436	257	
v/s Ratio Prot	0.28		0.05	c0.81	c0.11	
v/s Ratio Perm						
v/c Ratio	0.44		0.57	1.06	0.72	
Uniform Delay, d1	12.0		56.2	15.0	52.9	
Progression Factor	1.73		1.02	0.67	1.00	
Incremental Delay, d2	0.4		2.3	29.8	9.5	
Delay (s)	21.2		59.5	39.8	62.4	
Level of Service	C		E	D	E	
Approach Delay (s)	21.2			40.3	62.4	
Approach LOS	C			D	E	

Intersection Summary			
HCM Average Control Delay	36.0	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	83.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Timings
16: Pali Momi IN &

7/1/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	227	1015	111	2927
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	40.0	90.0	40.0	90.0
Total Split (%)	30.8%	69.2%	30.8%	69.2%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 30 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &

ø1	ø2
40 s	90 s
ø5	ø6
40 s	90 s

HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	227	1015	28	111	2927	355	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4727		1652	4626							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4727		1652	4626							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	247	1103	30	121	3182	386	0	0	0	0	0	0
RTOR Reduction (vph)	0	1	0	0	7	0	0	0	0	0	0	0
Lane Group Flow (vph)	247	1132	0	121	3561	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	15.4	104.1		14.9	103.6							
Effective Green, g (s)	15.4	104.1		14.9	103.6							
Actuated g/C Ratio	0.12	0.80		0.11	0.80							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	380	3785		189	3687							
v/s Ratio Prot	c0.08	0.24		0.07	c0.77							
v/s Ratio Perm												
v/c Ratio	0.65	0.30		0.64	0.97							
Uniform Delay, d1	54.7	3.4		55.0	11.6							
Progression Factor	0.87	0.60		1.11	0.18							
Incremental Delay, d2	3.6	0.2		2.9	4.3							
Delay (s)	51.1	2.2		63.7	6.4							
Level of Service	D	A		E	A							
Approach Delay (s)		11.0			8.3			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	9.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

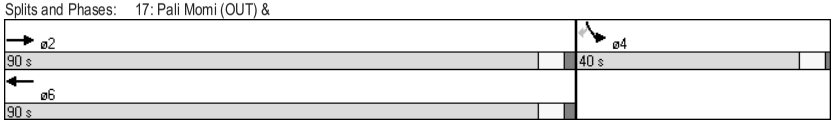
Timings
17: Pali Momi (OUT) &

7/1/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1015	3175	285	131
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	23.0	33.0	33.0
Total Split (s)	90.0	90.0	40.0	40.0
Total Split (%)	69.2%	69.2%	30.8%	30.8%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 25 (19%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 130
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/1/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1015	3175	0	285	131
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1306
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1306
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1103	3451	0	310	142
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	0	1103	3451	0	310	141
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		98.9	98.9		20.1	20.1
Effective Green, g (s)		98.9	98.9		20.1	20.1
Actuated g/C Ratio		0.76	0.76		0.15	0.15
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3611	3611		513	202
v/s Ratio Prot		0.23	c0.73		0.09	
v/s Ratio Perm						c0.11
v/c Ratio		0.31	0.96		0.60	0.70
Uniform Delay, d1		4.8	13.6		51.2	52.1
Progression Factor		0.49	1.00		1.00	1.00
Incremental Delay, d2		0.2	7.7		2.0	10.1
Delay (s)		2.6	21.4		53.3	62.2
Level of Service		A	C		D	E
Approach Delay (s)		2.6	21.4		56.1	
Approach LOS		A	C		E	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	92.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1530	23	26	1509	14	73
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1663	25	28	1640	15	79
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.78	
vC, conflicting volume			1688		2552	844
vC1, stage 1 conf vol					1676	
vC2, stage 2 conf vol					877	
vCu, unblocked vol			1688		2423	844
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			92		88	74
cM capacity (veh/h)			375		129	307

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1109	579	28	820	820	95
Volume Left	0	0	28	0	0	15
Volume Right	0	25	0	0	0	79
cSH	1700	1700	375	1700	1700	251
Volume to Capacity	0.65	0.34	0.08	0.48	0.48	0.38
Queue Length 95th (ft)	0	0	6	0	0	42
Control Delay (s)	0.0	0.0	15.4	0.0	0.0	27.7
Lane LOS			C			D
Approach Delay (s)	0.0		0.3			27.7
Approach LOS						D

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	55.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	4	1603	1538	13	13	11
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	1742	1672	14	14	12
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.77				0.77	0.77
vC, conflicting volume	1686				2559	843
vC1, stage 1 conf vol					1679	
vC2, stage 2 conf vol					880	
vCu, unblocked vol	1299				2429	209
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	98
cM capacity (veh/h)	409				150	616

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	4	871	871	1114	571	26
Volume Left	4	0	0	0	0	14
Volume Right	0	0	0	0	14	12
cSH	409	1700	1700	1700	1700	229
Volume to Capacity	0.01	0.51	0.51	0.66	0.34	0.11
Queue Length 95th (ft)	1	0	0	0	0	9
Control Delay (s)	13.9	0.0	0.0	0.0	0.0	22.7
Lane LOS	B					C
Approach Delay (s)	0.0			0.0		22.7
Approach LOS						C

Intersection Summary			
Average Delay		0.2	
Intersection Capacity Utilization		54.3%	ICU Level of Service	A
Analysis Period (min)		15	

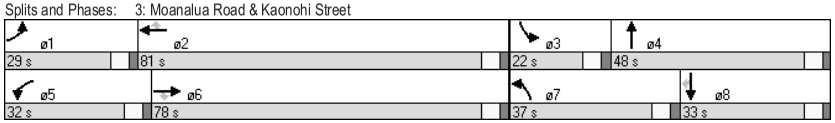
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	129	1089	391	163	952	195	428	165	180	136	179
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	33.0	11.0	33.0	33.0
Total Split (s)	29.0	78.0	78.0	32.0	81.0	81.0	37.0	48.0	22.0	33.0	33.0
Total Split (%)	16.1%	43.3%	43.3%	17.8%	45.0%	45.0%	20.6%	26.7%	12.2%	18.3%	18.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 180
Actuated Cycle Length: 159.6
Natural Cycle: 110
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	129	1089	391	163	952	195	428	165	281	180	136	179
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3205		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3205		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	140	1184	425	177	1035	212	465	179	305	196	148	195
RTOR Reduction (vph)	0	0	208	0	0	115	0	183	0	0	0	172
Lane Group Flow (vph)	140	1184	217	177	1035	97	465	301	0	196	148	23
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	17.6	69.4	69.4	21.1	72.9	72.9	26.4	30.9		13.9	18.4	18.4
Effective Green, g (s)	17.6	69.4	69.4	21.1	72.9	72.9	26.4	30.9		13.9	18.4	18.4
Actuated g/C Ratio	0.11	0.44	0.44	0.13	0.46	0.46	0.17	0.19		0.09	0.12	0.12
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	196	1542	690	234	1620	724	569	622		300	215	183
v/s Ratio Prot	0.08	c0.33		c0.10	c0.29		c0.14	0.09		0.06	c0.08	
v/s Ratio Perm			0.14			0.06						0.01
v/c Ratio	0.71	0.77	0.31	0.76	0.64	0.13	0.82	0.48		0.65	0.69	0.12
Uniform Delay, d1	68.4	38.1	29.4	66.6	33.1	25.0	64.1	57.1		70.4	67.7	63.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.7	2.8	0.6	13.4	1.2	0.2	8.9	0.6		5.0	8.8	0.3
Delay (s)	80.1	40.9	30.0	80.0	34.3	25.1	73.0	57.7		75.4	76.5	63.5
Level of Service	F	D	C	F	C	C	E	E		E	E	E
Approach Delay (s)		41.4			38.6			65.2			71.4	
Approach LOS		D			D			E			E	

Intersection Summary				
HCM Average Control Delay	48.9	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.81			
Actuated Cycle Length (s)	159.3	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	78.5%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	35	0	0	149	0	747	86	0	578	125
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	38	0	0	162	0	812	93	0	628	136
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.92	0.92	0.92	0.92	0.92		0.92					
vC, conflicting volume	1061	1602	696	1593	1623	250	764			905		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1025	1610	631	1600	1633	250	704			905		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	90	100	100	78	100			100		
cM capacity (veh/h)	137	96	392	59	93	750	823			747		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	38	162	232	232	232	209	764
Volume Left	0	0	0	0	0	0	0
Volume Right	38	162	0	0	0	93	136
cSH	392	750	1700	1700	1700	1700	1700
Volume to Capacity	0.10	0.22	0.14	0.14	0.14	0.12	0.45
Queue Length 95th (ft)	8	20	0	0	0	0	0
Control Delay (s)	15.2	11.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B					
Approach Delay (s)	15.2	11.1	0.0				0.0
Approach LOS	C	B					

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	48.0%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	93	166	658	118	147	471
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	101	180	715	128	160	512
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	1355	422			843	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1355	422			843	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	10	69			80	
cM capacity (veh/h)	112	580			788	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	101	180	477	367	330	341
Volume Left	101	0	0	0	160	0
Volume Right	0	180	0	128	0	0
cSH	112	580	1700	1700	788	1700
Volume to Capacity	0.90	0.31	0.28	0.22	0.20	0.20
Queue Length 95th (ft)	138	33	0	0	19	0
Control Delay (s)	131.2	14.0	0.0	0.0	6.4	0.0
Lane LOS	F	B			A	
Approach Delay (s)	56.1		0.0		3.2	
Approach LOS	F					

Intersection Summary			
Average Delay		10.0	
Intersection Capacity Utilization		54.4%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	88	18	348	178	0	174	0	487	208	135	439	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	96	20	378	193	0	189	0	529	226	147	477	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	1226	1527	240	1562	1415	378	479			755		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1226	1527	240	1562	1415	378	479			755		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	80	50	0	100	69	100			83		
cM capacity (veh/h)	81	96	761	28	113	620	1079			851		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	493	193	189	353	403	147	318	161
Volume Left	96	193	0	0	0	147	0	0
Volume Right	378	0	189	0	226	0	0	2
cSH	263	28	620	1700	1700	851	1700	1700
Volume to Capacity	1.88	6.91	0.31	0.21	0.24	0.17	0.19	0.09
Queue Length 95th (ft)	856	Err	32	0	0	16	0	0
Control Delay (s)	440.9	Err	13.3	0.0	0.0	10.1	0.0	0.0
Lane LOS	F	F	B			B		
Approach Delay (s)	440.9	5062.9		0.0		2.4		
Approach LOS	F	F						

Intersection Summary			
Average Delay		955.1	
Intersection Capacity Utilization		79.0%	ICU Level of Service D
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	23	41	22	667	848	109
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	45	24	725	922	118
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	1391	520	1040			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1391	520	1040			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	81	91	96			
cM capacity (veh/h)	128	501	664			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	70	266	483	614	426
Volume Left	25	24	0	0	0
Volume Right	45	0	0	0	118
cSH	245	664	1700	1700	1700
Volume to Capacity	0.28	0.04	0.28	0.36	0.25
Queue Length 95th (ft)	28	3	0	0	0
Control Delay (s)	25.4	1.4	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	25.4	0.5		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	27	85	41	682	888	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	92	45	741	965	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	1439	496	992			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1439	496	992			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	82	94			
cM capacity (veh/h)	116	519	693			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	122	292	494	643	349
Volume Left	29	45	0	0	0
Volume Right	92	0	0	0	27
cSH	282	693	1700	1700	1700
Volume to Capacity	0.43	0.06	0.29	0.38	0.21
Queue Length 95th (ft)	52	5	0	0	0
Control Delay (s)	27.1	2.3	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	27.1	0.8		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	62.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	63	75	633	76	40	844
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	68	82	688	83	43	917
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	1122	385			771	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1122	385			771	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	64	87			95	
cM capacity (veh/h)	189	613			840	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	150	459	312	227	367	367
Volume Left	68	0	0	43	0	0
Volume Right	82	0	83	0	0	0
cSH	303	1700	1700	840	1700	1700
Volume to Capacity	0.49	0.27	0.18	0.05	0.22	0.22
Queue Length 95th (ft)	65	0	0	4	0	0
Control Delay (s)	27.9	0.0	0.0	2.3	0.0	0.0
Lane LOS	D			A		
Approach Delay (s)	27.9	0.0		0.5		
Approach LOS	D					

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	38	102	82	668	925	58
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	41	111	89	726	1005	63
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1578	367	1005			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1578	367	1005			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	53	82	87			
cM capacity (veh/h)	87	630	685			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	152	89	363	363	402	402	264
Volume Left	41	89	0	0	0	0	0
Volume Right	111	0	0	0	0	0	63
cSH	234	685	1700	1700	1700	1700	1700
Volume to Capacity	0.65	0.13	0.21	0.21	0.24	0.24	0.16
Queue Length 95th (ft)	100	11	0	0	0	0	0
Control Delay (s)	45.1	11.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	B					
Approach Delay (s)	45.1	1.2			0.0		
Approach LOS	E						

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

Timings
11: Kamehameha Highway & Kaonohi Street

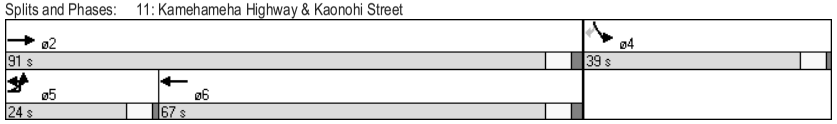
7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	362	1648	1389	541	480
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	26.0	28.0	33.0	33.0
Total Split (s)	24.0	91.0	67.0	39.0	39.0
Total Split (%)	18.5%	70.0%	51.5%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary

Cycle Length: 130
Actuated Cycle Length: 130
Offset: 14 (11%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	362	1648	1389	385	541	480
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.97		0.98	0.90
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		0.97	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4618		3283	1293
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4618		3283	1293
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	393	1791	1510	418	588	522
RTOR Reduction (vph)	0	0	38	0	21	196
Lane Group Flow (vph)	393	1791	1890	0	739	154
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	18.5	85.0	61.5		34.0	34.0
Effective Green, g (s)	18.5	85.0	61.5		34.0	34.0
Actuated g/C Ratio	0.14	0.65	0.47		0.26	0.26
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	456	3103	2185		859	338
v/s Ratio Prot	c0.12	0.38	c0.41		c0.22	
v/s Ratio Perm						0.12
v/c Ratio	0.86	0.58	0.87		0.86	0.45
Uniform Delay, d1	54.5	12.5	30.5		45.7	40.2
Progression Factor	0.91	1.23	0.67		1.00	1.00
Incremental Delay, d2	13.0	0.7	4.2		11.0	4.4
Delay (s)	62.8	16.1	24.5		56.7	44.6
Level of Service	E	B	C		E	D
Approach Delay (s)		24.5	24.5		52.9	
Approach LOS		C	C		D	

Intersection Summary

HCM Average Control Delay	30.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	90	1516	208	1616	195	50	294	84	35	130
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	33.0	9.0	28.0	27.0	27.0	27.0	26.0	26.0	26.0
Total Split (s)	16.0	68.0	17.0	69.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	12.3%	52.3%	13.1%	53.1%	34.6%	34.6%	34.6%	34.6%	34.6%	34.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 116 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street

ø1	ø2	ø4
17 s	68 s	45 s
ø5	ø6	ø8
16 s	69 s	45 s

HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1516	268	208	1616	57	195	50	294	84	35	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.97	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4625		3204	4717			1681	1531		1679	1423
Flt Permitted	0.95	1.00		0.95	1.00			0.65	1.00		0.50	1.00
Satd. Flow (perm)	1652	4625		3204	4717			1139	1531		875	1423
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	1648	291	226	1757	62	212	54	320	91	38	141
RTOR Reduction (vph)	0	19	0	0	3	0	0	0	119	0	0	98
Lane Group Flow (vph)	98	1920	0	226	1816	0	0	266	201	0	129	43
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	10.5	62.3		11.7	63.5			40.0	40.0		40.0	40.0
Effective Green, g (s)	10.5	62.3		11.7	63.5			40.0	40.0		40.0	40.0
Actuated g/C Ratio	0.08	0.48		0.09	0.49			0.31	0.31		0.31	0.31
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	133	2216		288	2304			350	471		269	438
v/s Ratio Prot	0.06	c0.42		c0.07	0.38							
v/s Ratio Perm								c0.23	0.13		0.15	0.03
v/c Ratio	0.74	0.87		0.78	0.79			0.76	0.43		0.48	0.10
Uniform Delay, d1	58.4	30.1		57.9	27.7			40.7	35.9		36.5	32.1
Progression Factor	0.95	0.81		1.40	0.32			1.00	1.00		1.00	1.00
Incremental Delay, d2	11.0	2.7		9.6	2.0			14.4	2.8		6.0	0.5
Delay (s)	66.4	27.1		90.9	11.0			55.0	38.7		42.6	32.6
Level of Service	E	C		F	B			E	D		D	C
Approach Delay (s)		29.0			19.8			46.1			37.3	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	27.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

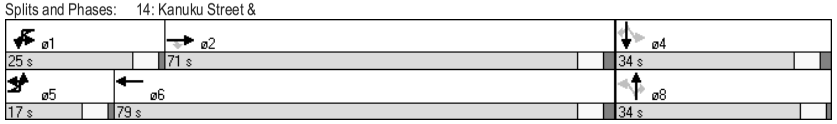
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	67	1651	96	99	1698	60	16	66	113	12	70
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	25.0	28.0	23.0	23.0	23.0	34.0	34.0	34.0
Total Split (s)	17.0	71.0	71.0	25.0	79.0	34.0	34.0	34.0	34.0	34.0	34.0
Total Split (%)	13.1%	54.6%	54.6%	19.2%	60.8%	26.2%	26.2%	26.2%	26.2%	26.2%	26.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 100 (77%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	67	1651	96	99	1698	216	60	16	66	113	12	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4666			1732	1531		1663	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.68	1.00		0.69	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4666			1232	1531		1196	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	73	1795	104	108	1846	235	65	17	72	123	13	76
RTOR Reduction (vph)	0	0	29	0	12	0	0	0	56	0	0	60
Lane Group Flow (vph)	73	1795	75	108	2069	0	0	82	16	0	136	16
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	8.9	75.3	75.3	9.7	76.1			29.0	29.0		28.0	28.0
Effective Green, g (s)	8.9	75.3	75.3	9.7	76.1			29.0	29.0		28.0	28.0
Actuated g/C Ratio	0.07	0.58	0.58	0.07	0.59			0.22	0.22		0.22	0.22
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	113	2749	856	239	2731			275	342		258	318
v/s Ratio Prot	c0.04	0.38		0.03	c0.44							
v/s Ratio Perm			0.05					0.07	0.01		c0.11	0.01
v/c Ratio	0.65	0.65	0.09	0.45	0.76			0.30	0.05		0.53	0.05
Uniform Delay, d1	59.0	18.5	12.1	57.6	20.1			42.0	39.7		45.1	40.5
Progression Factor	0.79	1.13	1.93	1.16	0.40			1.00	1.00		1.00	1.00
Incremental Delay, d2	7.1	0.7	0.1	0.8	1.3			2.8	0.3		7.5	0.3
Delay (s)	53.9	21.6	23.5	67.4	9.2			44.8	39.9		52.7	40.8
Level of Service	D	C	C	E	A			D	D		D	D
Approach Delay (s)		22.9			12.1			42.5			48.4	
Approach LOS		C			B			D			D	

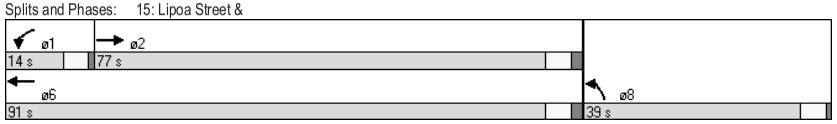
Intersection Summary			
HCM Average Control Delay	19.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	69.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1914	44	1815	149
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	26.0	39.0
Total Split (s)	77.0	14.0	91.0	39.0
Total Split (%)	59.2%	10.8%	70.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 74 (57%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1914	59	44	1815	149	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4722		1652	4746	1675	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4722		1652	4746	1675	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2080	64	48	1973	162	67
RTOR Reduction (vph)	2	0	0	0	13	0
Lane Group Flow (vph)	2142	0	48	1973	216	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	85.1		6.9	97.0	22.0	
Effective Green, g (s)	85.1		6.9	97.0	22.0	
Actuated g/C Ratio	0.65		0.05	0.75	0.17	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3091		88	3541	283	
v/s Ratio Prot	c0.45		0.03	c0.42	c0.13	
v/s Ratio Perm						
v/c Ratio	0.69		0.55	0.56	0.76	
Uniform Delay, d1	14.2		60.0	7.2	51.5	
Progression Factor	0.76		1.24	0.50	1.00	
Incremental Delay, d2	1.0		5.5	0.5	11.5	
Delay (s)	11.8		79.7	4.1	63.0	
Level of Service	B		E	A	E	
Approach Delay (s)	11.8			5.9	63.0	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	74.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

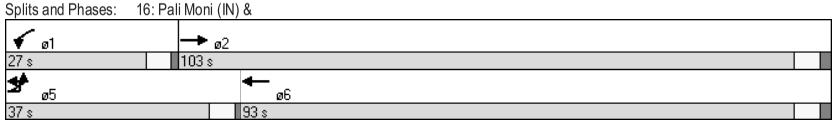
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	432	1463	137	1626
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	37.0	103.0	27.0	93.0
Total Split (%)	28.5%	79.2%	20.8%	71.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 50 (38%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

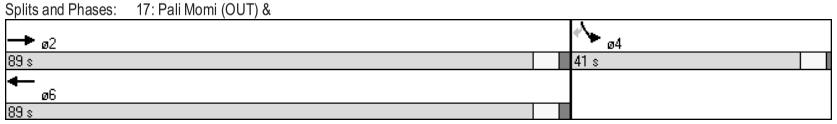
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	432	1463	47	137	1626	453	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4724		1652	4525							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4724		1652	4525							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	470	1590	51	149	1767	492	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	23	0	0	0	0	0	0	0
Lane Group Flow (vph)	470	1639	0	149	2236	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	24.3	102.3		16.7	94.7							
Effective Green, g (s)	24.3	102.3		16.7	94.7							
Actuated g/C Ratio	0.19	0.79		0.13	0.73							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	599	3717		212	3296							
v/s Ratio Prot	c0.15	0.35		0.09	c0.49							
v/s Ratio Perm												
v/c Ratio	0.78	0.44		0.70	0.68							
Uniform Delay, d1	50.4	4.5		54.3	9.5							
Progression Factor	0.67	1.14		1.10	0.43							
Incremental Delay, d2	4.9	0.3		8.6	1.0							
Delay (s)	38.7	5.4		68.1	5.0							
Level of Service	D	A		E	A							
Approach Delay (s)		12.8			8.9			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	10.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1425	1894	321	171
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	32.0	32.0
Total Split (s)	89.0	89.0	41.0	41.0
Total Split (%)	68.5%	68.5%	31.5%	31.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 58 (45%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1425	1894	0	321	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.83
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1265
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1265
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1549	2059	0	349	186
RTOR Reduction (vph)	0	0	0	0	0	11
Lane Group Flow (vph)	0	1549	2059	0	349	175
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		95.5	95.5		23.5	23.5
Effective Green, g (s)		95.5	95.5		23.5	23.5
Actuated g/C Ratio		0.73	0.73		0.18	0.18
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3486	3486		600	229
v/s Ratio Prot		0.33	c0.43		0.11	
v/s Ratio Perm						c0.14
v/c Ratio		0.44	0.59		0.58	0.77
Uniform Delay, d1		6.8	8.1		48.7	50.6
Progression Factor		0.31	1.00		1.00	1.00
Incremental Delay, d2		0.4	0.7		1.4	14.1
Delay (s)		2.5	8.8		50.2	64.8
Level of Service		A	A		D	E
Approach Delay (s)		2.5	8.8		55.3	
Approach LOS		A	A		E	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2015

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1525	15	30	1075	15	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1658	16	33	1168	16	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.90	
vC, conflicting volume			1674		2315	837
vC1, stage 1 conf vol					1666	
vC2, stage 2 conf vol					649	
vCu, unblocked vol			1674		2237	837
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			91		88	86
cM capacity (veh/h)			379		132	310

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1105	569	33	584	584	60
Volume Left	0	0	33	0	0	16
Volume Right	0	16	0	0	0	43
cSH	1700	1700	379	1700	1700	226
Volume to Capacity	0.65	0.33	0.09	0.34	0.34	0.26
Queue Length 95th (ft)	0	0	7	0	0	26
Control Delay (s)	0.0	0.0	15.4	0.0	0.0	26.5
Lane LOS			C			D
Approach Delay (s)	0.0		0.4			26.5
Approach LOS						D

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	52.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	155	1435	800	205	45	270
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	168	1560	870	223	49	293
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.85				0.85	0.85
vC, conflicting volume	1092				2098	546
vC1, stage 1 conf vol					981	
vC2, stage 2 conf vol					1117	
vCu, unblocked vol	743				1933	97
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	77				74	63
cM capacity (veh/h)	727				185	795

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	168	780	780	580	513	342
Volume Left	168	0	0	0	0	49
Volume Right	0	0	0	0	223	293
cSH	727	1700	1700	1700	1700	541
Volume to Capacity	0.23	0.46	0.46	0.34	0.30	0.63
Queue Length 95th (ft)	22	0	0	0	0	110
Control Delay (s)	11.4	0.0	0.0	0.0	0.0	22.4
Lane LOS	B					C
Approach Delay (s)	1.1			0.0		22.4
Approach LOS						C

Intersection Summary			
Average Delay		3.0	
Intersection Capacity Utilization		66.4%	ICU Level of Service C
Analysis Period (min)		15	

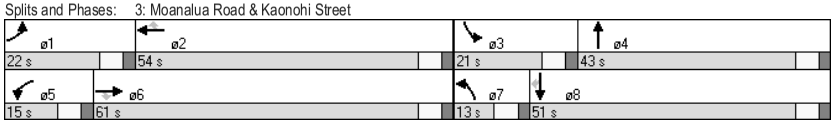
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	1175	195	75	715	95	75	80	275	215	225
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	22.0	61.0	61.0	15.0	54.0	54.0	13.0	43.0	21.0	51.0	51.0
Total Split (%)	15.7%	43.6%	43.6%	10.7%	38.6%	38.6%	9.3%	30.7%	15.0%	36.4%	36.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 113
Natural Cycle: 110
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1175	195	75	715	95	75	80	80	275	215	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1277	212	82	777	103	82	87	87	299	234	245
RTOR Reduction (vph)	0	0	113	0	0	58	0	76	0	0	0	177
Lane Group Flow (vph)	114	1277	99	82	777	45	82	98	0	299	234	68
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.3	53.6	53.6	8.8	50.1	50.1	5.4	13.9		14.0	22.5	22.5
Effective Green, g (s)	12.3	53.6	53.6	8.8	50.1	50.1	5.4	13.9		14.0	22.5	22.5
Actuated g/C Ratio	0.11	0.47	0.47	0.08	0.44	0.44	0.05	0.12		0.12	0.20	0.20
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	190	1660	742	136	1551	694	162	398		420	367	312
v/s Ratio Prot	c0.06	c0.36		0.05	0.22		0.02	0.03		c0.09	c0.13	
v/s Ratio Perm			0.06			0.03						0.04
v/c Ratio	0.60	0.77	0.13	0.60	0.50	0.07	0.51	0.25		0.71	0.64	0.22
Uniform Delay, d1	48.7	25.2	17.2	51.1	23.1	18.6	53.1	45.5		48.2	42.2	38.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.0	2.6	0.2	7.7	0.5	0.1	2.5	0.3		5.6	3.6	0.4
Delay (s)	53.7	27.8	17.4	58.8	23.6	18.6	55.6	45.8		53.8	45.8	38.9
Level of Service	D	C	B	E	C	B	E	D		D	D	D
Approach Delay (s)		28.3			26.1			48.9			46.7	
Approach LOS		C			C			D			D	

Intersection Summary				
HCM Average Control Delay	33.1	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.77			
Actuated Cycle Length (s)	114.3	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	72.1%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	10	0	240	20	0	505	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	11	0	261	22	0	549	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.89	0.89	0.89	0.89	0.89		0.89					
vC, conflicting volume	625	832	549	821	821	76	549			283		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	511	745	425	732	732	76	425			283		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	99	100			100		
cM capacity (veh/h)	390	302	511	273	307	970	1000			1277		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	11	75	75	75	59	549
Volume Left	0	0	0	0	0	0	0
Volume Right	0	11	0	0	0	22	0
cSH	1700	970	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.01	0.04	0.04	0.04	0.03	0.32
Queue Length 95th (ft)	0	1	0	0	0	0	0
Control Delay (s)	0.0	8.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	8.8	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	29.9%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	30	235	15	25	465
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	33	255	16	27	505
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	571	136			272	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	571	136			272	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	96			98	
cM capacity (veh/h)	442	888			1289	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	16	33	170	101	196	337
Volume Left	16	0	0	0	27	0
Volume Right	0	33	0	16	0	0
cSH	442	888	1700	1700	1289	1700
Volume to Capacity	0.04	0.04	0.10	0.06	0.02	0.20
Queue Length 95th (ft)	3	3	0	0	2	0
Control Delay (s)	13.5	9.2	0.0	0.0	1.2	0.0
Lane LOS	B	A			A	
Approach Delay (s)	10.6		0.0		0.5	
Approach LOS	B					

Intersection Summary				
Average Delay		0.9		
Intersection Capacity Utilization		33.9%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	30	0	10	0	230	35	35	460	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	33	0	11	0	250	38	38	500	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	712	864	250	595	845	144	500			288		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	712	864	250	595	845	144	500			288		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	91	100	99	100			97		
cM capacity (veh/h)	308	282	750	379	289	877	1060			1271		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	0	33	11	167	121	38	333	167
Volume Left	0	33	0	0	0	38	0	0
Volume Right	0	0	11	0	38	0	0	0
cSH	1700	379	877	1700	1700	1271	1700	1700
Volume to Capacity	0.00	0.09	0.01	0.10	0.07	0.03	0.20	0.10
Queue Length 95th (ft)	0	7	1	0	0	2	0	0
Control Delay (s)	0.0	15.4	9.2	0.0	0.0	7.9	0.0	0.0
Lane LOS	A	C	A			A		
Approach Delay (s)	0.0	13.8		0.0		0.6		
Approach LOS	A	B						

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		24.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	30	15	235	415	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	33	16	255	451	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	641	255	511			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	641	255	511			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	96	98			
cM capacity (veh/h)	401	744	1051			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	101	170	301	210
Volume Left	43	16	0	0	0
Volume Right	33	0	0	0	60
cSH	499	1051	1700	1700	1700
Volume to Capacity	0.15	0.02	0.10	0.18	0.12
Queue Length 95th (ft)	13	1	0	0	0
Control Delay (s)	13.5	1.5	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	13.5	0.6		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.4		
Intersection Capacity Utilization		28.5%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	45	20	240	445	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	49	22	261	484	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	660	245	489			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	660	245	489			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	94	98			
cM capacity (veh/h)	388	756	1070			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	109	174	322	167
Volume Left	16	22	0	0	0
Volume Right	49	0	0	0	5
cSH	611	1070	1700	1700	1700
Volume to Capacity	0.11	0.02	0.10	0.19	0.10
Queue Length 95th (ft)	9	2	0	0	0
Control Delay (s)	11.6	1.8	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.6	0.7		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.1		
Intersection Capacity Utilization		32.2%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	245	50	25	465
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	266	54	27	505
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	516	160			321	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	516	160			321	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	98			98	
cM capacity (veh/h)	478	856			1236	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	178	143	128	202	202
Volume Left	49	0	0	27	0	0
Volume Right	16	0	54	0	0	0
cSH	537	1700	1700	1236	1700	1700
Volume to Capacity	0.12	0.10	0.08	0.02	0.12	0.12
Queue Length 95th (ft)	10	0	0	2	0	0
Control Delay (s)	12.6	0.0	0.0	1.8	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	12.6	0.0		0.4		
Approach LOS	B					

Intersection Summary				
Average Delay		1.2		
Intersection Capacity Utilization		31.3%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	80	145	55	210	485	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	158	60	228	527	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	780	195	527			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	780	195	527			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	72	81	94			
cM capacity (veh/h)	313	814	1036			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	245	60	114	114	211	211	143
Volume Left	87	60	0	0	0	0	0
Volume Right	158	0	0	0	0	0	38
cSH	519	1036	1700	1700	1700	1700	1700
Volume to Capacity	0.47	0.06	0.07	0.07	0.12	0.12	0.08
Queue Length 95th (ft)	62	5	0	0	0	0	0
Control Delay (s)	18.0	8.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	18.0	1.8			0.0		
Approach LOS	C						

Intersection Summary				
Average Delay		4.5		
Intersection Capacity Utilization		36.8%	ICU Level of Service	A
Analysis Period (min)		15		

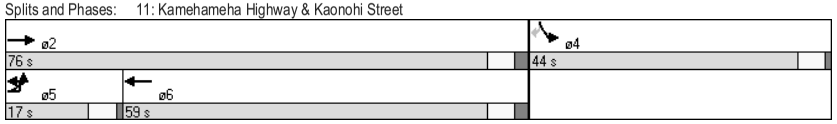
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	125	1655	775	525	110
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	17.0	76.0	59.0	44.0	44.0
Total Split (%)	14.2%	63.3%	49.2%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 68 (57%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	125	1655	775	165	525	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	0.93
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4723		3430	1343
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4723		3430	1343
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	136	1799	842	179	571	120
RTOR Reduction (vph)	0	0	21	0	2	85
Lane Group Flow (vph)	136	1799	1000	0	581	23
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	10.1	82.9	67.8		26.1	26.1
Effective Green, g (s)	10.1	82.9	67.8		26.1	26.1
Actuated g/C Ratio	0.08	0.69	0.56		0.22	0.22
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	270	3279	2668		746	292
v/s Ratio Prot	0.04	c0.38	0.21		c0.17	
v/s Ratio Perm						0.02
v/c Ratio	0.50	0.55	0.37		0.78	0.08
Uniform Delay, d1	52.6	9.2	14.4		44.2	37.4
Progression Factor	1.26	0.47	0.74		1.00	1.00
Incremental Delay, d2	1.3	0.6	0.4		5.2	0.1
Delay (s)	67.7	4.9	11.1		49.4	37.5
Level of Service	E	A	B		D	D
Approach Delay (s)		9.3	11.1		47.5	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	17.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1635	85	825	55	5	55	110	15	75
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	1.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	6.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	14.0	69.0	12.0	67.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	11.7%	57.5%	10.0%	55.8%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 72 (60%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street

ø1	ø2	ø4
12 s	69 s	39 s
ø5	ø6	ø8
14 s	67 s	39 s

HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1635	180	85	825	30	55	5	55	110	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.96		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.99		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4663		3204	4717			1720	1469		1644	1459
Flt Permitted	0.95	1.00		0.95	1.00			0.54	1.00		0.71	1.00
Satd. Flow (perm)	1652	4663		3204	4717			963	1469		1210	1459
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1777	196	92	897	33	60	5	60	120	16	82
RTOR Reduction (vph)	0	8	0	0	2	0	0	0	51	0	0	69
Lane Group Flow (vph)	54	1965	0	92	928	0	0	65	9	0	136	13
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.0	78.3		6.9	78.2			18.8	18.8		18.8	18.8
Effective Green, g (s)	7.0	78.3		6.9	78.2			18.8	18.8		18.8	18.8
Actuated g/C Ratio	0.06	0.65		0.06	0.65			0.16	0.16		0.16	0.16
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	96	3043		184	3074			151	230		190	229
v/s Ratio Prot	c0.03	c0.42		0.03	0.20							
v/s Ratio Perm								0.07	0.01		c0.11	0.01
v/c Ratio	0.56	0.65		0.50	0.30			0.43	0.04		0.72	0.06
Uniform Delay, d1	55.0	12.5		54.9	9.1			45.8	42.9		48.1	43.1
Progression Factor	0.93	0.69		0.88	0.96			1.00	1.00		1.00	1.00
Incremental Delay, d2	6.0	0.9		2.1	0.2			2.0	0.1		12.1	0.1
Delay (s)	56.9	9.5		50.5	9.0			47.7	43.0		60.1	43.2
Level of Service	E	A		D	A			D	D		E	D
Approach Delay (s)		10.8			12.7			45.5			53.8	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

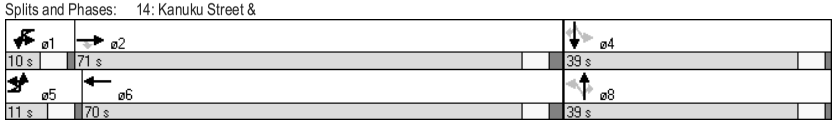
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	25	1685	20	15	895	5	5	15	135	10	40
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	11.0	71.0	71.0	10.0	70.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	9.2%	59.2%	59.2%	8.3%	58.3%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 105 (88%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	1685	20	15	895	65	5	5	15	135	10	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1451	3204	4692			1754	1531		1661	1454
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1451	3204	4692			1588	1531		1276	1454
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	1832	22	16	973	71	5	5	16	147	11	43
RTOR Reduction (vph)	0	0	5	0	5	0	0	0	13	0	0	36
Lane Group Flow (vph)	27	1832	17	16	1039	0	0	10	3	0	158	7
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.6	81.8	81.8	2.0	80.2			20.2	20.2		20.2	20.2
Effective Green, g (s)	3.6	81.8	81.8	2.0	80.2			20.2	20.2		20.2	20.2
Actuated g/C Ratio	0.03	0.68	0.68	0.02	0.67			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	50	3235	989	53	3136			267	258		215	245
v/s Ratio Prot	c0.02	c0.39		0.00	0.22							
v/s Ratio Perm			0.01					0.01	0.00		c0.12	0.00
v/c Ratio	0.54	0.57	0.02	0.30	0.33			0.04	0.01		0.73	0.03
Uniform Delay, d1	57.4	9.9	6.2	58.3	8.5			41.8	41.6		47.4	41.7
Progression Factor	1.11	0.56	0.39	0.77	1.58			1.00	1.00		1.00	1.00
Incremental Delay, d2	9.1	0.6	0.0	3.1	0.3			0.1	0.0		12.2	0.0
Delay (s)	72.5	6.2	2.5	48.0	13.7			41.8	41.6		59.6	41.8
Level of Service	E	A	A	D	B			D	D		E	D
Approach Delay (s)		7.1			14.2			41.7			55.8	
Approach LOS		A			B			D			E	

Intersection Summary				
HCM Average Control Delay	12.8	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.57			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	60.6%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

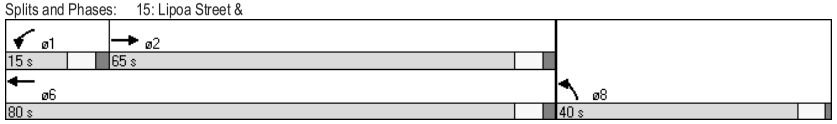
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2145	45	940	70
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	33.0	39.0
Total Split (s)	65.0	15.0	80.0	40.0
Total Split (%)	54.2%	12.5%	66.7%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 119 (99%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2145	50	45	940	70	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		6.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4730		1652	4746	1651	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4730		1652	4746	1651	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2332	54	49	1022	76	65
RTOR Reduction (vph)	1	0	0	0	32	0
Lane Group Flow (vph)	2385	0	49	1022	109	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	82.9		6.9	95.8	13.2	
Effective Green, g (s)	82.9		6.9	95.8	13.2	
Actuated g/C Ratio	0.69		0.06	0.80	0.11	
Clearance Time (s)	6.0		6.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3268		95	3789	182	
v/s Ratio Prot	c0.50		c0.03	0.22	c0.07	
v/s Ratio Perm						
v/c Ratio	0.73		0.52	0.27	0.60	
Uniform Delay, d1	11.6		54.9	3.1	50.9	
Progression Factor	0.35		0.87	0.98	1.00	
Incremental Delay, d2	1.3		4.5	0.2	5.2	
Delay (s)	5.3		52.1	3.2	56.1	
Level of Service	A		D	A	E	
Approach Delay (s)	5.3			5.5	56.1	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	7.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

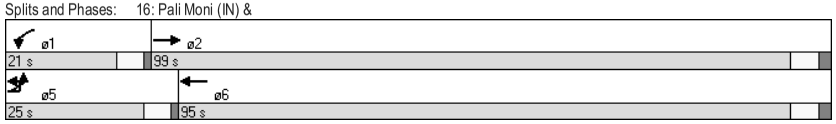
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	195	2040	45	970
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	25.0	99.0	21.0	95.0
Total Split (%)	20.8%	82.5%	17.5%	79.2%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 105 (88%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 40
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	2040	15	45	970	175	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4741		1652	4638							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4741		1652	4638							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	2217	16	49	1054	190	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	0	0	0	0	0
Lane Group Flow (vph)	212	2233	0	49	1227	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	13.2	101.2		7.8	95.8							
Effective Green, g (s)	13.2	101.2		7.8	95.8							
Actuated g/C Ratio	0.11	0.84		0.06	0.80							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	352	3998		107	3703							
v/s Ratio Prot	c0.07	c0.47		0.03	0.26							
v/s Ratio Perm												
v/c Ratio	0.60	0.56		0.46	0.33							
Uniform Delay, d1	50.9	2.8		54.1	3.3							
Progression Factor	0.93	0.41		1.04	0.46							
Incremental Delay, d2	2.1	0.4		3.0	0.2							
Delay (s)	49.5	1.6		59.1	1.7							
Level of Service	D	A		E	A							
Approach Delay (s)		5.7			3.9			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	52.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

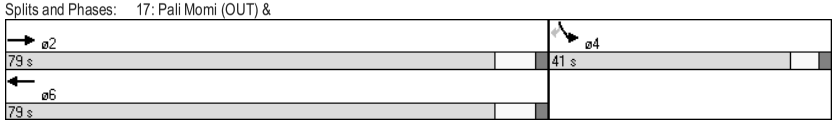
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1930	1105	315	75
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	79.0	79.0	41.0	41.0
Total Split (%)	65.8%	65.8%	34.2%	34.2%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 7 (6%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1930	1105	0	315	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.94
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1434
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1434
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2098	1201	0	342	82
RTOR Reduction (vph)	0	0	0	0	0	62
Lane Group Flow (vph)	0	2098	1201	0	342	20
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		88.3	88.3		17.7	17.7
Effective Green, g (s)		88.3	88.3		17.7	17.7
Actuated g/C Ratio		0.74	0.74		0.15	0.15
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3492	3492		490	212
v/s Ratio Prot		c0.44	0.25		c0.10	
v/s Ratio Perm						0.01
v/c Ratio		0.60	0.34		0.70	0.09
Uniform Delay, d1		7.5	5.6		48.6	44.2
Progression Factor		0.15	1.00		1.00	1.00
Incremental Delay, d2		0.7	0.3		4.3	0.2
Delay (s)		1.8	5.9		52.9	44.4
Level of Service		A	A		D	D
Approach Delay (s)		1.8	5.9		51.3	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	73.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/1/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1170	25	20	1850	15	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1272	27	22	2011	16	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.61	
vC, conflicting volume			1299		2334	649
vC1, stage 1 conf vol					1285	
vC2, stage 2 conf vol					1049	
vCu, unblocked vol			1299		1901	649
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			96		92	95
cM capacity (veh/h)			529		204	412

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	848	451	22	1005	1005	38
Volume Left	0	0	22	0	0	16
Volume Right	0	27	0	0	0	22
cSH	1700	1700	529	1700	1700	286
Volume to Capacity	0.50	0.27	0.04	0.59	0.59	0.13
Queue Length 95th (ft)	0	0	3	0	0	11
Control Delay (s)	0.0	0.0	12.1	0.0	0.0	19.5
Lane LOS			B			C
Approach Delay (s)	0.0		0.1			19.5
Approach LOS						C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/1/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	55	1155	1765	80	60	80
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	1255	1918	87	65	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.60				0.60	0.60
vC, conflicting volume	2005				2709	1003
vC1, stage 1 conf vol					1962	
vC2, stage 2 conf vol					747	
vCu, unblocked vol	1338				2514	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	80				47	87
cM capacity (veh/h)	306				122	649

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	60	628	628	1279	726	152
Volume Left	60	0	0	0	0	65
Volume Right	0	0	0	0	87	87
cSH	306	1700	1700	1700	1700	228
Volume to Capacity	0.20	0.37	0.37	0.75	0.43	0.67
Queue Length 95th (ft)	18	0	0	0	0	104
Control Delay (s)	19.6	0.0	0.0	0.0	0.0	47.7
Lane LOS	C					E
Approach Delay (s)	0.9			0.0		47.7
Approach LOS						E

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		

Timings
3: Moanalua Road & Kaonohi Street

7/1/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	195	860	190	105	1345	280	380	145	120	95	135
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	22.0	62.0	62.0	23.0	63.0	63.0	22.0	49.0	16.0	43.0	43.0
Total Split (%)	14.7%	41.3%	41.3%	15.3%	42.0%	42.0%	14.7%	32.7%	10.7%	28.7%	28.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 125.3
Natural Cycle: 150
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street

ø1	ø2	ø3	ø4
22 s	63 s	16 s	49 s
ø5	**ø6**	**ø7**	**ø8**
23 s	62 s	22 s	43 s

HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	860	190	105	1345	280	380	145	110	120	95	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3310		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3310		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	935	207	114	1462	304	413	158	120	130	103	147
RTOR Reduction (vph)	0	0	108	0	0	135	0	102	0	0	0	133
Lane Group Flow (vph)	212	935	99	114	1462	169	413	176	0	130	103	14
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	16.0	59.6	59.6	13.4	57.0	57.0	16.0	18.9		9.3	12.2	12.2
Effective Green, g (s)	16.0	59.6	59.6	13.4	57.0	57.0	16.0	18.9		9.3	12.2	12.2
Actuated g/C Ratio	0.13	0.48	0.48	0.11	0.46	0.46	0.13	0.15		0.07	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	226	1685	754	189	1611	721	439	500		255	182	154
v/s Ratio Prot	c0.12	c0.26		0.06	c0.41		c0.12	0.05		0.04	c0.06	
v/s Ratio Perm			0.06			0.11						0.01
v/c Ratio	0.94	0.55	0.13	0.60	0.91	0.23	0.94	0.35		0.51	0.57	0.09
Uniform Delay, d1	54.1	23.4	18.3	53.4	31.7	20.8	54.1	47.7		55.8	54.0	51.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	42.5	0.7	0.2	5.6	8.2	0.4	28.5	0.4		1.6	4.0	0.3
Delay (s)	96.6	24.0	18.5	59.0	39.9	21.1	82.6	48.1		57.4	58.0	51.7
Level of Service	F	C	B	E	D	C	F	D		E	E	D
Approach Delay (s)		34.5			38.0			68.7			55.3	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM Average Control Delay	43.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	125.2	Sum of lost time (s)	30.0
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	70	0	570	40	0	385	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	76	0	620	43	0	418	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	649	1082	418	1060	1060	177	418			663		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	606	1060	363	1037	1037	177	363			663		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	91	100			100		
cM capacity (veh/h)	330	212	603	176	219	836	1134			922		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	76	177	177	177	132	418
Volume Left	0	0	0	0	0	0	0
Volume Right	0	76	0	0	0	43	0
cSH	1700	836	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.09	0.10	0.10	0.10	0.08	0.25
Queue Length 95th (ft)	0	7	0	0	0	0	0
Control Delay (s)	0.0	9.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	9.7	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay		0.6		
Intersection Capacity Utilization		23.6%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/1/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	100	180	445	70	90	305
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	196	484	76	98	332
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	883	280			560	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	883	280			560	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	58	73			90	
cM capacity (veh/h)	257	717			1007	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	109	196	322	237	208	221
Volume Left	109	0	0	0	98	0
Volume Right	0	196	0	76	0	0
cSH	257	717	1700	1700	1007	1700
Volume to Capacity	0.42	0.27	0.19	0.14	0.10	0.13
Queue Length 95th (ft)	50	28	0	0	8	0
Control Delay (s)	28.8	11.9	0.0	0.0	4.7	0.0
Lane LOS	D	B			A	
Approach Delay (s)	17.9		0.0		2.3	
Approach LOS	C					

Intersection Summary				
Average Delay		5.0		
Intersection Capacity Utilization		41.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	0	5	155	0	100	0	410	90	55	350	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	168	0	109	0	446	98	60	380	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	834	1046	193	810	1000	272	386			543		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	834	1046	193	810	1000	272	386			543		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	99	35	100	85	100			94		
cM capacity (veh/h)	212	214	816	258	228	726	1169			1022		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	11	168	109	297	246	60	254	132
Volume Left	5	168	0	0	0	60	0	0
Volume Right	5	0	109	0	98	0	0	5
cSH	336	258	726	1700	1700	1022	1700	1700
Volume to Capacity	0.03	0.65	0.15	0.17	0.14	0.06	0.15	0.08
Queue Length 95th (ft)	2	103	13	0	0	5	0	0
Control Delay (s)	16.1	42.0	10.8	0.0	0.0	8.7	0.0	0.0
Lane LOS	C	E	B			A		
Approach Delay (s)	16.1	29.8		0.0		1.2		
Approach LOS	C	D						

Intersection Summary				
Average Delay	7.0			
Intersection Capacity Utilization	42.7%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/1/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	475	450	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	516	489	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	1135	
pX, platoon unblocked						
vC, conflicting volume	815	269	538			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	815	269	538			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	96	98			
cM capacity (veh/h)	309	729	1026			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	194	344	326	212
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	434	1026	1700	1700	1700
Volume to Capacity	0.15	0.02	0.20	0.19	0.12
Queue Length 95th (ft)	13	2	0	0	0
Control Delay (s)	14.8	1.1	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	14.8	0.4		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	38.0%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/1/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	475	465	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	516	505	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	829	264	527			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	829	264	527			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	92	97			
cM capacity (veh/h)	301	735	1036			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	199	344	337	190
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	22
cSH	561	1036	1700	1700	1700
Volume to Capacity	0.14	0.03	0.20	0.20	0.11
Queue Length 95th (ft)	12	2	0	0	0
Control Delay (s)	12.4	1.4	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	12.4	0.5		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/1/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	455	50	30	490
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	495	54	33	533
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	764	274			549	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	764	274			549	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	77	93			97	
cM capacity (veh/h)	329	723			1017	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	330	219	139	213	213
Volume Left	76	0	0	33	0	0
Volume Right	49	0	54	0	0	0
cSH	418	1700	1700	1017	1700	1700
Volume to Capacity	0.30	0.19	0.13	0.03	0.13	0.13
Queue Length 95th (ft)	31	0	0	2	0	0
Control Delay (s)	17.2	0.0	0.0	2.3	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	17.2	0.0		0.6		
Approach LOS	C					

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	40.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/1/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	110	120	480	500	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	120	130	522	543	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1095	211	543			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1095	211	543			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	79	85	87			
cM capacity (veh/h)	181	794	1022			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	158	130	261	261	217	217	168
Volume Left	38	130	0	0	0	0	0
Volume Right	120	0	0	0	0	0	60
cSH	438	1022	1700	1700	1700	1700	1700
Volume to Capacity	0.36	0.13	0.15	0.15	0.13	0.13	0.10
Queue Length 95th (ft)	40	11	0	0	0	0	0
Control Delay (s)	17.8	9.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	17.8	1.8			0.0		
Approach LOS	C						

Intersection Summary				
Average Delay		2.8		
Intersection Capacity Utilization		36.3%	ICU Level of Service	A
Analysis Period (min)		15		

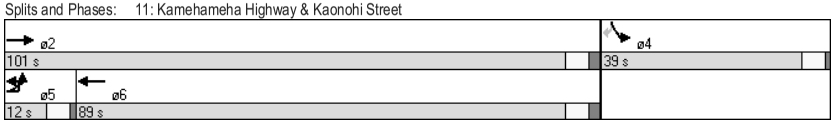
Timings
11: Kamehameha Highway & Kaonohi Street

7/1/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	215	1215	3875	290	305
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	39.0	39.0
Total Split (s)	12.0	101.0	89.0	39.0	39.0
Total Split (%)	8.6%	72.1%	63.6%	27.9%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 116 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/1/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	215	1215	3875	380	290	305
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		0.96	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4791		3338	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4791		3338	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	234	1321	4212	413	315	332
RTOR Reduction (vph)	0	0	7	0	37	71
Lane Group Flow (vph)	234	1321	4618	0	407	132
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	7.0	106.4	94.4		22.6	22.6
Effective Green, g (s)	7.0	106.4	94.4		22.6	22.6
Actuated g/C Ratio	0.05	0.76	0.67		0.16	0.16
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	172	3865	3231		539	233
v/s Ratio Prot	c0.07	0.26	c0.96		c0.12	
v/s Ratio Perm						0.09
v/c Ratio	1.36	0.34	1.43		0.76	0.57
Uniform Delay, d1	66.5	5.4	22.8		56.1	54.2
Progression Factor	0.82	0.83	0.56		1.00	1.00
Incremental Delay, d2	193.8	0.2	193.4		6.0	3.1
Delay (s)	248.5	4.8	206.1		62.0	57.3
Level of Service	F	A	F		E	E
Approach Delay (s)		41.4	206.1		60.5	
Approach LOS		D	F		E	

Intersection Summary			
HCM Average Control Delay	154.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	113.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

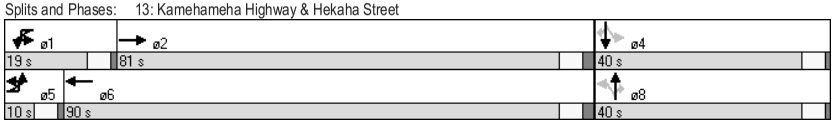
Timings
13: Kamehameha Highway & Hekaha Street

7/1/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1035	185	2730	230	45	225	65	45	95
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	33.0	8.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	10.0	81.0	19.0	90.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	7.1%	57.9%	13.6%	64.3%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 52 (37%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1035	145	185	2730	75	230	45	225	65	45	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4643		3204	4724			1728	1444		1665	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.63	1.00		0.41	1.00
Satd. Flow (perm)	1652	4643		3204	4724			1137	1444		706	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1125	158	201	2967	82	250	49	245	71	49	103
RTOR Reduction (vph)	0	13	0	0	2	0	0	0	130	0	0	50
Lane Group Flow (vph)	54	1270	0	201	3047	0	0	299	115	0	120	54
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	76.1		12.9	84.0			35.0	35.0		35.0	35.0
Effective Green, g (s)	5.0	76.1		12.9	84.0			35.0	35.0		35.0	35.0
Actuated g/C Ratio	0.04	0.54		0.09	0.60			0.25	0.25		0.25	0.25
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	59	2524		295	2834			284	361		177	370
v/s Ratio Prot	0.03	0.27		c0.06	c0.65							
v/s Ratio Perm								c0.26	0.08		0.17	0.04
v/c Ratio	0.92	0.50		0.68	1.08			1.05	0.32		0.68	0.14
Uniform Delay, d1	67.3	20.1		61.6	28.0			52.5	42.8		47.4	40.9
Progression Factor	1.14	0.69		1.19	0.71			1.00	1.00		1.00	1.00
Incremental Delay, d2	81.6	0.7		0.6	34.6			68.0	0.5		9.9	0.2
Delay (s)	158.4	14.4		73.7	54.5			120.5	43.3		57.3	41.0
Level of Service	F	B		E	D			F	D		E	D
Approach Delay (s)		20.2			55.7			85.7			49.8	
Approach LOS		C			E			F			D	

Intersection Summary			
HCM Average Control Delay	49.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

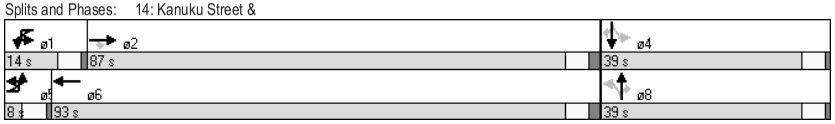
Timings
14: Kanuku Street &

7/1/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1190	75	90	3155	90	15	55	60	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	87.0	87.0	14.0	93.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	5.7%	62.1%	62.1%	10.0%	66.4%	27.9%	27.9%	27.9%	27.9%	27.9%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 55 (39%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1190	75	90	3155	215	90	15	55	60	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1432	3204	4694			1699	1531		1671	1430
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.67	1.00		0.57	1.00
Satd. Flow (perm)	1652	4746	1432	3204	4694			1189	1531		990	1430
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1293	82	98	3429	234	98	16	60	65	16	38
RTOR Reduction (vph)	0	0	25	0	4	0	0	0	52	0	0	33
Lane Group Flow (vph)	38	1293	57	98	3659	0	0	114	8	0	81	5
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	97.3	97.3	8.5	102.8			18.2	18.2		18.2	18.2
Effective Green, g (s)	3.0	97.3	97.3	8.5	102.8			18.2	18.2		18.2	18.2
Actuated g/C Ratio	0.02	0.69	0.69	0.06	0.73			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	35	3298	995	195	3447			155	199		129	186
v/s Ratio Prot	c0.02	0.27		0.03	c0.78							
v/s Ratio Perm			0.04					c0.10	0.01		0.08	0.00
v/c Ratio	1.09	0.39	0.06	0.50	1.06			0.74	0.04		0.63	0.03
Uniform Delay, d1	68.5	9.0	6.8	63.7	18.6			58.6	53.3		57.7	53.2
Progression Factor	0.97	0.49	0.23	1.20	0.15			1.00	1.00		1.00	1.00
Incremental Delay, d2	168.4	0.3	0.1	0.2	28.5			16.5	0.1		9.2	0.1
Delay (s)	235.0	4.7	1.6	76.6	31.3			75.1	53.3		66.9	53.2
Level of Service	F	A	A	E	C			E	D		E	D
Approach Delay (s)		10.7			32.5			67.6			62.5	
Approach LOS		B			C			E			E	

Intersection Summary			
HCM Average Control Delay	28.6	HCM Level of Service	C
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

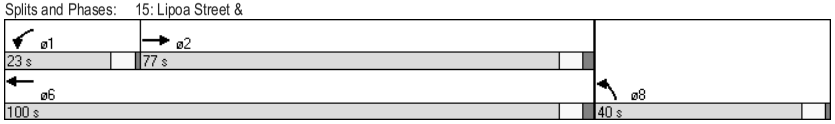
Timings
15: Lipoa Street &

7/1/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1320	95	4085	155
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	10.0	28.0	39.0
Total Split (s)	77.0	23.0	100.0	40.0
Total Split (%)	55.0%	16.4%	71.4%	28.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 48 (34%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/1/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1320	55	95	4085	155	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	*0.80	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5055		1652	4173	1745	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5055		1652	4173	1745	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1435	60	103	4440	168	38
RTOR Reduction (vph)	2	0	0	0	7	0
Lane Group Flow (vph)	1493	0	103	4440	199	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	89.0		13.7	107.7	21.3	
Effective Green, g (s)	89.0		13.7	107.7	21.3	
Actuated g/C Ratio	0.64		0.10	0.77	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3214		162	3210	265	
v/s Ratio Prot	0.30		0.06	c1.06	c0.11	
v/s Ratio Perm						
v/c Ratio	0.46		0.64	1.38	0.75	
Uniform Delay, d1	13.2		60.8	16.1	56.8	
Progression Factor	1.04		1.10	0.52	1.00	
Incremental Delay, d2	0.5		5.4	173.8	11.4	
Delay (s)	14.2		72.4	182.2	68.2	
Level of Service	B		E	F	E	
Approach Delay (s)	14.2			179.7	68.2	
Approach LOS	B			F	E	

Intersection Summary			
HCM Average Control Delay	136.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	98.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

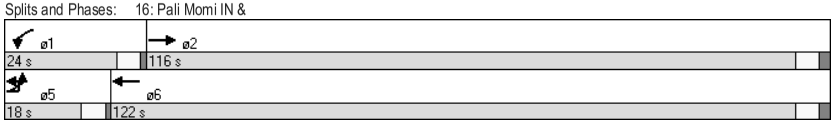
Timings
16: Pali Momi IN &

7/1/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	240	1070	120	3085
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	18.0	116.0	24.0	122.0
Total Split (%)	12.9%	82.9%	17.1%	87.1%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 126 (90%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	240	1070	30	120	3085	375	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4727		1652	4622							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4727		1652	4622							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	261	1163	33	130	3353	408	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	261	1194	0	130	3757	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	13.0	113.4		15.6	116.0							
Effective Green, g (s)	13.0	113.4		15.6	116.0							
Actuated g/C Ratio	0.09	0.81		0.11	0.83							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	298	3829		184	3830							
v/s Ratio Prot	c0.08	0.25		0.08	c0.81							
v/s Ratio Perm												
v/c Ratio	0.88	0.31		0.71	0.98							
Uniform Delay, d1	62.7	3.4		60.0	11.0							
Progression Factor	0.92	0.88		1.08	0.37							
Incremental Delay, d2	21.8	0.2		4.0	4.9							
Delay (s)	79.5	3.2		68.7	9.0							
Level of Service	E	A		E	A							
Approach Delay (s)		16.8			11.0			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	84.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

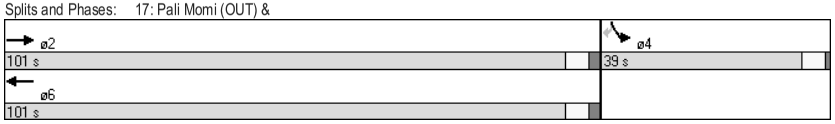
Timings
17: Pali Momi (OUT) &

7/1/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1070	3345	305	140
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	101.0	101.0	39.0	39.0
Total Split (%)	72.1%	72.1%	27.9%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 136 (97%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/1/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1070	3345	0	305	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.87
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1336
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1336
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1163	3636	0	332	152
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	0	1163	3636	0	332	151
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		107.4	107.4		21.6	21.6
Effective Green, g (s)		107.4	107.4		21.6	21.6
Actuated g/C Ratio		0.77	0.77		0.15	0.15
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3641	3641		512	206
v/s Ratio Prot		0.25	c0.77		0.10	
v/s Ratio Perm						c0.11
v/c Ratio		0.32	1.00		0.65	0.73
Uniform Delay, d1		5.0	16.2		55.6	56.5
Progression Factor		0.55	1.00		1.00	1.00
Incremental Delay, d2		0.2	14.6		2.8	12.7
Delay (s)		3.0	30.8		58.5	69.1
Level of Service		A	C		E	E
Approach Delay (s)		3.0	30.8		61.8	
Approach LOS		A	C		E	

Intersection Summary			
HCM Average Control Delay	27.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	101.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1615	25	30	1590	15	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1755	27	33	1728	16	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.73	
vC, conflicting volume			1783		2698	891
vC1, stage 1 conf vol					1769	
vC2, stage 2 conf vol					929	
vCu, unblocked vol			1783		2584	891
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			91		86	71
cM capacity (veh/h)			344		116	285

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1170	612	33	864	864	98
Volume Left	0	0	33	0	0	16
Volume Right	0	27	0	0	0	82
cSH	1700	1700	344	1700	1700	229
Volume to Capacity	0.69	0.36	0.09	0.51	0.51	0.43
Queue Length 95th (ft)	0	0	8	0	0	50
Control Delay (s)	0.0	0.0	16.6	0.0	0.0	31.9
Lane LOS			C			D
Approach Delay (s)	0.0		0.3			31.9
Approach LOS						D

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	1690	1620	15	15	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1837	1761	16	16	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.72				0.72	0.72
vC, conflicting volume	1777				2698	889
vC1, stage 1 conf vol					1769	
vC2, stage 2 conf vol					929	
vCu, unblocked vol	1299				2581	64
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				88	98
cM capacity (veh/h)	380				139	710

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	5	918	918	1174	603	33
Volume Left	5	0	0	0	0	16
Volume Right	0	0	0	0	16	16
cSH	380	1700	1700	1700	1700	233
Volume to Capacity	0.01	0.54	0.54	0.69	0.35	0.14
Queue Length 95th (ft)	1	0	0	0	0	12
Control Delay (s)	14.6	0.0	0.0	0.0	0.0	23.0
Lane LOS	B					C
Approach Delay (s)	0.0			0.0		23.0
Approach LOS						C

Intersection Summary				
Average Delay		0.2		
Intersection Capacity Utilization		56.7%	ICU Level of Service	B
Analysis Period (min)		15		

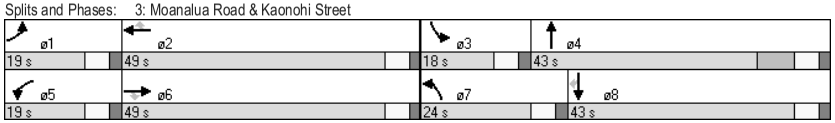
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	140	1150	415	175	1005	210	455	175	190	145	190
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	19.0	49.0	49.0	19.0	49.0	49.0	24.0	43.0	18.0	43.0	43.0
Total Split (%)	14.1%	36.3%	36.3%	14.1%	36.3%	36.3%	17.8%	31.9%	13.3%	31.9%	31.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 113.3
Natural Cycle: 150
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	1150	415	175	1005	210	455	175	300	190	145	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3204		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3204		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	1250	451	190	1092	228	495	190	326	207	158	207
RTOR Reduction (vph)	0	0	269	0	0	141	0	177	0	0	0	179
Lane Group Flow (vph)	152	1250	182	190	1092	87	495	339	0	207	158	28
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.8	43.1	43.1	13.0	43.3	43.3	18.0	22.1		11.1	15.2	15.2
Effective Green, g (s)	12.8	43.1	43.1	13.0	43.3	43.3	18.0	22.1		11.1	15.2	15.2
Actuated g/C Ratio	0.11	0.38	0.38	0.11	0.38	0.38	0.16	0.20		0.10	0.13	0.13
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	200	1346	602	203	1353	605	545	625		336	250	212
v/s Ratio Prot	0.09	c0.35		c0.11	0.31		c0.14	0.11		0.06	c0.08	
v/s Ratio Perm			0.12			0.06						0.02
v/c Ratio	0.76	0.93	0.30	0.94	0.81	0.14	0.91	0.54		0.62	0.63	0.13
Uniform Delay, d1	48.8	33.6	24.6	49.7	31.3	22.9	46.8	41.0		49.1	46.4	43.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	15.5	11.7	0.6	45.4	4.1	0.2	18.9	1.0		3.3	5.1	0.3
Delay (s)	64.3	45.4	25.2	95.1	35.4	23.1	65.7	42.0		52.4	51.5	43.5
Level of Service	E	D	C	F	D	C	E	D		D	D	D
Approach Delay (s)		42.0			41.1			53.6			48.9	
Approach LOS		D			D			D			D	

Intersection Summary				
HCM Average Control Delay	44.9	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.87			
Actuated Cycle Length (s)	113.3	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	82.1%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	40	0	0	160	0	790	95	0	610	135
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	43	0	0	174	0	859	103	0	663	147
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.92	0.92	0.92	0.92	0.92		0.92					
vC, conflicting volume	1125	1698	736	1690	1720	266	810			962		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1093	1715	671	1706	1739	266	751			962		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	88	100	100	76	100			100		
cM capacity (veh/h)	119	82	367	48	79	732	787			711		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	43	174	245	245	245	226	810
Volume Left	0	0	0	0	0	0	0
Volume Right	43	174	0	0	0	103	147
cSH	367	732	1700	1700	1700	1700	1700
Volume to Capacity	0.12	0.24	0.14	0.14	0.14	0.13	0.48
Queue Length 95th (ft)	10	23	0	0	0	0	0
Control Delay (s)	16.1	11.4	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B					
Approach Delay (s)	16.1	11.4	0.0				0.0
Approach LOS	C	B					

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	50.3%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	100	175	695	125	155	500
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	190	755	136	168	543
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	1432	446			891	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1432	446			891	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	66			78	
cM capacity (veh/h)	97	560			756	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	109	190	504	388	350	362
Volume Left	109	0	0	0	168	0
Volume Right	0	190	0	136	0	0
cSH	97	560	1700	1700	756	1700
Volume to Capacity	1.12	0.34	0.30	0.23	0.22	0.21
Queue Length 95th (ft)	179	37	0	0	21	0
Control Delay (s)	207.6	14.7	0.0	0.0	6.8	0.0
Lane LOS	F	B			A	
Approach Delay (s)	84.9		0.0		3.3	
Approach LOS	F					

Intersection Summary				
Average Delay		14.6		
Intersection Capacity Utilization		57.1%	ICU Level of Service	B
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	95	20	370	190	0	185	0	515	220	145	465	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	103	22	402	207	0	201	0	560	239	158	505	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	1304	1622	255	1660	1505	399	511			799		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1304	1622	255	1660	1505	399	511			799		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	74	46	0	100	66	100			81		
cM capacity (veh/h)	67	82	744	20	97	600	1051			819		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	527	207	201	373	426	158	337	174
Volume Left	103	207	0	0	0	158	0	0
Volume Right	402	0	201	0	239	0	0	5
cSH	224	20	600	1700	1700	819	1700	1700
Volume to Capacity	2.35	10.30	0.34	0.22	0.25	0.19	0.20	0.10
Queue Length 95th (ft)	1063	Err	37	0	0	18	0	0
Control Delay (s)	656.2	Err	14.0	0.0	0.0	10.4	0.0	0.0
Lane LOS	F	F	B			B		
Approach Delay (s)	656.2	5073.1		0.0		2.5		
Approach LOS	F	F						

Intersection Summary				
Average Delay		1005.5		
Intersection Capacity Utilization		83.2%	ICU Level of Service	E
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	25	45	25	705	895	115
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	49	27	766	973	125
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	1473	549	1098			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1473	549	1098			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	76	90	96			
cM capacity (veh/h)	113	480	632			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	283	511	649	449
Volume Left	27	27	0	0	0
Volume Right	49	0	0	0	125
cSH	221	632	1700	1700	1700
Volume to Capacity	0.34	0.04	0.30	0.38	0.26
Queue Length 95th (ft)	36	3	0	0	0
Control Delay (s)	29.5	1.6	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	29.5	0.6		0.0	
Approach LOS	D				

Intersection Summary				
Average Delay		1.4		
Intersection Capacity Utilization		48.5%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	90	45	720	940	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	98	49	783	1022	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	1527	527	1054			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1527	527	1054			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	67	80	93			
cM capacity (veh/h)	100	496	656			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	130	310	522	681	373
Volume Left	33	49	0	0	0
Volume Right	98	0	0	0	33
cSH	249	656	1700	1700	1700
Volume to Capacity	0.52	0.07	0.31	0.40	0.22
Queue Length 95th (ft)	69	6	0	0	0
Control Delay (s)	34.2	2.5	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	34.2	0.9		0.0	
Approach LOS	D				

Intersection Summary				
Average Delay		2.6		
Intersection Capacity Utilization		65.4%	ICU Level of Service	C
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	80	670	85	45	890
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	87	728	92	49	967
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	1195	410			821	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1195	410			821	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	55	85			94	
cM capacity (veh/h)	168	590			804	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	163	486	335	242	387	387
Volume Left	76	0	0	49	0	0
Volume Right	87	0	92	0	0	0
cSH	272	1700	1700	804	1700	1700
Volume to Capacity	0.60	0.29	0.20	0.06	0.23	0.23
Queue Length 95th (ft)	89	0	0	5	0	0
Control Delay (s)	36.3	0.0	0.0	2.5	0.0	0.0
Lane LOS	E			A		
Approach Delay (s)	36.3	0.0		0.6		
Approach LOS	E					

Intersection Summary				
Average Delay		3.3		
Intersection Capacity Utilization		58.1%	ICU Level of Service	B
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	110	90	705	975	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	120	98	766	1060	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1674	389	1060			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1674	389	1060			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	33	80	85			
cM capacity (veh/h)	73	610	653			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	98	383	383	424	424	283
Volume Left	49	98	0	0	0	0	0
Volume Right	120	0	0	0	0	0	71
cSH	195	653	1700	1700	1700	1700	1700
Volume to Capacity	0.86	0.15	0.23	0.23	0.25	0.25	0.17
Queue Length 95th (ft)	161	13	0	0	0	0	0
Control Delay (s)	82.4	11.5	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	82.4	1.3			0.0		
Approach LOS	F						

Intersection Summary				
Average Delay		6.9		
Intersection Capacity Utilization		44.5%	ICU Level of Service	A
Analysis Period (min)		15		

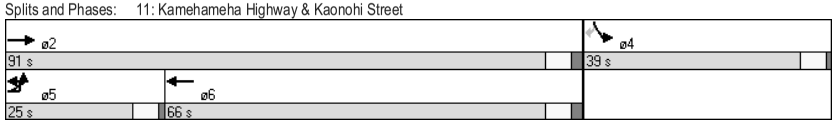
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	385	1740	1465	570	510
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	32.0	32.0
Total Split (s)	25.0	91.0	66.0	39.0	39.0
Total Split (%)	19.2%	70.0%	50.8%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 87 (67%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	385	1740	1465	410	570	510
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.97		0.98	0.90
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		0.97	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4615		3282	1293
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4615		3282	1293
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	418	1891	1592	446	620	554
RTOR Reduction (vph)	0	0	38	0	22	206
Lane Group Flow (vph)	418	1891	2000	0	781	165
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	19.4	85.7	61.3		33.3	33.3
Effective Green, g (s)	19.4	85.7	61.3		33.3	33.3
Actuated g/C Ratio	0.15	0.66	0.47		0.26	0.26
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	478	3129	2176		841	331
v/s Ratio Prot	c0.13	0.40	c0.43		c0.24	
v/s Ratio Perm						0.13
v/c Ratio	0.87	0.60	0.92		0.93	0.50
Uniform Delay, d1	54.1	12.5	32.0		47.2	41.2
Progression Factor	0.98	1.24	0.60		1.00	1.00
Incremental Delay, d2	14.0	0.7	6.0		16.1	1.2
Delay (s)	66.8	16.3	25.2		63.3	42.4
Level of Service	E	B	C		E	D
Approach Delay (s)		25.4	25.2		56.7	
Approach LOS		C	C		E	

Intersection Summary			
HCM Average Control Delay	32.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	95	1600	220	1705	210	55	310	90	40	140
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	17.0	70.0	17.0	70.0	43.0	43.0	43.0	43.0	43.0	43.0
Total Split (%)	13.1%	53.8%	13.1%	53.8%	33.1%	33.1%	33.1%	33.1%	33.1%	33.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 60 (46%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street

ø1	ø2	ø4
17 s	70 s	43 s
ø5	ø6	ø8
17 s	70 s	43 s

HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	1600	285	220	1705	65	210	55	310	90	40	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4623		3204	4715			1700	1531		1680	1417
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.41	1.00
Satd. Flow (perm)	1652	4623		3204	4715			1100	1531		716	1417
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	1739	310	239	1853	71	228	60	337	98	43	152
RTOR Reduction (vph)	0	19	0	0	3	0	0	0	129	0	0	110
Lane Group Flow (vph)	103	2030	0	239	1921	0	0	288	208	0	141	42
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	11.2	66.1		11.9	66.8			36.0	36.0		36.0	36.0
Effective Green, g (s)	11.2	66.1		11.9	66.8			36.0	36.0		36.0	36.0
Actuated g/C Ratio	0.09	0.51		0.09	0.51			0.28	0.28		0.28	0.28
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	142	2351		293	2423			305	424		198	392
v/s Ratio Prot	0.06	c0.44		c0.07	0.41							
v/s Ratio Perm								c0.26	0.14		0.20	0.03
v/c Ratio	0.73	0.86		0.82	0.79			0.94	0.49		0.71	0.11
Uniform Delay, d1	57.9	28.0		58.0	25.9			46.0	39.3		42.3	35.0
Progression Factor	0.82	0.88		1.24	0.33			1.00	1.00		1.00	1.00
Incremental Delay, d2	9.2	2.4		11.9	2.0			36.7	0.9		11.4	0.1
Delay (s)	56.6	27.0		83.8	10.5			82.7	40.2		53.8	35.1
Level of Service	E	C		F	B			F	D		D	D
Approach Delay (s)		28.4			18.6			59.8			44.1	
Approach LOS		C			B			E			D	

Intersection Summary			
HCM Average Control Delay	29.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

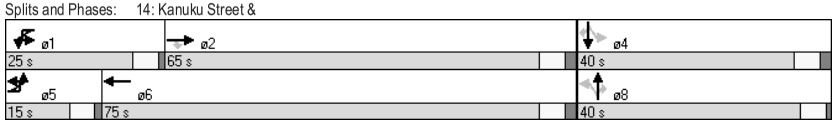
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	75	1740	105	105	1790	65	20	70	120	15	75
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	40.0	40.0	40.0
Total Split (s)	15.0	65.0	65.0	25.0	75.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	11.5%	50.0%	50.0%	19.2%	57.7%	30.8%	30.8%	30.8%	30.8%	30.8%	30.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 48 (37%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1740	105	105	1790	230	65	20	70	120	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4665			1734	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.57	1.00		0.66	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4665			1034	1531		1141	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	1891	114	114	1946	250	71	22	76	130	16	82
RTOR Reduction (vph)	0	0	25	0	10	0	0	0	63	0	0	69
Lane Group Flow (vph)	82	1891	89	114	2186	0	0	93	13	0	146	13
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	9.5	81.6	81.6	10.0	82.1			22.4	22.4		21.4	21.4
Effective Green, g (s)	9.5	81.6	81.6	10.0	82.1			22.4	22.4		21.4	21.4
Actuated g/C Ratio	0.07	0.63	0.63	0.08	0.63			0.17	0.17		0.16	0.16
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	121	2979	928	246	2946			178	264		188	243
v/s Ratio Prot	c0.05	0.40		0.04	c0.47							
v/s Ratio Perm			0.06					0.09	0.01		c0.13	0.01
v/c Ratio	0.68	0.63	0.10	0.46	0.74			0.52	0.05		0.78	0.06
Uniform Delay, d1	58.8	15.0	9.6	57.4	16.6			48.9	44.9		52.0	45.8
Progression Factor	0.79	1.25	1.86	1.08	0.39			1.00	1.00		1.00	1.00
Incremental Delay, d2	8.1	0.6	0.1	0.8	1.0			2.8	0.1		18.0	0.1
Delay (s)	54.7	19.3	18.0	62.5	7.4			51.7	45.0		70.0	45.9
Level of Service	D	B	B	E	A			D	D		E	D
Approach Delay (s)		20.6			10.1			48.7			61.3	
Approach LOS		C			B			D			E	

Intersection Summary			
HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

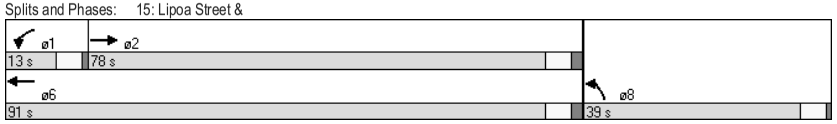
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2020	50	1915	160
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	78.0	13.0	91.0	39.0
Total Split (%)	60.0%	10.0%	70.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 12 (9%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2020	65	50	1915	160	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4720		1652	4746	1672	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4720		1652	4746	1672	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2196	71	54	2082	174	76
RTOR Reduction (vph)	3	0	0	0	12	0
Lane Group Flow (vph)	2264	0	54	2082	238	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	73.6		6.4	85.0	34.0	
Effective Green, g (s)	73.6		6.4	85.0	34.0	
Actuated g/C Ratio	0.57		0.05	0.65	0.26	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	2672		81	3103	437	
v/s Ratio Prot	c0.48		0.03	c0.44	c0.14	
v/s Ratio Perm						
v/c Ratio	0.85		0.67	0.67	0.55	
Uniform Delay, d1	23.5		60.8	13.9	41.3	
Progression Factor	0.76		1.29	0.45	1.00	
Incremental Delay, d2	2.6		14.8	0.9	4.8	
Delay (s)	20.5		93.3	7.1	46.2	
Level of Service	C		F	A	D	
Approach Delay (s)	20.5			9.3	46.2	
Approach LOS	C			A	D	

Intersection Summary			
HCM Average Control Delay	16.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

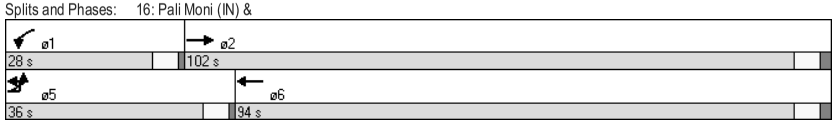
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	455	1545	145	1715
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	36.0	102.0	28.0	94.0
Total Split (%)	27.7%	78.5%	21.5%	72.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 120 (92%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	455	1545	50	145	1715	480	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4724		1652	4524							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4724		1652	4524							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	495	1679	54	158	1864	522	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	19	0	0	0	0	0	0	0
Lane Group Flow (vph)	495	1731	0	158	2367	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	25.2	101.6		17.4	93.8							
Effective Green, g (s)	25.2	101.6		17.4	93.8							
Actuated g/C Ratio	0.19	0.78		0.13	0.72							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	621	3692		221	3264							
v/s Ratio Prot	c0.15	0.37		0.10	c0.52							
v/s Ratio Perm												
v/c Ratio	0.80	0.47		0.71	0.73							
Uniform Delay, d1	50.0	4.9		53.9	10.6							
Progression Factor	0.58	1.50		1.09	0.44							
Incremental Delay, d2	3.9	0.2		8.7	1.2							
Delay (s)	32.7	7.6		67.5	5.8							
Level of Service	C	A		E	A							
Approach Delay (s)		13.2			9.6			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

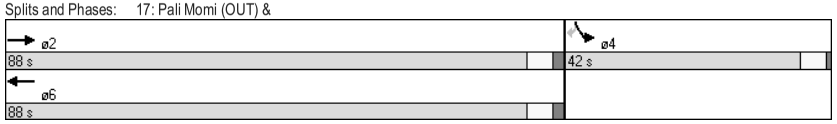
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1505	1995	340	185
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	88.0	88.0	42.0	42.0
Total Split (%)	67.7%	67.7%	32.3%	32.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1505	1995	0	340	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.86
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1316
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1316
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1636	2168	0	370	201
RTOR Reduction (vph)	0	0	0	0	0	8
Lane Group Flow (vph)	0	1636	2168	0	370	193
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		94.5	94.5		24.5	24.5
Effective Green, g (s)		94.5	94.5		24.5	24.5
Actuated g/C Ratio		0.73	0.73		0.19	0.19
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3450	3450		626	248
v/s Ratio Prot		0.34	c0.46		0.11	
v/s Ratio Perm						c0.15
v/c Ratio		0.47	0.63		0.59	0.78
Uniform Delay, d1		7.4	8.9		48.2	50.2
Progression Factor		0.34	1.00		1.00	1.00
Incremental Delay, d2		0.4	0.9		1.5	14.2
Delay (s)		2.9	9.8		49.7	64.4
Level of Service		A	A		D	E
Approach Delay (s)		2.9	9.8		54.8	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2017

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1555	15	30	1100	15	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1690	16	33	1196	16	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.90	
vC, conflicting volume			1707		2361	853
vC1, stage 1 conf vol					1698	
vC2, stage 2 conf vol					663	
vCu, unblocked vol			1707		2287	853
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			91		87	86
cM capacity (veh/h)			368		127	302

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1127	580	33	598	598	60
Volume Left	0	0	33	0	0	16
Volume Right	0	16	0	0	0	43
cSH	1700	1700	368	1700	1700	219
Volume to Capacity	0.66	0.34	0.09	0.35	0.35	0.27
Queue Length 95th (ft)	0	0	7	0	0	27
Control Delay (s)	0.0	0.0	15.7	0.0	0.0	27.5
Lane LOS			C			D
Approach Delay (s)	0.0		0.4			27.5
Approach LOS						D

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	53.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	155	1465	815	205	45	270
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	168	1592	886	223	49	293
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.84				0.84	0.84
vC, conflicting volume	1109				2130	554
vC1, stage 1 conf vol					997	
vC2, stage 2 conf vol					1133	
vCu, unblocked vol	758				1969	101
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	76				73	63
cM capacity (veh/h)	716				181	788

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	168	796	796	591	518	342
Volume Left	168	0	0	0	0	49
Volume Right	0	0	0	0	223	293
cSH	716	1700	1700	1700	1700	533
Volume to Capacity	0.24	0.47	0.47	0.35	0.30	0.64
Queue Length 95th (ft)	23	0	0	0	0	113
Control Delay (s)	11.6	0.0	0.0	0.0	0.0	23.1
Lane LOS	B					C
Approach Delay (s)	1.1			0.0		23.1
Approach LOS						C

Intersection Summary			
Average Delay		3.1	
Intersection Capacity Utilization		66.8%	ICU Level of Service C
Analysis Period (min)		15	

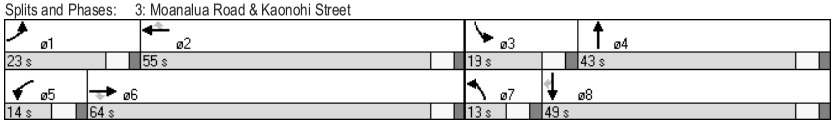
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	1200	200	80	730	95	80	80	280	220	230
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	23.0	64.0	64.0	14.0	55.0	55.0	13.0	43.0	19.0	49.0	49.0
Total Split (%)	16.4%	45.7%	45.7%	10.0%	39.3%	39.3%	9.3%	30.7%	13.6%	35.0%	35.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 116
Natural Cycle: 120
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1200	200	80	730	95	80	80	80	280	220	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1304	217	87	793	103	87	87	87	304	239	250
RTOR Reduction (vph)	0	0	112	0	0	57	0	76	0	0	0	188
Lane Group Flow (vph)	114	1304	105	87	793	46	87	98	0	304	239	62
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.6	56.1	56.1	8.1	51.6	51.6	6.9	14.6		13.1	20.8	20.8
Effective Green, g (s)	12.6	56.1	56.1	8.1	51.6	51.6	6.9	14.6		13.1	20.8	20.8
Actuated g/C Ratio	0.11	0.48	0.48	0.07	0.45	0.45	0.06	0.13		0.11	0.18	0.18
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	192	1713	766	124	1576	705	204	412		388	334	284
v/s Ratio Prot	c0.06	c0.37		0.05	0.22		0.03	0.03		c0.09	c0.13	
v/s Ratio Perm			0.07			0.03						0.04
v/c Ratio	0.59	0.76	0.14	0.70	0.50	0.07	0.43	0.24		0.78	0.72	0.22
Uniform Delay, d1	49.2	24.4	16.5	52.7	23.0	18.4	52.6	45.6		50.0	44.8	40.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.9	2.4	0.2	17.0	0.5	0.1	1.4	0.3		9.9	7.1	0.4
Delay (s)	54.1	26.9	16.7	69.7	23.5	18.5	54.0	45.9		60.0	51.9	41.0
Level of Service	D	C	B	E	C	B	D	D		E	D	D
Approach Delay (s)		27.4			27.1			48.6			51.5	
Approach LOS		C			C			D			D	

Intersection Summary				
HCM Average Control Delay	34.0	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.79			
Actuated Cycle Length (s)	115.9	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	73.3%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	10	0	245	20	0	515	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	11	0	266	22	0	560	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.88	0.88	0.88	0.88	0.88		0.88					
vC, conflicting volume	637	848	560	837	837	77	560			288		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	519	759	431	746	746	77	431			288		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	99	100			100		
cM capacity (veh/h)	382	294	504	266	299	968	989			1271		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	11	76	76	76	60	560
Volume Left	0	0	0	0	0	0	0
Volume Right	0	11	0	0	0	22	0
cSH	1700	968	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.01	0.04	0.04	0.04	0.04	0.33
Queue Length 95th (ft)	0	1	0	0	0	0	0
Control Delay (s)	0.0	8.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	8.8	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	30.4%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	30	240	15	25	470
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	33	261	16	27	511
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	579	139			277	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	579	139			277	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	96			98	
cM capacity (veh/h)	436	884			1283	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	16	33	174	103	197	341
Volume Left	16	0	0	0	27	0
Volume Right	0	33	0	16	0	0
cSH	436	884	1700	1700	1283	1700
Volume to Capacity	0.04	0.04	0.10	0.06	0.02	0.20
Queue Length 95th (ft)	3	3	0	0	2	0
Control Delay (s)	13.6	9.2	0.0	0.0	1.2	0.0
Lane LOS	B	A			A	
Approach Delay (s)	10.7		0.0		0.5	
Approach LOS	B					

Intersection Summary				
Average Delay		0.9		
Intersection Capacity Utilization		34.2%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	30	0	10	0	235	35	35	470	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	33	0	11	0	255	38	38	511	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	726	880	255	606	861	147	511			293		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	726	880	255	606	861	147	511			293		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	91	100	99	100			97		
cM capacity (veh/h)	301	276	744	372	283	874	1051			1265		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	0	33	11	170	123	38	341	170
Volume Left	0	33	0	0	0	38	0	0
Volume Right	0	0	11	0	38	0	0	0
cSH	1700	372	874	1700	1700	1265	1700	1700
Volume to Capacity	0.00	0.09	0.01	0.10	0.07	0.03	0.20	0.10
Queue Length 95th (ft)	0	7	1	0	0	2	0	0
Control Delay (s)	0.0	15.6	9.2	0.0	0.0	7.9	0.0	0.0
Lane LOS	A	C	A			A		
Approach Delay (s)	0.0	14.0		0.0		0.5		
Approach LOS	A	B						

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		24.3%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	30	20	240	420	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	33	22	261	457	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	660	258	516			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	660	258	516			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	96	98			
cM capacity (veh/h)	388	741	1046			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	109	174	304	212
Volume Left	43	22	0	0	0
Volume Right	33	0	0	0	60
cSH	487	1046	1700	1700	1700
Volume to Capacity	0.16	0.02	0.10	0.18	0.12
Queue Length 95th (ft)	14	2	0	0	0
Control Delay (s)	13.8	1.9	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	13.8	0.7		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	32.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	50	20	245	450	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	54	22	266	489	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	668	247	495			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	668	247	495			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	93	98			
cM capacity (veh/h)	383	753	1065			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	111	178	326	168
Volume Left	16	22	0	0	0
Volume Right	54	0	0	0	5
cSH	616	1065	1700	1700	1700
Volume to Capacity	0.11	0.02	0.10	0.19	0.10
Queue Length 95th (ft)	10	2	0	0	0
Control Delay (s)	11.6	1.8	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.6	0.7		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	32.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	250	50	25	475
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	272	54	27	516
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	525	163			326	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	525	163			326	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	98			98	
cM capacity (veh/h)	471	853			1230	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	181	145	130	207	207
Volume Left	49	0	0	27	0	0
Volume Right	16	0	54	0	0	0
cSH	531	1700	1700	1230	1700	1700
Volume to Capacity	0.12	0.11	0.09	0.02	0.12	0.12
Queue Length 95th (ft)	10	0	0	2	0	0
Control Delay (s)	12.7	0.0	0.0	1.8	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	12.7	0.0		0.4		
Approach LOS	B					

Intersection Summary				
Average Delay		1.1		
Intersection Capacity Utilization		31.6%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	80	150	55	215	495	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	163	60	234	538	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	793	198	538			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	793	198	538			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	72	80	94			
cM capacity (veh/h)	307	809	1026			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	250	60	117	117	215	215	146
Volume Left	87	60	0	0	0	0	0
Volume Right	163	0	0	0	0	0	38
cSH	515	1026	1700	1700	1700	1700	1700
Volume to Capacity	0.49	0.06	0.07	0.07	0.13	0.13	0.09
Queue Length 95th (ft)	65	5	0	0	0	0	0
Control Delay (s)	18.4	8.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	18.4	1.8			0.0		
Approach LOS	C						

Intersection Summary				
Average Delay		4.6		
Intersection Capacity Utilization		37.3%	ICU Level of Service	A
Analysis Period (min)		15		

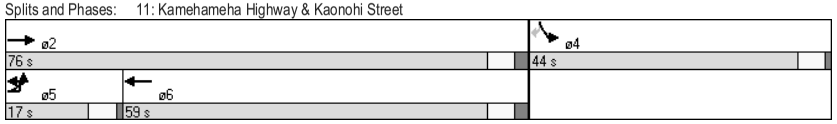
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	130	1690	790	535	115
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	17.0	76.0	59.0	44.0	44.0
Total Split (%)	14.2%	63.3%	49.2%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 69 (58%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	130	1690	790	165	535	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	0.93
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4726		3429	1343
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4726		3429	1343
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	1837	859	179	582	125
RTOR Reduction (vph)	0	0	21	0	2	87
Lane Group Flow (vph)	141	1837	1017	0	593	25
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	10.3	82.5	67.2		26.5	26.5
Effective Green, g (s)	10.3	82.5	67.2		26.5	26.5
Actuated g/C Ratio	0.09	0.69	0.56		0.22	0.22
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	275	3263	2647		757	297
v/s Ratio Prot	0.04	c0.39	0.22		c0.17	
v/s Ratio Perm						0.02
v/c Ratio	0.51	0.56	0.38		0.78	0.08
Uniform Delay, d1	52.5	9.6	14.8		44.1	37.1
Progression Factor	1.22	0.25	0.71		1.00	1.00
Incremental Delay, d2	1.4	0.6	0.4		5.3	0.1
Delay (s)	65.4	3.0	10.9		49.4	37.2
Level of Service	E	A	B		D	D
Approach Delay (s)		7.4	10.9		47.5	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	16.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1670	90	845	55	5	60	110	15	75
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	14.0	69.0	12.0	67.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	11.7%	57.5%	10.0%	55.8%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 92 (77%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street

ø1	ø2	ø4
12 s	69 s	39 s
ø5	ø6	ø8
14 s	67 s	39 s

HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1670	185	90	845	30	55	5	60	110	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.96		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.99		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4663		3204	4718			1720	1469		1644	1459
Flt Permitted	0.95	1.00		0.95	1.00			0.54	1.00		0.71	1.00
Satd. Flow (perm)	1652	4663		3204	4718			963	1469		1210	1459
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1815	201	98	918	33	60	5	65	120	16	82
RTOR Reduction (vph)	0	8	0	0	2	0	0	0	55	0	0	69
Lane Group Flow (vph)	54	2008	0	98	949	0	0	65	10	0	136	13
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.0	78.3		6.9	78.2			18.8	18.8		18.8	18.8
Effective Green, g (s)	7.0	78.3		6.9	78.2			18.8	18.8		18.8	18.8
Actuated g/C Ratio	0.06	0.65		0.06	0.65			0.16	0.16		0.16	0.16
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	96	3043		184	3075			151	230		190	229
v/s Ratio Prot	c0.03	c0.43		0.03	0.20							
v/s Ratio Perm								0.07	0.01		c0.11	0.01
v/c Ratio	0.56	0.66		0.53	0.31			0.43	0.04		0.72	0.06
Uniform Delay, d1	55.0	12.7		55.0	9.1			45.8	43.0		48.1	43.1
Progression Factor	0.90	0.88		0.72	1.74			1.00	1.00		1.00	1.00
Incremental Delay, d2	5.9	0.9		2.8	0.3			2.0	0.1		12.1	0.1
Delay (s)	55.4	12.2		42.5	16.1			47.7	43.1		60.1	43.2
Level of Service	E	B		D	B			D	D		E	D
Approach Delay (s)		13.3			18.6			45.4			53.8	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

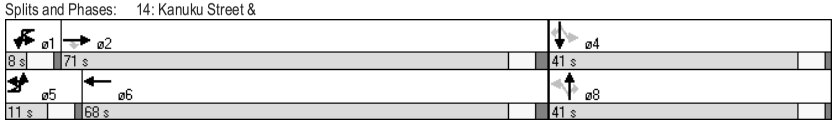
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	25	1720	20	20	910	5	5	15	140	10	40
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	11.0	71.0	71.0	8.0	68.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	9.2%	59.2%	59.2%	6.7%	56.7%	34.2%	34.2%	34.2%	34.2%	34.2%	34.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 108 (90%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	1720	20	20	910	65	5	5	15	140	10	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1451	3204	4693			1754	1531		1661	1454
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1451	3204	4693			1588	1531		1275	1454
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	1870	22	22	989	71	5	5	16	152	11	43
RTOR Reduction (vph)	0	0	5	0	5	0	0	0	13	0	0	36
Lane Group Flow (vph)	27	1870	17	22	1055	0	0	10	3	0	163	7
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.6	81.5	81.5	1.8	79.7			20.7	20.7		20.7	20.7
Effective Green, g (s)	3.6	81.5	81.5	1.8	79.7			20.7	20.7		20.7	20.7
Actuated g/C Ratio	0.03	0.68	0.68	0.02	0.66			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	50	3223	985	48	3117			274	264		220	251
v/s Ratio Prot	c0.02	c0.39		0.01	0.22							
v/s Ratio Perm			0.01					0.01	0.00		c0.13	0.01
v/c Ratio	0.54	0.58	0.02	0.46	0.34			0.04	0.01		0.74	0.03
Uniform Delay, d1	57.4	10.2	6.2	58.6	8.7			41.3	41.2		47.1	41.3
Progression Factor	1.28	0.21	0.05	0.77	1.57			1.00	1.00		1.00	1.00
Incremental Delay, d2	8.9	0.6	0.0	6.5	0.3			0.1	0.0		12.6	0.0
Delay (s)	82.2	2.7	0.4	51.9	14.0			41.4	41.2		59.7	41.3
Level of Service	F	A	A	D	B			D	D		E	D
Approach Delay (s)		3.8			14.7			41.3			55.9	
Approach LOS		A			B			D			E	

Intersection Summary				
HCM Average Control Delay	11.1	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.59			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	61.5%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

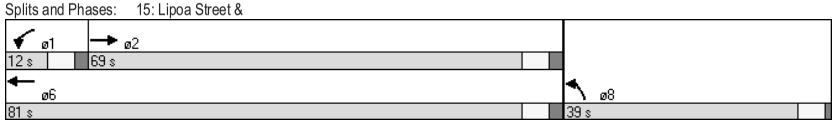
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2185	45	955	70
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	33.0	39.0
Total Split (s)	69.0	12.0	81.0	39.0
Total Split (%)	57.5%	10.0%	67.5%	32.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 116 (97%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2185	50	45	955	70	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		6.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4730		1652	4746	1651	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4730		1652	4746	1651	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2375	54	49	1038	76	65
RTOR Reduction (vph)	1	0	0	0	32	0
Lane Group Flow (vph)	2428	0	49	1038	109	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	85.0		4.8	95.8	13.2	
Effective Green, g (s)	85.0		4.8	95.8	13.2	
Actuated g/C Ratio	0.71		0.04	0.80	0.11	
Clearance Time (s)	6.0		6.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3350		66	3789	182	
v/s Ratio Prot	c0.51		c0.03	0.22	c0.07	
v/s Ratio Perm						
v/c Ratio	0.72		0.74	0.27	0.60	
Uniform Delay, d1	10.5		57.0	3.1	50.9	
Progression Factor	1.01		0.87	0.98	1.00	
Incremental Delay, d2	1.2		34.5	0.2	5.2	
Delay (s)	11.8		84.1	3.2	56.1	
Level of Service	B		F	A	E	
Approach Delay (s)	11.8			6.9	56.1	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	12.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

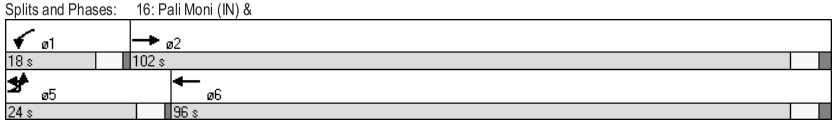
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	200	2080	45	995
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	24.0	102.0	18.0	96.0
Total Split (%)	20.0%	85.0%	15.0%	80.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 102 (85%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 40
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	2080	15	45	995	180	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4741		1652	4637							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4741		1652	4637							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	2261	16	49	1082	196	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	0	0	0	0	0
Lane Group Flow (vph)	217	2277	0	49	1261	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	13.4	101.2		7.8	95.6							
Effective Green, g (s)	13.4	101.2		7.8	95.6							
Actuated g/C Ratio	0.11	0.84		0.06	0.80							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	358	3998		107	3694							
v/s Ratio Prot	c0.07	c0.48		0.03	0.27							
v/s Ratio Perm												
v/c Ratio	0.61	0.57		0.46	0.34							
Uniform Delay, d1	50.8	2.8		54.1	3.4							
Progression Factor	0.94	0.44		1.03	0.46							
Incremental Delay, d2	2.1	0.4		3.0	0.2							
Delay (s)	49.7	1.7		58.9	1.8							
Level of Service	D	A		E	A							
Approach Delay (s)		5.9			3.9			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

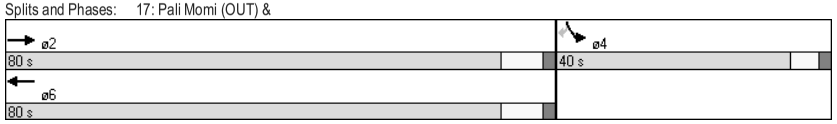
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1970	1130	320	80
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	80.0	80.0	40.0	40.0
Total Split (%)	66.7%	66.7%	33.3%	33.3%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 4 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1970	1130	0	320	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.94
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1434
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1434
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2141	1228	0	348	87
RTOR Reduction (vph)	0	0	0	0	0	60
Lane Group Flow (vph)	0	2141	1228	0	348	27
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		88.1	88.1		17.9	17.9
Effective Green, g (s)		88.1	88.1		17.9	17.9
Actuated g/C Ratio		0.73	0.73		0.15	0.15
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3484	3484		495	214
v/s Ratio Prot		c0.45	0.26		c0.10	
v/s Ratio Perm						0.02
v/c Ratio		0.61	0.35		0.70	0.12
Uniform Delay, d1		7.7	5.7		48.5	44.3
Progression Factor		0.17	1.00		1.00	1.00
Incremental Delay, d2		0.7	0.3		4.5	0.3
Delay (s)		2.0	6.0		53.0	44.5
Level of Service		A	A		D	D
Approach Delay (s)		2.0	6.0		51.3	
Approach LOS		A	A		D	

Intersection Summary			
HCM Average Control Delay	8.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/1/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1195	25	20	1890	15	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1299	27	22	2054	16	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.60	
vC, conflicting volume			1326		2383	663
vC1, stage 1 conf vol					1312	
vC2, stage 2 conf vol					1071	
vCu, unblocked vol			1326		1966	663
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			96		92	95
cM capacity (veh/h)			517		197	404

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	866	460	22	1027	1027	38
Volume Left	0	0	22	0	0	16
Volume Right	0	27	0	0	0	22
cSH	1700	1700	517	1700	1700	278
Volume to Capacity	0.51	0.27	0.04	0.60	0.60	0.14
Queue Length 95th (ft)	0	0	3	0	0	12
Control Delay (s)	0.0	0.0	12.3	0.0	0.0	20.0
Lane LOS			B			C
Approach Delay (s)	0.0		0.1			20.0
Approach LOS						C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	62.2%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/1/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	55	1180	1805	80	60	80
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	1283	1962	87	65	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.59				0.59	0.59
vC, conflicting volume	2049				2766	1024
vC1, stage 1 conf vol					2005	
vC2, stage 2 conf vol					761	
vCu, unblocked vol	1387				2604	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	79				43	86
cM capacity (veh/h)	289				114	639

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	60	641	641	1308	741	152
Volume Left	60	0	0	0	0	65
Volume Right	0	0	0	0	87	87
cSH	289	1700	1700	1700	1700	215
Volume to Capacity	0.21	0.38	0.38	0.77	0.44	0.71
Queue Length 95th (ft)	19	0	0	0	0	115
Control Delay (s)	20.7	0.0	0.0	0.0	0.0	54.3
Lane LOS	C					F
Approach Delay (s)	0.9			0.0		54.3
Approach LOS						F

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

Timings
3: Moanalua Road & Kaonohi Street

7/1/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	200	875	195	105	1375	285	390	150	125	95	135
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	24.0	69.0	69.0	24.0	69.0	69.0	24.0	43.0	24.0	43.0	43.0
Total Split (%)	15.0%	43.1%	43.1%	15.0%	43.1%	43.1%	15.0%	26.9%	15.0%	26.9%	26.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 135.9
Natural Cycle: 150
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street

ø1	ø2	ø3	ø4
24 s	69 s	24 s	43 s
ø5	ø6	ø7	ø8
24 s	69 s	24 s	43 s

HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	875	195	105	1375	285	390	150	110	125	95	135
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3314		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3314		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	951	212	114	1495	310	424	163	120	136	103	147
RTOR Reduction (vph)	0	0	107	0	0	127	0	94	0	0	0	133
Lane Group Flow (vph)	217	951	105	114	1495	183	424	189	0	136	103	14
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	18.0	67.0	67.0	14.1	63.1	63.1	18.0	20.1		10.7	12.8	12.8
Effective Green, g (s)	18.0	67.0	67.0	14.1	63.1	63.1	18.0	20.1		10.7	12.8	12.8
Actuated g/C Ratio	0.13	0.49	0.49	0.10	0.46	0.46	0.13	0.15		0.08	0.09	0.09
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	234	1745	780	184	1643	735	455	490		270	175	149
v/s Ratio Prot	c0.12	c0.27		0.06	c0.42		c0.12	0.06		0.04	c0.06	
v/s Ratio Perm			0.07			0.12						0.01
v/c Ratio	0.93	0.54	0.13	0.62	0.91	0.25	0.93	0.39		0.50	0.59	0.09
Uniform Delay, d1	58.3	23.9	18.7	58.3	33.8	22.0	58.3	52.3		60.1	59.0	56.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	39.0	0.6	0.2	6.4	8.3	0.4	26.0	0.5		1.5	5.0	0.3
Delay (s)	97.3	24.5	18.9	64.7	42.0	22.4	84.3	52.8		61.5	64.0	56.5
Level of Service	F	C	B	E	D	C	F	D		E	E	E
Approach Delay (s)		35.1			40.2			71.7			60.3	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	45.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	135.9	Sum of lost time (s)	30.0
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	70	0	580	40	0	395	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	76	0	630	43	0	429	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	663	1103	429	1082	1082	179	429			674		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	619	1082	373	1059	1059	179	373			674		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	91	100			100		
cM capacity (veh/h)	322	205	593	170	212	833	1123			913		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	76	180	180	180	134	429
Volume Left	0	0	0	0	0	0	0
Volume Right	0	76	0	0	0	43	0
cSH	1700	833	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.09	0.11	0.11	0.11	0.08	0.25
Queue Length 95th (ft)	0	8	0	0	0	0	0
Control Delay (s)	0.0	9.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	9.8	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay		0.6		
Intersection Capacity Utilization		24.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/1/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	105	185	455	75	90	310
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	201	495	82	98	337
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	899	288			576	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	899	288			576	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	55	72			90	
cM capacity (veh/h)	251	709			993	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	114	201	330	246	210	225
Volume Left	114	0	0	0	98	0
Volume Right	0	201	0	82	0	0
cSH	251	709	1700	1700	993	1700
Volume to Capacity	0.45	0.28	0.19	0.14	0.10	0.13
Queue Length 95th (ft)	55	29	0	0	8	0
Control Delay (s)	30.8	12.1	0.0	0.0	4.7	0.0
Lane LOS	D	B			A	
Approach Delay (s)	18.9		0.0		2.3	
Approach LOS	C					

Intersection Summary				
Average Delay		5.2		
Intersection Capacity Utilization		42.0%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	0	5	155	0	105	0	420	90	60	360	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	168	0	114	0	457	98	65	391	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	867	1079	198	837	1033	277	397			554		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	867	1079	198	837	1033	277	397			554		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	99	31	100	84	100			94		
cM capacity (veh/h)	197	203	809	245	216	720	1158			1012		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	11	168	114	304	250	65	261	136
Volume Left	5	168	0	0	0	65	0	0
Volume Right	5	0	114	0	98	0	0	5
cSH	318	245	720	1700	1700	1012	1700	1700
Volume to Capacity	0.03	0.69	0.16	0.18	0.15	0.06	0.15	0.08
Queue Length 95th (ft)	3	112	14	0	0	5	0	0
Control Delay (s)	16.7	46.8	10.9	0.0	0.0	8.8	0.0	0.0
Lane LOS	C	E	B			A		
Approach Delay (s)	16.7	32.3		0.0		1.2		
Approach LOS	C	D						

Intersection Summary				
Average Delay		7.5		
Intersection Capacity Utilization		43.0%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/1/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	485	460	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	527	500	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	1135	
pX, platoon unblocked						
vC, conflicting volume	832	274	549			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	832	274	549			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	95	98			
cM capacity (veh/h)	301	723	1017			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	197	351	333	216
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	425	1017	1700	1700	1700
Volume to Capacity	0.15	0.02	0.21	0.20	0.13
Queue Length 95th (ft)	13	2	0	0	0
Control Delay (s)	15.0	1.1	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	15.0	0.4		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		38.2%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/1/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	485	475	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	527	516	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	845	269	538			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	845	269	538			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	92	97			
cM capacity (veh/h)	294	729	1026			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	203	351	344	194
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	22
cSH	553	1026	1700	1700	1700
Volume to Capacity	0.14	0.03	0.21	0.20	0.11
Queue Length 95th (ft)	12	2	0	0	0
Control Delay (s)	12.5	1.4	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	12.5	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.1		
Intersection Capacity Utilization		42.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/1/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	465	50	30	500
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	505	54	33	543
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	779	280			560	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	779	280			560	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	76	93			97	
cM capacity (veh/h)	322	717			1007	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	337	223	141	217	217
Volume Left	76	0	0	33	0	0
Volume Right	49	0	54	0	0	0
cSH	410	1700	1700	1007	1700	1700
Volume to Capacity	0.30	0.20	0.13	0.03	0.13	0.13
Queue Length 95th (ft)	32	0	0	3	0	0
Control Delay (s)	17.6	0.0	0.0	2.2	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	17.6	0.0		0.5		
Approach LOS	C					

Intersection Summary				
Average Delay		2.0		
Intersection Capacity Utilization		41.3%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/1/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	110	125	490	510	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	120	136	533	554	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1122	215	554			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1122	215	554			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	78	85	87			
cM capacity (veh/h)	173	790	1012			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	158	136	266	266	222	222	171
Volume Left	38	136	0	0	0	0	0
Volume Right	120	0	0	0	0	0	60
cSH	424	1012	1700	1700	1700	1700	1700
Volume to Capacity	0.37	0.13	0.16	0.16	0.13	0.13	0.10
Queue Length 95th (ft)	42	12	0	0	0	0	0
Control Delay (s)	18.4	9.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	18.4	1.9			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay		2.9	
Intersection Capacity Utilization		36.7%	ICU Level of Service	A
Analysis Period (min)		15	

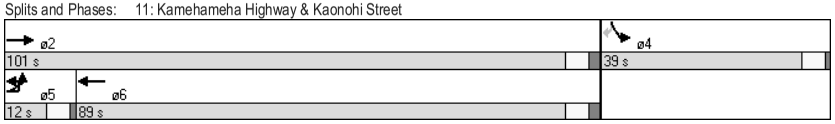
Timings
11: Kamehameha Highway & Kaonohi Street

7/1/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	220	1240	3955	295	310
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	39.0	39.0
Total Split (s)	12.0	101.0	89.0	39.0	39.0
Total Split (%)	8.6%	72.1%	63.6%	27.9%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 106 (76%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/1/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	220	1240	3955	390	295	310
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		0.96	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4791		3340	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4791		3340	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	239	1348	4299	424	321	337
RTOR Reduction (vph)	0	0	7	0	35	71
Lane Group Flow (vph)	239	1348	4716	0	414	138
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	7.0	106.1	94.1		22.9	22.9
Effective Green, g (s)	7.0	106.1	94.1		22.9	22.9
Actuated g/C Ratio	0.05	0.76	0.67		0.16	0.16
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	172	3854	3220		546	236
v/s Ratio Prot	c0.07	0.27	c0.98		c0.12	
v/s Ratio Perm						0.10
v/c Ratio	1.39	0.35	1.46		0.76	0.58
Uniform Delay, d1	66.5	5.6	23.0		55.9	54.1
Progression Factor	0.83	0.88	0.55		1.00	1.00
Incremental Delay, d2	205.6	0.2	209.2		6.0	3.7
Delay (s)	261.1	5.1	221.9		61.9	57.8
Level of Service	F	A	F		E	E
Approach Delay (s)		43.7	221.9		60.6	
Approach LOS		D	F		E	

Intersection Summary			
HCM Average Control Delay	166.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	116.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

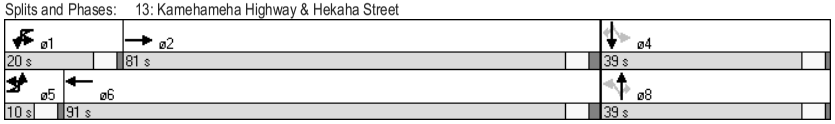
Timings
13: Kamehameha Highway & Hekaha Street

7/1/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1055	190	2785	235	45	230	65	45	100
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	33.0	8.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	10.0	81.0	20.0	91.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	7.1%	57.9%	14.3%	65.0%	27.9%	27.9%	27.9%	27.9%	27.9%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 40 (29%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1055	150	190	2785	80	235	45	230	65	45	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4642		3204	4723			1728	1442		1665	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.63	1.00		0.39	1.00
Satd. Flow (perm)	1652	4642		3204	4723			1131	1442		661	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1147	163	207	3027	87	255	49	250	71	49	109
RTOR Reduction (vph)	0	13	0	0	2	0	0	0	137	0	0	49
Lane Group Flow (vph)	54	1297	0	207	3112	0	0	304	113	0	120	60
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	76.5		13.5	85.0			34.0	34.0		34.0	34.0
Effective Green, g (s)	5.0	76.5		13.5	85.0			34.0	34.0		34.0	34.0
Actuated g/C Ratio	0.04	0.55		0.10	0.61			0.24	0.24		0.24	0.24
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	59	2537		309	2868			275	350		161	359
v/s Ratio Prot	0.03	0.28		c0.06	c0.66							
v/s Ratio Perm								c0.27	0.08		0.18	0.04
v/c Ratio	0.92	0.51		0.67	1.09			1.11	0.32		0.75	0.17
Uniform Delay, d1	67.3	20.0		61.1	27.5			53.0	43.5		49.0	41.8
Progression Factor	1.12	0.68		1.17	0.72			1.00	1.00		1.00	1.00
Incremental Delay, d2	81.4	0.7		0.5	39.0			85.5	0.5		17.0	0.2
Delay (s)	156.7	14.3		72.0	58.7			138.5	44.1		66.0	42.0
Level of Service	F	B		E	E			F	D		E	D
Approach Delay (s)		19.9			59.6			95.9			54.6	
Approach LOS		B			E			F			D	

Intersection Summary			
HCM Average Control Delay	53.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	98.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

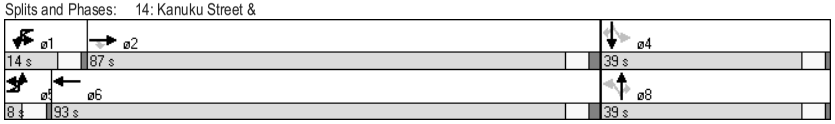
Timings
14: Kanuku Street &

7/1/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1215	75	90	3220	90	15	55	60	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	87.0	87.0	14.0	93.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	5.7%	62.1%	62.1%	10.0%	66.4%	27.9%	27.9%	27.9%	27.9%	27.9%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 44 (31%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1215	75	90	3220	220	90	15	55	60	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1432	3204	4694			1699	1531		1671	1430
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.67	1.00		0.57	1.00
Satd. Flow (perm)	1652	4746	1432	3204	4694			1189	1531		990	1430
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1321	82	98	3500	239	98	16	60	65	16	38
RTOR Reduction (vph)	0	0	25	0	4	0	0	0	52	0	0	33
Lane Group Flow (vph)	38	1321	57	98	3735	0	0	114	8	0	81	5
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	97.3	97.3	8.5	102.8			18.2	18.2		18.2	18.2
Effective Green, g (s)	3.0	97.3	97.3	8.5	102.8			18.2	18.2		18.2	18.2
Actuated g/C Ratio	0.02	0.69	0.69	0.06	0.73			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	35	3298	995	195	3447			155	199		129	186
v/s Ratio Prot	c0.02	0.28		0.03	c0.80							
v/s Ratio Perm			0.04					c0.10	0.01		0.08	0.00
v/c Ratio	1.09	0.40	0.06	0.50	1.08			0.74	0.04		0.63	0.03
Uniform Delay, d1	68.5	9.0	6.8	63.7	18.6			58.6	53.3		57.7	53.2
Progression Factor	0.98	0.47	0.19	1.18	0.19			1.00	1.00		1.00	1.00
Incremental Delay, d2	167.7	0.3	0.1	0.2	38.2			16.5	0.1		9.2	0.1
Delay (s)	234.9	4.5	1.4	75.5	41.8			75.1	53.3		66.9	53.2
Level of Service	F	A	A	E	D			E	D		E	D
Approach Delay (s)		10.4			42.7			67.6			62.5	
Approach LOS		B			D			E			E	

Intersection Summary			
HCM Average Control Delay	35.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

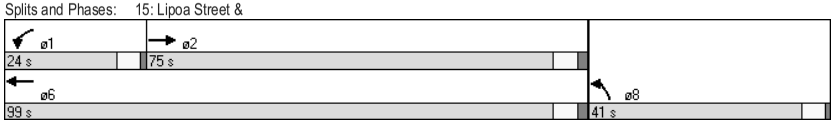
Timings
15: Lipoa Street &

7/1/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1350	95	4170	160
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	10.0	28.0	39.0
Total Split (s)	75.0	24.0	99.0	41.0
Total Split (%)	53.6%	17.1%	70.7%	29.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 40 (29%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/1/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1350	55	95	4170	160	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	*0.80	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5055		1652	4173	1746	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5055		1652	4173	1746	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1467	60	103	4533	174	38
RTOR Reduction (vph)	2	0	0	0	7	0
Lane Group Flow (vph)	1525	0	103	4533	205	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	88.4		13.9	107.3	21.7	
Effective Green, g (s)	88.4		13.9	107.3	21.7	
Actuated g/C Ratio	0.63		0.10	0.77	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3192		164	3198	271	
v/s Ratio Prot	0.30		0.06	c1.09	c0.12	
v/s Ratio Perm						
v/c Ratio	0.48		0.63	1.42	0.76	
Uniform Delay, d1	13.6		60.6	16.4	56.6	
Progression Factor	0.98		1.12	0.58	1.00	
Incremental Delay, d2	0.5		4.9	189.1	11.4	
Delay (s)	13.8		72.5	198.6	68.1	
Level of Service	B		E	F	E	
Approach Delay (s)	13.8			195.8	68.1	
Approach LOS	B			F	E	

Intersection Summary			
HCM Average Control Delay	148.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	100.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

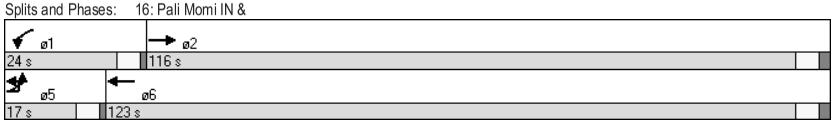
Timings
16: Pali Momi IN &

7/1/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	245	1095	120	3150
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	17.0	116.0	24.0	123.0
Total Split (%)	12.1%	82.9%	17.1%	87.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 126 (90%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/1/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	245	1095	35	120	3150	385	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4724		1652	4622							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4724		1652	4622							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	1190	38	130	3424	418	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	266	1226	0	130	3839	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	12.0	113.4		15.6	117.0							
Effective Green, g (s)	12.0	113.4		15.6	117.0							
Actuated g/C Ratio	0.09	0.81		0.11	0.84							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	275	3826		184	3863							
v/s Ratio Prot	c0.08	0.26		0.08	c0.83							
v/s Ratio Perm												
v/c Ratio	0.97	0.32		0.71	0.99							
Uniform Delay, d1	63.8	3.4		60.0	11.2							
Progression Factor	0.99	0.93		1.07	0.44							
Incremental Delay, d2	42.0	0.2		3.3	6.2							
Delay (s)	105.4	3.4		67.7	11.2							
Level of Service	F	A		E	B							
Approach Delay (s)		21.5			13.0			0.0			0.0	
Approach LOS		C			B			A			A	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	85.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

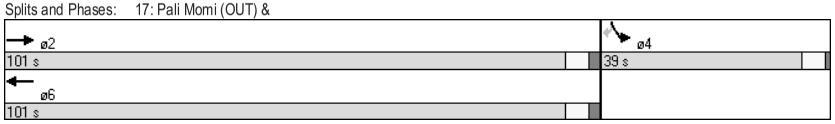
Timings
17: Pali Momi (OUT) &

7/1/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1095	3415	310	145
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	101.0	101.0	39.0	39.0
Total Split (%)	72.1%	72.1%	27.9%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 136 (97%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/1/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1095	3415	0	310	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.87
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1336
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1336
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1190	3712	0	337	158
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1190	3712	0	337	158
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		106.8	106.8		22.2	22.2
Effective Green, g (s)		106.8	106.8		22.2	22.2
Actuated g/C Ratio		0.76	0.76		0.16	0.16
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3621	3621		526	212
v/s Ratio Prot		0.25	c0.78		0.10	
v/s Ratio Perm						c0.12
v/c Ratio		0.33	1.03		0.64	0.75
Uniform Delay, d1		5.3	16.6		55.2	56.2
Progression Factor		0.77	1.00		1.00	1.00
Incremental Delay, d2		0.2	21.8		2.7	13.3
Delay (s)		4.3	38.4		57.8	69.5
Level of Service		A	D		E	E
Approach Delay (s)		4.3	38.4		61.5	
Approach LOS		A	D		E	

Intersection Summary			
HCM Average Control Delay	33.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	102.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1650	25	30	1625	15	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1793	27	33	1766	16	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.73	
vC, conflicting volume			1821		2755	910
vC1, stage 1 conf vol					1807	
vC2, stage 2 conf vol					948	
vCu, unblocked vol			1821		2663	910
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			90		85	71
cM capacity (veh/h)			333		110	277

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1196	625	33	883	883	98
Volume Left	0	0	33	0	0	16
Volume Right	0	27	0	0	0	82
cSH	1700	1700	333	1700	1700	221
Volume to Capacity	0.70	0.37	0.10	0.52	0.52	0.44
Queue Length 95th (ft)	0	0	8	0	0	52
Control Delay (s)	0.0	0.0	17.0	0.0	0.0	33.5
Lane LOS			C			D
Approach Delay (s)	0.0		0.3			33.5
Approach LOS						D

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	1725	1655	15	15	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1875	1799	16	16	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.72				0.72	0.72
vC, conflicting volume	1815				2755	908
vC1, stage 1 conf vol					1807	
vC2, stage 2 conf vol					948	
vCu, unblocked vol	1355				2661	96
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				88	98
cM capacity (veh/h)	363				131	679

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	5	938	938	1199	616	33
Volume Left	5	0	0	0	0	16
Volume Right	0	0	0	0	16	16
cSH	363	1700	1700	1700	1700	219
Volume to Capacity	0.01	0.55	0.55	0.71	0.36	0.15
Queue Length 95th (ft)	1	0	0	0	0	13
Control Delay (s)	15.1	0.0	0.0	0.0	0.0	24.2
Lane LOS	C					C
Approach Delay (s)	0.0			0.0		24.2
Approach LOS						C

Intersection Summary			
Average Delay		0.2	
Intersection Capacity Utilization		57.7%	ICU Level of Service	B
Analysis Period (min)		15	

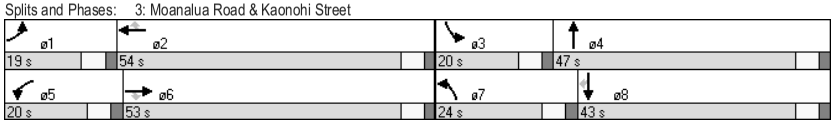
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	140	1175	425	180	1025	210	465	180	195	150	195
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	19.0	53.0	53.0	20.0	54.0	54.0	24.0	47.0	20.0	43.0	43.0
Total Split (%)	13.6%	37.9%	37.9%	14.3%	38.6%	38.6%	17.1%	33.6%	14.3%	30.7%	30.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 119.1
Natural Cycle: 150
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	140	1175	425	180	1025	210	465	180	305	195	150	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3205		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3205		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	1277	462	196	1114	228	505	196	332	212	163	212
RTOR Reduction (vph)	0	0	261	0	0	136	0	169	0	0	0	174
Lane Group Flow (vph)	152	1277	201	196	1114	92	505	359	0	212	163	38
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	13.0	47.1	47.1	14.0	48.1	48.1	18.0	21.9		12.1	16.0	16.0
Effective Green, g (s)	13.0	47.1	47.1	14.0	48.1	48.1	18.0	21.9		12.1	16.0	16.0
Actuated g/C Ratio	0.11	0.40	0.40	0.12	0.40	0.40	0.15	0.18		0.10	0.13	0.13
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	193	1400	626	208	1429	639	519	589		349	250	213
v/s Ratio Prot	0.09	c0.36		c0.11	0.31		c0.15	c0.11		0.06	0.09	
v/s Ratio Perm			0.13			0.06						0.02
v/c Ratio	0.79	0.91	0.32	0.94	0.78	0.14	0.97	0.61		0.61	0.65	0.18
Uniform Delay, d1	51.7	34.0	24.9	52.1	30.9	22.5	50.3	44.7		51.2	48.9	45.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	18.8	9.7	0.6	46.4	3.2	0.2	32.4	1.8		3.0	6.0	0.4
Delay (s)	70.5	43.8	25.6	98.6	34.1	22.7	82.7	46.5		54.2	54.9	46.1
Level of Service	E	D	C	F	C	C	F	D		D	D	D
Approach Delay (s)		41.5			40.6			64.2			51.5	
Approach LOS		D			D			E			D	

Intersection Summary				
HCM Average Control Delay	47.0	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.89			
Actuated Cycle Length (s)	119.1	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	83.6%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	40	0	0	165	0	805	95	0	625	135
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	43	0	0	179	0	875	103	0	679	147
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.92	0.92	0.92	0.92	0.92		0.92					
vC, conflicting volume	1151	1731	753	1723	1753	270	826			978		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1120	1751	686	1743	1775	270	766			978		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	88	100	100	75	100			100		
cM capacity (veh/h)	112	78	358	45	75	727	774			701		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	43	179	250	250	250	228	826
Volume Left	0	0	0	0	0	0	0
Volume Right	43	179	0	0	0	103	147
cSH	358	727	1700	1700	1700	1700	1700
Volume to Capacity	0.12	0.25	0.15	0.15	0.15	0.13	0.49
Queue Length 95th (ft)	10	24	0	0	0	0	0
Control Delay (s)	16.4	11.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B					
Approach Delay (s)	16.4	11.6	0.0				0.0
Approach LOS	C	B					

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	51.1%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	100	180	710	130	160	510
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	196	772	141	174	554
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	1467	457			913	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1467	457			913	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	64			77	
cM capacity (veh/h)	91	551			742	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	109	196	514	399	359	370
Volume Left	109	0	0	0	174	0
Volume Right	0	196	0	141	0	0
cSH	91	551	1700	1700	742	1700
Volume to Capacity	1.20	0.36	0.30	0.23	0.23	0.22
Queue Length 95th (ft)	190	40	0	0	23	0
Control Delay (s)	242.0	15.1	0.0	0.0	7.0	0.0
Lane LOS	F	C			A	
Approach Delay (s)	96.1		0.0		3.5	
Approach LOS	F					

Intersection Summary			
Average Delay	16.3		
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	95	20	375	195	0	190	0	525	225	150	475	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	103	22	408	212	0	207	0	571	245	163	516	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	1337	1660	261	1696	1541	408	522			815		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1337	1660	261	1696	1541	408	522			815		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	72	45	0	100	65	100			80		
cM capacity (veh/h)	61	77	738	18	91	593	1041			808		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	533	212	207	380	435	163	344	178
Volume Left	103	212	0	0	0	163	0	0
Volume Right	408	0	207	0	245	0	0	5
cSH	212	18	593	1700	1700	808	1700	1700
Volume to Capacity	2.52	11.83	0.35	0.22	0.26	0.20	0.20	0.10
Queue Length 95th (ft)	1115	Err	39	0	0	19	0	0
Control Delay (s)	732.3	Err	14.3	0.0	0.0	10.6	0.0	0.0
Lane LOS	F	F	B			B		
Approach Delay (s)	732.3	5071.5		0.0		2.5		
Approach LOS	F	F						

Intersection Summary			
Average Delay	1025.7		
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	25	45	25	720	915	120
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	49	27	783	995	130
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	1505	562	1125			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1505	562	1125			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	90	96			
cM capacity (veh/h)	107	470	617			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	288	522	663	462
Volume Left	27	27	0	0	0
Volume Right	49	0	0	0	130
cSH	212	617	1700	1700	1700
Volume to Capacity	0.36	0.04	0.31	0.39	0.27
Queue Length 95th (ft)	38	3	0	0	0
Control Delay (s)	31.1	1.6	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	31.1	0.6		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	95	45	735	955	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	103	49	799	1038	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	1552	535	1071			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1552	535	1071			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	66	79	92			
cM capacity (veh/h)	96	490	647			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	136	315	533	692	379
Volume Left	33	49	0	0	0
Volume Right	103	0	0	0	33
cSH	247	647	1700	1700	1700
Volume to Capacity	0.55	0.08	0.31	0.41	0.22
Queue Length 95th (ft)	75	6	0	0	0
Control Delay (s)	36.0	2.5	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	36.0	0.9		0.0	
Approach LOS	E				

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	85	685	85	45	910
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	92	745	92	49	989
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	1218	418			837	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1218	418			837	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	53	84			94	
cM capacity (veh/h)	162	583			793	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	168	496	341	247	396	396
Volume Left	76	0	0	49	0	0
Volume Right	92	0	92	0	0	0
cSH	269	1700	1700	793	1700	1700
Volume to Capacity	0.63	0.29	0.20	0.06	0.23	0.23
Queue Length 95th (ft)	97	0	0	5	0	0
Control Delay (s)	38.6	0.0	0.0	2.5	0.0	0.0
Lane LOS	E			A		
Approach Delay (s)	38.6	0.0		0.6		
Approach LOS	E					

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	110	90	720	995	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	120	98	783	1082	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1704	396	1082			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1704	396	1082			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	30	80	85			
cM capacity (veh/h)	70	603	641			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	98	391	391	433	433	287
Volume Left	49	98	0	0	0	0	0
Volume Right	120	0	0	0	0	0	71
cSH	188	641	1700	1700	1700	1700	1700
Volume to Capacity	0.90	0.15	0.23	0.23	0.25	0.25	0.17
Queue Length 95th (ft)	171	13	0	0	0	0	0
Control Delay (s)	92.2	11.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	92.2	1.3			0.0		
Approach LOS	F						

Intersection Summary			
Average Delay	7.6		
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

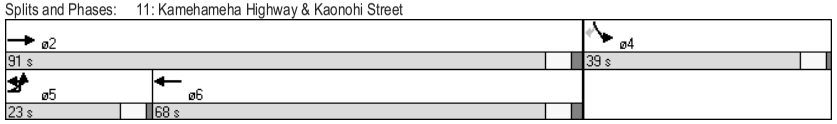
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	390	1775	1495	585	520
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	32.0	32.0
Total Split (s)	23.0	91.0	68.0	39.0	39.0
Total Split (%)	17.7%	70.0%	52.3%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 94 (72%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	390	1775	1495	415	585	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.97		0.98	0.90
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		0.97	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4618		3283	1293
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4618		3283	1293
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	424	1929	1625	451	636	565
RTOR Reduction (vph)	0	0	38	0	22	186
Lane Group Flow (vph)	424	1929	2038	0	800	193
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	18.0	85.4	62.4		33.6	33.6
Effective Green, g (s)	18.0	85.4	62.4		33.6	33.6
Actuated g/C Ratio	0.14	0.66	0.48		0.26	0.26
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	444	3118	2217		849	334
v/s Ratio Prot	c0.13	0.41	c0.44		c0.24	
v/s Ratio Perm						0.15
v/c Ratio	0.95	0.62	0.92		0.94	0.58
Uniform Delay, d1	55.6	12.9	31.5		47.3	42.0
Progression Factor	1.25	0.27	0.64		1.00	1.00
Incremental Delay, d2	27.8	0.8	6.3		18.4	2.4
Delay (s)	97.3	4.3	26.5		65.7	44.4
Level of Service	F	A	C		E	D
Approach Delay (s)		21.1	26.5		59.0	
Approach LOS		C	C		E	

Intersection Summary			
HCM Average Control Delay	31.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	100	1635	225	1740	210	55	320	95	40	140
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	17.0	68.0	17.0	68.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	13.1%	52.3%	13.1%	52.3%	34.6%	34.6%	34.6%	34.6%	34.6%	34.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 126 (97%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street

ø1	ø2	ø4
17 s	68 s	45 s
ø5	ø6	ø8
17 s	68 s	45 s

HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	1635	290	225	1740	65	210	55	320	95	40	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4623		3204	4715			1700	1531		1679	1417
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.41	1.00
Satd. Flow (perm)	1652	4623		3204	4715			1091	1531		717	1417
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1777	315	245	1891	71	228	60	348	103	43	152
RTOR Reduction (vph)	0	18	0	0	3	0	0	0	130	0	0	109
Lane Group Flow (vph)	109	2074	0	245	1959	0	0	288	218	0	146	43
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	11.4	65.2		11.9	65.7			36.9	36.9		36.9	36.9
Effective Green, g (s)	11.4	65.2		11.9	65.7			36.9	36.9		36.9	36.9
Actuated g/C Ratio	0.09	0.50		0.09	0.51			0.28	0.28		0.28	0.28
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	145	2319		293	2383			310	435		204	402
v/s Ratio Prot	0.07	c0.45		c0.08	0.42							
v/s Ratio Perm								c0.26	0.14		0.20	0.03
v/c Ratio	0.75	0.89		0.84	0.82			0.93	0.50		0.72	0.11
Uniform Delay, d1	57.9	29.3		58.1	27.2			45.3	38.9		41.8	34.4
Progression Factor	0.91	0.94		1.04	0.81			1.00	1.00		1.00	1.00
Incremental Delay, d2	11.2	3.3		13.5	2.4			32.7	0.9		11.3	0.1
Delay (s)	63.9	30.8		73.8	24.5			78.0	39.8		53.1	34.5
Level of Service	E	C		E	C			E	D		D	C
Approach Delay (s)		32.4			29.9			57.1			43.6	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM Average Control Delay	34.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	101.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	75	1780	105	110	1830	65	20	75	125	15	80
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	40.0	40.0	40.0
Total Split (s)	14.0	76.0	76.0	14.0	76.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	10.8%	58.5%	58.5%	10.8%	58.5%	30.8%	30.8%	30.8%	30.8%	30.8%	30.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 6 (5%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &

ø1	ø2	ø4
14 s	76 s	40 s
ø5	ø6	ø8
14 s	76 s	40 s

HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1780	105	110	1830	235	65	20	75	125	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4665			1734	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.56	1.00		0.66	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4665			1014	1531		1143	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	1935	114	120	1989	255	71	22	82	136	16	87
RTOR Reduction (vph)	0	0	28	0	10	0	0	0	67	0	0	72
Lane Group Flow (vph)	82	1935	86	120	2234	0	0	93	15	0	152	15
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	8.7	82.3	82.3	8.7	82.3			23.0	23.0		22.0	22.0
Effective Green, g (s)	8.7	82.3	82.3	8.7	82.3			23.0	23.0		22.0	22.0
Actuated g/C Ratio	0.07	0.63	0.63	0.07	0.63			0.18	0.18		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	111	3005	936	214	2953			179	271		193	250
v/s Ratio Prot	c0.05	0.41		0.04	c0.48							
v/s Ratio Perm			0.06					0.09	0.01		c0.13	0.01
v/c Ratio	0.74	0.64	0.09	0.56	0.76			0.52	0.05		0.79	0.06
Uniform Delay, d1	59.5	14.8	9.3	58.8	16.8			48.5	44.5		51.8	45.3
Progression Factor	1.11	0.33	0.16	0.81	1.37			1.00	1.00		1.00	1.00
Incremental Delay, d2	12.5	0.6	0.1	1.8	1.0			2.5	0.1		18.8	0.1
Delay (s)	78.8	5.5	1.6	49.5	24.0			51.0	44.5		70.6	45.4
Level of Service	E	A	A	D	C			D	D		E	D
Approach Delay (s)		8.1			25.3			48.0			61.4	
Approach LOS		A			C			D			E	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

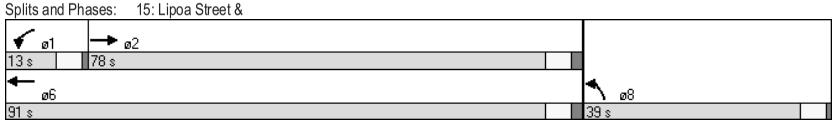
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2060	50	1955	165
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	78.0	13.0	91.0	39.0
Total Split (%)	60.0%	10.0%	70.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 26 (20%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2060	65	50	1955	165	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4721		1652	4746	1674	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4721		1652	4746	1674	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2239	71	54	2125	179	76
RTOR Reduction (vph)	2	0	0	0	13	0
Lane Group Flow (vph)	2308	0	54	2125	242	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	83.6		6.4	95.0	24.0	
Effective Green, g (s)	83.6		6.4	95.0	24.0	
Actuated g/C Ratio	0.64		0.05	0.73	0.18	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3036		81	3468	309	
v/s Ratio Prot	c0.49		0.03	c0.45	c0.14	
v/s Ratio Perm						
v/c Ratio	0.76		0.67	0.61	0.78	
Uniform Delay, d1	16.2		60.8	8.5	50.5	
Progression Factor	0.77		1.18	0.51	1.00	
Incremental Delay, d2	1.3		14.6	0.6	12.2	
Delay (s)	13.8		86.3	5.0	62.7	
Level of Service	B		F	A	E	
Approach Delay (s)	13.8			7.0	62.7	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

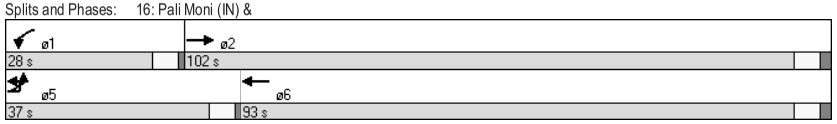
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	465	1575	150	1750
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	37.0	102.0	28.0	93.0
Total Split (%)	28.5%	78.5%	21.5%	71.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 6 (5%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	465	1575	55	150	1750	490	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	0.99		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4722		1652	4524							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4722		1652	4524							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	505	1712	60	163	1902	533	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	20	0	0	0	0	0	0	0
Lane Group Flow (vph)	505	1770	0	163	2415	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	25.6	101.3		17.7	93.4							
Effective Green, g (s)	25.6	101.3		17.7	93.4							
Actuated g/C Ratio	0.20	0.78		0.14	0.72							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	631	3680		225	3250							
v/s Ratio Prot	c0.16	0.37		0.10	c0.53							
v/s Ratio Perm												
v/c Ratio	0.80	0.48		0.72	0.74							
Uniform Delay, d1	49.8	5.1		53.8	11.1							
Progression Factor	0.71	1.20		1.08	0.44							
Incremental Delay, d2	4.8	0.3		9.0	1.3							
Delay (s)	40.1	6.4		67.2	6.1							
Level of Service	D	A		E	A							
Approach Delay (s)		13.8			10.0			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

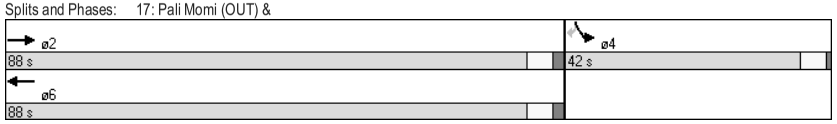
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1535	2040	350	185
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	88.0	88.0	42.0	42.0
Total Split (%)	67.7%	67.7%	32.3%	32.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 16 (12%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1535	2040	0	350	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.86
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1316
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1316
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1668	2217	0	380	201
RTOR Reduction (vph)	0	0	0	0	0	7
Lane Group Flow (vph)	0	1668	2217	0	380	194
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		94.4	94.4		24.6	24.6
Effective Green, g (s)		94.4	94.4		24.6	24.6
Actuated g/C Ratio		0.73	0.73		0.19	0.19
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3446	3446		628	249
v/s Ratio Prot		0.35	c0.47		0.11	
v/s Ratio Perm						c0.15
v/c Ratio		0.48	0.64		0.61	0.78
Uniform Delay, d1		7.5	9.1		48.3	50.1
Progression Factor		0.26	1.00		1.00	1.00
Incremental Delay, d2		0.4	0.9		1.7	14.2
Delay (s)		2.4	10.1		49.9	64.3
Level of Service		A	B		D	E
Approach Delay (s)		2.4	10.1		54.9	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	76.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2019

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1590	15	30	1120	15	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1728	16	33	1217	16	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.89	
vC, conflicting volume			1745		2410	872
vC1, stage 1 conf vol					1736	
vC2, stage 2 conf vol					674	
vCu, unblocked vol			1745		2336	872
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			91		87	85
cM capacity (veh/h)			356		121	294

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1152	592	33	609	609	60
Volume Left	0	0	33	0	0	16
Volume Right	0	16	0	0	0	43
cSH	1700	1700	356	1700	1700	211
Volume to Capacity	0.68	0.35	0.09	0.36	0.36	0.28
Queue Length 95th (ft)	0	0	8	0	0	28
Control Delay (s)	0.0	0.0	16.1	0.0	0.0	28.6
Lane LOS			C			D
Approach Delay (s)	0.0		0.4			28.6
Approach LOS						D

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	155	1495	835	205	45	270
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	168	1625	908	223	49	293
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.84				0.84	0.84
vC, conflicting volume	1130				2168	565
vC1, stage 1 conf vol					1019	
vC2, stage 2 conf vol					1149	
vCu, unblocked vol	770				2008	96
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	76				72	63
cM capacity (veh/h)	704				176	790

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	168	812	812	605	525	342
Volume Left	168	0	0	0	0	49
Volume Right	0	0	0	0	223	293
cSH	704	1700	1700	1700	1700	527
Volume to Capacity	0.24	0.48	0.48	0.36	0.31	0.65
Queue Length 95th (ft)	23	0	0	0	0	116
Control Delay (s)	11.7	0.0	0.0	0.0	0.0	23.6
Lane LOS	B					C
Approach Delay (s)	1.1			0.0		23.6
Approach LOS						C

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		

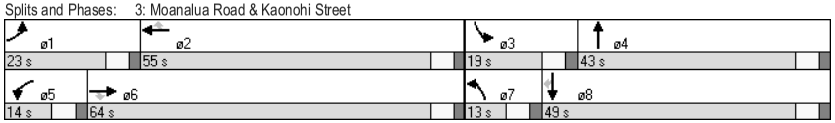
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	110	1225	205	80	745	100	80	85	285	225	235
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	23.0	64.0	64.0	14.0	55.0	55.0	13.0	43.0	19.0	49.0	49.0
Total Split (%)	16.4%	45.7%	45.7%	10.0%	39.3%	39.3%	9.3%	30.7%	13.6%	35.0%	35.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 116.9
Natural Cycle: 120
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	1225	205	80	745	100	80	85	85	285	225	235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	1332	223	87	810	109	87	92	92	310	245	255
RTOR Reduction (vph)	0	0	115	0	0	61	0	80	0	0	0	185
Lane Group Flow (vph)	120	1332	108	87	810	48	87	104	0	310	245	70
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.8	56.6	56.6	8.0	51.8	51.8	6.9	15.0		13.1	21.2	21.2
Effective Green, g (s)	12.8	56.6	56.6	8.0	51.8	51.8	6.9	15.0		13.1	21.2	21.2
Actuated g/C Ratio	0.11	0.49	0.49	0.07	0.44	0.44	0.06	0.13		0.11	0.18	0.18
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	194	1716	768	121	1571	703	203	421		385	338	288
v/s Ratio Prot	c0.07	c0.38		0.05	0.23		0.03	0.03		c0.09	c0.13	
v/s Ratio Perm			0.07			0.03						0.04
v/c Ratio	0.62	0.78	0.14	0.72	0.52	0.07	0.43	0.25		0.81	0.72	0.24
Uniform Delay, d1	49.6	24.8	16.6	53.2	23.4	18.6	53.0	45.8		50.6	45.0	40.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.8	2.7	0.2	19.0	0.6	0.1	1.5	0.3		11.6	7.5	0.4
Delay (s)	55.4	27.5	16.8	72.2	24.0	18.7	54.5	46.1		62.2	52.5	41.3
Level of Service	E	C	B	E	C	B	D	D		E	D	D
Approach Delay (s)		28.1			27.6			48.8			52.7	
Approach LOS		C			C			D			D	

Intersection Summary				
HCM Average Control Delay	34.7	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.81			
Actuated Cycle Length (s)	116.7	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	74.3%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	10	0	250	20	0	525	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	11	0	272	22	0	571	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.88	0.88	0.88	0.88	0.88		0.88					
vC, conflicting volume	649	864	571	853	853	79	571			293		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	529	774	439	762	762	79	439			293		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	99	100			100		
cM capacity (veh/h)	375	287	495	258	292	966	979			1265		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	11	78	78	78	61	571
Volume Left	0	0	0	0	0	0	0
Volume Right	0	11	0	0	0	22	0
cSH	1700	966	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.01	0.05	0.05	0.05	0.04	0.34
Queue Length 95th (ft)	0	1	0	0	0	0	0
Control Delay (s)	0.0	8.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	8.8	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay	0.1			
Intersection Capacity Utilization	31.0%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	30	245	15	30	480
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	33	266	16	33	522
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	601	141			283	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	601	141			283	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	96			97	
cM capacity (veh/h)	421	881			1277	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	16	33	178	105	207	348
Volume Left	16	0	0	0	33	0
Volume Right	0	33	0	16	0	0
cSH	421	881	1700	1700	1277	1700
Volume to Capacity	0.04	0.04	0.10	0.06	0.03	0.20
Queue Length 95th (ft)	3	3	0	0	2	0
Control Delay (s)	13.9	9.2	0.0	0.0	1.4	0.0
Lane LOS	B	A			A	
Approach Delay (s)	10.8		0.0		0.5	
Approach LOS	B					

Intersection Summary				
Average Delay		0.9		
Intersection Capacity Utilization		34.7%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	30	0	10	0	240	40	35	480	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	33	0	11	0	261	43	38	522	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	739	902	261	620	880	152	522			304		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	739	902	261	620	880	152	522			304		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	91	100	99	100			97		
cM capacity (veh/h)	295	268	738	364	276	867	1041			1253		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	0	33	11	174	130	38	348	174
Volume Left	0	33	0	0	0	38	0	0
Volume Right	0	0	11	0	43	0	0	0
cSH	1700	364	867	1700	1700	1253	1700	1700
Volume to Capacity	0.00	0.09	0.01	0.10	0.08	0.03	0.20	0.10
Queue Length 95th (ft)	0	7	1	0	0	2	0	0
Control Delay (s)	0.0	15.9	9.2	0.0	0.0	8.0	0.0	0.0
Lane LOS	A	C	A			A		
Approach Delay (s)	0.0	14.2		0.0		0.5		
Approach LOS	A	B						

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		24.6%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	30	20	245	430	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	33	22	266	467	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	674	264	527			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	674	264	527			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	96	98			
cM capacity (veh/h)	380	735	1036			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	111	178	312	216
Volume Left	43	22	0	0	0
Volume Right	33	0	0	0	60
cSH	479	1036	1700	1700	1700
Volume to Capacity	0.16	0.02	0.10	0.18	0.13
Queue Length 95th (ft)	14	2	0	0	0
Control Delay (s)	13.9	1.8	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	13.9	0.7		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	32.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	50	20	250	460	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	54	22	272	500	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	682	253	505			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	682	253	505			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	93	98			
cM capacity (veh/h)	376	747	1055			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	112	181	333	172
Volume Left	16	22	0	0	0
Volume Right	54	0	0	0	5
cSH	608	1055	1700	1700	1700
Volume to Capacity	0.12	0.02	0.11	0.20	0.10
Queue Length 95th (ft)	10	2	0	0	0
Control Delay (s)	11.7	1.8	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.7	0.7		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	32.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	255	55	25	485
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	277	60	27	527
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	537	168			337	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	537	168			337	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	98			98	
cM capacity (veh/h)	463	846			1219	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	185	152	133	211	211
Volume Left	49	0	0	27	0	0
Volume Right	16	0	60	0	0	0
cSH	522	1700	1700	1219	1700	1700
Volume to Capacity	0.12	0.11	0.09	0.02	0.12	0.12
Queue Length 95th (ft)	11	0	0	2	0	0
Control Delay (s)	12.9	0.0	0.0	1.8	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	12.9	0.0		0.4		
Approach LOS	B					

Intersection Summary				
Average Delay		1.1		
Intersection Capacity Utilization		32.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	85	155	55	220	505	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	168	60	239	549	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	807	202	549			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	807	202	549			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	69	79	94			
cM capacity (veh/h)	300	805	1017			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	261	60	120	120	220	220	148
Volume Left	92	60	0	0	0	0	0
Volume Right	168	0	0	0	0	0	38
cSH	505	1017	1700	1700	1700	1700	1700
Volume to Capacity	0.52	0.06	0.07	0.07	0.13	0.13	0.09
Queue Length 95th (ft)	73	5	0	0	0	0	0
Control Delay (s)	19.5	8.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	19.5	1.8			0.0		
Approach LOS	C						

Intersection Summary				
Average Delay		4.9		
Intersection Capacity Utilization		38.1%	ICU Level of Service	A
Analysis Period (min)		15		

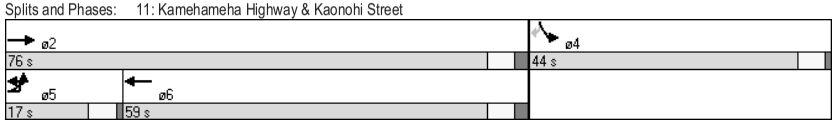
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	130	1725	805	545	115
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	17.0	76.0	59.0	44.0	44.0
Total Split (%)	14.2%	63.3%	49.2%	36.7%	36.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 80 (67%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	130	1725	805	170	545	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	0.93
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4724		3429	1343
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4724		3429	1343
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	1875	875	185	592	125
RTOR Reduction (vph)	0	0	27	0	1	76
Lane Group Flow (vph)	141	1875	1033	0	604	36
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	10.3	70.0	54.7		39.0	39.0
Effective Green, g (s)	10.3	70.0	54.7		39.0	39.0
Actuated g/C Ratio	0.09	0.58	0.46		0.32	0.32
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	275	2769	2153		1114	436
v/s Ratio Prot	0.04	c0.40	0.22		c0.18	
v/s Ratio Perm						0.03
v/c Ratio	0.51	0.68	0.48		0.54	0.08
Uniform Delay, d1	52.5	17.2	22.7		33.2	28.1
Progression Factor	1.30	0.43	0.69		1.00	1.00
Incremental Delay, d2	1.3	1.1	0.7		1.9	0.4
Delay (s)	69.5	8.5	16.4		35.1	28.5
Level of Service	E	A	B		D	C
Approach Delay (s)		12.7	16.4		34.0	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	17.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

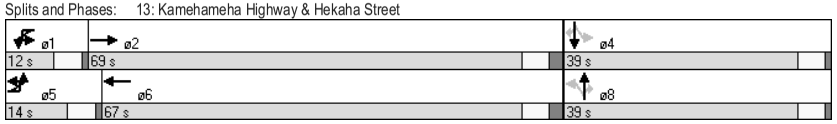
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1705	90	860	55	5	60	115	15	75
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	39.0	39.0	39.0
Total Split (s)	14.0	69.0	12.0	67.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	11.7%	57.5%	10.0%	55.8%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 101 (84%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1705	190	90	860	30	55	5	60	115	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.96		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4662		3204	4718			1720	1470		1643	1459
Flt Permitted	0.95	1.00		0.95	1.00			0.53	1.00		0.70	1.00
Satd. Flow (perm)	1652	4662		3204	4718			956	1470		1208	1459
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1853	207	98	935	33	60	5	65	125	16	82
RTOR Reduction (vph)	0	8	0	0	2	0	0	0	55	0	0	69
Lane Group Flow (vph)	54	2052	0	98	966	0	0	65	10	0	141	13
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.0	77.8		6.9	77.7			19.3	19.3		19.3	19.3
Effective Green, g (s)	7.0	77.8		6.9	77.7			19.3	19.3		19.3	19.3
Actuated g/C Ratio	0.06	0.65		0.06	0.65			0.16	0.16		0.16	0.16
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	96	3023		184	3055			154	236		194	235
v/s Ratio Prot	c0.03	c0.44		0.03	0.20							
v/s Ratio Perm								0.07	0.01		c0.12	0.01
v/c Ratio	0.56	0.68		0.53	0.32			0.42	0.04		0.73	0.06
Uniform Delay, d1	55.0	13.3		55.0	9.4			45.3	42.6		47.8	42.6
Progression Factor	0.98	0.67		0.62	1.35			1.00	1.00		1.00	1.00
Incremental Delay, d2	5.8	1.0		2.8	0.3			1.9	0.1		12.7	0.1
Delay (s)	59.7	9.9		36.7	12.9			47.2	42.6		60.6	42.7
Level of Service	E	A		D	B			D	D		E	D
Approach Delay (s)		11.1			15.1			44.9			54.0	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	30	1755	20	20	930	5	5	15	140	10	45
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	39.0	39.0	39.0
Total Split (s)	11.0	70.0	70.0	10.0	69.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	9.2%	58.3%	58.3%	8.3%	57.5%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 8 (7%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &

ø1	ø2	ø4
10 s	70 s	40 s
ø5	ø6	ø8
11 s	69 s	40 s

HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	1755	20	20	930	65	5	5	15	140	10	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1451	3204	4694			1754	1531		1661	1454
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1451	3204	4694			1588	1531		1275	1454
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	1908	22	22	1011	71	5	5	16	152	11	49
RTOR Reduction (vph)	0	0	5	0	5	0	0	0	13	0	0	41
Lane Group Flow (vph)	33	1908	17	22	1077	0	0	10	3	0	163	8
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.6	80.3	80.3	3.0	79.7			20.7	20.7		20.7	20.7
Effective Green, g (s)	3.6	80.3	80.3	3.0	79.7			20.7	20.7		20.7	20.7
Actuated g/C Ratio	0.03	0.67	0.67	0.02	0.66			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	50	3176	971	80	3118			274	264		220	251
v/s Ratio Prot	c0.02	c0.40		0.01	0.23							
v/s Ratio Perm			0.01					0.01	0.00		c0.13	0.01
v/c Ratio	0.66	0.60	0.02	0.28	0.35			0.04	0.01		0.74	0.03
Uniform Delay, d1	57.6	11.0	6.6	57.4	8.8			41.3	41.2		47.1	41.3
Progression Factor	1.25	0.39	0.17	0.73	1.67			1.00	1.00		1.00	1.00
Incremental Delay, d2	22.1	0.6	0.0	1.7	0.3			0.1	0.0		12.6	0.1
Delay (s)	94.2	5.0	1.1	43.5	14.9			41.4	41.2		59.7	41.4
Level of Service	F	A	A	D	B			D	D		E	D
Approach Delay (s)		6.4			15.5			41.3			55.5	
Approach LOS		A			B			D			E	

Intersection Summary				
HCM Average Control Delay	12.9	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.60			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	62.2%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

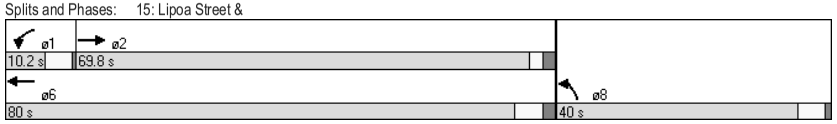
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2235	45	975	75
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	69.8	10.2	80.0	40.0
Total Split (%)	58.2%	8.5%	66.7%	33.3%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 17 (14%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2235	50	45	975	75	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4731		1652	4746	1656	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4731		1652	4746	1656	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2429	54	49	1060	82	65
RTOR Reduction (vph)	1	0	0	0	30	0
Lane Group Flow (vph)	2482	0	49	1060	117	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	88.2		4.6	95.3	13.7	
Effective Green, g (s)	88.2		4.6	95.3	13.7	
Actuated g/C Ratio	0.74		0.04	0.79	0.11	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3477		63	3769	189	
v/s Ratio Prot	c0.52		c0.03	0.22	c0.07	
v/s Ratio Perm						
v/c Ratio	0.71		0.78	0.28	0.62	
Uniform Delay, d1	8.9		57.2	3.3	50.7	
Progression Factor	0.48		0.84	0.93	1.00	
Incremental Delay, d2	1.0		42.7	0.2	5.9	
Delay (s)	5.3		90.5	3.2	56.6	
Level of Service	A		F	A	E	
Approach Delay (s)	5.3			7.1	56.6	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	76.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	200	2125	45	1015
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	24.0	102.0	18.0	96.0
Total Split (%)	20.0%	85.0%	15.0%	80.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 114 (95%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &

ø1	ø2
18 s	102 s

ø5	ø6
24 s	96 s

HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	2125	15	45	1015	180	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4741		1652	4639							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4741		1652	4639							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	2310	16	49	1103	196	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	0	0	0	0	0
Lane Group Flow (vph)	217	2326	0	49	1282	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	13.4	101.2		7.8	95.6							
Effective Green, g (s)	13.4	101.2		7.8	95.6							
Actuated g/C Ratio	0.11	0.84		0.06	0.80							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	358	3998		107	3696							
v/s Ratio Prot	c0.07	c0.49		0.03	0.28							
v/s Ratio Perm												
v/c Ratio	0.61	0.58		0.46	0.35							
Uniform Delay, d1	50.8	2.9		54.1	3.4							
Progression Factor	0.75	0.90		0.92	0.45							
Incremental Delay, d2	2.1	0.5		2.9	0.2							
Delay (s)	40.0	3.1		52.5	1.8							
Level of Service	D	A		D	A							
Approach Delay (s)		6.2			3.6			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

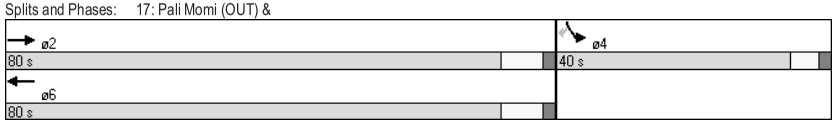
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	2010	1155	325	80
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	80.0	80.0	40.0	40.0
Total Split (%)	66.7%	66.7%	33.3%	33.3%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 16 (13%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	2010	1155	0	325	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.94
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1434
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1434
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2185	1255	0	353	87
RTOR Reduction (vph)	0	0	0	0	0	48
Lane Group Flow (vph)	0	2185	1255	0	353	39
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		72.0	72.0		34.0	34.0
Effective Green, g (s)		72.0	72.0		34.0	34.0
Actuated g/C Ratio		0.60	0.60		0.28	0.28
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2848	2848		940	406
v/s Ratio Prot		c0.46	0.26		c0.11	
v/s Ratio Perm						0.03
v/c Ratio		0.77	0.44		0.38	0.10
Uniform Delay, d1		17.8	13.1		34.5	31.7
Progression Factor		0.34	1.00		1.00	1.00
Incremental Delay, d2		1.7	0.5		1.1	0.5
Delay (s)		7.7	13.5		35.6	32.1
Level of Service		A	B		D	C
Approach Delay (s)		7.7	13.5		34.9	
Approach LOS		A	B		C	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1220	25	20	1930	15	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1326	27	22	2098	16	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.59	
vC, conflicting volume			1353		2432	677
vC1, stage 1 conf vol					1340	
vC2, stage 2 conf vol					1092	
vCu, unblocked vol			1353		2034	677
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			96		91	95
cM capacity (veh/h)			504		190	396

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	884	469	22	1049	1049	38
Volume Left	0	0	22	0	0	16
Volume Right	0	27	0	0	0	22
cSH	1700	1700	504	1700	1700	271
Volume to Capacity	0.52	0.28	0.04	0.62	0.62	0.14
Queue Length 95th (ft)	0	0	3	0	0	12
Control Delay (s)	0.0	0.0	12.5	0.0	0.0	20.5
Lane LOS			B			C
Approach Delay (s)	0.0		0.1			20.5
Approach LOS						C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	55	1200	1840	80	60	80
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	1304	2000	87	65	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.58				0.58	0.58
vC, conflicting volume	2087				2815	1043
vC1, stage 1 conf vol					2043	
vC2, stage 2 conf vol					772	
vCu, unblocked vol	1420				2680	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	78				40	86
cM capacity (veh/h)	275				108	626

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	60	652	652	1333	754	152
Volume Left	60	0	0	0	0	65
Volume Right	0	0	0	0	87	87
cSH	275	1700	1700	1700	1700	205
Volume to Capacity	0.22	0.38	0.38	0.78	0.44	0.74
Queue Length 95th (ft)	20	0	0	0	0	124
Control Delay (s)	21.7	0.0	0.0	0.0	0.0	60.8
Lane LOS	C					F
Approach Delay (s)	1.0			0.0		60.8
Approach LOS						F

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		

Timings
3: Moanalua Road & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	200	895	200	110	1405	290	400	155	125	100	140
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	35.0	35.0	11.0	35.0	35.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	22.0	61.0	61.0	23.0	62.0	62.0	23.0	47.0	19.0	43.0	43.0
Total Split (%)	14.7%	40.7%	40.7%	15.3%	41.3%	41.3%	15.3%	31.3%	12.7%	28.7%	28.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 125.7
Natural Cycle: 150
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street

ø1	ø2	ø3	ø4
22 s	62 s	19 s	47 s
ø5	ø6	ø7	ø8
23 s	61 s	23 s	43 s

HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	895	200	110	1405	290	400	155	115	125	100	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3313		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3313		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	973	217	120	1527	315	435	168	125	136	109	152
RTOR Reduction (vph)	0	0	116	0	0	135	0	106	0	0	0	137
Lane Group Flow (vph)	217	973	101	120	1527	180	435	187	0	136	109	15
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	16.0	58.3	58.3	13.7	56.0	56.0	17.0	19.4		10.3	12.7	12.7
Effective Green, g (s)	16.0	58.3	58.3	13.7	56.0	56.0	17.0	19.4		10.3	12.7	12.7
Actuated g/C Ratio	0.13	0.46	0.46	0.11	0.45	0.45	0.14	0.15		0.08	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	225	1641	734	193	1577	705	464	511		281	188	160
v/s Ratio Prot	c0.12	0.27		0.07	c0.43		c0.13	0.06		0.04	c0.06	
v/s Ratio Perm			0.06			0.11						0.01
v/c Ratio	0.96	0.59	0.14	0.62	0.97	0.26	0.94	0.37		0.48	0.58	0.10
Uniform Delay, d1	54.6	24.9	19.3	53.5	34.0	21.8	53.8	47.6		55.2	54.0	51.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	49.6	0.9	0.2	6.4	15.9	0.4	26.6	0.4		1.3	4.3	0.3
Delay (s)	104.1	25.8	19.5	59.9	49.8	22.2	80.4	48.1		56.5	58.2	51.6
Level of Service	F	C	B	E	D	C	F	D		E	E	D
Approach Delay (s)		36.9			46.0			67.4			55.1	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	47.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	125.7	Sum of lost time (s)	24.0
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	75	0	595	40	0	400	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	82	0	647	43	0	435	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	678	1125	435	1103	1103	183	435			690		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	633	1104	376	1082	1082	183	376			690		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	90	100			100		
cM capacity (veh/h)	311	199	589	163	205	828	1117			900		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	82	185	185	185	136	435
Volume Left	0	0	0	0	0	0	0
Volume Right	0	82	0	0	0	43	0
cSH	1700	828	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.10	0.11	0.11	0.11	0.08	0.26
Queue Length 95th (ft)	0	8	0	0	0	0	0
Control Delay (s)	0.0	9.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	9.8	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay		0.7		
Intersection Capacity Utilization		24.4%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/7/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	105	190	465	75	95	315
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	207	505	82	103	342
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	924	293			587	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	924	293			587	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	53	71			90	
cM capacity (veh/h)	240	703			984	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	114	207	337	250	217	228
Volume Left	114	0	0	0	103	0
Volume Right	0	207	0	82	0	0
cSH	240	703	1700	1700	984	1700
Volume to Capacity	0.47	0.29	0.20	0.15	0.10	0.13
Queue Length 95th (ft)	59	31	0	0	9	0
Control Delay (s)	32.8	12.2	0.0	0.0	4.9	0.0
Lane LOS	D	B			A	
Approach Delay (s)	19.6		0.0		2.4	
Approach LOS	C					

Intersection Summary				
Average Delay		5.4		
Intersection Capacity Utilization		42.5%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	0	5	160	0	105	0	430	95	60	365	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	174	0	114	0	467	103	65	397	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	878	1101	201	853	1052	285	402			571		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	878	1101	201	853	1052	285	402			571		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	99	27	100	84	100			93		
cM capacity (veh/h)	193	197	806	238	211	711	1153			998		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	11	174	114	312	259	65	264	138
Volume Left	5	174	0	0	0	65	0	0
Volume Right	5	0	114	0	103	0	0	5
cSH	312	238	711	1700	1700	998	1700	1700
Volume to Capacity	0.03	0.73	0.16	0.18	0.15	0.07	0.16	0.08
Queue Length 95th (ft)	3	125	14	0	0	5	0	0
Control Delay (s)	17.0	52.4	11.0	0.0	0.0	8.9	0.0	0.0
Lane LOS	C	F	B			A		
Approach Delay (s)	17.0	36.0		0.0		1.2		
Approach LOS	C	E						

Intersection Summary				
Average Delay		8.3		
Intersection Capacity Utilization	43.8%	ICU Level of Service	A	
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	495	470	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	538	511	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	1135	
pX, platoon unblocked						
vC, conflicting volume	848	280	560			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	848	280	560			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	95	98			
cM capacity (veh/h)	294	717	1007			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	201	359	341	219
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	417	1007	1700	1700	1700
Volume to Capacity	0.16	0.02	0.21	0.20	0.13
Queue Length 95th (ft)	14	2	0	0	0
Control Delay (s)	15.2	1.1	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	15.2	0.4		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization	38.5%	ICU Level of Service	A	
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	500	485	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	543	527	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	864	274	549			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	864	274	549			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	92	97			
cM capacity (veh/h)	285	723	1017			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	208	362	351	197
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	22
cSH	544	1017	1700	1700	1700
Volume to Capacity	0.14	0.03	0.21	0.21	0.12
Queue Length 95th (ft)	12	2	0	0	0
Control Delay (s)	12.7	1.4	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	12.7	0.5		0.0	
Approach LOS	B				

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	42.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/7/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	475	55	30	515
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	516	60	33	560
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	798	288			576	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	798	288			576	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	76	93			97	
cM capacity (veh/h)	313	709			993	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	344	232	145	224	224
Volume Left	76	0	0	33	0	0
Volume Right	49	0	60	0	0	0
cSH	400	1700	1700	993	1700	1700
Volume to Capacity	0.31	0.20	0.14	0.03	0.13	0.13
Queue Length 95th (ft)	33	0	0	3	0	0
Control Delay (s)	18.0	0.0	0.0	2.2	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	18.0	0.0		0.5		
Approach LOS	C					

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	115	125	500	520	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	125	136	543	565	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1139	218	565			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1139	218	565			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	74	84	86			
cM capacity (veh/h)	168	786	1003			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	136	272	272	226	226	173
Volume Left	43	136	0	0	0	0	0
Volume Right	125	0	0	0	0	0	60
cSH	404	1003	1700	1700	1700	1700	1700
Volume to Capacity	0.42	0.14	0.16	0.16	0.13	0.13	0.10
Queue Length 95th (ft)	50	12	0	0	0	0	0
Control Delay (s)	20.1	9.2	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	20.1	1.8			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay		3.1	
Intersection Capacity Utilization		37.5%	ICU Level of Service	A
Analysis Period (min)		15	

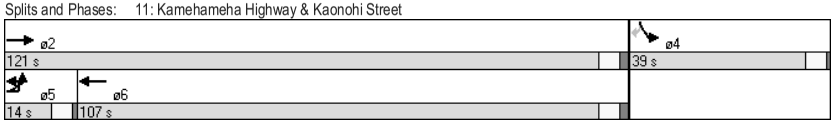
Timings
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	225	1265	3680	305	320
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	28.0	28.0	39.0	39.0
Total Split (s)	14.0	121.0	107.0	39.0	39.0
Total Split (%)	8.8%	75.6%	66.9%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 130 (81%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	225	1265	3680	395	305	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		0.96	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4773		3340	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4773		3340	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	245	1375	4000	429	332	348
RTOR Reduction (vph)	0	0	7	0	29	74
Lane Group Flow (vph)	245	1375	4422	0	435	142
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	9.0	122.7	108.7		26.3	26.3
Effective Green, g (s)	9.0	122.7	108.7		26.3	26.3
Actuated g/C Ratio	0.06	0.77	0.68		0.16	0.16
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	193	3900	3243		549	237
v/s Ratio Prot	c0.07	0.27	c0.93		c0.13	
v/s Ratio Perm						0.10
v/c Ratio	1.27	0.35	1.36		0.79	0.60
Uniform Delay, d1	75.5	6.0	25.6		64.2	61.9
Progression Factor	0.85	1.09	0.60		1.00	1.00
Incremental Delay, d2	154.1	0.2	163.8		7.7	4.0
Delay (s)	218.1	6.7	179.3		71.9	66.0
Level of Service	F	A	F		E	E
Approach Delay (s)		38.7	179.3		70.0	
Approach LOS		D	F		E	

Intersection Summary			
HCM Average Control Delay	134.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	113.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

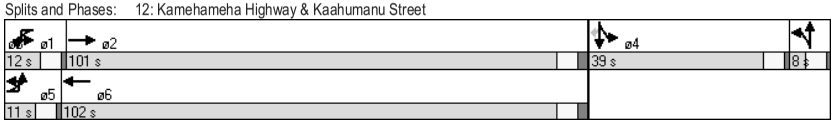
Timings
12: Kamehameha Highway & Kaahumanu Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBT	SBL	SBT	SBR
Lane Configurations								
Volume (vph)	120	815	30	2455	15	470	40	115
Turn Type	Prot		Prot			Split		Perm
Protected Phases	5	2	1	6	8	4	4	
Permitted Phases								4
Detector Phase	5	2	1	6	8	4	4	4
Switch Phase								
Minimum Initial (s)	5.0	20.0	5.0	20.0	3.0	3.0	3.0	3.0
Minimum Split (s)	10.0	28.0	10.0	28.0	8.0	39.0	39.0	39.0
Total Split (s)	11.0	101.0	12.0	102.0	8.0	39.0	39.0	39.0
Total Split (%)	6.9%	63.1%	7.5%	63.8%	5.0%	24.4%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag				
Lead-Lag Optimize?								
Recall Mode	None	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 84 (53%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 12: Kamehameha Highway & Kaahumanu Street



HCM Signalized Intersection Capacity Analysis
12: Kamehameha Highway & Kaahumanu Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	815	15	30	2455	440	10	15	20	470	40	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	12	12	12	12	12	12	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0		5.0	5.0	5.0
Lane Util. Factor	0.97	0.91		1.00	0.91			1.00		0.95	0.95	1.00
Frpb, ped/bikes	1.00	1.00		1.00	0.99			1.00		1.00	1.00	0.93
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.98			0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99		0.95	0.96	1.00
Satd. Flow (prot)	3204	4730		1770	4930			1730		1569	1585	1380
Flt Permitted	0.95	1.00		0.95	1.00			0.99		0.95	0.96	1.00
Satd. Flow (perm)	3204	4730		1770	4930			1730		1569	1585	1380
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	886	16	33	2668	478	11	16	22	511	43	125
RTOR Reduction (vph)	0	1	0	0	15	0	0	19	0	0	0	63
Lane Group Flow (vph)	130	901	0	33	3131	0	0	30	0	276	278	62
Confl. Peds. (#/hr)			5			19	39					39
Turn Type	Prot			Prot			Split			Split		Perm
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases												4
Actuated Green, G (s)	6.0	98.9		5.6	98.5			3.0		31.5	31.5	31.5
Effective Green, g (s)	6.0	98.9		5.6	98.5			3.0		31.5	31.5	31.5
Actuated g/C Ratio	0.04	0.62		0.03	0.62			0.02		0.20	0.20	0.20
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0		5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	120	2924		62	3035			32		309	312	272
v/s Ratio Prot	c0.04	0.19		0.02	c0.64			c0.02		c0.18	0.18	
v/s Ratio Perm												0.04
v/c Ratio	1.08	0.31		0.53	1.03			0.95		0.89	0.89	0.23
Uniform Delay, d1	77.0	14.4		75.9	30.8			78.4		62.6	62.6	54.0
Progression Factor	1.00	1.00		1.28	0.27			1.00		1.00	1.00	1.00
Incremental Delay, d2	106.3	0.3		0.8	15.8			136.2		26.0	25.6	0.4
Delay (s)	183.3	14.7		97.8	24.0			214.7		88.6	88.1	54.4
Level of Service	F	B		F	C			F		F	F	D
Approach Delay (s)		35.9			24.7			214.7			82.1	
Approach LOS		D			C			F			F	

Intersection Summary			
HCM Average Control Delay	36.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	97.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

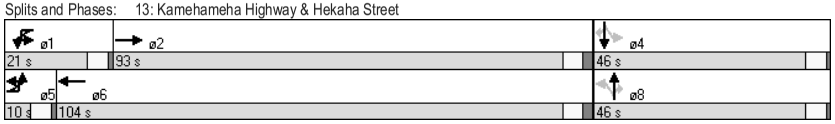
Timings
13: Kamehameha Highway & Hekaha Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1080	190	2845	240	45	235	65	45	100
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	33.0	10.0	33.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	10.0	93.0	21.0	104.0	46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	6.3%	58.1%	13.1%	65.0%	28.8%	28.8%	28.8%	28.8%	28.8%	28.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 68 (43%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1080	155	190	2845	80	240	45	235	65	45	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4640		3204	4723			1728	1445		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.39	1.00
Satd. Flow (perm)	1652	4640		3204	4723			1118	1445		661	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1174	168	207	3092	87	261	49	255	71	49	109
RTOR Reduction (vph)	0	12	0	0	2	0	0	0	129	0	0	42
Lane Group Flow (vph)	54	1330	0	207	3177	0	0	310	126	0	120	67
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	88.5		14.5	98.0			41.0	41.0		41.0	41.0
Effective Green, g (s)	5.0	88.5		14.5	98.0			41.0	41.0		41.0	41.0
Actuated g/C Ratio	0.03	0.55		0.09	0.61			0.26	0.26		0.26	0.26
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	52	2567		290	2893			286	370		169	379
v/s Ratio Prot	0.03	0.29		c0.06	c0.67							
v/s Ratio Perm								c0.28	0.09		0.18	0.05
v/c Ratio	1.04	0.52		0.71	1.10			1.08	0.34		0.71	0.18
Uniform Delay, d1	77.5	22.4		70.7	31.0			59.5	48.5		54.1	46.4
Progression Factor	1.20	0.76		1.19	0.49			1.00	1.00		1.00	1.00
Incremental Delay, d2	128.1	0.7		0.8	44.8			77.4	0.5		13.1	0.2
Delay (s)	221.1	17.7		85.1	59.8			136.9	49.0		67.2	46.6
Level of Service	F	B		F	E			F	D		E	D
Approach Delay (s)		25.6			61.4			97.2			57.4	
Approach LOS		C			E			F			E	

Intersection Summary			
HCM Average Control Delay	55.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	99.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

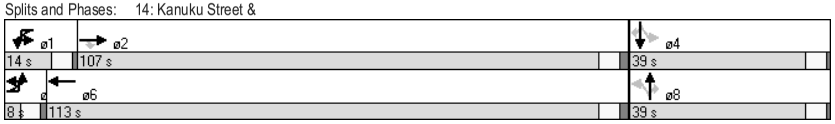
Timings
14: Kanuku Street &

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1240	75	90	3290	95	15	55	65	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	107.0	107.0	14.0	113.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	5.0%	66.9%	66.9%	8.8%	70.6%	24.4%	24.4%	24.4%	24.4%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 44 (28%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1240	75	90	3290	225	95	15	55	65	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1428	3204	4694			1695	1531		1670	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.63	1.00		0.53	1.00
Satd. Flow (perm)	1652	4746	1428	3204	4694			1111	1531		925	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1348	82	98	3576	245	103	16	60	71	16	38
RTOR Reduction (vph)	0	0	23	0	4	0	0	0	52	0	0	28
Lane Group Flow (vph)	38	1348	59	98	3817	0	0	119	8	0	87	10
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	113.9	113.9	8.7	119.6			21.4	21.4		21.4	21.4
Effective Green, g (s)	3.0	113.9	113.9	8.7	119.6			21.4	21.4		21.4	21.4
Actuated g/C Ratio	0.02	0.71	0.71	0.05	0.75			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	31	3379	1017	174	3509			149	205		124	191
v/s Ratio Prot	c0.02	0.28		0.03	c0.81							
v/s Ratio Perm			0.04					c0.11	0.01		0.09	0.01
v/c Ratio	1.23	0.40	0.06	0.56	1.09			0.80	0.04		0.70	0.05
Uniform Delay, d1	78.5	9.3	6.9	73.8	20.2			67.2	60.3		66.2	60.5
Progression Factor	0.91	0.52	0.12	1.10	0.27			1.00	1.00		1.00	1.00
Incremental Delay, d2	224.4	0.3	0.1	0.4	40.1			25.0	0.1		16.4	0.1
Delay (s)	295.6	5.1	0.9	81.9	45.6			92.2	60.4		82.7	60.6
Level of Service	F	A	A	F	D			F	E		F	E
Approach Delay (s)		12.4			46.6			81.6			76.0	
Approach LOS		B			D			F			E	

Intersection Summary			
HCM Average Control Delay	39.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

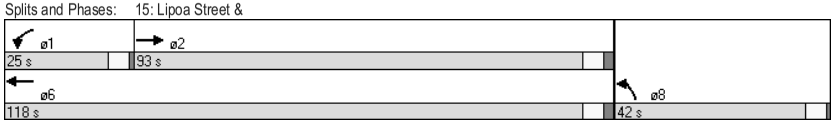
Timings
15: Lipoa Street &

7/7/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1375	100	3670	165
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	93.0	25.0	118.0	42.0
Total Split (%)	58.1%	15.6%	73.8%	26.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 48 (30%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1375	55	100	3670	165	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	*0.80	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5056		1652	4173	1747	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5056		1652	4173	1747	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1495	60	109	3989	179	38
RTOR Reduction (vph)	2	0	0	0	5	0
Lane Group Flow (vph)	1553	0	109	3989	212	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	103.8		15.5	124.3	24.7	
Effective Green, g (s)	103.8		15.5	124.3	24.7	
Actuated g/C Ratio	0.65		0.10	0.78	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3280		160	3242	270	
v/s Ratio Prot	0.31		0.07	c0.96	c0.12	
v/s Ratio Perm						
v/c Ratio	0.47		0.68	1.23	0.78	
Uniform Delay, d1	14.2		69.9	17.9	65.1	
Progression Factor	1.20		1.09	0.51	1.00	
Incremental Delay, d2	0.5		5.6	105.1	13.9	
Delay (s)	17.5		81.9	114.2	79.0	
Level of Service	B		F	F	E	
Approach Delay (s)	17.5			113.4	79.0	
Approach LOS	B			F	E	

Intersection Summary			
HCM Average Control Delay	86.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	91.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

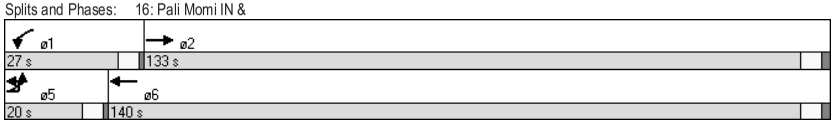
Timings
16: Pali Momi IN &

7/7/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	250	1115	125	3215
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	20.0	133.0	27.0	140.0
Total Split (%)	12.5%	83.1%	16.9%	87.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 141 (88%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	1115	35	125	3215	390	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4725		1652	4617							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4725		1652	4617							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	1212	38	136	3495	424	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	272	1248	0	136	3916	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	15.0	131.2		17.8	134.0							
Effective Green, g (s)	15.0	131.2		17.8	134.0							
Actuated g/C Ratio	0.09	0.82		0.11	0.84							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	300	3875		184	3867							
v/s Ratio Prot	c0.08	0.26		0.08	c0.85							
v/s Ratio Perm												
v/c Ratio	0.91	0.32		0.74	1.01							
Uniform Delay, d1	71.8	3.5		68.9	13.0							
Progression Factor	0.92	0.33		1.07	0.40							
Incremental Delay, d2	26.7	0.2		4.0	10.7							
Delay (s)	92.9	1.3		77.9	15.9							
Level of Service	F	A		E	B							
Approach Delay (s)		17.7			18.0			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	87.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

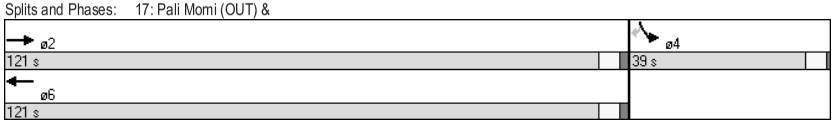
Timings
17: Pali Momi (OUT) &

7/7/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1115	3490	315	145
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	121.0	121.0	39.0	39.0
Total Split (%)	75.6%	75.6%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 148 (93%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1115	3490	0	315	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.86
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1311
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1311
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1212	3793	0	342	158
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	0	1212	3793	0	342	157
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		124.4	124.4		24.6	24.6
Effective Green, g (s)		124.4	124.4		24.6	24.6
Actuated g/C Ratio		0.78	0.78		0.15	0.15
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3690	3690		510	202
v/s Ratio Prot		0.26	c0.80		0.10	
v/s Ratio Perm						c0.12
v/c Ratio		0.33	1.03		0.67	0.78
Uniform Delay, d1		5.3	17.8		63.9	65.1
Progression Factor		0.77	1.00		1.00	1.00
Incremental Delay, d2		0.2	22.6		3.5	17.0
Delay (s)		4.3	40.4		67.3	82.1
Level of Service		A	D		E	F
Approach Delay (s)		4.3	40.4		72.0	
Approach LOS		A	D		E	

Intersection Summary			
HCM Average Control Delay	35.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	104.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2019 RT

HCM Unsignalized Intersection Capacity Analysis
1: Harbor Pointe & Moanalua Road

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1195	15	30	940	0	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1299	16	33	1022	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.93	
vC, conflicting volume			1315		1883	658
vC1, stage 1 conf vol					1307	
vC2, stage 2 conf vol					576	
vCu, unblocked vol			1315		1802	658
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			94		100	89
cM capacity (veh/h)			522		202	407

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	866	449	33	511	511	43
Volume Left	0	0	33	0	0	0
Volume Right	0	16	0	0	0	43
cSH	1700	1700	522	1700	1700	407
Volume to Capacity	0.51	0.26	0.06	0.30	0.30	0.11
Queue Length 95th (ft)	0	0	5	0	0	9
Control Delay (s)	0.0	0.0	12.4	0.0	0.0	14.9
Lane LOS			B			B
Approach Delay (s)	0.0		0.4			14.9
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	43.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	155	1120	700	205	45	270
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	168	1217	761	223	49	293
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.87				0.87	0.87
vC, conflicting volume	984				1818	492
vC1, stage 1 conf vol					872	
vC2, stage 2 conf vol					946	
vCu, unblocked vol	686				1643	122
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	79				79	63
cM capacity (veh/h)	787				231	790

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	168	609	609	507	476	342
Volume Left	168	0	0	0	0	49
Volume Right	0	0	0	0	223	293
cSH	787	1700	1700	1700	1700	587
Volume to Capacity	0.21	0.36	0.36	0.30	0.28	0.58
Queue Length 95th (ft)	20	0	0	0	0	94
Control Delay (s)	10.8	0.0	0.0	0.0	0.0	19.4
Lane LOS	B					C
Approach Delay (s)	1.3			0.0		19.4
Approach LOS						C

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	63.6%	ICU Level of Service	B
Analysis Period (min)	15		

Timings
3: Kaonohi Street & Moanalua Road

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	100	920	205	80	625	90	80	75	260	205	215
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	44.0	44.0	11.0	44.0	44.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	24.0	70.0	70.0	21.0	67.0	67.0	14.0	43.0	26.0	55.0	55.0
Total Split (%)	15.0%	43.8%	43.8%	13.1%	41.9%	41.9%	8.8%	26.9%	16.3%	34.4%	34.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 115.5
Natural Cycle: 110
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Kaonohi Street & Moanalua Road

ø1	ø2	ø3	ø4
24 s	67 s	26 s	43 s

ø5	ø6	ø7	ø8
21 s	70 s	14 s	55 s

HCM Signalized Intersection Capacity Analysis
3: Kaonohi Street & Moanalua Road

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	920	205	80	625	90	80	75	85	260	205	215
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3259		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3259		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1000	223	87	679	98	87	82	92	283	223	234
RTOR Reduction (vph)	0	0	125	0	0	56	0	81	0	0	0	192
Lane Group Flow (vph)	109	1000	98	87	679	42	87	93	0	283	223	42
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.8	50.5	50.5	11.6	49.3	49.3	7.7	13.1		15.3	20.7	20.7
Effective Green, g (s)	12.8	50.5	50.5	11.6	49.3	49.3	7.7	13.1		15.3	20.7	20.7
Actuated g/C Ratio	0.11	0.44	0.44	0.10	0.43	0.43	0.07	0.11		0.13	0.18	0.18
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	198	1561	698	179	1524	682	231	373		459	337	286
v/s Ratio Prot	c0.06	c0.28		0.05	0.19		0.03	0.03		c0.08	c0.12	
v/s Ratio Perm			0.06			0.03						0.03
v/c Ratio	0.55	0.64	0.14	0.49	0.45	0.06	0.38	0.25		0.62	0.66	0.15
Uniform Delay, d1	48.1	24.9	19.1	48.6	23.0	19.1	51.1	46.2		46.8	43.6	39.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.3	1.2	0.2	2.4	0.4	0.1	1.0	0.3		2.5	4.8	0.2
Delay (s)	51.4	26.2	19.3	51.1	23.4	19.2	52.1	46.6		49.3	48.5	39.7
Level of Service	D	C	B	D	C	B	D	D		D	D	D
Approach Delay (s)		27.1			25.7			48.4			46.0	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	32.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	114.5	Sum of lost time (s)	18.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Kaonohi Street & RIRO Driveway/PR Macy's Upstairs

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	10	0	250	20	0	525	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	11	0	272	22	0	571	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.89	0.89	0.89	0.89	0.89		0.89					
vC, conflicting volume	649	864	571	853	853	79	571			293		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	543	785	455	773	773	79	455			293		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	99	100			100		
cM capacity (veh/h)	371	287	491	257	292	966	980			1265		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	11	78	78	78	61	571
Volume Left	0	0	0	0	0	0	0
Volume Right	0	11	0	0	0	22	0
cSH	1700	966	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.01	0.05	0.05	0.05	0.04	0.34
Queue Length 95th (ft)	0	1	0	0	0	0	0
Control Delay (s)	0.0	8.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	8.8	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay		0.1		
Intersection Capacity Utilization		31.0%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Kaonohi Street & Pearlridge Driveway 1

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	30	245	15	30	480
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	33	266	16	33	522
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	601	141			283	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	601	141			283	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	96			97	
cM capacity (veh/h)	421	881			1277	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	16	33	178	105	207	348
Volume Left	16	0	0	0	33	0
Volume Right	0	33	0	16	0	0
cSH	421	881	1700	1700	1277	1700
Volume to Capacity	0.04	0.04	0.10	0.06	0.03	0.20
Queue Length 95th (ft)	3	3	0	0	2	0
Control Delay (s)	13.9	9.2	0.0	0.0	1.4	0.0
Lane LOS	B	A			A	
Approach Delay (s)	10.8		0.0		0.5	
Approach LOS	B					

Intersection Summary				
Average Delay		0.9		
Intersection Capacity Utilization		34.7%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Kaonohi Street & Pearlridge Driveway 2

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	30	0	10	0	240	40	35	480	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	33	0	11	0	261	43	38	522	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	739	902	261	620	880	152	522			304		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	739	902	261	620	880	152	522			304		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	91	100	99	100			97		
cM capacity (veh/h)	295	268	738	364	276	867	1041			1253		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	0	33	11	174	130	38	261	261
Volume Left	0	33	0	0	0	38	0	0
Volume Right	0	0	11	0	43	0	0	0
cSH	1700	364	867	1700	1700	1253	1700	1700
Volume to Capacity	0.00	0.09	0.01	0.10	0.08	0.03	0.15	0.15
Queue Length 95th (ft)	0	7	1	0	0	2	0	0
Control Delay (s)	0.0	15.9	9.2	0.0	0.0	8.0	0.0	0.0
Lane LOS	A	C	A			A		
Approach Delay (s)	0.0	14.2		0.0		0.5		
Approach LOS	A	B						

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	24.6%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
7: Kaonohi Street & Westridge (north)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	30	20	245	430	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	33	22	266	467	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	674	264	527			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	674	264	527			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	96	98			
cM capacity (veh/h)	380	735	1036			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	111	178	312	216
Volume Left	43	22	0	0	0
Volume Right	33	0	0	0	60
cSH	479	1036	1700	1700	1700
Volume to Capacity	0.16	0.02	0.10	0.18	0.13
Queue Length 95th (ft)	14	2	0	0	0
Control Delay (s)	13.9	1.8	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	13.9	0.7		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	32.8%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: Kaonohi Street & Westridge (south)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	50	20	250	460	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	54	22	272	500	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	682	253	505			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	682	253	505			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	93	98			
cM capacity (veh/h)	376	747	1055			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	112	181	333	172
Volume Left	16	22	0	0	0
Volume Right	54	0	0	0	5
cSH	608	1055	1700	1700	1700
Volume to Capacity	0.12	0.02	0.11	0.20	0.10
Queue Length 95th (ft)	10	2	0	0	0
Control Delay (s)	11.7	1.8	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.7	0.7		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.2		
Intersection Capacity Utilization		32.8%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Kaonohi Street & Ana Miller's Driveway

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	255	55	25	485
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	277	60	27	527
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	537	168			337	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	537	168			337	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	98			98	
cM capacity (veh/h)	463	846			1219	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	185	152	133	211	211
Volume Left	49	0	0	27	0	0
Volume Right	16	0	60	0	0	0
cSH	522	1700	1700	1219	1700	1700
Volume to Capacity	0.12	0.11	0.09	0.02	0.12	0.12
Queue Length 95th (ft)	11	0	0	2	0	0
Control Delay (s)	12.9	0.0	0.0	1.8	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	12.9	0.0		0.4		
Approach LOS	B					

Intersection Summary				
Average Delay		1.1		
Intersection Capacity Utilization		32.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Kaonohi Street & Moanalua Loop

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	85	155	55	220	505	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	168	60	239	549	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	807	202	549			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	807	202	549			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	69	79	94			
cM capacity (veh/h)	300	805	1017			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	261	60	120	120	220	220	148
Volume Left	92	60	0	0	0	0	0
Volume Right	168	0	0	0	0	0	38
cSH	505	1017	1700	1700	1700	1700	1700
Volume to Capacity	0.52	0.06	0.07	0.07	0.13	0.13	0.09
Queue Length 95th (ft)	73	5	0	0	0	0	0
Control Delay (s)	19.5	8.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	19.5	1.8			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	38.1%	ICU Level of Service	A
Analysis Period (min)	15		

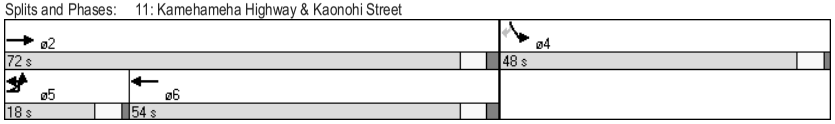
Timings
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	130	1450	785	545	115
Turn Type	Prot	NA	NA	NA	Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	18.0	72.0	54.0	48.0	48.0
Total Split (%)	15.0%	60.0%	45.0%	40.0%	40.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 87 (73%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	130	1450	785	170	545	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	0.93
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4720		3429	1343
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4720		3429	1343
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	1576	853	185	592	125
RTOR Reduction (vph)	0	0	27	0	1	72
Lane Group Flow (vph)	141	1576	1011	0	604	40
Confl. Peds. (#/hr)				38		54
Turn Type	Prot	NA	NA		NA	Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	10.2	66.0	50.8		43.0	43.0
Effective Green, g (s)	10.2	66.0	50.8		43.0	43.0
Actuated g/C Ratio	0.08	0.55	0.42		0.36	0.36
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	272	2610	1998		1229	481
v/s Ratio Prot	0.04	c0.33	0.21		c0.18	
v/s Ratio Perm						0.03
v/c Ratio	0.52	0.60	0.51		0.49	0.08
Uniform Delay, d1	52.5	18.2	25.4		30.0	25.5
Progression Factor	1.36	0.33	0.69		1.00	1.00
Incremental Delay, d2	1.5	1.0	0.9		1.4	0.3
Delay (s)	73.0	7.0	18.3		31.4	25.8
Level of Service	E	A	B		C	C
Approach Delay (s)		12.4	18.3		30.5	
Approach LOS		B	B		C	

Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

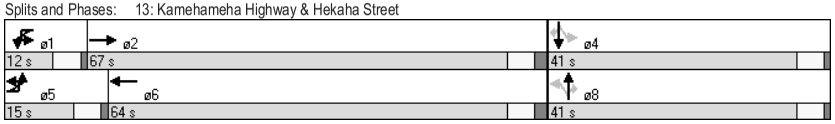
Timings
13: Kamehameha Highway & Hekaha Street

9/27/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1430	90	835	55	5	60	115	15	75
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	39.0	39.0	39.0
Total Split (s)	15.0	67.0	12.0	64.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	12.5%	55.8%	10.0%	53.3%	34.2%	34.2%	34.2%	34.2%	34.2%	34.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 102 (85%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1430	190	90	835	30	55	5	60	115	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4648		3204	4717			1720	1490		1643	1459
Flt Permitted	0.95	1.00		0.95	1.00			0.69	1.00		0.70	1.00
Satd. Flow (perm)	1652	4648		3204	4717			1240	1490		1208	1459
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1554	207	98	908	33	60	5	65	125	16	82
RTOR Reduction (vph)	0	14	0	0	3	0	0	0	46	0	0	57
Lane Group Flow (vph)	54	1747	0	98	938	0	0	65	20	0	141	25
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.3	61.1		6.9	60.7			36.0	36.0		36.0	36.0
Effective Green, g (s)	7.3	61.1		6.9	60.7			36.0	36.0		36.0	36.0
Actuated g/C Ratio	0.06	0.51		0.06	0.51			0.30	0.30		0.30	0.30
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	100	2367		184	2386			372	447		362	438
v/s Ratio Prot	c0.03	c0.38		0.03	0.20							
v/s Ratio Perm								0.05	0.01		c0.12	0.02
v/c Ratio	0.54	0.74		0.53	0.39			0.17	0.04		0.39	0.06
Uniform Delay, d1	54.7	23.2		55.0	18.3			31.0	29.8		33.3	29.9
Progression Factor	1.01	0.81		0.62	1.02			1.00	1.00		1.00	1.00
Incremental Delay, d2	5.2	1.9		2.9	0.5			1.0	0.2		3.1	0.2
Delay (s)	60.6	20.5		37.2	19.2			32.0	30.0		36.4	30.1
Level of Service	E	C		D	B			C	C		D	C
Approach Delay (s)		21.7			20.9			31.0			34.1	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	86.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

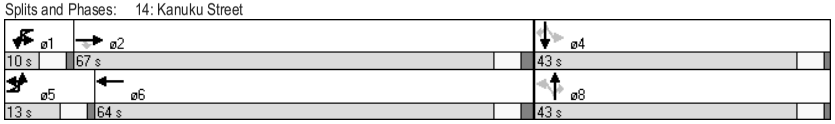
Timings
14: Kanuku Street

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	30	1475	20	20	905	5	5	15	140	10	45
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	39.0	39.0	39.0
Total Split (s)	13.0	67.0	67.0	10.0	64.0	43.0	43.0	43.0	43.0	43.0	43.0
Total Split (%)	10.8%	55.8%	55.8%	8.3%	53.3%	35.8%	35.8%	35.8%	35.8%	35.8%	35.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 25 (21%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	1475	20	20	905	65	5	5	15	140	10	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1451	3204	4693			1754	1531		1661	1454
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1451	3204	4693			1583	1531		1275	1454
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	1603	22	22	984	71	5	5	16	152	11	49
RTOR Reduction (vph)	0	0	6	0	4	0	0	0	13	0	0	41
Lane Group Flow (vph)	33	1603	16	22	1051	0	0	10	3	0	163	8
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	4.7	81.2	81.2	3.0	79.5			19.8	19.8		19.8	19.8
Effective Green, g (s)	4.7	81.2	81.2	3.0	79.5			19.8	19.8		19.8	19.8
Actuated g/C Ratio	0.04	0.68	0.68	0.02	0.66			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	65	3211	982	80	3109			261	253		210	240
v/s Ratio Prot	c0.02	c0.34		0.01	0.22							
v/s Ratio Perm			0.01					0.01	0.00		c0.13	0.01
v/c Ratio	0.51	0.50	0.02	0.28	0.34			0.04	0.01		0.78	0.03
Uniform Delay, d1	56.5	9.5	6.3	57.4	8.8			42.1	41.9		48.0	42.1
Progression Factor	1.28	0.38	0.30	0.75	1.93			1.00	1.00		1.00	1.00
Incremental Delay, d2	4.7	0.4	0.0	1.7	0.3			0.1	0.0		16.3	0.1
Delay (s)	76.9	4.0	1.9	44.6	17.3			42.2	41.9		64.3	42.1
Level of Service	E	A	A	D	B			D	D		E	D
Approach Delay (s)		5.4			17.8			42.0			59.2	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

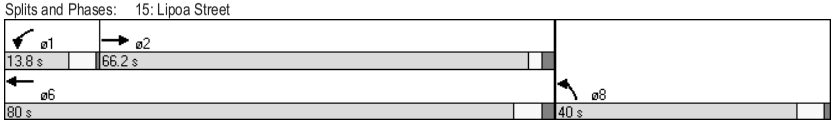
Timings
15: Lipoa Street

9/27/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1875	45	950	75
Turn Type	NA	Prot	NA	NA
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	66.2	13.8	80.0	40.0
Total Split (%)	55.2%	11.5%	66.7%	33.3%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 19 (16%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1875	50	45	950	75	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4728		1652	4746	1656	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4728		1652	4746	1656	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2038	54	49	1033	82	65
RTOR Reduction (vph)	1	0	0	0	30	0
Lane Group Flow (vph)	2091	0	49	1033	117	0
Confl. Peds. (#/hr)			2			50
Turn Type	NA		Prot	NA	NA	
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	85.9		6.9	95.3	13.7	
Effective Green, g (s)	85.9		6.9	95.3	13.7	
Actuated g/C Ratio	0.72		0.06	0.79	0.11	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3384		95	3769	189	
v/s Ratio Prot	c0.44		c0.03	0.22	c0.07	
v/s Ratio Perm						
v/c Ratio	0.62		0.52	0.27	0.62	
Uniform Delay, d1	8.7		54.9	3.2	50.7	
Progression Factor	0.47		0.77	0.97	1.00	
Incremental Delay, d2	0.7		4.5	0.2	5.9	
Delay (s)	4.8		46.7	3.3	56.6	
Level of Service	A		D	A	E	
Approach Delay (s)	4.8			5.3	56.6	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

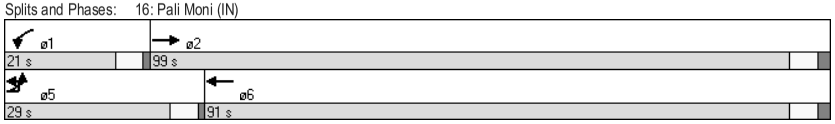
Timings
16: Pali Moni (IN)

9/27/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	200	1785	45	985
Turn Type	Prot	NA	Prot	NA
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	29.0	99.0	21.0	91.0
Total Split (%)	24.2%	82.5%	17.5%	75.8%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 4 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN)



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN)

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	1785	15	45	985	180	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4740		1652	4636							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4740		1652	4636							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	1940	16	49	1071	196	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	0	0	0	0
Lane Group Flow (vph)	217	1956	0	49	1252	0	0	0	0	0	0	0
Turn Type	Prot	NA		Prot	NA							
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	12.9	101.4		7.6	96.1							
Effective Green, g (s)	12.9	101.4		7.6	96.1							
Actuated g/C Ratio	0.11	0.85		0.06	0.80							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	344	4005		105	3713							
v/s Ratio Prot	c0.07	c0.41		0.03	0.27							
v/s Ratio Perm												
v/c Ratio	0.63	0.49		0.47	0.34							
Uniform Delay, d1	51.3	2.5		54.2	3.3							
Progression Factor	0.76	0.91		0.90	0.44							
Incremental Delay, d2	3.2	0.4		3.0	0.2							
Delay (s)	42.1	2.6		51.9	1.7							
Level of Service	D	A		D	A							
Approach Delay (s)		6.5			3.5			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	47.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

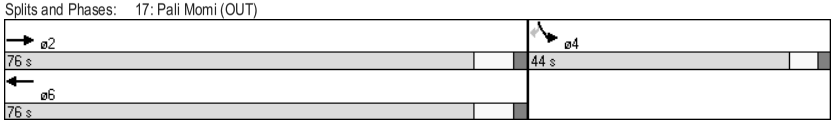
Timings
17: Pali Momi (OUT)

9/27/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1690	1120	325	80
Turn Type	NA	NA	NA	Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	76.0	76.0	44.0	44.0
Total Split (%)	63.3%	63.3%	36.7%	36.7%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 24 (20%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT)



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT)

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1690	1120	0	325	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.94
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1434
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1434
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1837	1217	0	353	87
RTOR Reduction (vph)	0	0	0	0	0	42
Lane Group Flow (vph)	0	1837	1217	0	353	45
Confl. Peds. (#/hr)						49
Turn Type		NA	NA		NA	Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		68.0	68.0		38.0	38.0
Effective Green, g (s)		68.0	68.0		38.0	38.0
Actuated g/C Ratio		0.57	0.57		0.32	0.32
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2689	2689		1051	454
v/s Ratio Prot		c0.39	0.26		c0.11	
v/s Ratio Perm						0.03
v/c Ratio		0.68	0.45		0.34	0.10
Uniform Delay, d1		18.4	15.2		31.4	28.9
Progression Factor		0.35	1.00		1.00	1.00
Incremental Delay, d2		1.3	0.6		0.9	0.4
Delay (s)		7.8	15.7		32.2	29.3
Level of Service		A	B		C	C
Approach Delay (s)		7.8	15.7		31.6	
Approach LOS		A	B		C	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Harbor Pointe & Moanalua Road

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1145	25	20	1620	15	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1245	27	22	1761	16	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.68	
vC, conflicting volume			1272		2182	636
vC1, stage 1 conf vol					1258	
vC2, stage 2 conf vol					924	
vCu, unblocked vol			1272		1797	636
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			96		92	95
cM capacity (veh/h)			542		214	421

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	830	442	22	880	880	38
Volume Left	0	0	22	0	0	16
Volume Right	0	27	0	0	0	22
cSH	1700	1700	542	1700	1700	298
Volume to Capacity	0.49	0.26	0.04	0.52	0.52	0.13
Queue Length 95th (ft)	0	0	3	0	0	11
Control Delay (s)	0.0	0.0	11.9	0.0	0.0	18.9
Lane LOS			B			C
Approach Delay (s)	0.0		0.1			18.9
Approach LOS						C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	55	1130	1545	80	60	80
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	1228	1679	87	65	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.67				0.67	0.67
vC, conflicting volume	1766				2457	883
vC1, stage 1 conf vol					1723	
vC2, stage 2 conf vol					734	
vCu, unblocked vol	1154				2187	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	85				60	88
cM capacity (veh/h)	402				163	725

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	60	614	614	1120	647	152
Volume Left	60	0	0	0	0	65
Volume Right	0	0	0	0	87	87
cSH	402	1700	1700	1700	1700	293
Volume to Capacity	0.15	0.36	0.36	0.66	0.38	0.52
Queue Length 95th (ft)	13	0	0	0	0	70
Control Delay (s)	15.5	0.0	0.0	0.0	0.0	29.9
Lane LOS	C					D
Approach Delay (s)	0.7			0.0		29.9
Approach LOS						D

Intersection Summary			
Average Delay		1.7	
Intersection Capacity Utilization		60.6%	ICU Level of Service	B
Analysis Period (min)		15	

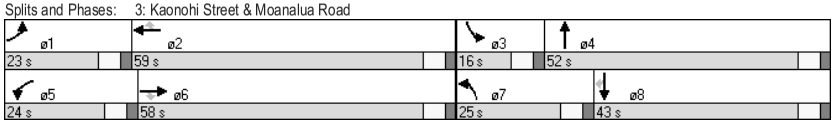
Timings
3: Kaonohi Street & Moanalua Road

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	185	840	200	110	1180	265	400	140	115	90	125
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	44.0	44.0	11.0	44.0	44.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	23.0	58.0	58.0	24.0	59.0	59.0	25.0	52.0	16.0	43.0	43.0
Total Split (%)	15.3%	38.7%	38.7%	16.0%	39.3%	39.3%	16.7%	34.7%	10.7%	28.7%	28.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 124.9
Natural Cycle: 150
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Kaonohi Street & Moanalua Road



HCM Signalized Intersection Capacity Analysis
3: Kaonohi Street & Moanalua Road

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	840	200	110	1180	265	400	140	115	115	90	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3300		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3300		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	913	217	120	1283	288	435	152	125	125	98	136
RTOR Reduction (vph)	0	0	119	0	0	148	0	103	0	0	0	123
Lane Group Flow (vph)	201	913	98	120	1283	140	435	174	0	125	98	13
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	17.0	56.2	56.2	13.9	53.1	53.1	19.0	21.7		9.2	11.9	11.9
Effective Green, g (s)	17.0	56.2	56.2	13.9	53.1	53.1	19.0	21.7		9.2	11.9	11.9
Actuated g/C Ratio	0.14	0.45	0.45	0.11	0.42	0.42	0.15	0.17		0.07	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	241	1591	712	197	1503	672	522	573		253	177	151
v/s Ratio Prot	c0.11	c0.26		0.07	c0.36		c0.13	0.05		0.04	c0.05	
v/s Ratio Perm			0.06			0.09						0.01
v/c Ratio	0.83	0.57	0.14	0.61	0.85	0.21	0.83	0.30		0.49	0.55	0.09
Uniform Delay, d1	52.6	25.5	20.2	53.0	32.4	22.7	51.5	45.1		55.7	54.0	51.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	21.3	0.8	0.2	5.5	5.4	0.3	11.0	0.3		1.5	3.7	0.2
Delay (s)	73.9	26.3	20.4	58.5	37.9	23.0	62.4	45.4		57.2	57.7	51.8
Level of Service	E	C	C	E	D	C	E	D		E	E	D
Approach Delay (s)		32.5			36.8			55.8			55.3	
Approach LOS		C			D			E			E	

Intersection Summary				
HCM Average Control Delay	40.3	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.87			
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	79.0%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: Kaonohi Street & RIRO Driveway/PR Macy's Upstairs

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	75	0	595	40	0	400	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	82	0	647	43	0	435	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	678	1125	435	1103	1103	183	435			690		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	638	1107	382	1084	1084	183	382			690		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	90	100			100		
cM capacity (veh/h)	311	199	587	163	205	828	1118			900		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	82	185	185	185	136	435
Volume Left	0	0	0	0	0	0	0
Volume Right	0	82	0	0	0	43	0
cSH	1700	828	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.10	0.11	0.11	0.11	0.08	0.26
Queue Length 95th (ft)	0	8	0	0	0	0	0
Control Delay (s)	0.0	9.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	9.8	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay	0.7			
Intersection Capacity Utilization	24.4%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Kaonohi Street & Pearlridge Driveway 1

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	105	190	465	75	95	315
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	207	505	82	103	342
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	924	293			587	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	924	293			587	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	53	71			90	
cM capacity (veh/h)	240	703			984	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	114	207	337	250	217	228
Volume Left	114	0	0	0	103	0
Volume Right	0	207	0	82	0	0
cSH	240	703	1700	1700	984	1700
Volume to Capacity	0.47	0.29	0.20	0.15	0.10	0.13
Queue Length 95th (ft)	59	31	0	0	9	0
Control Delay (s)	32.8	12.2	0.0	0.0	4.9	0.0
Lane LOS	D	B			A	
Approach Delay (s)	19.6		0.0		2.4	
Approach LOS	C					

Intersection Summary			
Average Delay		5.4	
Intersection Capacity Utilization		42.5%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
6: Kaonohi Street & Pearlridge Driveway 2

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	0	5	160	0	105	0	430	95	60	370	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	174	0	114	0	467	103	65	402	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	880	1103	201	856	1052	285	402			571		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	880	1103	201	856	1052	285	402			571		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	99	27	100	84	100			93		
cM capacity (veh/h)	192	196	806	237	211	711	1153			998		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	11	174	114	312	259	65	201	201
Volume Left	5	174	0	0	0	65	0	0
Volume Right	5	0	114	0	103	0	0	0
cSH	311	237	711	1700	1700	998	1700	1700
Volume to Capacity	0.03	0.73	0.16	0.18	0.15	0.07	0.12	0.12
Queue Length 95th (ft)	3	126	14	0	0	5	0	0
Control Delay (s)	17.0	52.9	11.0	0.0	0.0	8.9	0.0	0.0
Lane LOS	C	F	B			A		
Approach Delay (s)	17.0	36.3		0.0		1.2		
Approach LOS	C	E						

Intersection Summary			
Average Delay		8.4	
Intersection Capacity Utilization		43.8%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
7: Kaonohi Street & Westridge (north)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	495	470	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	538	511	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	1135	
pX, platoon unblocked						
vC, conflicting volume	848	280	560			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	848	280	560			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	95	98			
cM capacity (veh/h)	294	717	1007			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	201	359	341	219
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	417	1007	1700	1700	1700
Volume to Capacity	0.16	0.02	0.21	0.20	0.13
Queue Length 95th (ft)	14	2	0	0	0
Control Delay (s)	15.2	1.1	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	15.2	0.4		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		38.5%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Kaonohi Street & Westridge (south)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	500	485	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	543	527	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	864	274	549			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	864	274	549			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	92	97			
cM capacity (veh/h)	285	723	1017			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	208	362	351	197
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	22
cSH	544	1017	1700	1700	1700
Volume to Capacity	0.14	0.03	0.21	0.21	0.12
Queue Length 95th (ft)	12	2	0	0	0
Control Delay (s)	12.7	1.4	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	12.7	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		42.8%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Kaonohi Street & Ana Miller's Driveway

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	475	55	30	515
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	516	60	33	560
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	798	288			576	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	798	288			576	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	76	93			97	
cM capacity (veh/h)	313	709			993	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	344	232	145	224	224
Volume Left	76	0	0	33	0	0
Volume Right	49	0	60	0	0	0
cSH	400	1700	1700	993	1700	1700
Volume to Capacity	0.31	0.20	0.14	0.03	0.13	0.13
Queue Length 95th (ft)	33	0	0	3	0	0
Control Delay (s)	18.0	0.0	0.0	2.2	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	18.0	0.0		0.5		
Approach LOS	C					

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Kaonohi Street & Moanalua Loop

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	115	125	500	520	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	125	136	543	565	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1139	218	565			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1139	218	565			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	74	84	86			
cM capacity (veh/h)	168	786	1003			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	136	272	272	226	226	173
Volume Left	43	136	0	0	0	0	0
Volume Right	125	0	0	0	0	0	60
cSH	404	1003	1700	1700	1700	1700	1700
Volume to Capacity	0.42	0.14	0.16	0.16	0.13	0.13	0.10
Queue Length 95th (ft)	50	12	0	0	0	0	0
Control Delay (s)	20.1	9.2	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	20.1	1.8			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	37.5%	ICU Level of Service	A
Analysis Period (min)	15		

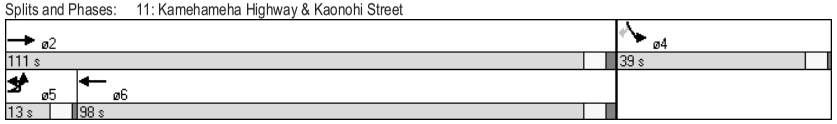
Timings
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	225	1230	3315	305	320
Turn Type	Prot	NA	NA	NA	Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	28.0	28.0	39.0	39.0
Total Split (s)	13.0	111.0	98.0	39.0	39.0
Total Split (%)	8.7%	74.0%	65.3%	26.0%	26.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 109 (73%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	225	1230	3315	395	305	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		0.96	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4763		3340	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4763		3340	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	245	1337	3603	429	332	348
RTOR Reduction (vph)	0	0	8	0	32	73
Lane Group Flow (vph)	245	1337	4024	0	432	144
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot	NA	NA		NA	Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	8.0	114.0	101.0		25.0	25.0
Effective Green, g (s)	8.0	114.0	101.0		25.0	25.0
Actuated g/C Ratio	0.05	0.76	0.67		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	183	3865	3207		557	240
v/s Ratio Prot	c0.07	0.26	c0.84		c0.13	
v/s Ratio Perm						0.10
v/c Ratio	1.34	0.35	1.25		0.78	0.60
Uniform Delay, d1	71.0	5.9	24.5		59.8	57.8
Progression Factor	0.83	1.06	0.60		1.00	1.00
Incremental Delay, d2	183.5	0.2	115.5		6.7	4.0
Delay (s)	242.5	6.5	130.3		66.5	61.8
Level of Service	F	A	F		E	E
Approach Delay (s)		43.0	130.3		65.0	
Approach LOS		D	F		E	

Intersection Summary			
HCM Average Control Delay	101.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	106.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

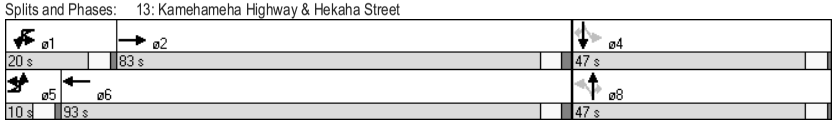
Timings
13: Kamehameha Highway & Hekaha Street

9/27/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1045	190	2560	240	45	235	65	45	100
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	33.0	10.0	33.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	10.0	83.0	20.0	93.0	47.0	47.0	47.0	47.0	47.0	47.0
Total Split (%)	6.7%	55.3%	13.3%	62.0%	31.3%	31.3%	31.3%	31.3%	31.3%	31.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 51 (34%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1045	155	190	2560	80	240	45	235	65	45	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.95		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4638		3204	4721			1728	1449		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.63	1.00		0.43	1.00
Satd. Flow (perm)	1652	4638		3204	4721			1139	1449		737	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1136	168	207	2783	87	261	49	255	71	49	109
RTOR Reduction (vph)	0	13	0	0	2	0	0	0	126	0	0	47
Lane Group Flow (vph)	54	1291	0	207	2868	0	0	310	129	0	120	62
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	79.6		13.5	88.1			40.9	40.9		40.9	40.9
Effective Green, g (s)	5.0	79.6		13.5	88.1			40.9	40.9		40.9	40.9
Actuated g/C Ratio	0.03	0.53		0.09	0.59			0.27	0.27		0.27	0.27
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	55	2461		288	2773			311	395		201	403
v/s Ratio Prot	0.03	0.28		c0.06	c0.61							
v/s Ratio Perm								c0.27	0.09		0.16	0.04
v/c Ratio	0.98	0.52		0.72	1.03			1.00	0.33		0.60	0.15
Uniform Delay, d1	72.5	22.9		66.4	31.0			54.5	43.6		47.4	41.4
Progression Factor	1.18	0.75		1.24	0.58			1.00	1.00		1.00	1.00
Incremental Delay, d2	108.6	0.7		3.6	21.3			49.8	0.5		4.7	0.2
Delay (s)	194.5	17.8		85.7	39.2			104.3	44.0		52.1	41.6
Level of Service	F	B		F	D			F	D		D	D
Approach Delay (s)		24.9			42.3			77.1			47.1	
Approach LOS		C			D			E			D	

Intersection Summary			
HCM Average Control Delay	41.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	93.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

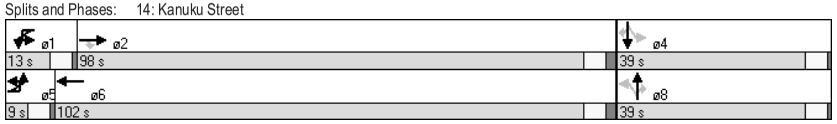
Timings
14: Kanuku Street

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1205	75	90	2960	95	15	55	65	15	35
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	9.0	98.0	98.0	13.0	102.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	6.0%	65.3%	65.3%	8.7%	68.0%	26.0%	26.0%	26.0%	26.0%	26.0%	26.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 34 (23%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1205	75	90	2960	225	95	15	55	65	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1430	3204	4689			1697	1531		1670	1427
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.64	1.00		0.54	1.00
Satd. Flow (perm)	1652	4746	1430	3204	4689			1128	1531		937	1427
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1310	82	98	3217	245	103	16	60	71	16	38
RTOR Reduction (vph)	0	0	24	0	4	0	0	0	52	0	0	33
Lane Group Flow (vph)	38	1310	58	98	3458	0	0	119	8	0	87	5
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.2	106.5	106.5	7.8	111.1			19.7	19.7		19.7	19.7
Effective Green, g (s)	3.2	106.5	106.5	7.8	111.1			19.7	19.7		19.7	19.7
Actuated g/C Ratio	0.02	0.71	0.71	0.05	0.74			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	35	3370	1015	167	3473			148	201		123	187
v/s Ratio Prot	c0.02	0.28		0.03	c0.74							
v/s Ratio Perm			0.04					c0.11	0.01		0.09	0.00
v/c Ratio	1.09	0.39	0.06	0.59	1.00			0.80	0.04		0.71	0.03
Uniform Delay, d1	73.4	8.7	6.6	69.5	19.2			63.3	56.9		62.4	56.8
Progression Factor	0.89	0.53	0.20	1.11	0.19			1.00	1.00		1.00	1.00
Incremental Delay, d2	169.7	0.3	0.1	0.5	3.7			26.2	0.1		16.9	0.1
Delay (s)	235.0	4.9	1.4	77.9	7.4			89.4	57.0		79.3	56.9
Level of Service	F	A	A	E	A			F	E		E	E
Approach Delay (s)		10.8			9.3			78.6			72.5	
Approach LOS		B			A			E			E	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

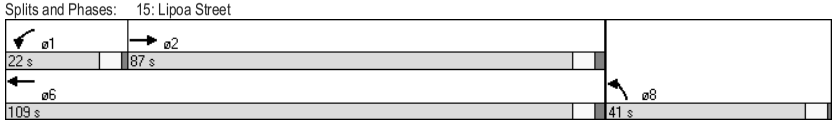
Timings
15: Lipoa Street

9/27/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1335	100	3300	165
Turn Type	NA	Prot	NA	NA
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	87.0	22.0	109.0	41.0
Total Split (%)	58.0%	14.7%	72.7%	27.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 32 (21%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1335	55	100	3300	165	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	*0.80	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5055		1652	4173	1747	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5055		1652	4173	1747	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1451	60	109	3587	179	38
RTOR Reduction (vph)	2	0	0	0	6	0
Lane Group Flow (vph)	1509	0	109	3587	211	0
Turn Type	NA		Prot	NA	NA	
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	96.7		13.9	115.6	23.4	
Effective Green, g (s)	96.7		13.9	115.6	23.4	
Actuated g/C Ratio	0.64		0.09	0.77	0.16	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3259		153	3216	273	
v/s Ratio Prot	0.30		0.07	c0.86	c0.12	
v/s Ratio Perm						
v/c Ratio	0.46		0.71	1.12	0.77	
Uniform Delay, d1	13.5		66.1	17.2	60.8	
Progression Factor	1.28		1.19	0.48	1.00	
Incremental Delay, d2	0.4		9.7	55.2	12.8	
Delay (s)	17.7		88.5	63.5	73.5	
Level of Service	B		F	E	E	
Approach Delay (s)	17.7			64.3	73.5	
Approach LOS	B			E	E	

Intersection Summary			
HCM Average Control Delay	51.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	84.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

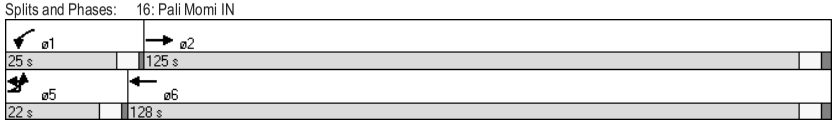
Timings
16: Pali Momi IN

9/27/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	250	1085	125	2895
Turn Type	Prot	NA	Prot	NA
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	22.0	125.0	25.0	128.0
Total Split (%)	14.7%	83.3%	16.7%	85.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 133 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	1085	35	125	2895	390	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4724		1652	4608							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4724		1652	4608							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	1179	38	136	3147	424	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	8	0	0	0	0	0	0	0
Lane Group Flow (vph)	272	1215	0	136	3563	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot	NA		Prot	NA							
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	15.8	122.8		16.2	123.2							
Effective Green, g (s)	15.8	122.8		16.2	123.2							
Actuated g/C Ratio	0.11	0.82		0.11	0.82							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	337	3867		178	3785							
v/s Ratio Prot	c0.08	0.26		0.08	c0.77							
v/s Ratio Perm												
v/c Ratio	0.81	0.31		0.76	0.94							
Uniform Delay, d1	65.6	3.3		65.0	10.6							
Progression Factor	0.98	0.46		1.10	0.26							
Incremental Delay, d2	12.0	0.2		10.2	3.7							
Delay (s)	76.5	1.7		82.0	6.4							
Level of Service	E	A		F	A							
Approach Delay (s)		15.4			9.2			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

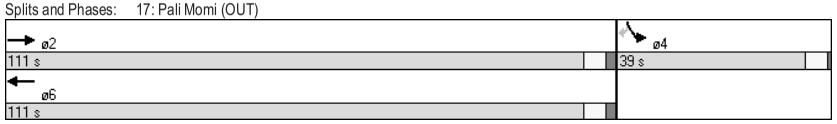
Timings
17: Pali Momi (OUT)

9/27/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1085	3140	315	145
Turn Type	NA	NA	NA	Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	111.0	111.0	39.0	39.0
Total Split (%)	74.0%	74.0%	26.0%	26.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 142 (95%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 130
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT)



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT)

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1085	3140	0	315	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.86
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1324
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1324
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1179	3413	0	342	158
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	0	1179	3413	0	342	157
Confl. Peds. (#/hr)						95
Turn Type		NA	NA		NA	Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		116.3	116.3		22.7	22.7
Effective Green, g (s)		116.3	116.3		22.7	22.7
Actuated g/C Ratio		0.78	0.78		0.15	0.15
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3680	3680		502	200
v/s Ratio Prot		0.25	c0.72		0.10	
v/s Ratio Perm						c0.12
v/c Ratio		0.32	0.93		0.68	0.79
Uniform Delay, d1		5.0	13.5		60.2	61.3
Progression Factor		0.60	1.00		1.00	1.00
Incremental Delay, d2		0.2	5.4		3.8	18.1
Delay (s)		3.2	18.8		64.0	79.4
Level of Service		A	B		E	E
Approach Delay (s)		3.2	18.8		68.9	
Approach LOS		A	B		E	

Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	97.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Harbor Pointe & Moanalua Road

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1515	25	30	1395	15	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1647	27	33	1516	16	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.79	
vC, conflicting volume			1674		2484	837
vC1, stage 1 conf vol					1660	
vC2, stage 2 conf vol					823	
vCu, unblocked vol			1674		2348	837
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			91		88	74
cM capacity (veh/h)			379		132	310

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1098	576	33	758	758	98
Volume Left	0	0	33	0	0	16
Volume Right	0	27	0	0	0	82
cSH	1700	1700	379	1700	1700	253
Volume to Capacity	0.65	0.34	0.09	0.45	0.45	0.39
Queue Length 95th (ft)	0	0	7	0	0	43
Control Delay (s)	0.0	0.0	15.4	0.0	0.0	27.9
Lane LOS			C			D
Approach Delay (s)	0.0		0.3			27.9
Approach LOS						D

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	1585	1420	15	15	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1723	1543	16	16	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.78				0.78	0.78
vC, conflicting volume	1560				2424	780
vC1, stage 1 conf vol					1552	
vC2, stage 2 conf vol					872	
vCu, unblocked vol	1160				2264	164
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	98
cM capacity (veh/h)	468				174	667

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	5	861	861	1029	531	33
Volume Left	5	0	0	0	0	16
Volume Right	0	0	0	0	16	16
cSH	468	1700	1700	1700	1700	276
Volume to Capacity	0.01	0.51	0.51	0.61	0.31	0.12
Queue Length 95th (ft)	1	0	0	0	0	10
Control Delay (s)	12.8	0.0	0.0	0.0	0.0	19.8
Lane LOS	B					C
Approach Delay (s)	0.0			0.0		19.8
Approach LOS						C

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

Timings
3: Kaonohi Street & Moanalua Road

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	130	1080	430	180	880	195	470	165	180	140	180
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	44.0	44.0	11.0	44.0	44.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	20.0	51.0	51.0	21.0	52.0	52.0	25.0	49.0	19.0	43.0	43.0
Total Split (%)	14.3%	36.4%	36.4%	15.0%	37.1%	37.1%	17.9%	35.0%	13.6%	30.7%	30.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 118.1
Natural Cycle: 140
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Kaonohi Street & Moanalua Road

ø1	ø2	ø3	ø4
20 s	52 s	19 s	49 s
ø5	ø6	ø7	ø8
21 s	51 s	25 s	43 s

HCM Signalized Intersection Capacity Analysis
3: Kaonohi Street & Moanalua Road

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	1080	430	180	880	195	470	165	310	180	140	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3192		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3192		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	141	1174	467	196	957	212	511	179	337	196	152	196
RTOR Reduction (vph)	0	0	287	0	0	128	0	184	0	0	0	171
Lane Group Flow (vph)	141	1174	180	196	957	84	511	332	0	196	152	25
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	13.1	45.1	45.1	15.0	47.0	47.0	19.0	22.6		11.4	15.0	15.0
Effective Green, g (s)	13.1	45.1	45.1	15.0	47.0	47.0	19.0	22.6		11.4	15.0	15.0
Actuated g/C Ratio	0.11	0.38	0.38	0.13	0.40	0.40	0.16	0.19		0.10	0.13	0.13
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	196	1351	605	225	1408	630	552	611		331	237	201
v/s Ratio Prot	0.08	c0.33		c0.11	0.27		c0.15	0.10		0.06	c0.08	
v/s Ratio Perm			0.11			0.05						0.02
v/c Ratio	0.72	0.87	0.30	0.87	0.68	0.13	0.93	0.54		0.59	0.64	0.12
Uniform Delay, d1	50.7	33.8	25.5	50.6	29.3	22.6	48.9	43.1		51.1	49.0	45.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.9	6.8	0.6	29.2	1.7	0.2	21.5	1.0		2.8	5.8	0.3
Delay (s)	62.6	40.5	26.0	79.8	31.1	22.8	70.4	44.1		54.0	54.8	46.0
Level of Service	E	D	C	E	C	C	E	D		D	D	D
Approach Delay (s)		38.5			36.8			57.2			51.3	
Approach LOS		D			D			E			D	

Intersection Summary			
HCM Average Control Delay	43.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	118.1	Sum of lost time (s)	24.0
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Kaonohi Street & RIRO Driveway/PR Macy's Upstairs

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	40	0	0	165	0	825	95	0	635	140
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	43	0	0	179	0	897	103	0	690	152
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.92	0.92	0.92	0.92	0.92		0.92					
vC, conflicting volume	1170	1766	766	1758	1791	276	842			1000		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1143	1788	706	1779	1815	276	789			1000		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	88	100	100	75	100			100		
cM capacity (veh/h)	108	74	350	42	72	722	764			688		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	43	179	256	256	256	231	842
Volume Left	0	0	0	0	0	0	0
Volume Right	43	179	0	0	0	103	152
cSH	350	722	1700	1700	1700	1700	1700
Volume to Capacity	0.12	0.25	0.15	0.15	0.15	0.14	0.50
Queue Length 95th (ft)	11	24	0	0	0	0	0
Control Delay (s)	16.8	11.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B					
Approach Delay (s)	16.8	11.6	0.0				0.0
Approach LOS	C	B					

Intersection Summary				
Average Delay		1.4		
Intersection Capacity Utilization		51.9%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Kaonohi Street & Pearlridge Driveway 1

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	105	185	725	130	165	520
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	201	788	141	179	565
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	1500	465			929	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1500	465			929	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	63			75	
cM capacity (veh/h)	85	544			732	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	114	201	525	404	368	377
Volume Left	114	0	0	0	179	0
Volume Right	0	201	0	141	0	0
cSH	85	544	1700	1700	732	1700
Volume to Capacity	1.34	0.37	0.31	0.24	0.25	0.22
Queue Length 95th (ft)	215	42	0	0	24	0
Control Delay (s)	301.0	15.4	0.0	0.0	7.2	0.0
Lane LOS	F	C			A	
Approach Delay (s)	118.8		0.0		3.6	
Approach LOS	F					

Intersection Summary				
Average Delay		20.2		
Intersection Capacity Utilization		59.2%	ICU Level of Service	B
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Kaonohi Street & Pearlridge Driveway 2

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	20	385	200	0	195	0	535	230	150	485	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	22	418	217	0	212	0	582	250	163	527	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	1356	1685	264	1726	1560	416	527			832		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1356	1685	264	1726	1560	416	527			832		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	71	43	0	100	64	100			80		
cM capacity (veh/h)	58	74	735	16	88	586	1036			797		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	549	217	212	388	444	163	264	264
Volume Left	109	217	0	0	0	163	0	0
Volume Right	418	0	212	0	250	0	0	0
cSH	201	16	586	1700	1700	797	1700	1700
Volume to Capacity	2.74	13.47	0.36	0.23	0.26	0.20	0.16	0.16
Queue Length 95th (ft)	1196	Err	41	0	0	19	0	0
Control Delay (s)	832.0	Err	14.6	0.0	0.0	10.7	0.0	0.0
Lane LOS	F	F	B			B		
Approach Delay (s)	832.0	5070.0		0.0		2.5		
Approach LOS	F	F						

Intersection Summary				
Average Delay	1054.1			
Intersection Capacity Utilization	86.2%	ICU Level of Service	E	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
7: Kaonohi Street & Westridge (north)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	50	25	735	935	120
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	54	27	799	1016	130
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	1535	573	1147			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1535	573	1147			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	68	88	96			
cM capacity (veh/h)	102	462	605			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	87	293	533	678	469
Volume Left	33	27	0	0	0
Volume Right	54	0	0	0	130
cSH	199	605	1700	1700	1700
Volume to Capacity	0.44	0.04	0.31	0.40	0.28
Queue Length 95th (ft)	51	4	0	0	0
Control Delay (s)	36.4	1.6	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	36.4	0.6		0.0	
Approach LOS	E				

Intersection Summary				
Average Delay	1.8			
Intersection Capacity Utilization	49.9%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: Kaonohi Street & Westridge (south)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	95	50	750	975	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	103	54	815	1060	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	1592	546	1092			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1592	546	1092			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	64	79	91			
cM capacity (veh/h)	90	482	635			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	136	326	543	707	386
Volume Left	33	54	0	0	0
Volume Right	103	0	0	0	33
cSH	235	635	1700	1700	1700
Volume to Capacity	0.58	0.09	0.32	0.42	0.23
Queue Length 95th (ft)	82	7	0	0	0
Control Delay (s)	39.5	2.8	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	39.5	1.1		0.0	
Approach LOS	E				

Intersection Summary			
Average Delay		3.0	
Intersection Capacity Utilization		67.6%	ICU Level of Service C
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
9: Kaonohi Street & Ana Miller's Driveway

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	85	695	85	45	930
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	92	755	92	49	1011
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	1236	424			848	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1236	424			848	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	52	84			94	
cM capacity (veh/h)	158	579			785	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	168	504	344	251	404	404
Volume Left	76	0	0	49	0	0
Volume Right	92	0	92	0	0	0
cSH	262	1700	1700	785	1700	1700
Volume to Capacity	0.64	0.30	0.20	0.06	0.24	0.24
Queue Length 95th (ft)	100	0	0	5	0	0
Control Delay (s)	40.4	0.0	0.0	2.5	0.0	0.0
Lane LOS	E			A		
Approach Delay (s)	40.4	0.0		0.6		
Approach LOS	E					

Intersection Summary			
Average Delay		3.6	
Intersection Capacity Utilization		59.9%	ICU Level of Service B
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
10: Kaonohi Street & Moanalua Loop

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	115	95	735	1020	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	125	103	799	1109	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1750	405	1109			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1750	405	1109			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	24	79	83			
cM capacity (veh/h)	64	595	626			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	174	103	399	399	443	443	292
Volume Left	49	103	0	0	0	0	0
Volume Right	125	0	0	0	0	0	71
cSH	179	626	1700	1700	1700	1700	1700
Volume to Capacity	0.97	0.17	0.23	0.23	0.26	0.26	0.17
Queue Length 95th (ft)	194	15	0	0	0	0	0
Control Delay (s)	113.0	11.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	113.0	1.4			0.0		
Approach LOS	F						

Intersection Summary				
Average Delay		9.3		
Intersection Capacity Utilization		46.0%	ICU Level of Service	A
Analysis Period (min)		15		

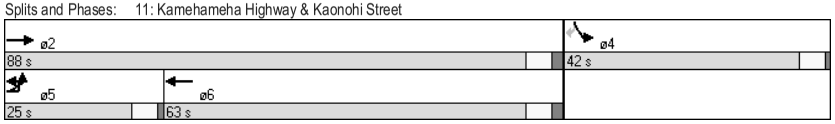
Timings
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	400	1665	1405	595	530
Turn Type	Prot	NA	NA	NA	Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	33.0	33.0
Total Split (s)	25.0	88.0	63.0	42.0	42.0
Total Split (%)	19.2%	67.7%	48.5%	32.3%	32.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 64 (49%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	400	1665	1405	425	595	530
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.97		0.98	0.90
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		0.97	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4597		3283	1293
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4597		3283	1293
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	435	1810	1527	462	647	576
RTOR Reduction (vph)	0	0	42	0	22	206
Lane Group Flow (vph)	435	1810	1947	0	815	180
Confl. Peds. (#/hr)				70		64
Turn Type	Prot	NA	NA		NA	Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	19.3	82.0	57.7		37.0	37.0
Effective Green, g (s)	19.3	82.0	57.7		37.0	37.0
Actuated g/C Ratio	0.15	0.63	0.44		0.28	0.28
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	476	2994	2040		934	368
v/s Ratio Prot	c0.14	0.38	c0.42		c0.25	
v/s Ratio Perm						0.14
v/c Ratio	0.91	0.60	0.95		0.87	0.49
Uniform Delay, d1	54.5	14.3	34.9		44.3	38.6
Progression Factor	0.94	1.12	0.63		1.00	1.00
Incremental Delay, d2	19.0	0.8	10.0		11.0	4.6
Delay (s)	69.9	16.8	32.0		55.3	43.2
Level of Service	E	B	C		E	D
Approach Delay (s)		27.1	32.0		51.5	
Approach LOS		C	C		D	

Intersection Summary			
HCM Average Control Delay	34.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

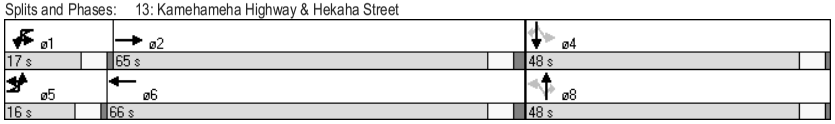
Timings
13: Kamehameha Highway & Hekaha Street

9/27/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	100	1535	230	1635	215	55	325	95	40	145
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	16.0	65.0	17.0	66.0	48.0	48.0	48.0	48.0	48.0	48.0
Total Split (%)	12.3%	50.0%	13.1%	50.8%	36.9%	36.9%	36.9%	36.9%	36.9%	36.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 42 (32%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	1535	295	230	1635	65	215	55	325	95	40	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4615		3204	4714			1699	1531		1679	1417
Flt Permitted	0.95	1.00		0.95	1.00			0.63	1.00		0.47	1.00
Satd. Flow (perm)	1652	4615		3204	4714			1118	1531		819	1417
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1668	321	250	1777	71	234	60	353	103	43	158
RTOR Reduction (vph)	0	22	0	0	3	0	0	0	118	0	0	106
Lane Group Flow (vph)	109	1967	0	250	1845	0	0	294	235	0	146	52
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	10.6	59.2		11.8	60.4			43.0	43.0		43.0	43.0
Effective Green, g (s)	10.6	59.2		11.8	60.4			43.0	43.0		43.0	43.0
Actuated g/C Ratio	0.08	0.46		0.09	0.46			0.33	0.33		0.33	0.33
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	135	2102		291	2190			370	506		271	469
v/s Ratio Prot	0.07	c0.43		c0.08	0.39							
v/s Ratio Perm								c0.26	0.15		0.18	0.04
v/c Ratio	0.81	0.94		0.86	0.84			0.79	0.46		0.54	0.11
Uniform Delay, d1	58.7	33.6		58.3	30.6			39.5	34.4		35.4	30.2
Progression Factor	0.86	0.79		1.44	0.27			1.00	1.00		1.00	1.00
Incremental Delay, d2	19.2	6.3		15.4	2.8			16.0	3.0		7.5	0.5
Delay (s)	69.4	32.9		99.4	11.1			55.5	37.4		42.9	30.7
Level of Service	E	C		F	B			E	D		D	C
Approach Delay (s)		34.8			21.6			45.6			36.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	30.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	108.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

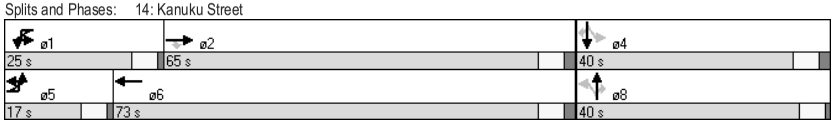
Timings
14: Kanuku Street

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	75	1670	110	110	1715	70	20	75	125	15	80
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	25.0	28.0	23.0	23.0	23.0	40.0	40.0	40.0
Total Split (s)	17.0	65.0	65.0	25.0	73.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	13.1%	50.0%	50.0%	19.2%	56.2%	30.8%	30.8%	30.8%	30.8%	30.8%	30.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 26 (20%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1670	110	110	1715	240	70	20	75	125	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4659			1733	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.68	1.00		0.67	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4659			1217	1531		1165	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	1815	120	120	1864	261	76	22	82	136	16	87
RTOR Reduction (vph)	0	0	34	0	14	0	0	0	60	0	0	64
Lane Group Flow (vph)	82	1815	86	120	2111	0	0	98	22	0	152	23
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	10.4	69.1	69.1	9.9	68.6			35.0	35.0		34.0	34.0
Effective Green, g (s)	10.4	69.1	69.1	9.9	68.6			35.0	35.0		34.0	34.0
Actuated g/C Ratio	0.08	0.53	0.53	0.08	0.53			0.27	0.27		0.26	0.26
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	132	2523	786	244	2459			328	412		305	387
v/s Ratio Prot	c0.05	0.38		0.04	c0.45							
v/s Ratio Perm			0.06					0.08	0.01		c0.13	0.02
v/c Ratio	0.62	0.72	0.11	0.49	0.86			0.30	0.05		0.50	0.06
Uniform Delay, d1	57.9	23.1	15.1	57.6	26.5			37.7	35.2		40.8	36.0
Progression Factor	0.81	1.22	1.91	1.19	0.41			1.00	1.00		1.00	1.00
Incremental Delay, d2	5.1	1.0	0.2	0.9	2.3			2.3	0.2		5.7	0.3
Delay (s)	52.0	29.1	29.1	69.7	13.3			40.1	35.5		46.5	36.3
Level of Service	D	C	C	E	B			D	D		D	D
Approach Delay (s)		30.1			16.3			38.0			42.8	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	24.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

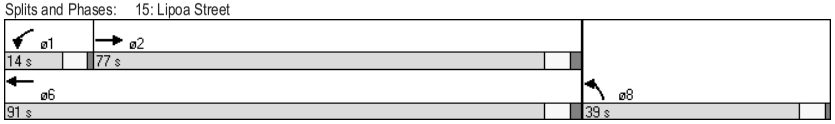
Timings
15: Lipoa Street

9/27/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1935	50	1835	165
Turn Type	NA	Prot	NA	NA
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	77.0	14.0	91.0	39.0
Total Split (%)	59.2%	10.8%	70.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 2 (2%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1935	65	50	1835	165	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4719		1652	4746	1674	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4719		1652	4746	1674	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2103	71	54	1995	179	76
RTOR Reduction (vph)	3	0	0	0	12	0
Lane Group Flow (vph)	2171	0	54	1995	243	0
Confl. Peds. (#/hr)		2				82
Turn Type	NA		Prot	NA	NA	
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	73.0		7.0	85.0	34.0	
Effective Green, g (s)	73.0		7.0	85.0	34.0	
Actuated g/C Ratio	0.56		0.05	0.65	0.26	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	2650		89	3103	438	
v/s Ratio Prot	c0.46		0.03	c0.42	c0.15	
v/s Ratio Perm						
v/c Ratio	0.82		0.61	0.64	0.56	
Uniform Delay, d1	23.1		60.2	13.4	41.5	
Progression Factor	0.86		1.35	0.46	1.00	
Incremental Delay, d2	2.3		9.3	0.9	5.0	
Delay (s)	22.2		90.2	7.1	46.5	
Level of Service	C		F	A	D	
Approach Delay (s)	22.2			9.3	46.5	
Approach LOS	C			A	D	

Intersection Summary			
HCM Average Control Delay	17.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

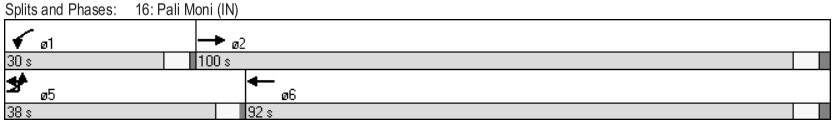
Timings
16: Pali Moni (IN)

9/27/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	475	1480	155	1645
Turn Type	Prot	NA	Prot	NA
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	38.0	100.0	30.0	92.0
Total Split (%)	29.2%	76.9%	23.1%	70.8%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 110 (85%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN)



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN)

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	475	1480	55	155	1645	500	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.98							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	0.99		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4721		1652	4510							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4721		1652	4510							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	516	1609	60	168	1788	543	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	20	0	0	0	0	0	0	0
Lane Group Flow (vph)	516	1667	0	168	2311	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot	NA		Prot	NA							
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	24.8	101.4		17.6	94.2							
Effective Green, g (s)	24.8	101.4		17.6	94.2							
Actuated g/C Ratio	0.19	0.78		0.14	0.72							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	611	3682		224	3268							
v/s Ratio Prot	c0.16	0.35		0.10	c0.51							
v/s Ratio Perm												
v/c Ratio	0.84	0.45		0.75	0.71							
Uniform Delay, d1	50.7	4.9		54.1	10.1							
Progression Factor	0.57	1.40		1.11	0.45							
Incremental Delay, d2	7.0	0.3		11.6	1.1							
Delay (s)	35.7	7.0		71.5	5.7							
Level of Service	D	A		E	A							
Approach Delay (s)		13.8			10.1			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	11.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

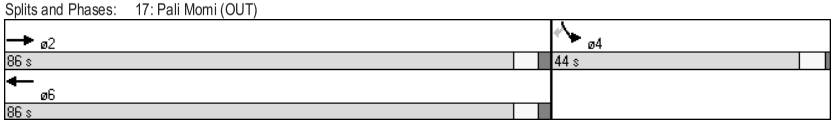
Timings
17: Pali Momi (OUT)

9/27/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1440	1915	355	190
Turn Type	NA	NA	NA	Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	86.0	86.0	44.0	44.0
Total Split (%)	66.2%	66.2%	33.8%	33.8%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 120 (92%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT)



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1440	1915	0	355	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.86
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1316
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1316
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1565	2082	0	386	207
RTOR Reduction (vph)	0	0	0	0	0	8
Lane Group Flow (vph)	0	1565	2082	0	386	199
Confl. Peds. (#/hr)						114
Turn Type		NA	NA		NA	Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		94.5	94.5		24.5	24.5
Effective Green, g (s)		94.5	94.5		24.5	24.5
Actuated g/C Ratio		0.73	0.73		0.19	0.19
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3450	3450		626	248
v/s Ratio Prot		0.33	c0.44		0.12	
v/s Ratio Perm						c0.15
v/c Ratio		0.45	0.60		0.62	0.80
Uniform Delay, d1		7.2	8.6		48.4	50.4
Progression Factor		0.34	1.00		1.00	1.00
Incremental Delay, d2		0.4	0.8		1.8	16.8
Delay (s)		2.9	9.4		50.2	67.2
Level of Service		A	A		D	E
Approach Delay (s)		2.9	9.4		56.2	
Approach LOS		A	A		E	

Intersection Summary			
HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2021 RT

HCM Unsignalized Intersection Capacity Analysis
1: Harbor Pointe & Moanalua Road

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1625	15	30	1145	15	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1766	16	33	1245	16	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.88	
vC, conflicting volume			1783		2462	891
vC1, stage 1 conf vol					1774	
vC2, stage 2 conf vol					688	
vCu, unblocked vol			1783		2388	891
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			91		86	85
cM capacity (veh/h)			344		115	285

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1178	605	33	622	622	60
Volume Left	0	0	33	0	0	16
Volume Right	0	16	0	0	0	43
cSH	1700	1700	344	1700	1700	203
Volume to Capacity	0.69	0.36	0.09	0.37	0.37	0.29
Queue Length 95th (ft)	0	0	8	0	0	29
Control Delay (s)	0.0	0.0	16.6	0.0	0.0	29.9
Lane LOS			C			D
Approach Delay (s)	0.0		0.4			29.9
Approach LOS						D

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	155	1525	850	205	45	270
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	168	1658	924	223	49	293
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.82				0.82	0.82
vC, conflicting volume	1147				2201	573
vC1, stage 1 conf vol					1035	
vC2, stage 2 conf vol					1166	
vCu, unblocked vol	743				2027	45
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	76				72	65
cM capacity (veh/h)	706				174	833

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	168	829	829	616	531	342
Volume Left	168	0	0	0	0	49
Volume Right	0	0	0	0	223	293
cSH	706	1700	1700	1700	1700	540
Volume to Capacity	0.24	0.49	0.49	0.36	0.31	0.63
Queue Length 95th (ft)	23	0	0	0	0	110
Control Delay (s)	11.7	0.0	0.0	0.0	0.0	22.5
Lane LOS	B					C
Approach Delay (s)	1.1			0.0		22.5
Approach LOS						C

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	68.0%	ICU Level of Service	C
Analysis Period (min)	15		

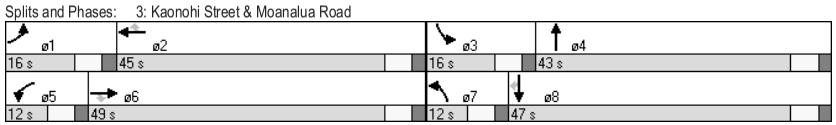
Timings
3: Kaonohi Street & Moanalua Road

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	110	1250	210	80	760	100	80	85	290	230	240
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	44.0	44.0	11.0	44.0	44.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	16.0	49.0	49.0	12.0	45.0	45.0	12.0	43.0	16.0	47.0	47.0
Total Split (%)	13.3%	40.8%	40.8%	10.0%	37.5%	37.5%	10.0%	35.8%	13.3%	39.2%	39.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 98
Natural Cycle: 120
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Kaonohi Street & Moanalua Road



HCM Signalized Intersection Capacity Analysis
3: Kaonohi Street & Moanalua Road

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	1250	210	80	760	100	80	85	85	290	230	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3274		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	120	1359	228	87	826	109	87	92	92	315	250	261
RTOR Reduction (vph)	0	0	129	0	0	66	0	77	0	0	0	132
Lane Group Flow (vph)	120	1359	99	87	826	43	87	107	0	315	250	129
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	9.8	43.3	43.3	6.0	39.5	39.5	4.7	16.0		10.0	21.3	21.3
Effective Green, g (s)	9.8	43.3	43.3	6.0	39.5	39.5	4.7	16.0		10.0	21.3	21.3
Actuated g/C Ratio	0.10	0.44	0.44	0.06	0.40	0.40	0.05	0.16		0.10	0.21	0.21
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	175	1543	690	107	1408	630	162	528		346	400	340
v/s Ratio Prot	c0.07	c0.38		0.05	0.23		0.03	0.03		c0.09	c0.13	
v/s Ratio Perm			0.06			0.03						0.08
v/c Ratio	0.69	0.88	0.14	0.81	0.59	0.07	0.54	0.20		0.91	0.62	0.38
Uniform Delay, d1	43.3	25.6	16.8	46.1	23.5	18.5	46.2	36.1		44.2	35.4	33.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.6	6.7	0.2	36.5	1.0	0.1	3.4	0.2		27.1	3.0	0.7
Delay (s)	53.9	32.3	17.1	82.6	24.5	18.6	49.6	36.3		71.3	38.4	34.1
Level of Service	D	C	B	F	C	B	D	D		E	D	C
Approach Delay (s)		31.8			28.8			40.6			49.6	
Approach LOS		C			C			D			D	

Intersection Summary				
HCM Average Control Delay	35.5	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.87			
Actuated Cycle Length (s)	99.3	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	75.3%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: Kaonohi Street & RIRO Driveway/PR Macy's Upstairs

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	10	0	255	20	0	535	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	11	0	277	22	0	582	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.88	0.88	0.88	0.88	0.88		0.88					
vC, conflicting volume	662	880	582	870	870	80	582			299		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	546	795	455	782	782	80	455			299		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	99	100			100		
cM capacity (veh/h)	366	280	486	250	285	964	969			1259		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	11	79	79	79	61	582
Volume Left	0	0	0	0	0	0	0
Volume Right	0	11	0	0	0	22	0
cSH	1700	964	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.01	0.05	0.05	0.05	0.04	0.34
Queue Length 95th (ft)	0	1	0	0	0	0	0
Control Delay (s)	0.0	8.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	8.8	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay		0.1		
Intersection Capacity Utilization		31.5%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Kaonohi Street & Pearlridge Driveway 1

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	15	30	250	15	30	490
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	33	272	16	33	533
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	611	144			288	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	611	144			288	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	96			97	
cM capacity (veh/h)	414	877			1271	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	16	33	181	107	210	355
Volume Left	16	0	0	0	33	0
Volume Right	0	33	0	16	0	0
cSH	414	877	1700	1700	1271	1700
Volume to Capacity	0.04	0.04	0.11	0.06	0.03	0.21
Queue Length 95th (ft)	3	3	0	0	2	0
Control Delay (s)	14.0	9.3	0.0	0.0	1.4	0.0
Lane LOS	B	A			A	
Approach Delay (s)	10.9		0.0		0.5	
Approach LOS	B					

Intersection Summary				
Average Delay		0.9		
Intersection Capacity Utilization		35.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Kaonohi Street & Pearlridge Driveway 2

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	30	0	10	0	245	40	35	490	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	33	0	11	0	266	43	38	533	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	753	918	266	630	897	155	533			310		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	753	918	266	630	897	155	533			310		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	91	100	99	100			97		
cM capacity (veh/h)	288	262	732	357	270	863	1031			1248		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	0	33	11	178	132	38	266	266
Volume Left	0	33	0	0	0	38	0	0
Volume Right	0	0	11	0	43	0	0	0
cSH	1700	357	863	1700	1700	1248	1700	1700
Volume to Capacity	0.00	0.09	0.01	0.10	0.08	0.03	0.16	0.16
Queue Length 95th (ft)	0	7	1	0	0	2	0	0
Control Delay (s)	0.0	16.1	9.2	0.0	0.0	8.0	0.0	0.0
Lane LOS	A	C	A			A		
Approach Delay (s)	0.0	14.4		0.0		0.5		
Approach LOS	A	B						

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	24.7%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
7: Kaonohi Street & Westridge (north)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	35	20	250	440	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	38	22	272	478	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	688	269	538			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	688	269	538			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	95	98			
cM capacity (veh/h)	372	729	1026			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	82	112	181	319	219
Volume Left	43	22	0	0	0
Volume Right	38	0	0	0	60
cSH	483	1026	1700	1700	1700
Volume to Capacity	0.17	0.02	0.11	0.19	0.13
Queue Length 95th (ft)	15	2	0	0	0
Control Delay (s)	14.0	1.8	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	14.0	0.7		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay	1.5			
Intersection Capacity Utilization	33.2%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: Kaonohi Street & Westridge (south)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	50	20	255	470	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	54	22	277	511	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	696	258	516			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	696	258	516			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	93	98			
cM capacity (veh/h)	368	741	1046			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	114	185	341	176
Volume Left	16	22	0	0	0
Volume Right	54	0	0	0	5
cSH	601	1046	1700	1700	1700
Volume to Capacity	0.12	0.02	0.11	0.20	0.10
Queue Length 95th (ft)	10	2	0	0	0
Control Delay (s)	11.8	1.8	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	11.8	0.7		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.2		
Intersection Capacity Utilization		32.9%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Kaonohi Street & Ana Miller's Driveway

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	260	55	25	495
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	283	60	27	538
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	546	171			342	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	546	171			342	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	98			98	
cM capacity (veh/h)	457	843			1213	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	188	154	135	215	215
Volume Left	49	0	0	27	0	0
Volume Right	16	0	60	0	0	0
cSH	516	1700	1700	1213	1700	1700
Volume to Capacity	0.13	0.11	0.09	0.02	0.13	0.13
Queue Length 95th (ft)	11	0	0	2	0	0
Control Delay (s)	13.0	0.0	0.0	1.8	0.0	0.0
Lane LOS	B			A		
Approach Delay (s)	13.0	0.0		0.4		
Approach LOS	B					

Intersection Summary				
Average Delay		1.1		
Intersection Capacity Utilization		32.4%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Kaonohi Street & Moanalua Loop

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	85	155	55	225	515	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	168	60	245	560	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	821	206	560			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	821	206	560			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	69	79	94			
cM capacity (veh/h)	294	801	1007			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	261	60	122	122	224	224	150
Volume Left	92	60	0	0	0	0	0
Volume Right	168	0	0	0	0	0	38
cSH	497	1007	1700	1700	1700	1700	1700
Volume to Capacity	0.52	0.06	0.07	0.07	0.13	0.13	0.09
Queue Length 95th (ft)	75	5	0	0	0	0	0
Control Delay (s)	19.9	8.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	19.9	1.7			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	38.3%	ICU Level of Service	A
Analysis Period (min)	15		

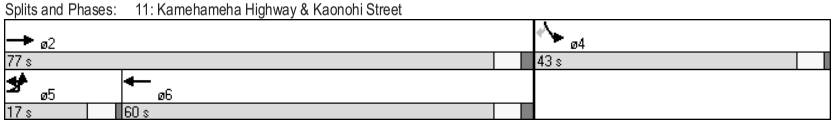
Timings
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	135	1760	825	555	120
Turn Type	Prot	NA	NA	NA	Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	17.0	77.0	60.0	43.0	43.0
Total Split (%)	14.2%	64.2%	50.0%	35.8%	35.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 84 (70%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	135	1760	825	175	555	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	0.93
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4723		3429	1343
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4723		3429	1343
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	147	1913	897	190	603	130
RTOR Reduction (vph)	0	0	22	0	2	90
Lane Group Flow (vph)	147	1913	1065	0	614	27
Confl. Peds. (#/hr)				38		54
Turn Type	Prot	NA	NA		NA	Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	10.2	81.6	66.4		27.4	27.4
Effective Green, g (s)	10.2	81.6	66.4		27.4	27.4
Actuated g/C Ratio	0.08	0.68	0.55		0.23	0.23
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	272	3227	2613		783	307
v/s Ratio Prot	0.05	c0.40	0.23		c0.18	
v/s Ratio Perm						0.02
v/c Ratio	0.54	0.59	0.41		0.78	0.09
Uniform Delay, d1	52.7	10.3	15.5		43.5	36.5
Progression Factor	1.32	0.24	0.71		1.00	1.00
Incremental Delay, d2	1.9	0.7	0.5		5.2	0.1
Delay (s)	71.5	3.1	11.4		48.7	36.6
Level of Service	E	A	B		D	D
Approach Delay (s)		8.0	11.4		46.8	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

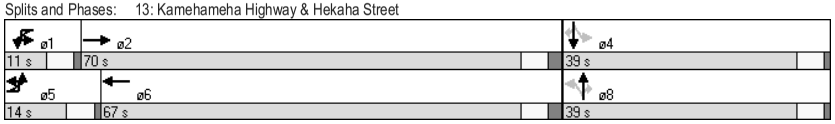
Timings
13: Kamehameha Highway & Hekaha Street

9/27/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1740	90	880	55	5	60	115	15	80
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	14.0	70.0	11.0	67.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	11.7%	58.3%	9.2%	55.8%	32.5%	32.5%	32.5%	32.5%	32.5%	32.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	Max	Max	Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 88 (73%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1740	195	90	880	30	55	5	60	115	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4662		3204	4719			1720	1488		1643	1459
Flt Permitted	0.95	1.00		0.95	1.00			0.69	1.00		0.70	1.00
Satd. Flow (perm)	1652	4662		3204	4719			1235	1488		1208	1459
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1891	212	98	957	33	60	5	65	125	16	87
RTOR Reduction (vph)	0	11	0	0	3	0	0	0	47	0	0	62
Lane Group Flow (vph)	54	2092	0	98	987	0	0	65	18	0	141	25
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	6.9	64.0		6.0	63.1			34.0	34.0		34.0	34.0
Effective Green, g (s)	6.9	64.0		6.0	63.1			34.0	34.0		34.0	34.0
Actuated g/C Ratio	0.06	0.53		0.05	0.53			0.28	0.28		0.28	0.28
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	95	2486		160	2481			350	422		342	413
v/s Ratio Prot	c0.03	c0.45		0.03	0.21							
v/s Ratio Perm								0.05	0.01		c0.12	0.02
v/c Ratio	0.57	0.84		0.61	0.40			0.19	0.04		0.41	0.06
Uniform Delay, d1	55.1	23.7		55.9	17.1			32.5	31.2		34.9	31.3
Progression Factor	1.14	0.75		0.65	1.02			1.00	1.00		1.00	1.00
Incremental Delay, d2	6.2	3.0		6.6	0.5			0.3	0.0		3.6	0.3
Delay (s)	69.3	20.7		43.0	17.8			32.8	31.2		38.5	31.6
Level of Service	E	C		D	B			C	C		D	C
Approach Delay (s)		21.9			20.1			32.0			35.9	
Approach LOS		C			C			C			D	

Intersection Summary			
HCM Average Control Delay	22.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

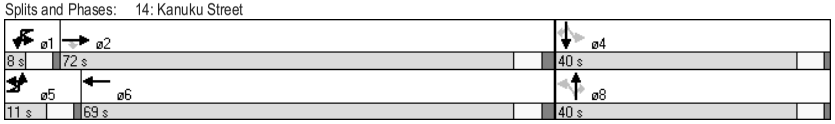
Timings
14: Kanuku Street

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	30	1790	20	20	950	5	5	15	145	10	45
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	11.0	72.0	72.0	8.0	69.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	9.2%	60.0%	60.0%	6.7%	57.5%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 1 (1%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	1790	20	20	950	70	5	5	15	145	10	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1451	3204	4692			1754	1531		1661	1454
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1451	3204	4692			1583	1531		1274	1454
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	1946	22	22	1033	76	5	5	16	158	11	49
RTOR Reduction (vph)	0	0	5	0	5	0	0	0	13	0	0	41
Lane Group Flow (vph)	33	1946	17	22	1104	0	0	10	3	0	169	8
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.6	82.0	82.0	1.8	80.2			20.2	20.2		20.2	20.2
Effective Green, g (s)	3.6	82.0	82.0	1.8	80.2			20.2	20.2		20.2	20.2
Actuated g/C Ratio	0.03	0.68	0.68	0.02	0.67			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	50	3243	992	48	3136			266	258		214	245
v/s Ratio Prot	c0.02	c0.41		0.01	0.24							
v/s Ratio Perm			0.01					0.01	0.00		c0.13	0.01
v/c Ratio	0.66	0.60	0.02	0.46	0.35			0.04	0.01		0.79	0.03
Uniform Delay, d1	57.6	10.2	6.1	58.6	8.6			41.8	41.6		47.9	41.7
Progression Factor	1.41	0.23	0.07	0.68	1.19			1.00	1.00		1.00	1.00
Incremental Delay, d2	19.3	0.5	0.0	6.5	0.3			0.1	0.0		17.4	0.1
Delay (s)	100.7	2.9	0.5	46.2	10.6			41.8	41.6		65.3	41.8
Level of Service	F	A	A	D	B			D	D		E	D
Approach Delay (s)		4.5			11.3			41.7			60.0	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	10.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

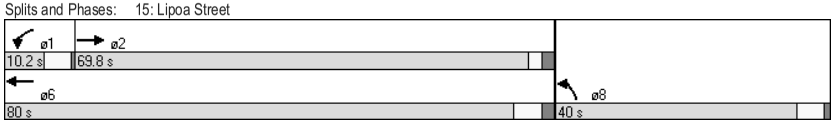
Timings
15: Lipoa Street

9/27/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2280	45	1000	75
Turn Type	NA	Prot	NA	NA
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	69.8	10.2	80.0	40.0
Total Split (%)	58.2%	8.5%	66.7%	33.3%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 11 (9%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2280	50	45	1000	75	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4731		1652	4746	1650	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4731		1652	4746	1650	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2478	54	49	1087	82	71
RTOR Reduction (vph)	1	0	0	0	33	0
Lane Group Flow (vph)	2531	0	49	1087	120	0
Confl. Peds. (#/hr)			2			50
Turn Type	NA		Prot	NA	NA	
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	87.9		4.6	95.0	14.0	
Effective Green, g (s)	87.9		4.6	95.0	14.0	
Actuated g/C Ratio	0.73		0.04	0.79	0.12	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3465		63	3757	193	
v/s Ratio Prot	c0.53		c0.03	0.23	c0.07	
v/s Ratio Perm						
v/c Ratio	0.73		0.78	0.29	0.62	
Uniform Delay, d1	9.2		57.2	3.4	50.5	
Progression Factor	0.30		0.77	0.97	1.00	
Incremental Delay, d2	1.2		42.9	0.2	6.1	
Delay (s)	3.9		86.9	3.5	56.6	
Level of Service	A		F	A	E	
Approach Delay (s)	3.9			7.1	56.6	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	7.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	77.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

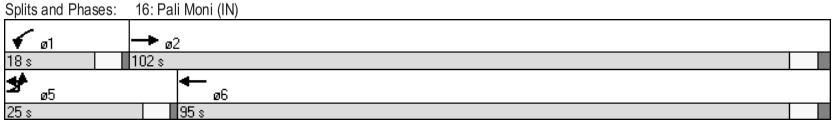
Timings
16: Pali Moni (IN)

9/27/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	205	2170	45	1035
Turn Type	Prot	NA	Prot	NA
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	25.0	102.0	18.0	95.0
Total Split (%)	20.8%	85.0%	15.0%	79.2%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 119 (99%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN)



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN)

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	2170	15	45	1035	185	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4741		1652	4638							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4741		1652	4638							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	2359	16	49	1125	201	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	0	0	0	0
Lane Group Flow (vph)	223	2375	0	49	1310	0	0	0	0	0	0	0
Turn Type	Prot	NA		Prot	NA							
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	13.1	101.4		7.6	95.9							
Effective Green, g (s)	13.1	101.4		7.6	95.9							
Actuated g/C Ratio	0.11	0.85		0.06	0.80							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	350	4006		105	3707							
v/s Ratio Prot	c0.07	c0.50		0.03	0.28							
v/s Ratio Perm												
v/c Ratio	0.64	0.59		0.47	0.35							
Uniform Delay, d1	51.2	2.9		54.2	3.4							
Progression Factor	0.90	0.47		0.92	0.46							
Incremental Delay, d2	2.9	0.5		3.0	0.2							
Delay (s)	48.8	1.8		52.9	1.8							
Level of Service	D	A		D	A							
Approach Delay (s)		5.9			3.6			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

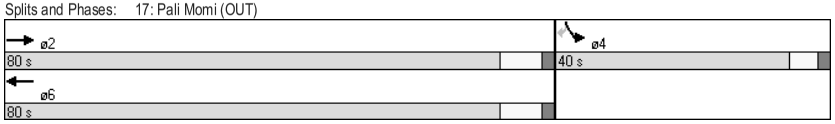
Timings
17: Pali Momi (OUT)

9/27/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	2055	1180	335	80
Turn Type	NA	NA	NA	Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	80.0	80.0	40.0	40.0
Total Split (%)	66.7%	66.7%	33.3%	33.3%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 20 (17%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT)



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT)

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	2055	1180	0	335	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.94
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1434
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1434
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2234	1283	0	364	87
RTOR Reduction (vph)	0	0	0	0	0	45
Lane Group Flow (vph)	0	2234	1283	0	364	42
Confl. Peds. (#/hr)						49
Turn Type		NA	NA		NA	Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		72.0	72.0		34.0	34.0
Effective Green, g (s)		72.0	72.0		34.0	34.0
Actuated g/C Ratio		0.60	0.60		0.28	0.28
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2848	2848		940	406
v/s Ratio Prot		c0.47	0.27		c0.11	
v/s Ratio Perm						0.03
v/c Ratio		0.78	0.45		0.39	0.10
Uniform Delay, d1		18.1	13.2		34.6	31.7
Progression Factor		0.31	1.00		1.00	1.00
Incremental Delay, d2		1.9	0.5		1.2	0.5
Delay (s)		7.5	13.7		35.8	32.3
Level of Service		A	B		D	C
Approach Delay (s)		7.5	13.7		35.1	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Harbor Pointe & Moanalua Road

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1245	25	20	1970	15	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1353	27	22	2141	16	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.58	
vC, conflicting volume			1380		2481	690
vC1, stage 1 conf vol					1367	
vC2, stage 2 conf vol					1114	
vCu, unblocked vol			1380		2103	690
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			96		91	94
cM capacity (veh/h)			492		184	387

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	902	478	22	1071	1071	38
Volume Left	0	0	22	0	0	16
Volume Right	0	27	0	0	0	22
cSH	1700	1700	492	1700	1700	263
Volume to Capacity	0.53	0.28	0.04	0.63	0.63	0.14
Queue Length 95th (ft)	0	0	3	0	0	12
Control Delay (s)	0.0	0.0	12.6	0.0	0.0	21.0
Lane LOS			B			C
Approach Delay (s)	0.0		0.1			21.0
Approach LOS						C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	55	1230	1880	80	60	80
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	1337	2043	87	65	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.57				0.57	0.57
vC, conflicting volume	2130				2875	1065
vC1, stage 1 conf vol					2087	
vC2, stage 2 conf vol					788	
vCu, unblocked vol	1470				2780	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	77				35	86
cM capacity (veh/h)	258				100	616

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	60	668	668	1362	768	152
Volume Left	60	0	0	0	0	65
Volume Right	0	0	0	0	87	87
cSH	258	1700	1700	1700	1700	192
Volume to Capacity	0.23	0.39	0.39	0.80	0.45	0.79
Queue Length 95th (ft)	22	0	0	0	0	136
Control Delay (s)	23.1	0.0	0.0	0.0	0.0	71.0
Lane LOS	C					F
Approach Delay (s)	1.0			0.0		71.0
Approach LOS						F

Intersection Summary			
Average Delay		3.3	
Intersection Capacity Utilization		69.4%	ICU Level of Service C
Analysis Period (min)		15	

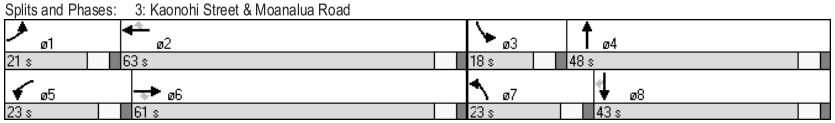
Timings
3: Kaonohi Street & Moanalua Road

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	205	915	205	110	1435	295	405	155	130	100	140
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	44.0	44.0	11.0	44.0	44.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	21.0	61.0	61.0	23.0	63.0	63.0	23.0	48.0	18.0	43.0	43.0
Total Split (%)	14.0%	40.7%	40.7%	15.3%	42.0%	42.0%	15.3%	32.0%	12.0%	28.7%	28.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 125.7
Natural Cycle: 150
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Kaonohi Street & Moanalua Road



HCM Signalized Intersection Capacity Analysis
3: Kaonohi Street & Moanalua Road

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	915	205	110	1435	295	405	155	115	130	100	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3313		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3313		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	995	223	120	1560	321	440	168	125	141	109	152
RTOR Reduction (vph)	0	0	120	0	0	134	0	106	0	0	0	137
Lane Group Flow (vph)	223	995	103	120	1560	187	440	187	0	141	109	15
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	15.0	58.3	58.3	13.7	57.0	57.0	17.0	19.5		10.2	12.7	12.7
Effective Green, g (s)	15.0	58.3	58.3	13.7	57.0	57.0	17.0	19.5		10.2	12.7	12.7
Actuated g/C Ratio	0.12	0.46	0.46	0.11	0.45	0.45	0.14	0.16		0.08	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	211	1641	734	193	1605	718	464	514		279	188	160
v/s Ratio Prot	c0.13	0.28		0.07	c0.44		c0.13	0.06		0.04	c0.06	
v/s Ratio Perm			0.07			0.12						0.01
v/c Ratio	1.06	0.61	0.14	0.62	0.97	0.26	0.95	0.36		0.51	0.58	0.10
Uniform Delay, d1	55.4	25.1	19.3	53.5	33.6	21.3	53.9	47.6		55.3	54.0	51.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	77.8	0.9	0.2	6.4	16.4	0.4	28.8	0.4		1.4	4.3	0.3
Delay (s)	133.1	26.1	19.5	59.9	50.0	21.7	82.7	48.0		56.8	58.2	51.6
Level of Service	F	C	B	E	D	C	F	D		E	E	D
Approach Delay (s)		41.6			46.0			68.8			55.2	
Approach LOS		D			D			E			E	

Intersection Summary				
HCM Average Control Delay	49.1	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.93			
Actuated Cycle Length (s)	125.7	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	87.8%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: Kaonohi Street & RIRO Driveway/PR Macy's Upstairs

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	0	0	75	0	605	40	0	410	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	82	0	658	43	0	446	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.95	0.95	0.95	0.95	0.95		0.95					
vC, conflicting volume	692	1147	446	1125	1125	186	446			701		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	647	1127	387	1104	1104	186	387			701		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	90	100			100		
cM capacity (veh/h)	304	192	579	157	199	824	1107			892		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	0	82	188	188	188	137	446
Volume Left	0	0	0	0	0	0	0
Volume Right	0	82	0	0	0	43	0
cSH	1700	824	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.10	0.11	0.11	0.11	0.08	0.26
Queue Length 95th (ft)	0	8	0	0	0	0	0
Control Delay (s)	0.0	9.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	A	A					
Approach Delay (s)	0.0	9.8	0.0				0.0
Approach LOS	A	A					

Intersection Summary				
Average Delay	0.7			
Intersection Capacity Utilization	24.9%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Kaonohi Street & Pearlridge Driveway 1

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	110	195	475	75	95	325
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	120	212	516	82	103	353
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	940	299			598	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	940	299			598	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	49	70			89	
cM capacity (veh/h)	234	697			975	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	120	212	344	254	221	236
Volume Left	120	0	0	0	103	0
Volume Right	0	212	0	82	0	0
cSH	234	697	1700	1700	975	1700
Volume to Capacity	0.51	0.30	0.20	0.15	0.11	0.14
Queue Length 95th (ft)	66	32	0	0	9	0
Control Delay (s)	35.4	12.4	0.0	0.0	4.8	0.0
Lane LOS	E	B			A	
Approach Delay (s)	20.7		0.0		2.3	
Approach LOS	C					

Intersection Summary			
Average Delay	5.7		
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Kaonohi Street & Pearlridge Driveway 2

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	0	5	165	0	110	0	435	95	60	375	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	5	179	0	120	0	473	103	65	408	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	894	1114	204	864	1062	288	408			576		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	894	1114	204	864	1062	288	408			576		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	99	23	100	83	100			93		
cM capacity (veh/h)	186	193	803	234	207	709	1148			993		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	11	179	120	315	261	65	204	204
Volume Left	5	179	0	0	0	65	0	0
Volume Right	5	0	120	0	103	0	0	0
cSH	302	234	709	1700	1700	993	1700	1700
Volume to Capacity	0.04	0.77	0.17	0.19	0.15	0.07	0.12	0.12
Queue Length 95th (ft)	3	137	15	0	0	5	0	0
Control Delay (s)	17.4	57.7	11.1	0.0	0.0	8.9	0.0	0.0
Lane LOS	C	F	B			A		
Approach Delay (s)	17.4	39.1		0.0		1.2		
Approach LOS	C	E						

Intersection Summary			
Average Delay	9.2		
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Kaonohi Street & Westridge (north)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	505	480	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	549	522	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	1135	
pX, platoon unblocked						
vC, conflicting volume	864	285	571			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	864	285	571			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	95	98			
cM capacity (veh/h)	287	711	998			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	205	366	348	223
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	409	998	1700	1700	1700
Volume to Capacity	0.16	0.02	0.22	0.20	0.13
Queue Length 95th (ft)	14	2	0	0	0
Control Delay (s)	15.5	1.1	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	15.5	0.4		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		38.8%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Kaonohi Street & Westridge (south)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	510	495	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	554	538	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	883	283	565			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	883	283	565			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	92	97			
cM capacity (veh/h)	277	714	1003			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	212	370	359	207
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	27
cSH	534	1003	1700	1700	1700
Volume to Capacity	0.14	0.03	0.22	0.21	0.12
Queue Length 95th (ft)	12	2	0	0	0
Control Delay (s)	12.9	1.3	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	12.9	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		43.5%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Kaonohi Street & Ana Miller's Driveway

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	485	55	35	525
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	527	60	38	571
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	823	293			587	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	823	293			587	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	75	93			96	
cM capacity (veh/h)	299	703			984	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	351	236	152	228	228
Volume Left	76	0	0	38	0	0
Volume Right	49	0	60	0	0	0
cSH	386	1700	1700	984	1700	1700
Volume to Capacity	0.32	0.21	0.14	0.04	0.13	0.13
Queue Length 95th (ft)	34	0	0	3	0	0
Control Delay (s)	18.7	0.0	0.0	2.5	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	18.7	0.0		0.6		
Approach LOS	C					

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Kaonohi Street & Moanalua Loop

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	115	130	510	535	60
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	125	141	554	582	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1174	226	582			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1174	226	582			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	73	84	86			
cM capacity (veh/h)	158	776	989			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	141	277	277	233	233	182
Volume Left	43	141	0	0	0	0	0
Volume Right	125	0	0	0	0	0	65
cSH	387	989	1700	1700	1700	1700	1700
Volume to Capacity	0.44	0.14	0.16	0.16	0.14	0.14	0.11
Queue Length 95th (ft)	54	12	0	0	0	0	0
Control Delay (s)	21.3	9.2	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	21.3	1.9			0.0		
Approach LOS	C						

Intersection Summary			
Average Delay	3.2		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

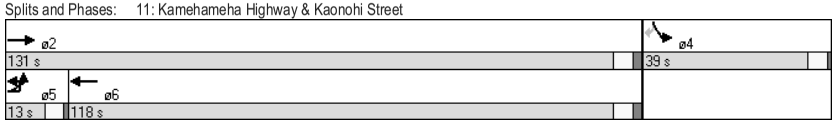
Timings
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	230	1295	4120	310	325
Turn Type	Prot	NA	NA	NA	Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	39.0	39.0
Total Split (s)	13.0	131.0	118.0	39.0	39.0
Total Split (%)	7.6%	77.1%	69.4%	22.9%	22.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 170
Actuated Cycle Length: 170
Offset: 144 (85%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	230	1295	4120	405	310	325
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.99		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.99		0.96	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4780		3340	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4780		3340	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	250	1408	4478	440	337	353
RTOR Reduction (vph)	0	0	6	0	28	61
Lane Group Flow (vph)	250	1408	4912	0	443	158
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot	NA	NA		NA	Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	8.0	131.1	118.1		27.9	27.9
Effective Green, g (s)	8.0	131.1	118.1		27.9	27.9
Actuated g/C Ratio	0.05	0.77	0.69		0.16	0.16
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	162	3921	3321		548	236
v/s Ratio Prot	c0.07	0.28	c1.03		c0.13	
v/s Ratio Perm						0.11
v/c Ratio	1.54	0.36	1.48		0.81	0.67
Uniform Delay, d1	81.0	6.2	26.0		68.5	66.7
Progression Factor	0.87	1.35	0.52		1.00	1.00
Incremental Delay, d2	271.7	0.2	215.7		8.6	7.0
Delay (s)	342.1	8.5	229.2		77.1	73.7
Level of Service	F	A	F		E	E
Approach Delay (s)		58.8	229.2		76.0	
Approach LOS		E	F		E	

Intersection Summary			
HCM Average Control Delay	175.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	121.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

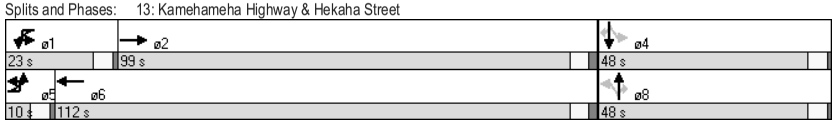
Timings
13: Kamehameha Highway & Hekaha Street

9/27/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1100	195	2905	245	45	240	65	45	100
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	33.0	8.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	10.0	99.0	23.0	112.0	48.0	48.0	48.0	48.0	48.0	48.0
Total Split (%)	5.9%	58.2%	13.5%	65.9%	28.2%	28.2%	28.2%	28.2%	28.2%	28.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 170
Actuated Cycle Length: 170
Offset: 74 (44%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 140
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1100	155	195	2905	80	245	45	240	65	45	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4641		3204	4724			1728	1445		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.61	1.00		0.36	1.00
Satd. Flow (perm)	1652	4641		3204	4724			1105	1445		618	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1196	168	212	3158	87	266	49	261	71	49	109
RTOR Reduction (vph)	0	11	0	0	2	0	0	0	137	0	0	39
Lane Group Flow (vph)	54	1353	0	212	3243	0	0	315	124	0	120	70
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	95.6		15.4	106.0			43.0	43.0		43.0	43.0
Effective Green, g (s)	5.0	95.6		15.4	106.0			43.0	43.0		43.0	43.0
Actuated g/C Ratio	0.03	0.56		0.09	0.62			0.25	0.25		0.25	0.25
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	49	2610		290	2946			280	366		156	374
v/s Ratio Prot	c0.03	0.29		0.07	c0.69							
v/s Ratio Perm								c0.28	0.09		0.19	0.05
v/c Ratio	1.10	0.52		0.73	1.10			1.12	0.34		0.77	0.19
Uniform Delay, d1	82.5	23.0		75.3	32.0			63.5	51.9		58.9	49.8
Progression Factor	1.14	0.82		1.22	0.53			1.00	1.00		1.00	1.00
Incremental Delay, d2	152.2	0.7		2.2	46.9			91.7	0.6		20.1	0.2
Delay (s)	246.1	19.5		93.7	64.0			155.2	52.5		79.0	50.0
Level of Service	F	B		F	E			F	D		E	D
Approach Delay (s)		28.1			65.8			108.7			65.2	
Approach LOS		C			E			F			E	

Intersection Summary			
HCM Average Control Delay	60.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

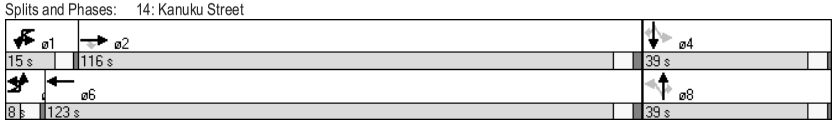
Timings
14: Kanuku Street

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1265	80	95	3355	95	15	55	65	15	35
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	116.0	116.0	15.0	123.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	4.7%	68.2%	68.2%	8.8%	72.4%	22.9%	22.9%	22.9%	22.9%	22.9%	22.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 170
Actuated Cycle Length: 170
Offset: 54 (32%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1265	80	95	3355	230	95	15	55	65	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1426	3204	4694			1693	1531		1670	1423
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.62	1.00		0.52	1.00
Satd. Flow (perm)	1652	4746	1426	3204	4694			1088	1531		899	1423
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1375	87	103	3647	250	103	16	60	71	16	38
RTOR Reduction (vph)	0	0	23	0	3	0	0	0	52	0	0	25
Lane Group Flow (vph)	38	1375	64	103	3894	0	0	119	8	0	87	13
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	122.5	122.5	9.3	128.8			22.2	22.2		22.2	22.2
Effective Green, g (s)	3.0	122.5	122.5	9.3	128.8			22.2	22.2		22.2	22.2
Actuated g/C Ratio	0.02	0.72	0.72	0.05	0.76			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	29	3420	1028	175	3556			142	200		117	186
v/s Ratio Prot	c0.02	0.29		0.03	c0.83							
v/s Ratio Perm			0.04					c0.11	0.01		0.10	0.01
v/c Ratio	1.31	0.40	0.06	0.59	1.09			0.84	0.04		0.74	0.07
Uniform Delay, d1	83.5	9.3	6.9	78.5	20.6			72.1	64.6		71.2	64.8
Progression Factor	0.94	0.52	0.17	1.17	0.14			1.00	1.00		1.00	1.00
Incremental Delay, d2	262.3	0.3	0.1	0.5	43.2			32.9	0.1		22.3	0.2
Delay (s)	340.4	5.2	1.3	92.7	46.0			105.0	64.7		93.4	65.0
Level of Service	F	A	A	F	D			F	E		F	E
Approach Delay (s)		13.4			47.2			91.5			84.8	
Approach LOS		B			D			F			F	

Intersection Summary				
HCM Average Control Delay	40.7	HCM Level of Service	D	
HCM Volume to Capacity ratio	1.06			
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	103.8%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

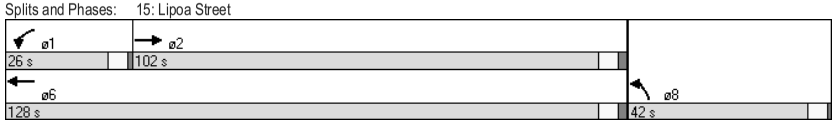
Timings
15: Lipoa Street

9/27/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1405	100	4350	165
Turn Type	NA	Prot	NA	NA
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	102.0	26.0	128.0	42.0
Total Split (%)	60.0%	15.3%	75.3%	24.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 170
Actuated Cycle Length: 170
Offset: 50 (29%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1405	55	100	4350	165	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	*0.80	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5056		1652	4173	1747	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5056		1652	4173	1747	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1527	60	109	4728	179	38
RTOR Reduction (vph)	2	0	0	0	5	0
Lane Group Flow (vph)	1585	0	109	4728	212	0
Turn Type	NA		Prot	NA	NA	
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	112.5		15.6	133.1	25.9	
Effective Green, g (s)	112.5		15.6	133.1	25.9	
Actuated g/C Ratio	0.66		0.09	0.78	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3346		152	3267	266	
v/s Ratio Prot	0.31		0.07	c1.13	c0.12	
v/s Ratio Perm						
v/c Ratio	0.47		0.72	1.45	0.80	
Uniform Delay, d1	14.2		75.1	18.5	69.5	
Progression Factor	0.96		1.10	0.51	1.00	
Incremental Delay, d2	0.4		10.6	202.5	15.1	
Delay (s)	14.0		93.4	211.8	84.7	
Level of Service	B		F	F	F	
Approach Delay (s)	14.0			209.2	84.7	
Approach LOS	B			F	F	

Intersection Summary			
HCM Average Control Delay	158.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	104.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

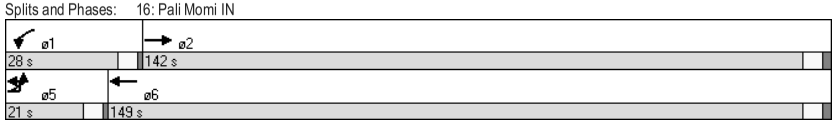
Timings
16: Pali Momi IN

9/27/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	255	1140	125	3285
Turn Type	Prot	NA	Prot	NA
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	21.0	142.0	28.0	149.0
Total Split (%)	12.4%	83.5%	16.5%	87.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 170
Actuated Cycle Length: 170
Offset: 159 (94%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	255	1140	35	125	3285	400	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4725		1652	4614							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4725		1652	4614							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	1239	38	136	3571	435	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	277	1275	0	136	4003	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot	NA		Prot	NA							
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	15.8	141.0		18.0	143.2							
Effective Green, g (s)	15.8	141.0		18.0	143.2							
Actuated g/C Ratio	0.09	0.83		0.11	0.84							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	298	3919		175	3887							
v/s Ratio Prot	c0.09	0.27		0.08	c0.87							
v/s Ratio Perm												
v/c Ratio	0.93	0.33		0.78	1.03							
Uniform Delay, d1	76.5	3.4		74.0	13.4							
Progression Factor	1.04	0.55		1.11	0.42							
Incremental Delay, d2	31.3	0.2		7.6	17.8							
Delay (s)	111.0	2.1		90.0	23.4							
Level of Service	F	A		F	C							
Approach Delay (s)		21.5			25.6			0.0			0.0	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM Average Control Delay	24.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	89.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

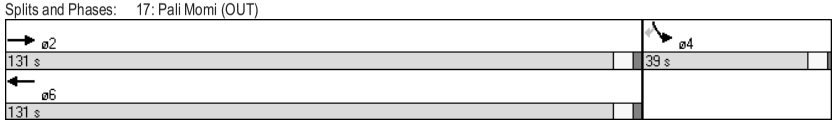
Timings
17: Pali Momi (OUT)

9/27/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1140	3560	320	150
Turn Type	NA	NA	NA	Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	131.0	131.0	39.0	39.0
Total Split (%)	77.1%	77.1%	22.9%	22.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 170
Actuated Cycle Length: 170
Offset: 162 (95%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT)



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT)

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1140	3560	0	320	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1298
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1298
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1239	3870	0	348	163
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	0	1239	3870	0	348	162
Confl. Peds. (#/hr)						95
Turn Type		NA	NA		NA	Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		133.3	133.3		25.7	25.7
Effective Green, g (s)		133.3	133.3		25.7	25.7
Actuated g/C Ratio		0.78	0.78		0.15	0.15
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3721	3721		502	196
v/s Ratio Prot		0.26	c0.82		0.10	
v/s Ratio Perm						c0.12
v/c Ratio		0.33	1.04		0.69	0.83
Uniform Delay, d1		5.4	18.3		68.4	70.0
Progression Factor		0.79	1.00		1.00	1.00
Incremental Delay, d2		0.2	26.5		4.1	23.9
Delay (s)		4.5	44.9		72.5	93.9
Level of Service		A	D		E	F
Approach Delay (s)		4.5	44.9		79.4	
Approach LOS		A	D		E	

Intersection Summary			
HCM Average Control Delay	39.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	170.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	105.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Harbor Pointe & Moanalua Road

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1715	25	30	1695	15	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1864	27	33	1842	16	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.71	
vC, conflicting volume			1891		2864	946
vC1, stage 1 conf vol					1878	
vC2, stage 2 conf vol					986	
vCu, unblocked vol			1891		2809	946
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			90		84	69
cM capacity (veh/h)			312		101	263

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1
Volume Total	1243	649	33	921	921	98
Volume Left	0	0	33	0	0	16
Volume Right	0	27	0	0	0	82
cSH	1700	1700	312	1700	1700	207
Volume to Capacity	0.73	0.38	0.10	0.54	0.54	0.47
Queue Length 95th (ft)	0	0	9	0	0	57
Control Delay (s)	0.0	0.0	17.9	0.0	0.0	37.0
Lane LOS			C			E
Approach Delay (s)	0.0		0.3			37.0
Approach LOS						E

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	1800	1725	15	15	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1957	1875	16	16	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	TWLTL			
Median storage veh)			2			
Upstream signal (ft)			733			
pX, platoon unblocked	0.71				0.71	0.71
vC, conflicting volume	1891				2872	946
vC1, stage 1 conf vol					1883	
vC2, stage 2 conf vol					989	
vCu, unblocked vol	1432				2819	95
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				86	98
cM capacity (veh/h)	333				118	667

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	5	978	978	1250	641	33
Volume Left	5	0	0	0	0	16
Volume Right	0	0	0	0	16	16
cSH	333	1700	1700	1700	1700	200
Volume to Capacity	0.02	0.58	0.58	0.74	0.38	0.16
Queue Length 95th (ft)	1	0	0	0	0	14
Control Delay (s)	16.0	0.0	0.0	0.0	0.0	26.4
Lane LOS	C					D
Approach Delay (s)	0.0			0.0		26.4
Approach LOS						D

Intersection Summary			
Average Delay	0.2		
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		

Timings
3: Kaonohi Street & Moanalua Road

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	145	1225	440	185	1070	220	480	185	205	155	205
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Prot	NA	Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	44.0	44.0	11.0	44.0	44.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	20.0	58.0	58.0	22.0	60.0	60.0	27.0	49.0	21.0	43.0	43.0
Total Split (%)	13.3%	38.7%	38.7%	14.7%	40.0%	40.0%	18.0%	32.7%	14.0%	28.7%	28.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 130.4
Natural Cycle: 150
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Kaonohi Street & Moanalua Road

ø1	ø2	ø3	ø4
20 s	60 s	21 s	49 s
ø5	ø6	ø7	ø8
22 s	58 s	27 s	43 s

HCM Signalized Intersection Capacity Analysis
3: Kaonohi Street & Moanalua Road

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1225	440	185	1070	220	480	185	315	205	155	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3205		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3205		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	1332	478	201	1163	239	522	201	342	223	168	223
RTOR Reduction (vph)	0	0	244	0	0	139	0	163	0	0	0	172
Lane Group Flow (vph)	158	1332	234	201	1163	100	522	380	0	223	168	51
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA		Prot	NA	Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	14.0	52.1	52.1	16.0	54.1	54.1	21.0	25.2		13.1	17.3	17.3
Effective Green, g (s)	14.0	52.1	52.1	16.0	54.1	54.1	21.0	25.2		13.1	17.3	17.3
Actuated g/C Ratio	0.11	0.40	0.40	0.12	0.41	0.41	0.16	0.19		0.10	0.13	0.13
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	190	1414	632	217	1468	657	553	619		345	247	210
v/s Ratio Prot	0.09	c0.38		c0.11	0.33		c0.15	c0.12		0.06	0.09	
v/s Ratio Perm			0.15			0.06						0.03
v/c Ratio	0.83	0.94	0.37	0.93	0.79	0.15	0.94	0.61		0.65	0.68	0.24
Uniform Delay, d1	57.0	37.7	27.6	56.6	33.3	23.8	54.1	48.1		56.4	53.9	50.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	25.5	13.0	0.8	41.3	3.5	0.2	24.9	1.8		4.1	7.5	0.6
Delay (s)	82.5	50.7	28.4	97.9	36.7	24.1	79.0	50.0		60.5	61.4	51.3
Level of Service	F	D	C	F	D	C	E	D		E	E	D
Approach Delay (s)		47.8			42.5			64.2			57.4	
Approach LOS		D			D			E			E	

Intersection Summary			
HCM Average Control Delay	50.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	130.4	Sum of lost time (s)	18.0
Intersection Capacity Utilization	86.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: Kaonohi Street & RIRO Driveway/PR Macy's Upstairs

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	40	0	0	170	0	840	100	0	650	145
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	43	0	0	185	0	913	109	0	707	158
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked	0.92	0.92	0.92	0.92	0.92		0.92					
vC, conflicting volume	1198	1807	785	1796	1832	283	864			1022		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1170	1835	719	1824	1862	283	805			1022		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	87	100	100	74	100			100		
cM capacity (veh/h)	100	69	339	38	66	714	746			675		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1
Volume Total	43	185	261	261	261	239	864
Volume Left	0	0	0	0	0	0	0
Volume Right	43	185	0	0	0	109	158
cSH	339	714	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.26	0.15	0.15	0.15	0.14	0.51
Queue Length 95th (ft)	11	26	0	0	0	0	0
Control Delay (s)	17.2	11.8	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	B					
Approach Delay (s)	17.2	11.8	0.0				0.0
Approach LOS	C	B					

Intersection Summary				
Average Delay		1.4		
Intersection Capacity Utilization		53.0%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Kaonohi Street & Pearlridge Driveway 1

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	105	190	740	135	165	530
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	114	207	804	147	179	576
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			1209			652
pX, platoon unblocked						
vC, conflicting volume	1524	476			951	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1524	476			951	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	0	61			75	
cM capacity (veh/h)	82	536			718	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	114	207	536	415	371	384
Volume Left	114	0	0	0	179	0
Volume Right	0	207	0	147	0	0
cSH	82	536	1700	1700	718	1700
Volume to Capacity	1.40	0.39	0.32	0.24	0.25	0.23
Queue Length 95th (ft)	222	45	0	0	25	0
Control Delay (s)	328.8	15.9	0.0	0.0	7.3	0.0
Lane LOS	F	C			A	
Approach Delay (s)	127.3		0.0		3.6	
Approach LOS	F					

Intersection Summary				
Average Delay		21.5		
Intersection Capacity Utilization		60.0%	ICU Level of Service	B
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
6: Kaonohi Street & Pearlridge Driveway 2

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	100	25	395	200	0	200	0	550	235	155	495	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	109	27	429	217	0	217	0	598	255	168	538	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	1391	1728	269	1774	1601	427	538			853		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1391	1728	269	1774	1601	427	538			853		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	60	41	0	100	62	100			78		
cM capacity (veh/h)	53	69	729	13	82	576	1026			782		

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	565	217	217	399	455	168	269	269
Volume Left	109	217	0	0	0	168	0	0
Volume Right	429	0	217	0	255	0	0	0
cSH	186	13	576	1700	1700	782	1700	1700
Volume to Capacity	3.05	17.26	0.38	0.23	0.27	0.22	0.16	0.16
Queue Length 95th (ft)	Err	Err	44	0	0	20	0	0
Control Delay (s)	Err	Err	15.0	0.0	0.0	10.9	0.0	0.0
Lane LOS	F	F	B			B		
Approach Delay (s)	Err	5007.0		0.0		2.6		
Approach LOS	F	F						

Intersection Summary				
Average Delay	3059.0			
Intersection Capacity Utilization	88.2%	ICU Level of Service	E	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
7: Kaonohi Street & Westridge (north)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	50	25	750	955	125
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	54	27	815	1038	136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	1568	587	1174			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1568	587	1174			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	66	88	95			
cM capacity (veh/h)	97	453	591			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	87	299	543	692	482
Volume Left	33	27	0	0	0
Volume Right	54	0	0	0	136
cSH	191	591	1700	1700	1700
Volume to Capacity	0.46	0.05	0.32	0.41	0.28
Queue Length 95th (ft)	54	4	0	0	0
Control Delay (s)	38.8	1.6	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	38.8	0.6		0.0	
Approach LOS	E				

Intersection Summary				
Average Delay	1.8			
Intersection Capacity Utilization	50.3%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: Kaonohi Street & Westridge (south)

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	100	50	765	1000	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	109	54	832	1087	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	1628	560	1120			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1628	560	1120			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	55	77	91			
cM capacity (veh/h)	85	472	620			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	147	332	554	725	395
Volume Left	38	54	0	0	0
Volume Right	109	0	0	0	33
cSH	216	620	1700	1700	1700
Volume to Capacity	0.68	0.09	0.33	0.43	0.23
Queue Length 95th (ft)	107	7	0	0	0
Control Delay (s)	51.1	2.9	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	51.1	1.1		0.0	
Approach LOS	F				

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	69.3%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Kaonohi Street & Ana Miller's Driveway

9/27/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	75	85	710	90	45	950
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	92	772	98	49	1033
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	1263	435			870	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1263	435			870	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	46	84			94	
cM capacity (veh/h)	151	569			771	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	174	514	355	255	413	413
Volume Left	82	0	0	49	0	0
Volume Right	92	0	98	0	0	0
cSH	248	1700	1700	771	1700	1700
Volume to Capacity	0.70	0.30	0.21	0.06	0.24	0.24
Queue Length 95th (ft)	117	0	0	5	0	0
Control Delay (s)	47.6	0.0	0.0	2.5	0.0	0.0
Lane LOS	E			A		
Approach Delay (s)	47.6	0.0		0.6		
Approach LOS	E					

Intersection Summary			
Average Delay	4.2		
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Kaonohi Street & Moanalua Loop

9/27/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	115	95	750	1040	70
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	125	103	815	1130	76
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1783	415	1130			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1783	415	1130			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	20	79	83			
cM capacity (veh/h)	61	587	614			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	174	103	408	408	452	452	302
Volume Left	49	103	0	0	0	0	0
Volume Right	125	0	0	0	0	0	76
cSH	171	614	1700	1700	1700	1700	1700
Volume to Capacity	1.02	0.17	0.24	0.24	0.27	0.27	0.18
Queue Length 95th (ft)	207	15	0	0	0	0	0
Control Delay (s)	128.5	12.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	128.5	1.4			0.0		
Approach LOS	F						

Intersection Summary			
Average Delay	10.3		
Intersection Capacity Utilization	46.5%	ICU Level of Service	A
Analysis Period (min)	15		

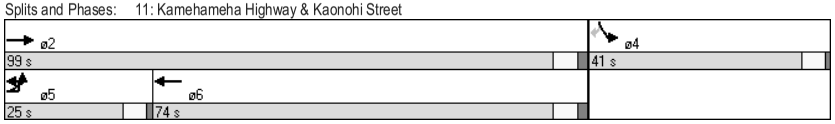
Timings
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	410	1850	1560	610	540
Turn Type	Prot	NA	NA	NA	Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	32.0	32.0
Total Split (s)	25.0	99.0	74.0	41.0	41.0
Total Split (%)	17.9%	70.7%	52.9%	29.3%	29.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 20 (14%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

9/27/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	410	1850	1560	435	610	540
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.97		0.98	0.89
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		0.97	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4607		3278	1283
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4607		3278	1283
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	446	2011	1696	473	663	587
RTOR Reduction (vph)	0	0	36	0	20	187
Lane Group Flow (vph)	446	2011	2133	0	837	206
Confl. Peds. (#/hr)				70		64
Turn Type	Prot	NA	NA		NA	Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	19.8	93.0	68.2		36.0	36.0
Effective Green, g (s)	19.8	93.0	68.2		36.0	36.0
Actuated g/C Ratio	0.14	0.66	0.49		0.26	0.26
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	453	3153	2244		843	330
v/s Ratio Prot	c0.14	0.42	c0.46		c0.26	
v/s Ratio Perm						0.16
v/c Ratio	0.98	0.64	0.95		0.99	0.62
Uniform Delay, d1	59.9	13.7	34.3		51.9	46.0
Progression Factor	1.01	1.43	0.73		1.00	1.00
Incremental Delay, d2	34.8	0.9	8.9		29.1	3.6
Delay (s)	95.3	20.5	33.9		80.9	49.7
Level of Service	F	C	C		F	D
Approach Delay (s)		34.0	33.9		71.1	
Approach LOS		C	C		E	

Intersection Summary			
HCM Average Control Delay	41.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

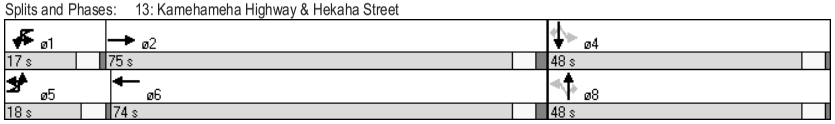
Timings
13: Kamehameha Highway & Hekaha Street

9/27/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	105	1700	235	1815	220	60	330	95	40	150
Turn Type	Prot	NA	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	18.0	75.0	17.0	74.0	48.0	48.0	48.0	48.0	48.0	48.0
Total Split (%)	12.9%	53.6%	12.1%	52.9%	34.3%	34.3%	34.3%	34.3%	34.3%	34.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 124 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1700	305	235	1815	65	220	60	330	95	40	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4621		3204	4717			1699	1531		1679	1414
Flt Permitted	0.95	1.00		0.95	1.00			0.61	1.00		0.39	1.00
Satd. Flow (perm)	1652	4621		3204	4717			1083	1531		670	1414
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1848	332	255	1973	71	239	65	359	103	43	163
RTOR Reduction (vph)	0	18	0	0	2	0	0	0	120	0	0	116
Lane Group Flow (vph)	114	2162	0	255	2042	0	0	304	239	0	146	47
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	12.2	71.7		12.0	71.5			40.3	40.3		40.3	40.3
Effective Green, g (s)	12.2	71.7		12.0	71.5			40.3	40.3		40.3	40.3
Actuated g/C Ratio	0.09	0.51		0.09	0.51			0.29	0.29		0.29	0.29
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	144	2367		275	2409			312	441		193	407
v/s Ratio Prot	0.07	c0.47		c0.08	0.43							
v/s Ratio Perm								c0.28	0.16		0.22	0.03
v/c Ratio	0.79	0.91		0.93	0.85			0.97	0.54		0.76	0.12
Uniform Delay, d1	62.7	31.3		63.6	29.5			49.3	42.1		45.4	36.7
Progression Factor	0.89	0.80		1.26	0.39			1.00	1.00		1.00	1.00
Incremental Delay, d2	15.9	4.3		28.4	2.9			43.6	1.4		15.5	0.1
Delay (s)	71.5	29.2		108.4	14.4			93.0	43.4		60.9	36.8
Level of Service	E	C		F	B			F	D		E	D
Approach Delay (s)		31.3			24.9			66.1			48.2	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM Average Control Delay	33.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	103.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

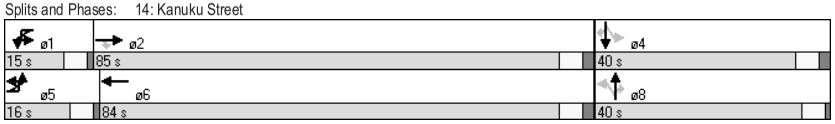
Timings
14: Kanuku Street

9/27/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	80	1855	110	115	1905	70	20	75	130	15	80
Turn Type	Prot	NA	Perm	Prot	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	40.0	40.0	40.0
Total Split (s)	16.0	85.0	85.0	15.0	84.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	11.4%	60.7%	60.7%	10.7%	60.0%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 102 (73%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	1855	110	115	1905	245	70	20	75	130	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4665			1733	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.53	1.00		0.63	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4665			955	1531		1095	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	2016	120	125	2071	266	76	22	82	141	16	87
RTOR Reduction (vph)	0	0	27	0	9	0	0	0	68	0	0	73
Lane Group Flow (vph)	87	2016	93	125	2328	0	0	98	14	0	157	14
Turn Type	Prot	NA	Perm	Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	10.2	90.5	90.5	9.3	89.6			24.2	24.2		23.2	23.2
Effective Green, g (s)	10.2	90.5	90.5	9.3	89.6			24.2	24.2		23.2	23.2
Actuated g/C Ratio	0.07	0.65	0.65	0.07	0.64			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	120	3068	955	213	2986			165	265		181	245
v/s Ratio Prot	c0.05	0.42		0.04	c0.50							
v/s Ratio Perm			0.06					0.10	0.01		c0.14	0.01
v/c Ratio	0.72	0.66	0.10	0.59	0.78			0.59	0.05		0.87	0.06
Uniform Delay, d1	63.5	15.2	9.3	63.5	18.1			53.4	48.3		56.9	49.2
Progression Factor	0.82	1.16	1.81	1.05	0.41			1.00	1.00		1.00	1.00
Incremental Delay, d2	11.6	0.6	0.1	2.2	1.1			5.6	0.1		32.6	0.1
Delay (s)	63.6	18.3	17.0	68.6	8.6			59.0	48.4		89.5	49.3
Level of Service	E	B	B	E	A			E	D		F	D
Approach Delay (s)		20.0			11.7			54.2			75.2	
Approach LOS		B			B			D			E	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

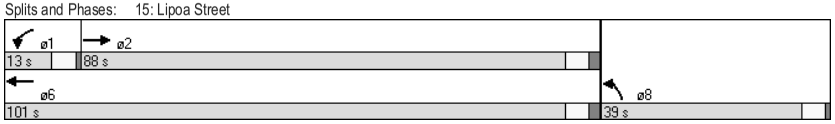
Timings
15: Lipoa Street

9/27/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2150	50	2035	170
Turn Type	NA	Prot	NA	NA
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	88.0	13.0	101.0	39.0
Total Split (%)	62.9%	9.3%	72.1%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 68 (49%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street

9/27/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2150	70	50	2035	170	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4720		1652	4746	1672	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4720		1652	4746	1672	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2337	76	54	2212	185	76
RTOR Reduction (vph)	2	0	0	0	11	0
Lane Group Flow (vph)	2411	0	54	2212	250	0
Confl. Peds. (#/hr)		2				82
Turn Type	NA		Prot	NA	NA	
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	91.7		6.4	103.1	25.9	
Effective Green, g (s)	91.7		6.4	103.1	25.9	
Actuated g/C Ratio	0.66		0.05	0.74	0.18	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3092		76	3495	309	
v/s Ratio Prot	c0.51		0.03	c0.47	c0.15	
v/s Ratio Perm						
v/c Ratio	0.78		0.71	0.63	0.81	
Uniform Delay, d1	17.0		65.9	9.1	54.7	
Progression Factor	0.57		1.28	0.39	1.00	
Incremental Delay, d2	1.4		21.5	0.7	14.3	
Delay (s)	11.1		106.1	4.3	68.9	
Level of Service	B		F	A	E	
Approach Delay (s)	11.1			6.7	68.9	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	12.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

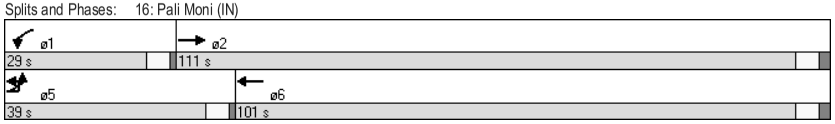
Timings
16: Pali Moni (IN)

9/27/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	485	1640	155	1825
Turn Type	Prot	NA	Prot	NA
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	39.0	111.0	29.0	101.0
Total Split (%)	27.9%	79.3%	20.7%	72.1%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 44 (31%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN)



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN)

9/27/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	485	1640	55	155	1825	510	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.98							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4723		1652	4521							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4723		1652	4521							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	527	1783	60	168	1984	554	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	16	0	0	0	0	0	0	0
Lane Group Flow (vph)	527	1841	0	168	2522	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot	NA		Prot	NA							
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	26.7	110.7		18.3	102.3							
Effective Green, g (s)	26.7	110.7		18.3	102.3							
Actuated g/C Ratio	0.19	0.79		0.13	0.73							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	611	3735		216	3304							
v/s Ratio Prot	c0.16	0.39		0.10	c0.56							
v/s Ratio Perm												
v/c Ratio	0.86	0.49		0.78	0.76							
Uniform Delay, d1	54.9	5.0		58.9	11.5							
Progression Factor	0.66	1.16		1.09	0.42							
Incremental Delay, d2	8.6	0.3		13.5	1.4							
Delay (s)	44.9	6.2		77.9	6.3							
Level of Service	D	A		E	A							
Approach Delay (s)		14.8			10.7			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

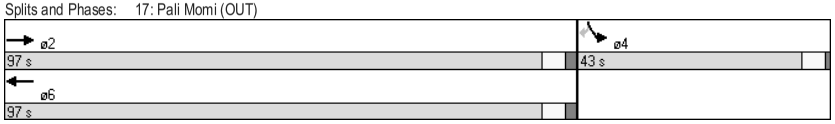
Timings
17: Pali Momi (OUT)

9/27/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1600	2125	360	195
Turn Type	NA	NA	NA	Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	97.0	97.0	43.0	43.0
Total Split (%)	69.3%	69.3%	30.7%	30.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 52 (37%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT)



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1600	2125	0	360	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1301
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1301
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1739	2310	0	391	212
RTOR Reduction (vph)	0	0	0	0	0	6
Lane Group Flow (vph)	0	1739	2310	0	391	206
Confl. Peds. (#/hr)						114
Turn Type		NA	NA		NA	Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		102.2	102.2		26.8	26.8
Effective Green, g (s)		102.2	102.2		26.8	26.8
Actuated g/C Ratio		0.73	0.73		0.19	0.19
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3465	3465		635	249
v/s Ratio Prot		0.37	c0.49		0.12	
v/s Ratio Perm						c0.16
v/c Ratio		0.50	0.67		0.62	0.83
Uniform Delay, d1		8.1	9.9		51.9	54.4
Progression Factor		0.35	1.00		1.00	1.00
Incremental Delay, d2		0.5	1.0		1.8	19.5
Delay (s)		3.3	11.0		53.7	73.9
Level of Service		A	B		D	E
Approach Delay (s)		3.3	11.0		60.8	
Approach LOS		A	B		E	

Intersection Summary			
HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Year 2015 with Project

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1620	15	0	1115	0	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1761	16	0	1212	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.89	
vC, conflicting volume			1777		2375	889
vC1, stage 1 conf vol					1769	
vC2, stage 2 conf vol					606	
vCu, unblocked vol			1777		2298	889
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	85
cM capacity (veh/h)			346		117	286

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1174	603	606	606	43
Volume Left	0	0	0	0	0
Volume Right	0	16	0	0	43
cSH	1700	1700	1700	1700	286
Volume to Capacity	0.69	0.35	0.36	0.36	0.15
Queue Length 95th (ft)	0	0	0	0	13
Control Delay (s)	0.0	0.0	0.0	0.0	19.8
Lane LOS					C
Approach Delay (s)	0.0		0.0		19.8
Approach LOS					C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	155	1435	95	45	805	205	50	5	25	45	5	270
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	168	1560	103	49	875	223	54	5	27	49	5	293
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					733							
pX, platoon unblocked	0.84						0.84	0.84		0.84	0.84	0.84
vC, conflicting volume	1098			1663			2728	3092	780	2231	3084	549
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	740			1663			2677	3110	780	2086	3100	88
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	77			87			0	15	92	0	16	63
cM capacity (veh/h)	726			383			1	6	338	5	6	802

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1
Volume Total	168	780	780	103	49	583	514	60	27	348
Volume Left	168	0	0	0	49	0	0	54	0	49
Volume Right	0	0	0	103	0	0	223	0	27	293
cSH	726	1700	1700	1700	383	1700	1700	1	338	33
Volume to Capacity	0.23	0.46	0.46	0.06	0.13	0.34	0.30	42.45	0.08	10.66
Queue Length 95th (ft)	22	0	0	0	11	0	0	Err	7	Err
Control Delay (s)	11.5	0.0	0.0	0.0	15.8	0.0	0.0	Err	16.6	Err
Lane LOS	B				C			F	C	F
Approach Delay (s)	1.1				0.7			6879.5		Err
Approach LOS								F		F

Intersection Summary			
Average Delay	1195.1		
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		

Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	1200	195	120	730	95	80	85	275	250	230
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	21.0	54.0	54.0	16.0	49.0	49.0	13.0	43.0	17.0	47.0	47.0
Total Split (%)	16.2%	41.5%	41.5%	12.3%	37.7%	37.7%	10.0%	33.1%	13.1%	36.2%	36.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 110.6
Natural Cycle: 125
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street

ø1	ø2	ø3	ø4
21 s	49 s	17 s	43 s

ø5	ø6	ø7	ø8
16 s	54 s	13 s	47 s

HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1200	195	120	730	95	80	85	110	275	250	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3239		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3239		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1304	212	130	793	103	87	92	120	299	272	250
RTOR Reduction (vph)	0	0	120	0	0	60	0	100	0	0	0	179
Lane Group Flow (vph)	114	1304	92	130	793	43	87	112	0	299	272	71
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	11.9	48.3	48.3	10.0	46.4	46.4	5.5	18.5		11.1	24.1	24.1
Effective Green, g (s)	11.9	48.3	48.3	10.0	46.4	46.4	5.5	18.5		11.1	24.1	24.1
Actuated g/C Ratio	0.11	0.43	0.43	0.09	0.41	0.41	0.05	0.17		0.10	0.22	0.22
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	188	1528	683	158	1467	656	169	535		341	401	341
v/s Ratio Prot	0.06	c0.37		c0.07	0.22		0.03	0.03		c0.09	c0.15	
v/s Ratio Perm			0.06			0.03						0.04
v/c Ratio	0.61	0.85	0.13	0.82	0.54	0.07	0.51	0.21		0.88	0.68	0.21
Uniform Delay, d1	47.8	28.6	19.2	50.1	24.7	19.7	51.9	40.4		49.7	40.3	36.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	5.4	5.3	0.2	28.5	0.7	0.1	2.6	0.2		21.5	4.5	0.3
Delay (s)	53.2	33.9	19.4	78.6	25.4	19.8	54.5	40.6		71.2	44.9	36.4
Level of Service	D	C	B	E	C	B	D	D		E	D	D
Approach Delay (s)		33.4			31.6			44.6			51.9	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	37.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	111.9	Sum of lost time (s)	18.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	15	0	0	10	0	275	20	0	525	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	16	0	0	11	0	299	22	0	571	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked												
vC, conflicting volume	689	924	318	611	946	86	636			321		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	689	924	318	611	946	86	636			321		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	100	100	99	100			100		
cM capacity (veh/h)	328	268	678	368	260	956	943			1236		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	16	11	85	85	85	64	380	255
Volume Left	0	0	0	0	0	0	0	0
Volume Right	16	11	0	0	0	22	0	65
cSH	678	956	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.01	0.05	0.05	0.05	0.04	0.22	0.15
Queue Length 95th (ft)	2	1	0	0	0	0	0	0
Control Delay (s)	10.4	8.8	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.4	8.8	0.0				0.0	
Approach LOS	B	A						

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization		26.4%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	0	20	15	0	30	35	260	15	30	490	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	0	22	16	0	33	38	283	16	33	533	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1209			652	
pX, platoon unblocked												
vC, conflicting volume	853	978	272	720	976	149	543			299		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	853	978	272	720	976	149	543			299		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	100	97	94	100	96	96			97		
cM capacity (veh/h)	231	233	726	291	234	870	1022			1259		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	11	22	16	33	38	188	111	33	355	188
Volume Left	11	0	16	0	38	0	0	33	0	0
Volume Right	0	22	0	33	0	0	16	0	0	11
cSH	231	726	291	870	1022	1700	1700	1259	1700	1700
Volume to Capacity	0.05	0.03	0.06	0.04	0.04	0.11	0.07	0.03	0.21	0.11
Queue Length 95th (ft)	4	2	4	3	3	0	0	2	0	0
Control Delay (s)	21.3	10.1	18.1	9.3	8.7	0.0	0.0	7.9	0.0	0.0
Lane LOS	C	B	C	A	A			A		
Approach Delay (s)	13.8		12.2		1.0			0.4		
Approach LOS	B		B							

Intersection Summary			
Average Delay		1.6	
Intersection Capacity Utilization		34.7%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	0	75	30	0	10	130	265	35	35	490	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	0	82	33	0	11	141	288	38	38	533	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	1052	1223	272	1014	1209	163	543			326		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1052	1223	272	1014	1209	163	543			326		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	83	100	89	78	100	99	86			97		
cM capacity (veh/h)	156	149	726	150	152	853	1022			1230		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	27	82	33	11	141	192	134	38	355	188
Volume Left	27	0	33	0	141	0	0	38	0	0
Volume Right	0	82	0	11	0	0	38	0	0	11
cSH	156	726	150	853	1022	1700	1700	1230	1700	1700
Volume to Capacity	0.17	0.11	0.22	0.01	0.14	0.11	0.08	0.03	0.21	0.11
Queue Length 95th (ft)	15	9	20	1	12	0	0	2	0	0
Control Delay (s)	32.9	10.6	35.7	9.3	9.1	0.0	0.0	8.0	0.0	0.0
Lane LOS	D	B	E	A	A			A		
Approach Delay (s)	16.2		29.1		2.7			0.5		
Approach LOS	C		D							

Intersection Summary				
Average Delay		3.8		
Intersection Capacity Utilization		39.4%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	30	15	395	520	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	33	16	429	565	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	842	312	625			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	842	312	625			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	85	95	98			
cM capacity (veh/h)	298	683	952			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	159	286	377	248
Volume Left	43	16	0	0	0
Volume Right	33	0	0	0	60
cSH	393	952	1700	1700	1700
Volume to Capacity	0.19	0.02	0.17	0.22	0.15
Queue Length 95th (ft)	18	1	0	0	0
Control Delay (s)	16.4	1.1	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	16.4	0.4		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.2		
Intersection Capacity Utilization		32.6%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	45	20	400	550	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	49	22	435	598	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	861	302	603			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	861	302	603			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	93	98			
cM capacity (veh/h)	288	694	970			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	167	290	399	205
Volume Left	16	22	0	0	0
Volume Right	49	0	0	0	5
cSH	513	970	1700	1700	1700
Volume to Capacity	0.13	0.02	0.17	0.23	0.12
Queue Length 95th (ft)	11	2	0	0	0
Control Delay (s)	13.0	1.3	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	13.0	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		36.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	405	50	25	570
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	440	54	27	620
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	728	247			495	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	728	247			495	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	98			97	
cM capacity (veh/h)	349	753			1065	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	293	201	151	248	248
Volume Left	49	0	0	27	0	0
Volume Right	16	0	54	0	0	0
cSH	403	1700	1700	1065	1700	1700
Volume to Capacity	0.16	0.17	0.12	0.03	0.15	0.15
Queue Length 95th (ft)	14	0	0	2	0	0
Control Delay (s)	15.6	0.0	0.0	1.7	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	15.6	0.0		0.4		
Approach LOS	C					

Intersection Summary				
Average Delay		1.1		
Intersection Capacity Utilization		37.7%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	80	145	55	370	590	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	158	60	402	641	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	981	233	641			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	981	233	641			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	62	80	94			
cM capacity (veh/h)	231	769	939			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	245	60	201	201	257	257	166
Volume Left	87	60	0	0	0	0	0
Volume Right	158	0	0	0	0	0	38
cSH	421	939	1700	1700	1700	1700	1700
Volume to Capacity	0.58	0.06	0.12	0.12	0.15	0.15	0.10
Queue Length 95th (ft)	90	5	0	0	0	0	0
Control Delay (s)	24.8	9.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	24.8	1.2			0.0		
Approach LOS	C						

Intersection Summary				
Average Delay		4.8		
Intersection Capacity Utilization		38.9%	ICU Level of Service	A
Analysis Period (min)		15		

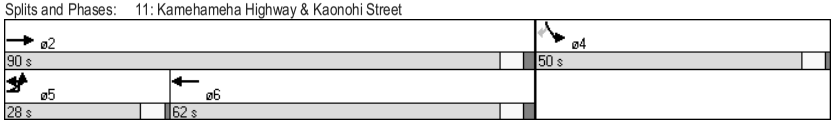
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	230	1655	775	600	140
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	28.0	90.0	62.0	50.0	50.0
Total Split (%)	20.0%	64.3%	44.3%	35.7%	35.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 95 (68%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	230	1655	775	220	600	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4662		3428	1329
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4662		3428	1329
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	250	1799	842	239	652	152
RTOR Reduction (vph)	0	0	34	0	1	93
Lane Group Flow (vph)	250	1799	1047	0	666	44
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	16.2	84.0	62.8		45.0	45.0
Effective Green, g (s)	16.2	84.0	62.8		45.0	45.0
Actuated g/C Ratio	0.12	0.60	0.45		0.32	0.32
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	371	2848	2091		1102	427
v/s Ratio Prot	0.08	c0.38	0.22		c0.19	
v/s Ratio Perm						0.03
v/c Ratio	0.67	0.63	0.50		0.60	0.10
Uniform Delay, d1	59.4	18.0	27.5		40.0	33.3
Progression Factor	1.11	0.38	0.62		1.00	1.00
Incremental Delay, d2	4.0	0.9	0.8		2.5	0.5
Delay (s)	70.1	7.7	17.9		42.5	33.8
Level of Service	E	A	B		D	C
Approach Delay (s)		15.3	17.9		41.0	
Approach LOS		B	B		D	

Intersection Summary			
HCM Average Control Delay	21.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

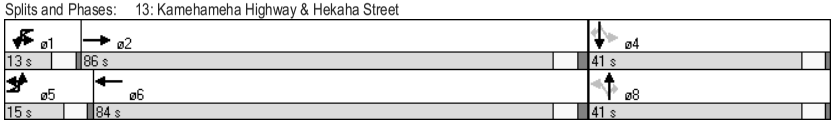
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1740	85	855	55	5	55	110	15	75
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	39.0	39.0	39.0
Total Split (s)	15.0	86.0	13.0	84.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	10.7%	61.4%	9.3%	60.0%	29.3%	29.3%	29.3%	29.3%	29.3%	29.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 111 (79%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1740	180	85	855	30	55	5	55	110	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.99		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4667		3204	4718			1720	1486		1640	1458
Flt Permitted	0.95	1.00		0.95	1.00			0.68	1.00		0.71	1.00
Satd. Flow (perm)	1652	4667		3204	4718			1218	1486		1207	1458
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1891	196	92	929	33	60	5	60	120	16	82
RTOR Reduction (vph)	0	9	0	0	3	0	0	0	45	0	0	61
Lane Group Flow (vph)	54	2078	0	92	959	0	0	65	15	0	136	21
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.6	80.3		7.7	80.4			36.0	36.0		36.0	36.0
Effective Green, g (s)	7.6	80.3		7.7	80.4			36.0	36.0		36.0	36.0
Actuated g/C Ratio	0.05	0.57		0.06	0.57			0.26	0.26		0.26	0.26
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	90	2677		176	2709			313	382		310	375
v/s Ratio Prot	c0.03	c0.45		0.03	0.20							
v/s Ratio Perm								0.05	0.01		c0.11	0.01
v/c Ratio	0.60	0.78		0.52	0.35			0.21	0.04		0.44	0.06
Uniform Delay, d1	64.7	22.9		64.4	15.9			40.8	39.0		43.5	39.2
Progression Factor	0.89	0.82		0.70	1.40			1.00	1.00		1.00	1.00
Incremental Delay, d2	8.4	1.8		2.7	0.4			1.5	0.2		4.5	0.3
Delay (s)	66.0	20.8		47.9	22.7			42.3	39.2		48.0	39.5
Level of Service	E	C		D	C			D	D		D	D
Approach Delay (s)		21.9			24.9			40.8			44.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	24.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

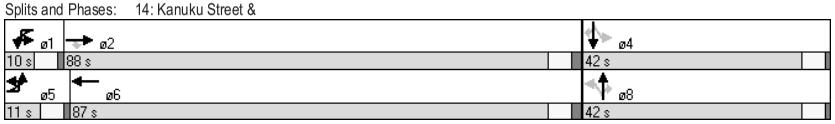
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	25	1790	20	15	925	5	5	15	135	10	40
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	39.0	39.0	39.0
Total Split (s)	11.0	88.0	88.0	10.0	87.0	42.0	42.0	42.0	42.0	42.0	42.0
Total Split (%)	7.9%	62.9%	62.9%	7.1%	62.1%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 139 (99%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	1790	20	15	925	65	5	5	15	135	10	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1449	3204	4694			1754	1531		1661	1453
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1449	3204	4694			1590	1531		1276	1453
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	1946	22	16	1005	71	5	5	16	147	11	43
RTOR Reduction (vph)	0	0	4	0	4	0	0	0	13	0	0	36
Lane Group Flow (vph)	27	1946	18	16	1072	0	0	10	3	0	158	7
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.6	99.3	99.3	2.0	97.7			22.7	22.7		22.7	22.7
Effective Green, g (s)	3.6	99.3	99.3	2.0	97.7			22.7	22.7		22.7	22.7
Actuated g/C Ratio	0.03	0.71	0.71	0.01	0.70			0.16	0.16		0.16	0.16
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	42	3366	1028	46	3276			258	248		207	236
v/s Ratio Prot	c0.02	c0.41		0.00	0.23							
v/s Ratio Perm			0.01					0.01	0.00		c0.12	0.00
v/c Ratio	0.64	0.58	0.02	0.35	0.33			0.04	0.01		0.76	0.03
Uniform Delay, d1	67.6	10.0	6.0	68.4	8.3			49.5	49.2		56.1	49.4
Progression Factor	1.36	0.21	0.03	0.75	1.24			1.00	1.00		1.00	1.00
Incremental Delay, d2	19.9	0.5	0.0	4.2	0.2			0.1	0.0		15.3	0.1
Delay (s)	111.6	2.5	0.2	55.2	10.5			49.5	49.2		71.4	49.4
Level of Service	F	A	A	E	B			D	D		E	D
Approach Delay (s)		4.0			11.1			49.3			66.7	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

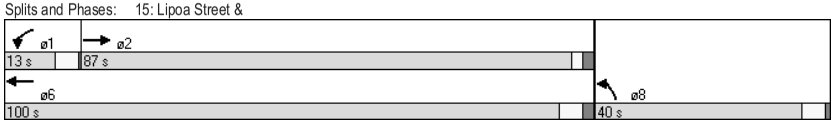
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2220	45	995	70
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	87.0	13.0	100.0	40.0
Total Split (%)	62.1%	9.3%	71.4%	28.6%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 4 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2220	50	45	995	70	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4731		1652	4746	1644	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4731		1652	4746	1644	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2413	54	49	1082	76	65
RTOR Reduction (vph)	1	0	0	0	26	0
Lane Group Flow (vph)	2466	0	49	1082	115	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	104.7		6.7	113.9	15.1	
Effective Green, g (s)	104.7		6.7	113.9	15.1	
Actuated g/C Ratio	0.75		0.05	0.81	0.11	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3538		79	3861	177	
v/s Ratio Prot	c0.52		c0.03	0.23	c0.07	
v/s Ratio Perm						
v/c Ratio	0.70		0.62	0.28	0.65	
Uniform Delay, d1	9.3		65.4	3.2	59.9	
Progression Factor	0.53		0.86	0.97	1.00	
Incremental Delay, d2	0.9		13.6	0.2	8.3	
Delay (s)	5.8		69.8	3.2	68.2	
Level of Service	A		E	A	E	
Approach Delay (s)	5.8			6.1	68.2	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	8.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

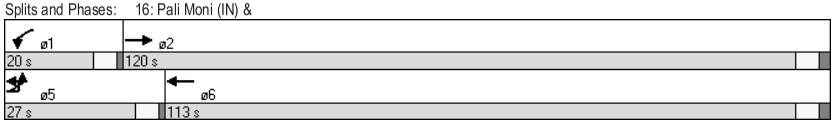
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	195	2115	45	1025
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	27.0	120.0	20.0	113.0
Total Split (%)	19.3%	85.7%	14.3%	80.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 127 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	2115	15	45	1025	175	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4741		1652	4643							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4741		1652	4643							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	2299	16	49	1114	190	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	212	2315	0	49	1291	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	14.6	120.6		8.4	114.4							
Effective Green, g (s)	14.6	120.6		8.4	114.4							
Actuated g/C Ratio	0.10	0.86		0.06	0.82							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	334	4084		99	3794							
v/s Ratio Prot	c0.07	c0.49		0.03	0.28							
v/s Ratio Perm												
v/c Ratio	0.63	0.57		0.49	0.34							
Uniform Delay, d1	60.1	2.6		63.7	3.2							
Progression Factor	0.83	0.53		0.95	0.39							
Incremental Delay, d2	2.9	0.4		3.6	0.2							
Delay (s)	52.9	1.8		64.4	1.5							
Level of Service	D	A		E	A							
Approach Delay (s)		6.1			3.8			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

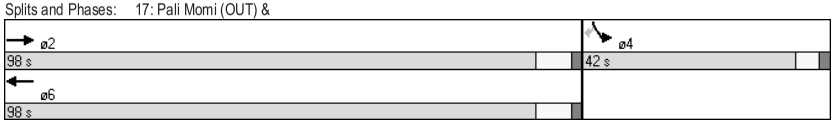
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	2005	1160	315	75
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	98.0	98.0	42.0	42.0
Total Split (%)	70.0%	70.0%	30.0%	30.0%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 7 (5%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	2005	1160	0	315	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.93
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1421
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1421
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2179	1261	0	342	82
RTOR Reduction (vph)	0	0	0	0	0	59
Lane Group Flow (vph)	0	2179	1261	0	342	23
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		90.0	90.0		36.0	36.0
Effective Green, g (s)		90.0	90.0		36.0	36.0
Actuated g/C Ratio		0.64	0.64		0.26	0.26
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3051	3051		853	365
v/s Ratio Prot		c0.46	0.27		c0.10	
v/s Ratio Perm						0.02
v/c Ratio		0.71	0.41		0.40	0.06
Uniform Delay, d1		16.5	12.2		43.1	39.3
Progression Factor		0.28	1.00		1.00	1.00
Incremental Delay, d2		1.2	0.4		1.4	0.3
Delay (s)		5.9	12.6		44.5	39.6
Level of Service		A	B		D	D
Approach Delay (s)		5.9	12.6		43.5	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	12.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1225	25	0	1955	0	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1332	27	0	2125	0	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.60	
vC, conflicting volume			1359		2408	679
vC1, stage 1 conf vol					1345	
vC2, stage 2 conf vol					1062	
vCu, unblocked vol			1359		2020	679
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	94
cM capacity (veh/h)			502		191	394

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	888	471	1062	1062	22
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	22
cSH	1700	1700	1700	1700	394
Volume to Capacity	0.52	0.28	0.63	0.63	0.06
Queue Length 95th (ft)	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	14.7
Lane LOS					B
Approach Delay (s)	0.0		0.0		14.7
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	1145	65	45	1675	80	215	5	60	60	5	80
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	1245	71	49	1821	87	234	5	65	65	5	87
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					733							
pX, platoon unblocked	0.60						0.60	0.60		0.60	0.60	0.60
vC, conflicting volume	1908			1315			2462	3370	622	2772	3397	954
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1168			1315			2098	3620	622	2617	3665	0
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	83			91			0	0	85	0	0	87
cM capacity (veh/h)	354			522			0	2	429	0	2	647

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1
Volume Total	60	622	622	71	49	1214	694	239	65	158
Volume Left	60	0	0	0	49	0	0	234	0	65
Volume Right	0	0	0	71	0	0	87	0	65	87
cSH	354	1700	1700	1700	522	1700	1700	0	429	0
Volume to Capacity	0.17	0.37	0.37	0.04	0.09	0.71	0.41	Err	0.15	Err
Queue Length 95th (ft)	15	0	0	0	8	0	0	Err	13	Err
Control Delay (s)	17.2	0.0	0.0	0.0	12.6	0.0	0.0	Err	14.9	Err
Lane LOS	C				B			F	B	F
Approach Delay (s)	0.7				0.3			Err		Err
Approach LOS								F		F

Intersection Summary			
Average Delay		Err	
Intersection Capacity Utilization		74.4%	ICU Level of Service	D
Analysis Period (min)		15	

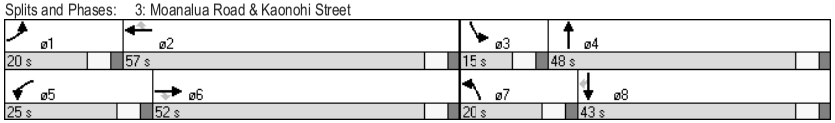
Timings
3: Moanalua Road & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	205	890	190	175	1355	280	305	160	120	110	140
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	20.0	52.0	52.0	25.0	57.0	57.0	20.0	48.0	15.0	43.0	43.0
Total Split (%)	14.3%	37.1%	37.1%	17.9%	40.7%	40.7%	14.3%	34.3%	10.7%	30.7%	30.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 115.8
Natural Cycle: 145
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	890	190	175	1355	280	305	160	140	120	110	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3292		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3292		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	967	207	190	1473	304	332	174	152	130	120	152
RTOR Reduction (vph)	0	0	121	0	0	144	0	128	0	0	0	135
Lane Group Flow (vph)	223	967	86	190	1473	160	332	198	0	130	120	17
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	14.0	48.0	48.0	17.1	51.1	51.1	14.0	18.2		8.6	12.8	12.8
Effective Green, g (s)	14.0	48.0	48.0	17.1	51.1	51.1	14.0	18.2		8.6	12.8	12.8
Actuated g/C Ratio	0.12	0.41	0.41	0.15	0.44	0.44	0.12	0.16		0.07	0.11	0.11
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	214	1466	656	261	1560	698	415	517		255	206	175
v/s Ratio Prot	c0.13	0.27		0.11	c0.42		c0.10	c0.06		0.04	c0.06	
v/s Ratio Perm			0.05			0.10						0.01
v/c Ratio	1.04	0.66	0.13	0.73	0.94	0.23	0.80	0.38		0.51	0.58	0.10
Uniform Delay, d1	51.0	27.4	21.0	47.2	31.0	20.2	49.6	43.8		51.6	49.0	46.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	73.0	1.5	0.2	10.0	12.3	0.4	10.6	0.5		1.6	4.2	0.2
Delay (s)	123.9	28.8	21.2	57.2	43.4	20.5	60.1	44.3		53.2	53.2	46.6
Level of Service	F	C	C	E	D	C	E	D		D	D	D
Approach Delay (s)		42.9			41.2			52.3			50.7	
Approach LOS		D			D			D			D	

Intersection Summary				
HCM Average Control Delay	44.2	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.94			
Actuated Cycle Length (s)	115.9	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	83.3%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	90	0	0	70	0	540	40	0	405	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	98	0	0	76	0	587	43	0	440	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked												
vC, conflicting volume	696	1103	253	927	1114	168	505			630		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	696	1103	253	927	1114	168	505			630		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	87	100	100	91	100			100		
cM capacity (veh/h)	299	210	747	194	207	846	1055			948		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	98	76	168	168	168	127	293	212
Volume Left	0	0	0	0	0	0	0	0
Volume Right	98	76	0	0	0	43	0	65
cSH	747	846	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.09	0.10	0.10	0.10	0.07	0.17	0.12
Queue Length 95th (ft)	11	7	0	0	0	0	0	0
Control Delay (s)	10.5	9.7	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.5	9.7	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	25.3%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	0	75	100	55	130	45	440	70	90	400	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	0	82	109	60	141	49	478	76	98	435	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1209			652	
pX, platoon unblocked												
vC, conflicting volume	1147	1291	226	1109	1261	277	451			554		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1147	1291	226	1109	1261	277	451			554		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	57	100	90	17	59	80	96			90		
cM capacity (veh/h)	76	140	778	132	146	720	1106			1012		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	33	82	168	141	49	319	236	98	290	161
Volume Left	33	0	109	0	49	0	0	98	0	0
Volume Right	0	82	0	141	0	0	76	0	0	16
cSH	76	778	136	720	1106	1700	1700	1012	1700	1700
Volume to Capacity	0.43	0.10	1.24	0.20	0.04	0.19	0.14	0.10	0.17	0.09
Queue Length 95th (ft)	43	9	255	18	3	0	0	8	0	0
Control Delay (s)	84.0	10.2	216.6	11.2	8.4	0.0	0.0	8.9	0.0	0.0
Lane LOS	F	B	F	B	A			A		
Approach Delay (s)	31.3		122.9		0.7			1.6		
Approach LOS	D		F							

Intersection Summary					
Average Delay		27.2			
Intersection Capacity Utilization		44.5%	ICU Level of Service		A
Analysis Period (min)		15			

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	35	0	145	155	35	75	190	450	90	55	510	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	0	158	168	38	82	207	489	98	60	554	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	1443	1685	288	1505	1647	293	576			587		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1443	1685	288	1505	1647	293	576			587		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	4	100	78	0	48	88	79			94		
cM capacity (veh/h)	40	69	709	52	73	703	993			984		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	38	158	207	82	207	326	261	60	370	207
Volume Left	38	0	168	0	207	0	0	60	0	0
Volume Right	0	158	0	82	0	0	98	0	0	22
cSH	40	709	55	703	993	1700	1700	984	1700	1700
Volume to Capacity	0.96	0.22	3.76	0.12	0.21	0.19	0.15	0.06	0.22	0.12
Queue Length 95th (ft)	92	21	Err	10	20	0	0	5	0	0
Control Delay (s)	283.3	11.5	Err	10.8	9.6	0.0	0.0	8.9	0.0	0.0
Lane LOS	F	B	F	B	A			A		
Approach Delay (s)	64.4		7172.1		2.5			0.8		
Approach LOS	F		F							

Intersection Summary					
Average Delay		1087.8			
Intersection Capacity Utilization		52.4%	ICU Level of Service		A
Analysis Period (min)		15			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	705	745	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	766	810	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	1135	
pX, platoon unblocked						
vC, conflicting volume	1261	429	859			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1261	429	859			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	79	94	97			
cM capacity (veh/h)	158	574	778			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	277	511	540	319
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	247	778	1700	1700	1700
Volume to Capacity	0.26	0.03	0.30	0.32	0.19
Queue Length 95th (ft)	26	2	0	0	0
Control Delay (s)	24.7	1.1	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	24.7	0.4		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	44.1%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	705	760	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	766	826	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	1274	424	848			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1274	424	848			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	90	97			
cM capacity (veh/h)	153	579	785			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	283	511	551	297
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	22
cSH	363	785	1700	1700	1700
Volume to Capacity	0.21	0.03	0.30	0.32	0.17
Queue Length 95th (ft)	19	3	0	0	0
Control Delay (s)	17.5	1.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	17.5	0.5		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	48.6%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/7/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	685	50	30	785
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	745	54	33	853
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	1121	399			799	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1121	399			799	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	60	92			96	
cM capacity (veh/h)	192	600			819	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	496	303	203	341	341
Volume Left	76	0	0	33	0	0
Volume Right	49	0	54	0	0	0
cSH	262	1700	1700	819	1700	1700
Volume to Capacity	0.48	0.29	0.18	0.04	0.20	0.20
Queue Length 95th (ft)	60	0	0	3	0	0
Control Delay (s)	30.7	0.0	0.0	1.9	0.0	0.0
Lane LOS	D			A		
Approach Delay (s)	30.7	0.0		0.4		
Approach LOS	D					

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	110	120	710	795	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	120	130	772	864	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1541	318	864			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1541	318	864			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	57	82	83			
cM capacity (veh/h)	88	678	774			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	158	130	386	386	346	346	233
Volume Left	38	130	0	0	0	0	0
Volume Right	120	0	0	0	0	0	60
cSH	259	774	1700	1700	1700	1700	1700
Volume to Capacity	0.61	0.17	0.23	0.23	0.20	0.20	0.14
Queue Length 95th (ft)	91	15	0	0	0	0	0
Control Delay (s)	38.3	10.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	B					
Approach Delay (s)	38.3	1.5			0.0		
Approach LOS	E						

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

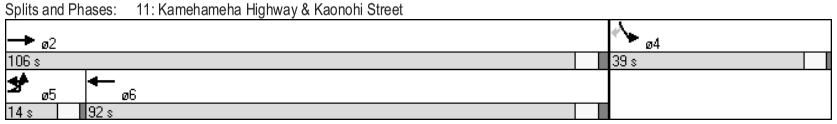
Timings
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	275	1215	3530	375	520
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	28.0	28.0	39.0	39.0
Total Split (s)	14.0	106.0	92.0	39.0	39.0
Total Split (%)	9.7%	73.1%	63.4%	26.9%	26.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 105 (72%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	275	1215	3530	545	375	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		0.94	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4727		3304	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4727		3304	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	299	1321	3837	592	408	565
RTOR Reduction (vph)	0	0	13	0	69	69
Lane Group Flow (vph)	299	1321	4416	0	593	242
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	9.0	103.7	89.7		30.3	30.3
Effective Green, g (s)	9.0	103.7	89.7		30.3	30.3
Actuated g/C Ratio	0.06	0.72	0.62		0.21	0.21
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	213	3637	2924		690	301
v/s Ratio Prot	c0.09	0.26	c0.93		c0.18	
v/s Ratio Perm						0.17
v/c Ratio	1.40	0.36	1.51		0.86	0.80
Uniform Delay, d1	68.0	7.9	27.6		55.3	54.5
Progression Factor	0.87	0.87	0.72		1.00	1.00
Incremental Delay, d2	206.3	0.3	229.7		10.4	14.4
Delay (s)	265.4	7.2	249.8		65.7	68.9
Level of Service	F	A	F		E	E
Approach Delay (s)		54.9	249.8		66.7	
Approach LOS		D	F		E	

Intersection Summary			
HCM Average Control Delay	179.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	123.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

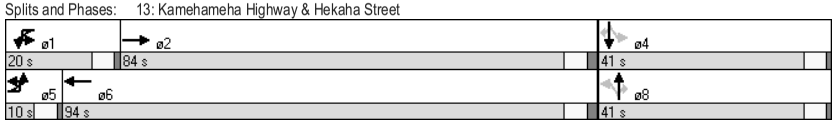
Timings
13: Kamehameha Highway & Hekaha Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1095	185	2945	230	45	225	65	45	95
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	33.0	10.0	33.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	10.0	84.0	20.0	94.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	6.9%	57.9%	13.8%	64.8%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 43 (30%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1095	145	185	2945	75	230	45	225	65	45	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4648		3204	4726			1728	1443		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.63	1.00		0.40	1.00
Satd. Flow (perm)	1652	4648		3204	4726			1130	1443		690	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1190	158	201	3201	82	250	49	245	71	49	103
RTOR Reduction (vph)	0	11	0	0	2	0	0	0	129	0	0	47
Lane Group Flow (vph)	54	1337	0	201	3281	0	0	299	116	0	120	56
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	79.5		13.5	88.0			36.0	36.0		36.0	36.0
Effective Green, g (s)	5.0	79.5		13.5	88.0			36.0	36.0		36.0	36.0
Actuated g/C Ratio	0.03	0.55		0.09	0.61			0.25	0.25		0.25	0.25
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	57	2548		298	2868			281	358		171	367
v/s Ratio Prot	0.03	0.29		c0.06	c0.69							
v/s Ratio Perm								c0.26	0.08		0.17	0.04
v/c Ratio	0.95	0.52		0.67	1.14			1.06	0.33		0.70	0.15
Uniform Delay, d1	69.9	20.8		63.6	28.5			54.5	44.6		49.6	42.6
Progression Factor	1.15	0.70		1.24	0.64			1.00	1.00		1.00	1.00
Incremental Delay, d2	93.3	0.7		0.6	65.3			71.6	0.5		12.3	0.2
Delay (s)	173.6	15.3		79.7	83.5			126.1	45.1		61.9	42.8
Level of Service	F	B		E	F			F	D		E	D
Approach Delay (s)		21.4			83.3			89.6			53.0	
Approach LOS		C			F			F			D	

Intersection Summary			
HCM Average Control Delay	67.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

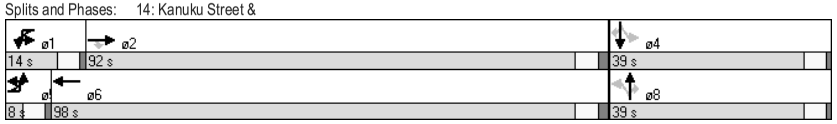
Timings
14: Kanuku Street &

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1250	75	90	3370	90	15	55	60	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	92.0	92.0	14.0	98.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	5.5%	63.4%	63.4%	9.7%	67.6%	26.9%	26.9%	26.9%	26.9%	26.9%	26.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 39 (27%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1250	75	90	3370	215	90	15	55	60	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1431	3204	4697			1698	1531		1671	1429
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.66	1.00		0.56	1.00
Satd. Flow (perm)	1652	4746	1431	3204	4697			1177	1531		978	1429
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1359	82	98	3663	234	98	16	60	65	16	38
RTOR Reduction (vph)	0	0	24	0	3	0	0	0	52	0	0	32
Lane Group Flow (vph)	38	1359	58	98	3894	0	0	114	8	0	81	6
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	101.7	101.7	8.5	107.2			18.8	18.8		18.8	18.8
Effective Green, g (s)	3.0	101.7	101.7	8.5	107.2			18.8	18.8		18.8	18.8
Actuated g/C Ratio	0.02	0.70	0.70	0.06	0.74			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	34	3329	1004	188	3473			153	199		127	185
v/s Ratio Prot	c0.02	0.29		0.03	c0.83							
v/s Ratio Perm			0.04					c0.10	0.01		0.08	0.00
v/c Ratio	1.12	0.41	0.06	0.52	1.12			0.75	0.04		0.64	0.03
Uniform Delay, d1	71.0	9.1	6.7	66.3	18.9			60.8	55.2		59.9	55.1
Progression Factor	0.92	0.53	0.30	1.08	0.36			1.00	1.00		1.00	1.00
Incremental Delay, d2	179.9	0.3	0.1	0.2	54.9			17.7	0.1		10.1	0.1
Delay (s)	245.5	5.1	2.1	71.9	61.7			78.5	55.3		69.9	55.2
Level of Service	F	A	A	E	E			E	E		E	E
Approach Delay (s)		11.1			62.0			70.5			65.2	
Approach LOS		B			E			E			E	

Intersection Summary			
HCM Average Control Delay	49.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

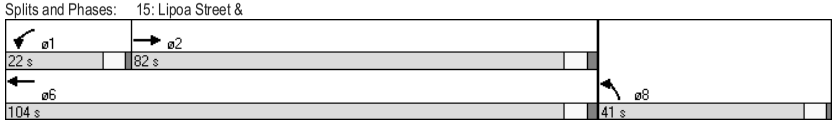
Timings
15: Lipoa Street &

7/7/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1405	95	3685	155
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	82.0	22.0	104.0	41.0
Total Split (%)	56.6%	15.2%	71.7%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 43 (30%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1405	55	95	3685	155	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5056		1652	4746	1745	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5056		1652	4746	1745	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1527	60	103	4005	168	38
RTOR Reduction (vph)	2	0	0	0	6	0
Lane Group Flow (vph)	1585	0	103	4005	200	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	93.4		13.7	112.1	21.9	
Effective Green, g (s)	93.4		13.7	112.1	21.9	
Actuated g/C Ratio	0.64		0.09	0.77	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3257		156	3669	264	
v/s Ratio Prot	0.31		0.06	c0.84	c0.11	
v/s Ratio Perm						
v/c Ratio	0.49		0.66	1.09	0.76	
Uniform Delay, d1	13.4		63.4	16.5	59.0	
Progression Factor	1.08		1.10	0.42	1.00	
Incremental Delay, d2	0.5		4.8	43.8	11.7	
Delay (s)	14.9		74.4	50.7	70.8	
Level of Service	B		E	D	E	
Approach Delay (s)	14.9			51.2	70.8	
Approach LOS	B			D	E	

Intersection Summary			
HCM Average Control Delay	42.2	HCM Level of Service	D
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	91.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

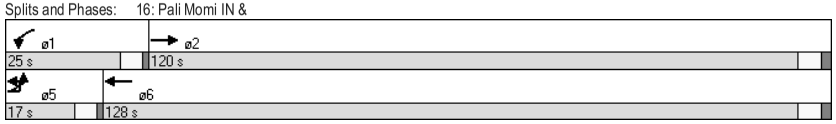
Timings
16: Pali Momi IN &

7/7/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	240	1155	120	3250
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	17.0	120.0	25.0	128.0
Total Split (%)	11.7%	82.8%	17.2%	88.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 126 (87%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	240	1155	30	120	3250	380	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4728		1652	4625							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4728		1652	4625							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	261	1255	33	130	3533	413	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	2	0	0	0	0	0	0	0
Lane Group Flow (vph)	261	1286	0	130	3944	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	12.0	117.9		16.1	122.0							
Effective Green, g (s)	12.0	117.9		16.1	122.0							
Actuated g/C Ratio	0.08	0.81		0.11	0.84							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	265	3844		183	3891							
v/s Ratio Prot	c0.08	0.27		0.08	c0.85							
v/s Ratio Perm												
v/c Ratio	0.98	0.33		0.71	1.01							
Uniform Delay, d1	66.4	3.5		62.2	11.5							
Progression Factor	0.99	0.60		1.08	0.44							
Incremental Delay, d2	47.6	0.2		3.0	10.6							
Delay (s)	113.4	2.3		69.9	15.7							
Level of Service	F	A		E	B							
Approach Delay (s)		21.0			17.4			0.0			0.0	
Approach LOS		C			B			A			A	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

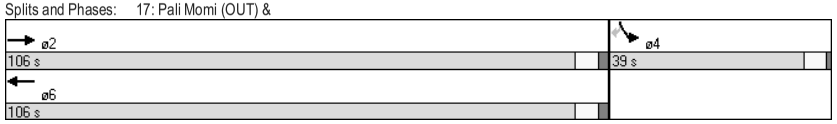
Timings
17: Pali Momi (OUT) &

7/7/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1155	3515	305	140
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	106.0	106.0	39.0	39.0
Total Split (%)	73.1%	73.1%	26.9%	26.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 135 (93%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1155	3515	0	305	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.87
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1330
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1330
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1255	3821	0	332	152
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1255	3821	0	332	152
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		111.8	111.8		22.2	22.2
Effective Green, g (s)		111.8	111.8		22.2	22.2
Actuated g/C Ratio		0.77	0.77		0.15	0.15
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3659	3659		508	204
v/s Ratio Prot		0.26	c0.81		0.10	
v/s Ratio Perm						c0.11
v/c Ratio		0.34	1.04		0.65	0.75
Uniform Delay, d1		5.2	16.6		57.8	58.7
Progression Factor		0.89	1.00		1.00	1.00
Incremental Delay, d2		0.2	28.1		3.0	13.7
Delay (s)		4.8	44.7		60.8	72.4
Level of Service		A	D		E	E
Approach Delay (s)		4.8	44.7		64.4	
Approach LOS		A	D		E	

Intersection Summary			
HCM Average Control Delay	37.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	104.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1655	25	0	1645	0	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1799	27	0	1788	0	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				987		
pX, platoon unblocked					0.74	
vC, conflicting volume			1826		2707	913
vC1, stage 1 conf vol					1812	
vC2, stage 2 conf vol					894	
vCu, unblocked vol			1826		2605	913
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	70
cM capacity (veh/h)			331		110	276

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1199	627	894	894	82
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	82
cSH	1700	1700	1700	1700	276
Volume to Capacity	0.71	0.37	0.53	0.53	0.30
Queue Length 95th (ft)	0	0	0	0	30
Control Delay (s)	0.0	0.0	0.0	0.0	23.4
Lane LOS					C
Approach Delay (s)	0.0		0.0		23.4
Approach LOS					C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	1605	125	60	1465	15	225	5	80	15	5	15
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	1745	136	65	1592	16	245	5	87	16	5	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)					733							
pX, platoon unblocked	0.73						0.73	0.73		0.73	0.73	0.73
vC, conflicting volume	1609			1880			2701	3495	872	2704	3622	804
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1106			1880			2593	3673	872	2597	3847	11
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			79			0	0	70	0	0	98
cM capacity (veh/h)	461			315			0	3	294	0	2	784

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1
Volume Total	5	872	872	136	65	1062	547	250	87	38
Volume Left	5	0	0	0	65	0	0	245	0	16
Volume Right	0	0	0	136	0	0	16	0	87	16
cSH	461	1700	1700	1700	315	1700	1700	0	294	0
Volume to Capacity	0.01	0.51	0.51	0.08	0.21	0.62	0.32	Err	0.30	Err
Queue Length 95th (ft)	1	0	0	0	19	0	0	Err	30	Err
Control Delay (s)	12.9	0.0	0.0	0.0	19.4	0.0	0.0	Err	22.3	Err
Lane LOS	B				C			F	C	F
Approach Delay (s)	0.0				0.8			Err		Err
Approach LOS								F		F

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	75.9%	ICU Level of Service	D
Analysis Period (min)	15		

Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	145	1200	350	200	1015	210	320	175	190	155	195
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	22.0	55.0	55.0	23.0	56.0	56.0	24.0	47.0	20.0	43.0	43.0
Total Split (%)	15.2%	37.9%	37.9%	15.9%	38.6%	38.6%	16.6%	32.4%	13.8%	29.7%	29.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 123.6
Natural Cycle: 145
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street

ø1	ø2	ø3	ø4
22 s	56 s	20 s	47 s
ø5	ø6	ø7	ø8
23 s	55 s	24 s	43 s

HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1200	350	200	1015	210	320	175	310	190	155	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3200		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3200		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	1304	380	217	1103	228	348	190	337	207	168	212
RTOR Reduction (vph)	0	0	203	0	0	133	0	195	0	0	0	183
Lane Group Flow (vph)	158	1304	177	217	1103	95	348	332	0	207	168	29
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	14.8	49.2	49.2	17.0	51.4	51.4	16.6	21.2		12.2	16.8	16.8
Effective Green, g (s)	14.8	49.2	49.2	17.0	51.4	51.4	16.6	21.2		12.2	16.8	16.8
Actuated g/C Ratio	0.12	0.40	0.40	0.14	0.42	0.42	0.13	0.17		0.10	0.14	0.14
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	212	1409	630	243	1472	658	461	549		339	253	215
v/s Ratio Prot	0.09	c0.37		c0.12	0.31		c0.10	c0.10		0.06	0.09	
v/s Ratio Perm			0.11			0.06						0.02
v/c Ratio	0.75	0.93	0.28	0.89	0.75	0.14	0.75	0.61		0.61	0.66	0.13
Uniform Delay, d1	52.6	35.5	25.2	52.4	30.6	22.4	51.5	47.3		53.4	50.7	47.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.3	11.0	0.5	31.5	2.6	0.2	6.9	1.9		3.2	6.4	0.3
Delay (s)	65.8	46.4	25.7	83.9	33.2	22.6	58.4	49.2		56.7	57.1	47.3
Level of Service	E	D	C	F	C	C	E	D		E	E	D
Approach Delay (s)		43.8			38.8			52.9			53.4	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	45.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	123.6	Sum of lost time (s)	24.0
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	75	0	0	160	0	660	95	0	615	95
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	82	0	0	174	0	717	103	0	668	103
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											212	
pX, platoon unblocked												
vC, conflicting volume	1073	1541	386	1185	1541	231	772			821		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1073	1541	386	1185	1541	231	772			821		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	87	100	100	77	100			100		
cM capacity (veh/h)	135	114	612	125	114	771	839			804		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	82	174	205	205	205	206	446	326
Volume Left	0	0	0	0	0	0	0	0
Volume Right	82	174	0	0	0	103	0	103
cSH	612	771	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.23	0.12	0.12	0.12	0.12	0.26	0.19
Queue Length 95th (ft)	11	22	0	0	0	0	0	0
Control Delay (s)	11.8	11.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	B						
Approach Delay (s)	11.8	11.0	0.0				0.0	
Approach LOS	B	B						

Intersection Summary			
Average Delay		1.6	
Intersection Capacity Utilization		31.3%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	40	0	70	100	50	125	50	575	125	155	530	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	0	76	109	54	136	54	625	136	168	576	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								1209			652	
pX, platoon unblocked												
vC, conflicting volume	1508	1793	299	1503	1736	380	598			761		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1508	1793	299	1503	1736	380	598			761		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	89	0	17	78	94			80		
cM capacity (veh/h)	17	60	697	61	65	617	975			847		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	43	76	163	136	54	417	344	168	384	214
Volume Left	43	0	109	0	54	0	0	168	0	0
Volume Right	0	76	0	136	0	0	136	0	0	22
cSH	17	697	62	617	975	1700	1700	847	1700	1700
Volume to Capacity	2.61	0.11	2.62	0.22	0.06	0.25	0.20	0.20	0.23	0.13
Queue Length 95th (ft)	151	9	409	21	4	0	0	18	0	0
Control Delay (s)	1202.7	10.8	876.7	12.5	8.9	0.0	0.0	10.3	0.0	0.0
Lane LOS	F	B	F	B	A			B		
Approach Delay (s)	444.2		483.9		0.6			2.3		
Approach LOS	F		F							

Intersection Summary			
Average Delay		100.0	
Intersection Capacity Utilization		53.3%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	35	10	140	190	55	135	205	560	220	145	550	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	11	152	207	60	147	223	609	239	158	598	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								926			935	
pX, platoon unblocked												
vC, conflicting volume	1848	2215	307	1946	2103	424	614			848		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1848	2215	307	1946	2103	424	614			848		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	59	78	0	0	75	77			80		
cM capacity (veh/h)	0	27	689	15	31	579	961			785		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	49	152	266	147	223	406	442	158	399	216
Volume Left	38	0	207	0	223	0	0	158	0	0
Volume Right	0	152	0	147	0	0	239	0	0	16
cSH	0	689	17	579	961	1700	1700	785	1700	1700
Volume to Capacity	Err	0.22	15.85	0.25	0.23	0.24	0.26	0.20	0.23	0.13
Queue Length 95th (ft)	Err	21	Err	25	22	0	0	19	0	0
Control Delay (s)	Err	11.7	Err	13.3	9.9	0.0	0.0	10.7	0.0	0.0
Lane LOS	F	B	F	B	A			B		
Approach Delay (s)	Err		6451.5		2.1			2.2		
Approach LOS	F		F							

Intersection Summary				
Average Delay		Err		
Intersection Capacity Utilization		60.6%	ICU Level of Service	B
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	25	45	25	955	750	115
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	49	27	1038	815	125
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	1118	
pX, platoon unblocked						
vC, conflicting volume	1451	470	940			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1451	470	940			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	77	91	96			
cM capacity (veh/h)	117	540	725			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	373	692	543	397
Volume Left	27	27	0	0	0
Volume Right	49	0	0	0	125
cSH	236	725	1700	1700	1700
Volume to Capacity	0.32	0.04	0.41	0.32	0.23
Queue Length 95th (ft)	34	3	0	0	0
Control Delay (s)	27.4	1.2	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	27.4	0.4		0.0	
Approach LOS	D				

Intersection Summary				
Average Delay		1.2		
Intersection Capacity Utilization		55.2%	ICU Level of Service	B
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	90	45	970	795	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	98	49	1054	864	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422		
pX, platoon unblocked						
vC, conflicting volume	1505	448	897			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1505	448	897			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	69	82	94			
cM capacity (veh/h)	105	558	753			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	130	400	703	576	321
Volume Left	33	49	0	0	0
Volume Right	98	0	0	0	33
cSH	268	753	1700	1700	1700
Volume to Capacity	0.49	0.06	0.41	0.34	0.19
Queue Length 95th (ft)	62	5	0	0	0
Control Delay (s)	30.6	2.0	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	30.6	0.7		0.0	
Approach LOS	D				

Intersection Summary				
Average Delay		2.2		
Intersection Capacity Utilization		68.3%	ICU Level of Service	C
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	80	920	85	45	745
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	87	1000	92	49	810
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			
pX, platoon unblocked						
vC, conflicting volume	1414	546			1092	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1414	546			1092	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	36	82			92	
cM capacity (veh/h)	119	482			635	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	163	667	426	211	324	324
Volume Left	76	0	0	49	0	0
Volume Right	87	0	92	0	0	0
cSH	198	1700	1700	635	1700	1700
Volume to Capacity	0.82	0.39	0.25	0.08	0.19	0.19
Queue Length 95th (ft)	148	0	0	6	0	0
Control Delay (s)	74.2	0.0	0.0	3.3	0.0	0.0
Lane LOS	F			A		
Approach Delay (s)	74.2	0.0		0.8		
Approach LOS	F					

Intersection Summary				
Average Delay		6.1		
Intersection Capacity Utilization		62.2%	ICU Level of Service	B
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	110	90	955	830	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	120	98	1038	902	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219		
pX, platoon unblocked						
vC, conflicting volume	1652	336	902			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1652	336	902			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	37	82	87			
cM capacity (veh/h)	78	660	749			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	98	519	519	361	361	251
Volume Left	49	98	0	0	0	0	0
Volume Right	120	0	0	0	0	0	71
cSH	208	749	1700	1700	1700	1700	1700
Volume to Capacity	0.81	0.13	0.31	0.31	0.21	0.21	0.15
Queue Length 95th (ft)	147	11	0	0	0	0	0
Control Delay (s)	70.0	10.5	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	70.0	0.9			0.0		
Approach LOS	F						

Intersection Summary				
Average Delay		5.6		
Intersection Capacity Utilization		42.3%	ICU Level of Service	A
Analysis Period (min)		15		

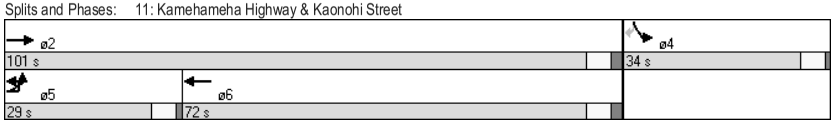
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	520	1740	1465	495	445
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	33.0	33.0
Total Split (s)	29.0	101.0	72.0	34.0	34.0
Total Split (%)	21.5%	74.8%	53.3%	25.2%	25.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 63 (47%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 120
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	520	1740	1465	525	495	445
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.96		0.98	0.89
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.96		0.96	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4549		3274	1288
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4549		3274	1288
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	565	1891	1592	571	538	484
RTOR Reduction (vph)	0	0	48	0	22	233
Lane Group Flow (vph)	565	1891	2115	0	681	86
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	24.0	95.0	66.0		29.0	29.0
Effective Green, g (s)	24.0	95.0	66.0		29.0	29.0
Actuated g/C Ratio	0.18	0.70	0.49		0.21	0.21
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	570	3340	2224		703	277
v/s Ratio Prot	c0.18	0.40	c0.46		c0.21	
v/s Ratio Perm						0.07
v/c Ratio	0.99	0.57	0.95		0.97	0.31
Uniform Delay, d1	55.4	9.9	33.0		52.6	44.6
Progression Factor	0.84	1.66	0.66		1.00	1.00
Incremental Delay, d2	31.6	0.6	8.8		26.0	0.6
Delay (s)	78.3	17.0	30.6		78.6	45.2
Level of Service	E	B	C		E	D
Approach Delay (s)		31.1	30.6		68.2	
Approach LOS		C	C		E	

Intersection Summary			
HCM Average Control Delay	37.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

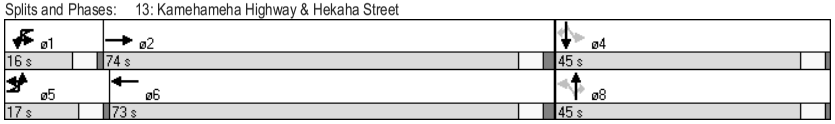
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	95	1735	220	1640	210	55	310	90	40	140
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	17.0	74.0	16.0	73.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	12.6%	54.8%	11.9%	54.1%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 33 (24%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	1735	285	220	1640	65	210	55	310	90	40	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4631		3204	4714			1699	1531		1680	1415
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.41	1.00
Satd. Flow (perm)	1652	4631		3204	4714			1095	1531		715	1415
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	1886	310	239	1783	71	228	60	337	98	43	152
RTOR Reduction (vph)	0	16	0	0	3	0	0	0	115	0	0	110
Lane Group Flow (vph)	103	2180	0	239	1851	0	0	288	222	0	141	42
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	11.3	70.3		11.0	70.0			37.7	37.7		37.7	37.7
Effective Green, g (s)	11.3	70.3		11.0	70.0			37.7	37.7		37.7	37.7
Actuated g/C Ratio	0.08	0.52		0.08	0.52			0.28	0.28		0.28	0.28
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	138	2412		261	2444			306	428		200	395
v/s Ratio Prot	0.06	c0.47		c0.07	0.39							
v/s Ratio Perm								c0.26	0.15		0.20	0.03
v/c Ratio	0.75	0.90		0.92	0.76			0.94	0.52		0.70	0.11
Uniform Delay, d1	60.4	29.3		61.5	25.8			47.6	41.0		43.7	36.1
Progression Factor	0.85	0.74		1.34	0.30			1.00	1.00		1.00	1.00
Incremental Delay, d2	10.6	3.3		27.8	1.7			36.0	1.1		10.7	0.1
Delay (s)	62.3	25.0		110.3	9.3			83.6	42.1		54.4	36.3
Level of Service	E	C		F	A			F	D		D	D
Approach Delay (s)		26.7			20.9			61.2			45.0	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM Average Control Delay	29.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	102.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

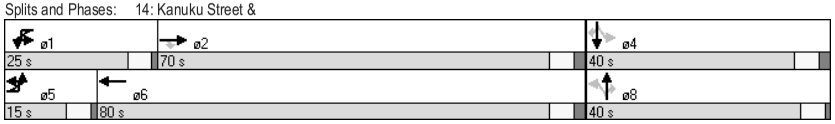
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	75	1875	105	105	1725	65	20	70	120	15	75
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	25.0	28.0	23.0	23.0	23.0	40.0	40.0	40.0
Total Split (s)	15.0	70.0	70.0	25.0	80.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	11.1%	51.9%	51.9%	18.5%	59.3%	29.6%	29.6%	29.6%	29.6%	29.6%	29.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 28 (21%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1875	105	105	1725	230	65	20	70	120	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4663			1734	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.57	1.00		0.65	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4663			1020	1531		1130	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	2038	114	114	1875	250	71	22	76	130	16	82
RTOR Reduction (vph)	0	0	23	0	10	0	0	0	63	0	0	69
Lane Group Flow (vph)	82	2038	91	114	2115	0	0	93	13	0	146	13
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	9.5	85.7	85.7	10.2	86.4			23.1	23.1		22.1	22.1
Effective Green, g (s)	9.5	85.7	85.7	10.2	86.4			23.1	23.1		22.1	22.1
Actuated g/C Ratio	0.07	0.63	0.63	0.08	0.64			0.17	0.17		0.16	0.16
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	116	3013	938	242	2984			175	262		185	242
v/s Ratio Prot	c0.05	0.43		0.04	c0.45							
v/s Ratio Perm			0.06					0.09	0.01		c0.13	0.01
v/c Ratio	0.71	0.68	0.10	0.47	0.71			0.53	0.05		0.79	0.06
Uniform Delay, d1	61.4	15.8	9.6	59.8	16.0			51.0	46.8		54.2	47.6
Progression Factor	0.84	0.95	1.45	1.22	0.40			1.00	1.00		1.00	1.00
Incremental Delay, d2	9.4	0.6	0.1	0.8	0.8			3.1	0.1		19.7	0.1
Delay (s)	60.7	15.6	14.0	73.9	7.2			54.1	46.9		73.9	47.7
Level of Service	E	B	B	E	A			D	D		E	D
Approach Delay (s)		17.1			10.6			50.8			64.5	
Approach LOS		B			B			D			E	

Intersection Summary			
HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

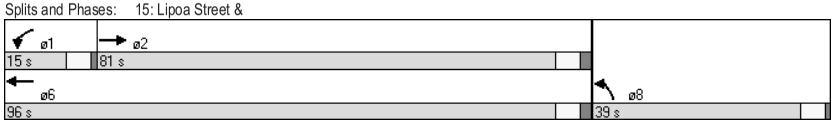
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1945	50	2030	160
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	81.0	15.0	96.0	39.0
Total Split (%)	60.0%	11.1%	71.1%	28.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 121 (90%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1945	65	50	2030	160	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4719		1652	4746	1670	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4719		1652	4746	1670	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2114	71	54	2207	174	76
RTOR Reduction (vph)	2	0	0	0	13	0
Lane Group Flow (vph)	2183	0	54	2207	237	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	87.1		7.6	99.7	24.3	
Effective Green, g (s)	87.1		7.6	99.7	24.3	
Actuated g/C Ratio	0.65		0.06	0.74	0.18	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3045		93	3505	301	
v/s Ratio Prot	c0.46		0.03	c0.46	c0.14	
v/s Ratio Perm						
v/c Ratio	0.72		0.58	0.63	0.79	
Uniform Delay, d1	15.8		62.1	8.6	52.9	
Progression Factor	0.93		1.27	0.40	1.00	
Incremental Delay, d2	1.1		6.6	0.6	12.7	
Delay (s)	15.7		85.7	4.1	65.6	
Level of Service	B		F	A	E	
Approach Delay (s)	15.7			6.1	65.6	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

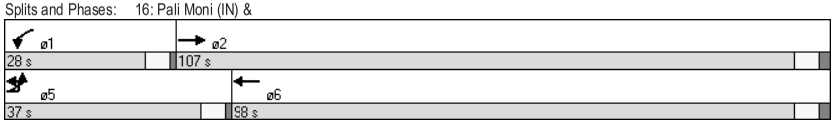
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	455	1470	145	1830
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	37.0	107.0	28.0	98.0
Total Split (%)	27.4%	79.3%	20.7%	72.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 94 (70%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	455	1470	50	145	1830	485	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4723		1652	4532							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4723		1652	4532							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	495	1598	54	158	1989	527	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	18	0	0	0	0	0	0	0
Lane Group Flow (vph)	495	1650	0	158	2498	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	26.0	106.2		17.8	98.0							
Effective Green, g (s)	26.0	106.2		17.8	98.0							
Actuated g/C Ratio	0.19	0.79		0.13	0.73							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	617	3715		218	3290							
v/s Ratio Prot	c0.15	0.35		0.10	c0.55							
v/s Ratio Perm												
v/c Ratio	0.80	0.44		0.72	0.76							
Uniform Delay, d1	52.0	4.7		56.2	11.3							
Progression Factor	0.68	1.21		1.08	0.43							
Incremental Delay, d2	5.3	0.3		9.1	1.3							
Delay (s)	40.6	6.0		69.8	6.2							
Level of Service	D	A		E	A							
Approach Delay (s)		14.0			9.9			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

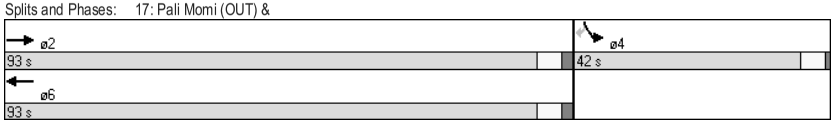
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1430	2115	340	185
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	93.0	93.0	42.0	42.0
Total Split (%)	68.9%	68.9%	31.1%	31.1%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 103 (76%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1430	2115	0	340	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1309
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1309
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1554	2299	0	370	201
RTOR Reduction (vph)	0	0	0	0	0	6
Lane Group Flow (vph)	0	1554	2299	0	370	195
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		98.5	98.5		25.5	25.5
Effective Green, g (s)		98.5	98.5		25.5	25.5
Actuated g/C Ratio		0.73	0.73		0.19	0.19
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3463	3463		627	247
v/s Ratio Prot		0.33	c0.48		0.11	
v/s Ratio Perm						c0.15
v/c Ratio		0.45	0.66		0.59	0.79
Uniform Delay, d1		7.3	9.6		50.0	52.2
Progression Factor		0.35	1.00		1.00	1.00
Incremental Delay, d2		0.4	1.0		1.5	15.2
Delay (s)		2.9	10.6		51.5	67.4
Level of Service		A	B		D	E
Approach Delay (s)		2.9	10.6		57.1	
Approach LOS		A	B		E	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Year 2015 with Project and Improvements

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1620	15	0	1115	0	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1761	16	0	1212	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.80	
vC, conflicting volume			1777		2375	889
vC1, stage 1 conf vol					1769	
vC2, stage 2 conf vol					606	
vCu, unblocked vol			1777		2223	889
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	85
cM capacity (veh/h)			346		118	286

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1174	603	606	606	43
Volume Left	0	0	0	0	0
Volume Right	0	16	0	0	43
cSH	1700	1700	1700	1700	286
Volume to Capacity	0.69	0.35	0.36	0.36	0.15
Queue Length 95th (ft)	0	0	0	0	13
Control Delay (s)	0.0	0.0	0.0	0.0	19.8
Lane LOS					C
Approach Delay (s)	0.0		0.0		19.8
Approach LOS					C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	55.3%	ICU Level of Service	B
Analysis Period (min)	15		

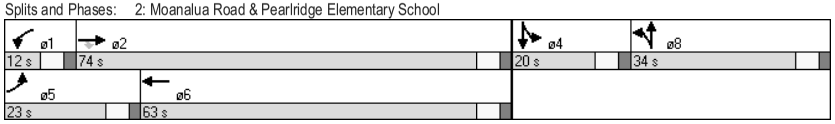
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	155	1435	95	45	805	50	5	130	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	23.0	74.0	74.0	12.0	63.0	34.0	34.0	20.0	20.0
Total Split (%)	16.4%	52.9%	52.9%	8.6%	45.0%	24.3%	24.3%	14.3%	14.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 131 (94%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1435	95	45	805	205	50	5	25	130	5	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.90		1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3431		1681	1577		1770	1590	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3431		1681	1577		1770	1590	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	1560	103	49	875	223	54	5	27	141	5	207
RTOR Reduction (vph)	0	0	17	0	12	0	0	25	0	0	187	0
Lane Group Flow (vph)	168	1560	86	49	1086	0	45	16	0	141	25	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	16.0	86.2	86.2	8.3	78.5		8.0	8.0		13.5	13.5	
Effective Green, g (s)	16.0	86.2	86.2	8.3	78.5		8.0	8.0		13.5	13.5	
Actuated g/C Ratio	0.11	0.62	0.62	0.06	0.56		0.06	0.06		0.10	0.10	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	202	2179	975	105	1924		96	90		171	153	
v/s Ratio Prot	c0.09	c0.44		0.03	0.32		c0.03	0.01		c0.08	0.02	
v/s Ratio Perm			0.05									
v/c Ratio	0.83	0.72	0.09	0.47	0.56		0.47	0.17		0.82	0.16	
Uniform Delay, d1	60.7	18.5	10.9	63.7	19.8		63.9	62.8		62.1	58.1	
Progression Factor	1.00	1.00	1.00	0.97	0.67		1.00	1.00		1.00	1.00	
Incremental Delay, d2	24.3	2.0	0.2	3.0	1.1		3.6	0.9		26.4	0.5	
Delay (s)	85.0	20.5	11.1	64.7	14.4		67.5	63.8		88.5	58.6	
Level of Service	F	C	B	E	B		E	E		F	E	
Approach Delay (s)		25.9			16.6			65.7			70.5	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	28.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

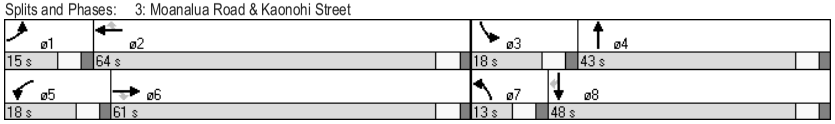
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	1200	195	120	730	95	80	85	275	250	230
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	15.0	61.0	61.0	18.0	64.0	64.0	13.0	43.0	18.0	48.0	48.0
Total Split (%)	10.7%	43.6%	43.6%	12.9%	45.7%	45.7%	9.3%	30.7%	12.9%	34.3%	34.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1200	195	120	730	95	80	85	110	275	250	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3239		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3239		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1304	212	130	793	103	87	92	120	299	272	250
RTOR Reduction (vph)	0	0	106	0	0	49	0	101	0	0	0	174
Lane Group Flow (vph)	114	1304	106	130	793	54	87	111	0	299	272	76
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.6	70.1	70.1	12.0	73.5	73.5	6.9	21.9		12.0	27.0	27.0
Effective Green, g (s)	8.6	70.1	70.1	12.0	73.5	73.5	6.9	21.9		12.0	27.0	27.0
Actuated g/C Ratio	0.06	0.50	0.50	0.09	0.52	0.52	0.05	0.16		0.09	0.19	0.19
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	211	1772	793	152	1858	831	169	507		294	359	305
v/s Ratio Prot	0.03	c0.37		c0.07	c0.22		0.03	0.03		c0.09	c0.15	
v/s Ratio Perm			0.07			0.03						0.05
v/c Ratio	0.54	0.74	0.13	0.86	0.43	0.07	0.51	0.22		1.02	0.76	0.25
Uniform Delay, d1	63.8	27.6	18.7	63.1	20.4	16.4	64.9	51.6		64.0	53.4	47.9
Progression Factor	1.35	0.52	0.09	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.0	2.0	0.2	35.4	0.7	0.2	2.6	0.2		56.9	8.8	0.4
Delay (s)	88.3	16.2	1.9	98.5	21.1	16.5	67.6	51.8		120.9	62.3	48.4
Level of Service	F	B	A	F	C	B	E	D		F	E	D
Approach Delay (s)		19.4			30.4			56.4			79.4	
Approach LOS		B			C			E			E	

Intersection Summary				
HCM Average Control Delay	38.4	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.85			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	77.1%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	15	0	0	10	0	275	20	0	525	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	16	0	0	11	0	299	22	0	571	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	689	924	318	611	946	86	636			321		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	689	924	318	611	946	86	636			321		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	100	100	99	100			100		
cM capacity (veh/h)	328	268	678	368	260	956	943			1236		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	16	11	85	85	85	64	380	255
Volume Left	0	0	0	0	0	0	0	0
Volume Right	16	11	0	0	0	22	0	65
cSH	678	956	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.01	0.05	0.05	0.05	0.04	0.22	0.15
Queue Length 95th (ft)	2	1	0	0	0	0	0	0
Control Delay (s)	10.4	8.8	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.4	8.8	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	26.4%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	0	20	15	0	30	35	260	15	30	490	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	0	22	16	0	33	38	283	16	33	533	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked												
vC, conflicting volume	853	978	272	720	976	149	543			299		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	853	978	272	720	976	149	543			299		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	100	97	94	100	96	96			97		
cM capacity (veh/h)	231	233	726	291	234	870	1022			1259		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	11	22	16	33	38	188	111	33	355	188
Volume Left	11	0	16	0	38	0	0	33	0	0
Volume Right	0	22	0	33	0	0	16	0	0	11
cSH	231	726	291	870	1022	1700	1700	1259	1700	1700
Volume to Capacity	0.05	0.03	0.06	0.04	0.04	0.11	0.07	0.03	0.21	0.11
Queue Length 95th (ft)	4	2	4	3	3	0	0	2	0	0
Control Delay (s)	21.3	10.1	18.1	9.3	8.7	0.0	0.0	7.9	0.0	0.0
Lane LOS	C	B	C	A	A			A		
Approach Delay (s)	13.8		12.2		1.0			0.4		
Approach LOS	B		B							

Intersection Summary				
Average Delay		1.6		
Intersection Capacity Utilization		34.7%	ICU Level of Service	A
Analysis Period (min)		15		

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	25	0	30	0	130	265	35	490
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	38.0	38.0	38.0	38.0
Total Split (%)	46.5%	46.5%	46.5%	46.5%	53.5%	53.5%	53.5%	53.5%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 71
Actuated Cycle Length: 23.5
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	0	75	30	0	10	130	265	35	35	490	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.85		1.00	0.85		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1583		1770	1583		1770	3477		1770	3528	
Flt Permitted	1.00	1.00		1.00	1.00		0.45	1.00		0.55	1.00	
Satd. Flow (perm)	1863	1583		1863	1583		836	3477		1033	3528	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	0	82	33	0	11	141	288	38	38	533	11
RTOR Reduction (vph)	0	72	0	0	10	0	0	14	0	0	2	0
Lane Group Flow (vph)	27	10	0	33	1	0	141	312	0	38	542	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	3.2	3.2		3.2	3.2		11.9	11.9		11.9	11.9	
Effective Green, g (s)	3.2	3.2		3.2	3.2		11.9	11.9		11.9	11.9	
Actuated g/C Ratio	0.13	0.13		0.13	0.13		0.47	0.47		0.47	0.47	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	238	202		238	202		396	1648		490	1673	
v/s Ratio Prot		0.01			0.00			0.09			0.15	
v/s Ratio Perm	0.01			c0.02			c0.17			0.04		
v/c Ratio	0.11	0.05		0.14	0.01		0.36	0.19		0.08	0.32	
Uniform Delay, d1	9.7	9.6		9.7	9.6		4.2	3.8		3.6	4.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.1		0.3	0.0		0.6	0.1		0.1	0.1	
Delay (s)	9.9	9.7		10.0	9.6		4.7	3.9		3.7	4.2	
Level of Service	A	A		A	A		A	A		A	A	
Approach Delay (s)		9.8			9.9			4.1			4.2	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	4.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	25.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	30	15	395	520	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	33	16	429	565	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.97	0.97	0.97			
vC, conflicting volume	842	312	625			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	772	224	547			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	86	96	98			
cM capacity (veh/h)	320	754	986			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	159	286	377	248
Volume Left	43	16	0	0	0
Volume Right	33	0	0	0	60
cSH	425	986	1700	1700	1700
Volume to Capacity	0.18	0.02	0.17	0.22	0.15
Queue Length 95th (ft)	16	1	0	0	0
Control Delay (s)	15.3	1.0	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	15.3	0.4		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	32.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	45	20	400	550	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	49	22	435	598	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked						
vC, conflicting volume	861	302	603			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	861	302	603			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	93	98			
cM capacity (veh/h)	288	694	970			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	167	290	399	205
Volume Left	16	22	0	0	0
Volume Right	49	0	0	0	5
cSH	513	970	1700	1700	1700
Volume to Capacity	0.13	0.02	0.17	0.23	0.12
Queue Length 95th (ft)	11	2	0	0	0
Control Delay (s)	13.0	1.3	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	13.0	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		36.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	405	50	25	570
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	440	54	27	620
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	728	247			495	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	728	247			495	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	98			97	
cM capacity (veh/h)	349	753			1065	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	293	201	151	248	248
Volume Left	49	0	0	27	0	0
Volume Right	16	0	54	0	0	0
cSH	403	1700	1700	1065	1700	1700
Volume to Capacity	0.16	0.17	0.12	0.03	0.15	0.15
Queue Length 95th (ft)	14	0	0	2	0	0
Control Delay (s)	15.6	0.0	0.0	1.7	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	15.6	0.0		0.4		
Approach LOS	C					

Intersection Summary				
Average Delay		1.1		
Intersection Capacity Utilization		37.7%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	80	145	55	370	590	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	158	60	402	641	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	981	233	641			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	981	233	641			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	62	80	94			
cM capacity (veh/h)	231	769	939			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	245	60	201	201	257	257	166
Volume Left	87	60	0	0	0	0	0
Volume Right	158	0	0	0	0	0	38
cSH	421	939	1700	1700	1700	1700	1700
Volume to Capacity	0.58	0.06	0.12	0.12	0.15	0.15	0.10
Queue Length 95th (ft)	90	5	0	0	0	0	0
Control Delay (s)	24.8	9.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	C	A					
Approach Delay (s)	24.8	1.2			0.0		
Approach LOS	C						

Intersection Summary				
Average Delay		4.8		
Intersection Capacity Utilization		38.9%	ICU Level of Service	A
Analysis Period (min)		15		

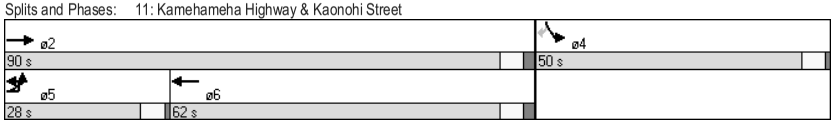
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	230	1655	775	600	140
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	28.0	90.0	62.0	50.0	50.0
Total Split (%)	20.0%	64.3%	44.3%	35.7%	35.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 95 (68%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	230	1655	775	220	600	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4662		3428	1329
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4662		3428	1329
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	250	1799	842	239	652	152
RTOR Reduction (vph)	0	0	34	0	1	93
Lane Group Flow (vph)	250	1799	1047	0	666	44
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	16.2	84.0	62.8		45.0	45.0
Effective Green, g (s)	16.2	84.0	62.8		45.0	45.0
Actuated g/C Ratio	0.12	0.60	0.45		0.32	0.32
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	371	2848	2091		1102	427
v/s Ratio Prot	0.08	c0.38	0.22		c0.19	
v/s Ratio Perm						0.03
v/c Ratio	0.67	0.63	0.50		0.60	0.10
Uniform Delay, d1	59.4	18.0	27.5		40.0	33.3
Progression Factor	1.11	0.38	0.62		1.00	1.00
Incremental Delay, d2	4.0	0.9	0.8		2.5	0.5
Delay (s)	70.1	7.7	17.9		42.5	33.8
Level of Service	E	A	B		D	C
Approach Delay (s)		15.3	17.9		41.0	
Approach LOS		B	B		D	

Intersection Summary			
HCM Average Control Delay	21.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	69.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

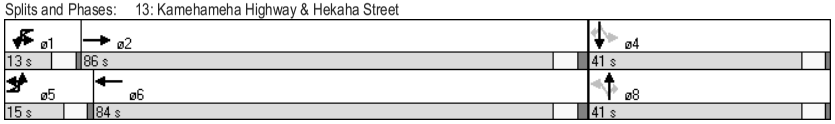
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1740	85	855	55	5	55	110	15	75
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	39.0	39.0	39.0
Total Split (s)	15.0	86.0	13.0	84.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	10.7%	61.4%	9.3%	60.0%	29.3%	29.3%	29.3%	29.3%	29.3%	29.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 111 (79%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1740	180	85	855	30	55	5	55	110	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.99		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4667		3204	4718			1720	1486		1640	1458
Flt Permitted	0.95	1.00		0.95	1.00			0.68	1.00		0.71	1.00
Satd. Flow (perm)	1652	4667		3204	4718			1218	1486		1207	1458
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1891	196	92	929	33	60	5	60	120	16	82
RTOR Reduction (vph)	0	9	0	0	3	0	0	0	45	0	0	61
Lane Group Flow (vph)	54	2078	0	92	959	0	0	65	15	0	136	21
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.6	80.3		7.7	80.4			36.0	36.0		36.0	36.0
Effective Green, g (s)	7.6	80.3		7.7	80.4			36.0	36.0		36.0	36.0
Actuated g/C Ratio	0.05	0.57		0.06	0.57			0.26	0.26		0.26	0.26
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	90	2677		176	2709			313	382		310	375
v/s Ratio Prot	c0.03	c0.45		0.03	0.20							
v/s Ratio Perm								0.05	0.01		c0.11	0.01
v/c Ratio	0.60	0.78		0.52	0.35			0.21	0.04		0.44	0.06
Uniform Delay, d1	64.7	22.9		64.4	15.9			40.8	39.0		43.5	39.2
Progression Factor	0.89	0.82		0.70	1.40			1.00	1.00		1.00	1.00
Incremental Delay, d2	8.4	1.8		2.7	0.4			1.5	0.2		4.5	0.3
Delay (s)	66.0	20.8		47.9	22.7			42.3	39.2		48.0	39.5
Level of Service	E	C		D	C			D	D		D	D
Approach Delay (s)		21.9			24.9			40.8			44.8	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	24.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

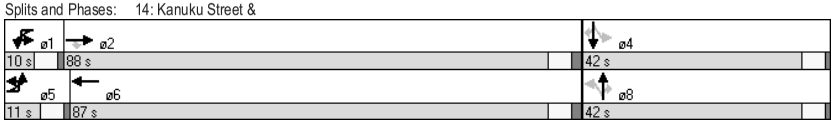
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	25	1790	20	15	925	5	5	15	135	10	40
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	39.0	39.0	39.0
Total Split (s)	11.0	88.0	88.0	10.0	87.0	42.0	42.0	42.0	42.0	42.0	42.0
Total Split (%)	7.9%	62.9%	62.9%	7.1%	62.1%	30.0%	30.0%	30.0%	30.0%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 139 (99%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	1790	20	15	925	65	5	5	15	135	10	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1449	3204	4694			1754	1531		1661	1453
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1449	3204	4694			1590	1531		1276	1453
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	1946	22	16	1005	71	5	5	16	147	11	43
RTOR Reduction (vph)	0	0	4	0	4	0	0	0	13	0	0	36
Lane Group Flow (vph)	27	1946	18	16	1072	0	0	10	3	0	158	7
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.6	99.3	99.3	2.0	97.7			22.7	22.7		22.7	22.7
Effective Green, g (s)	3.6	99.3	99.3	2.0	97.7			22.7	22.7		22.7	22.7
Actuated g/C Ratio	0.03	0.71	0.71	0.01	0.70			0.16	0.16		0.16	0.16
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	42	3366	1028	46	3276			258	248		207	236
v/s Ratio Prot	c0.02	c0.41		0.00	0.23							
v/s Ratio Perm			0.01					0.01	0.00		c0.12	0.00
v/c Ratio	0.64	0.58	0.02	0.35	0.33			0.04	0.01		0.76	0.03
Uniform Delay, d1	67.6	10.0	6.0	68.4	8.3			49.5	49.2		56.1	49.4
Progression Factor	1.36	0.21	0.03	0.75	1.24			1.00	1.00		1.00	1.00
Incremental Delay, d2	19.9	0.5	0.0	4.2	0.2			0.1	0.0		15.3	0.1
Delay (s)	111.6	2.5	0.2	55.2	10.5			49.5	49.2		71.4	49.4
Level of Service	F	A	A	E	B			D	D		E	D
Approach Delay (s)		4.0			11.1			49.3			66.7	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	62.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

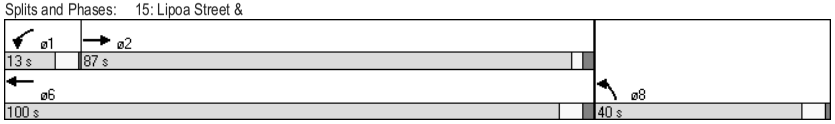
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2220	45	995	70
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	87.0	13.0	100.0	40.0
Total Split (%)	62.1%	9.3%	71.4%	28.6%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 4 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2220	50	45	995	70	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4731		1652	4746	1644	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4731		1652	4746	1644	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2413	54	49	1082	76	65
RTOR Reduction (vph)	1	0	0	0	26	0
Lane Group Flow (vph)	2466	0	49	1082	115	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	104.7		6.7	113.9	15.1	
Effective Green, g (s)	104.7		6.7	113.9	15.1	
Actuated g/C Ratio	0.75		0.05	0.81	0.11	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3538		79	3861	177	
v/s Ratio Prot	c0.52		c0.03	0.23	c0.07	
v/s Ratio Perm						
v/c Ratio	0.70		0.62	0.28	0.65	
Uniform Delay, d1	9.3		65.4	3.2	59.9	
Progression Factor	0.53		0.86	0.97	1.00	
Incremental Delay, d2	0.9		13.6	0.2	8.3	
Delay (s)	5.8		69.8	3.2	68.2	
Level of Service	A		E	A	E	
Approach Delay (s)	5.8			6.1	68.2	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	8.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

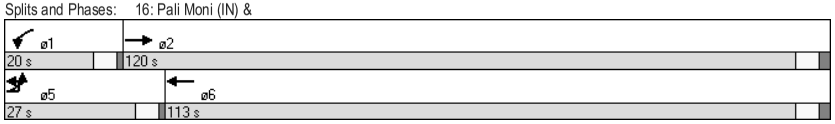
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	195	2115	45	1025
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	27.0	120.0	20.0	113.0
Total Split (%)	19.3%	85.7%	14.3%	80.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 127 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	2115	15	45	1025	175	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4741		1652	4643							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4741		1652	4643							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	212	2299	16	49	1114	190	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	212	2315	0	49	1291	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	14.6	120.6		8.4	114.4							
Effective Green, g (s)	14.6	120.6		8.4	114.4							
Actuated g/C Ratio	0.10	0.86		0.06	0.82							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	334	4084		99	3794							
v/s Ratio Prot	c0.07	c0.49		0.03	0.28							
v/s Ratio Perm												
v/c Ratio	0.63	0.57		0.49	0.34							
Uniform Delay, d1	60.1	2.6		63.7	3.2							
Progression Factor	0.83	0.53		0.95	0.39							
Incremental Delay, d2	2.9	0.4		3.6	0.2							
Delay (s)	52.9	1.8		64.4	1.5							
Level of Service	D	A		E	A							
Approach Delay (s)		6.1			3.8			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	53.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

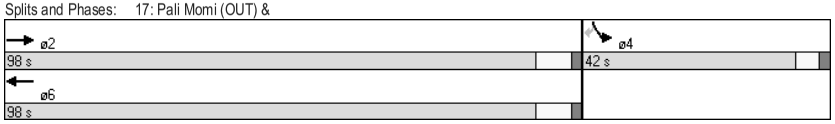
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	2005	1160	315	75
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	98.0	98.0	42.0	42.0
Total Split (%)	70.0%	70.0%	30.0%	30.0%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 7 (5%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	2005	1160	0	315	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.93
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1421
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1421
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2179	1261	0	342	82
RTOR Reduction (vph)	0	0	0	0	0	59
Lane Group Flow (vph)	0	2179	1261	0	342	23
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		90.0	90.0		36.0	36.0
Effective Green, g (s)		90.0	90.0		36.0	36.0
Actuated g/C Ratio		0.64	0.64		0.26	0.26
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3051	3051		853	365
v/s Ratio Prot		c0.46	0.27		c0.10	
v/s Ratio Perm						0.02
v/c Ratio		0.71	0.41		0.40	0.06
Uniform Delay, d1		16.5	12.2		43.1	39.3
Progression Factor		0.28	1.00		1.00	1.00
Incremental Delay, d2		1.2	0.4		1.4	0.3
Delay (s)		5.9	12.6		44.5	39.6
Level of Service		A	B		D	D
Approach Delay (s)		5.9	12.6		43.5	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	12.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1225	25	0	1955	0	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1332	27	0	2125	0	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.52	
vC, conflicting volume			1359		2408	679
vC1, stage 1 conf vol					1345	
vC2, stage 2 conf vol					1062	
vCu, unblocked vol			1359		1863	679
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	94
cM capacity (veh/h)			502		188	394

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	888	471	1062	1062	22
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	22
cSH	1700	1700	1700	1700	394
Volume to Capacity	0.52	0.28	0.63	0.63	0.06
Queue Length 95th (ft)	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	14.7
Lane LOS					B
Approach Delay (s)	0.0		0.0		14.7
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		

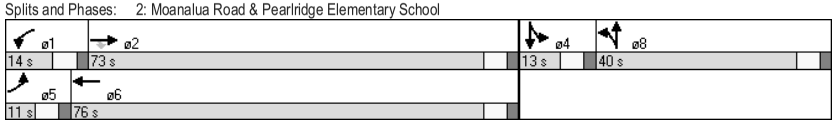
Timings
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	55	1145	65	45	1675	215	5	85	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	40.0	40.0	10.0	10.0
Total Split (s)	11.0	73.0	73.0	14.0	76.0	40.0	40.0	13.0	13.0
Total Split (%)	7.9%	52.1%	52.1%	10.0%	54.3%	28.6%	28.6%	9.3%	9.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 119 (85%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	1145	65	45	1675	80	215	5	60	85	5	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3515		1681	1610		1770	1603	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3515		1681	1610		1770	1603	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	1245	71	49	1821	87	234	5	65	92	5	65
RTOR Reduction (vph)	0	0	15	0	2	0	0	23	0	0	62	0
Lane Group Flow (vph)	60	1245	56	49	1906	0	157	124	0	92	8	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	5.0	84.2	84.2	6.4	85.6		18.4	18.4		7.0	7.0	
Effective Green, g (s)	5.0	84.2	84.2	6.4	85.6		18.4	18.4		7.0	7.0	
Actuated g/C Ratio	0.04	0.60	0.60	0.05	0.61		0.13	0.13		0.05	0.05	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	63	2128	952	81	2149		221	212		89	80	
v/s Ratio Prot	c0.03	0.35		0.03	c0.54		c0.09	0.08		c0.05	0.01	
v/s Ratio Perm			0.04									
v/c Ratio	0.95	0.59	0.06	0.60	0.89		0.71	0.58		1.03	0.10	
Uniform Delay, d1	67.4	17.2	11.5	65.6	23.1		58.2	57.2		66.5	63.5	
Progression Factor	1.00	1.00	1.00	1.05	0.60		1.00	1.00		1.00	1.00	
Incremental Delay, d2	96.0	1.2	0.1	7.9	3.9		10.3	4.0		104.9	0.6	
Delay (s)	163.3	18.3	11.6	76.7	17.7		68.5	61.2		171.4	64.1	
Level of Service	F	B	B	E	B		E	E		F	E	
Approach Delay (s)		24.3			19.1			65.0			125.0	
Approach LOS		C			B			E			F	

Intersection Summary				
HCM Average Control Delay	29.2	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.83			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	73.4%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

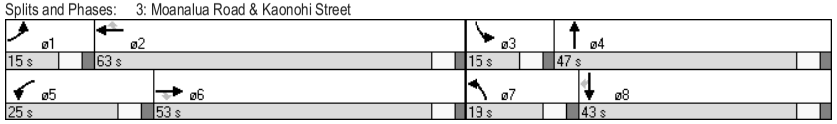
Timings
3: Moanalua Road & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	205	890	190	175	1355	280	305	160	120	110	140
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	15.0	53.0	53.0	25.0	63.0	63.0	19.0	47.0	15.0	43.0	43.0
Total Split (%)	10.7%	37.9%	37.9%	17.9%	45.0%	45.0%	13.6%	33.6%	10.7%	30.7%	30.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 136 (97%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 135
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	890	190	175	1355	280	305	160	140	120	110	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3292		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3292		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	967	207	190	1473	304	332	174	152	130	120	152
RTOR Reduction (vph)	0	0	103	0	0	119	0	132	0	0	0	134
Lane Group Flow (vph)	223	967	104	190	1473	185	332	194	0	130	120	18
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	9.0	70.6	70.6	18.0	79.6	79.6	13.0	18.7		8.7	14.4	14.4
Effective Green, g (s)	9.0	70.6	70.6	18.0	79.6	79.6	13.0	18.7		8.7	14.4	14.4
Actuated g/C Ratio	0.06	0.50	0.50	0.13	0.57	0.57	0.09	0.13		0.06	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	221	1785	798	228	2012	900	319	440		213	192	163
v/s Ratio Prot	0.06	0.27		c0.11	c0.42		c0.10	c0.06		0.04	c0.06	
v/s Ratio Perm			0.07			0.12						0.01
v/c Ratio	1.01	0.54	0.13	0.83	0.73	0.21	1.04	0.44		0.61	0.62	0.11
Uniform Delay, d1	65.5	23.7	18.4	59.5	22.3	14.8	63.5	55.8		64.0	60.2	57.0
Progression Factor	1.15	0.53	0.10	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	56.6	1.0	0.3	22.7	2.4	0.5	61.4	0.7		5.1	6.2	0.3
Delay (s)	132.2	13.4	2.1	82.2	24.7	15.3	124.9	56.6		69.1	66.4	57.3
Level of Service	F	B	A	F	C	B	F	E		E	E	E
Approach Delay (s)		30.7			28.8			91.0			63.8	
Approach LOS		C			C			F			E	

Intersection Summary			
HCM Average Control Delay	41.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	30.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	90	0	0	70	0	540	40	0	405	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	98	0	0	76	0	587	43	0	440	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	696	1103	253	927	1114	168	505			630		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	696	1103	253	927	1114	168	505			630		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	87	100	100	91	100			100		
cM capacity (veh/h)	299	210	747	194	207	846	1055			948		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	98	76	168	168	168	127	293	212
Volume Left	0	0	0	0	0	0	0	0
Volume Right	98	76	0	0	0	43	0	65
cSH	747	846	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.09	0.10	0.10	0.10	0.07	0.17	0.12
Queue Length 95th (ft)	11	7	0	0	0	0	0	0
Control Delay (s)	10.5	9.7	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.5	9.7	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay		1.3		
Intersection Capacity Utilization		25.3%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	0	75	100	55	130	45	440	70	90	400	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	0	82	109	60	141	49	478	76	98	435	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.99	0.99		0.99	0.99	0.99				0.99		
vC, conflicting volume	1147	1291	226	1109	1261	277	451			554		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1124	1270	226	1086	1240	244	451			525		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	59	100	90	20	60	81	96			90		
cM capacity (veh/h)	80	142	778	135	149	747	1106			1026		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	33	82	168	141	49	319	236	98	290	161
Volume Left	33	0	109	0	49	0	0	98	0	0
Volume Right	0	82	0	141	0	0	76	0	0	16
cSH	80	778	140	747	1106	1700	1700	1026	1700	1700
Volume to Capacity	0.41	0.10	1.21	0.19	0.04	0.19	0.14	0.10	0.17	0.09
Queue Length 95th (ft)	41	9	249	17	3	0	0	8	0	0
Control Delay (s)	78.7	10.2	203.9	10.9	8.4	0.0	0.0	8.9	0.0	0.0
Lane LOS	F	B	F	B	A			A		
Approach Delay (s)	29.8		115.9		0.7			1.6		
Approach LOS	D		F							

Intersection Summary				
Average Delay		25.7		
Intersection Capacity Utilization		44.5%	ICU Level of Service	A
Analysis Period (min)		15		

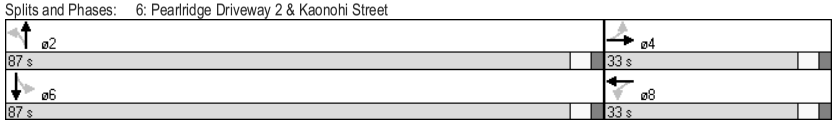
Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	35	0	155	35	190	450	55	510
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	87.0	87.0	87.0	87.0
Total Split (%)	27.5%	27.5%	27.5%	27.5%	72.5%	72.5%	72.5%	72.5%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 46.4
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	0	145	155	35	75	190	450	90	55	510	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.85		1.00	0.90		1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1583		1770	1672		1770	3451		1770	3519	
Flt Permitted	0.68	1.00		0.66	1.00		0.44	1.00		0.43	1.00	
Satd. Flow (perm)	1266	1583		1223	1672		811	3451		802	3519	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	0	158	168	38	82	207	489	98	60	554	22
RTOR Reduction (vph)	0	111	0	0	58	0	0	23	0	0	4	0
Lane Group Flow (vph)	38	47	0	168	62	0	207	564	0	60	572	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	13.4	13.4		13.4	13.4		22.0	22.0		22.0	22.0	
Effective Green, g (s)	13.4	13.4		13.4	13.4		22.0	22.0		22.0	22.0	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.48	0.48		0.48	0.48	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	374	467		361	493		393	1672		389	1705	
v/s Ratio Prot		0.03			0.04			0.16			0.16	
v/s Ratio Perm	0.03			c0.14			c0.26			0.07		
v/c Ratio	0.10	0.10		0.47	0.13		0.53	0.34		0.15	0.34	
Uniform Delay, d1	11.6	11.6		13.1	11.7		8.1	7.2		6.5	7.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		1.0	0.1		1.3	0.1		0.2	0.1	
Delay (s)	11.7	11.7		14.0	11.8		9.4	7.3		6.7	7.3	
Level of Service	B	B		B	B		A	A		A	A	
Approach Delay (s)		11.7			13.1			7.9			7.3	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	8.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	45.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	705	745	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	766	810	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	200	
pX, platoon unblocked	0.92	0.92	0.92			
vC, conflicting volume	1261	429	859			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1116	214	680			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	82	96	97			
cM capacity (veh/h)	181	729	838			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	277	511	540	319
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	290	838	1700	1700	1700
Volume to Capacity	0.22	0.03	0.30	0.32	0.19
Queue Length 95th (ft)	21	2	0	0	0
Control Delay (s)	20.9	1.0	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	20.9	0.4		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		44.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	705	760	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	766	826	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked						
vC, conflicting volume	1274	424	848			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1274	424	848			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	89	90	97			
cM capacity (veh/h)	153	579	785			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	283	511	551	297
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	22
cSH	363	785	1700	1700	1700
Volume to Capacity	0.21	0.03	0.30	0.32	0.17
Queue Length 95th (ft)	19	3	0	0	0
Control Delay (s)	17.5	1.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	17.5	0.5		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		48.6%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/7/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	685	50	30	785
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	745	54	33	853
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1121	399			799	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1121	399			799	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	60	92			96	
cM capacity (veh/h)	192	600			819	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	496	303	203	341	341
Volume Left	76	0	0	33	0	0
Volume Right	49	0	54	0	0	0
cSH	262	1700	1700	819	1700	1700
Volume to Capacity	0.48	0.29	0.18	0.04	0.20	0.20
Queue Length 95th (ft)	60	0	0	3	0	0
Control Delay (s)	30.7	0.0	0.0	1.9	0.0	0.0
Lane LOS	D			A		
Approach Delay (s)	30.7	0.0		0.4		
Approach LOS	D					

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	50.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	110	120	710	795	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	120	130	772	864	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1541	318	864			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1541	318	864			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	57	82	83			
cM capacity (veh/h)	88	678	774			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	158	130	386	386	346	346	233
Volume Left	38	130	0	0	0	0	0
Volume Right	120	0	0	0	0	0	60
cSH	259	774	1700	1700	1700	1700	1700
Volume to Capacity	0.61	0.17	0.23	0.23	0.20	0.20	0.14
Queue Length 95th (ft)	91	15	0	0	0	0	0
Control Delay (s)	38.3	10.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	B					
Approach Delay (s)	38.3	1.5			0.0		
Approach LOS	E						

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

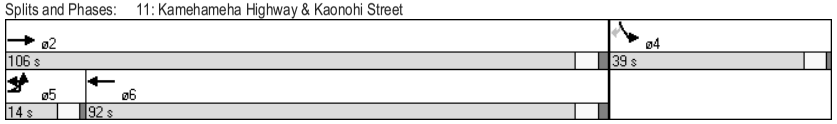
Timings
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	275	1215	3530	375	520
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	28.0	28.0	39.0	39.0
Total Split (s)	14.0	106.0	92.0	39.0	39.0
Total Split (%)	9.7%	73.1%	63.4%	26.9%	26.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 105 (72%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	275	1215	3530	545	375	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		0.94	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4727		3304	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4727		3304	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	299	1321	3837	592	408	565
RTOR Reduction (vph)	0	0	13	0	75	81
Lane Group Flow (vph)	299	1321	4416	0	587	230
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	9.0	103.7	89.7		30.3	30.3
Effective Green, g (s)	9.0	103.7	89.7		30.3	30.3
Actuated g/C Ratio	0.06	0.72	0.62		0.21	0.21
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	213	3637	2924		690	301
v/s Ratio Prot	c0.09	0.26	c0.93		c0.18	
v/s Ratio Perm						0.16
v/c Ratio	1.40	0.36	1.51		0.85	0.76
Uniform Delay, d1	68.0	7.9	27.6		55.2	54.0
Progression Factor	0.87	0.87	0.72		1.00	1.00
Incremental Delay, d2	206.3	0.3	229.7		9.8	10.9
Delay (s)	265.4	7.2	249.8		65.0	64.8
Level of Service	F	A	F		E	E
Approach Delay (s)		54.9	249.8		65.0	
Approach LOS		D	F		E	

Intersection Summary			
HCM Average Control Delay	179.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	123.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

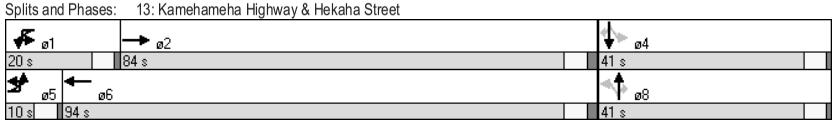
Timings
13: Kamehameha Highway & Hekaha Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1095	185	2945	230	45	225	65	45	95
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	33.0	10.0	33.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	10.0	84.0	20.0	94.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	6.9%	57.9%	13.8%	64.8%	28.3%	28.3%	28.3%	28.3%	28.3%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 43 (30%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1095	145	185	2945	75	230	45	225	65	45	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4648		3204	4726			1728	1443		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.63	1.00		0.40	1.00
Satd. Flow (perm)	1652	4648		3204	4726			1130	1443		690	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1190	158	201	3201	82	250	49	245	71	49	103
RTOR Reduction (vph)	0	11	0	0	2	0	0	0	129	0	0	47
Lane Group Flow (vph)	54	1337	0	201	3281	0	0	299	116	0	120	56
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	79.5		13.5	88.0			36.0	36.0		36.0	36.0
Effective Green, g (s)	5.0	79.5		13.5	88.0			36.0	36.0		36.0	36.0
Actuated g/C Ratio	0.03	0.55		0.09	0.61			0.25	0.25		0.25	0.25
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	57	2548		298	2868			281	358		171	367
v/s Ratio Prot	0.03	0.29		c0.06	c0.69							
v/s Ratio Perm								c0.26	0.08		0.17	0.04
v/c Ratio	0.95	0.52		0.67	1.14			1.06	0.33		0.70	0.15
Uniform Delay, d1	69.9	20.8		63.6	28.5			54.5	44.6		49.6	42.6
Progression Factor	1.15	0.70		1.24	0.64			1.00	1.00		1.00	1.00
Incremental Delay, d2	93.3	0.7		0.6	65.3			71.6	0.5		12.3	0.2
Delay (s)	173.6	15.3		79.6	83.5			126.1	45.1		61.9	42.8
Level of Service	F	B		E	F			F	D		E	D
Approach Delay (s)		21.4			83.3			89.6			53.0	
Approach LOS		C			F			F			D	

Intersection Summary			
HCM Average Control Delay	67.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

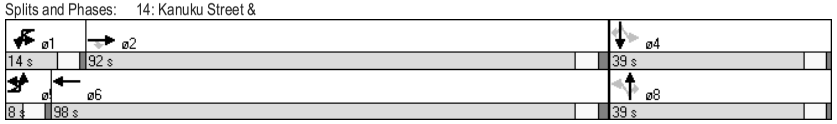
Timings
14: Kanuku Street &

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1250	75	90	3370	90	15	55	60	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	92.0	92.0	14.0	98.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	5.5%	63.4%	63.4%	9.7%	67.6%	26.9%	26.9%	26.9%	26.9%	26.9%	26.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 39 (27%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1250	75	90	3370	215	90	15	55	60	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1431	3204	4697			1698	1531		1671	1429
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.66	1.00		0.56	1.00
Satd. Flow (perm)	1652	4746	1431	3204	4697			1177	1531		978	1429
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1359	82	98	3663	234	98	16	60	65	16	38
RTOR Reduction (vph)	0	0	24	0	3	0	0	0	52	0	0	32
Lane Group Flow (vph)	38	1359	58	98	3894	0	0	114	8	0	81	6
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	101.7	101.7	8.5	107.2			18.8	18.8		18.8	18.8
Effective Green, g (s)	3.0	101.7	101.7	8.5	107.2			18.8	18.8		18.8	18.8
Actuated g/C Ratio	0.02	0.70	0.70	0.06	0.74			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	34	3329	1004	188	3473			153	199		127	185
v/s Ratio Prot	c0.02	0.29		0.03	c0.83							
v/s Ratio Perm			0.04					c0.10	0.01		0.08	0.00
v/c Ratio	1.12	0.41	0.06	0.52	1.12			0.75	0.04		0.64	0.03
Uniform Delay, d1	71.0	9.1	6.7	66.3	18.9			60.8	55.2		59.9	55.1
Progression Factor	0.92	0.53	0.30	1.09	0.37			1.00	1.00		1.00	1.00
Incremental Delay, d2	179.9	0.3	0.1	0.2	54.9			17.7	0.1		10.1	0.1
Delay (s)	245.5	5.1	2.1	72.3	62.0			78.5	55.3		69.9	55.2
Level of Service	F	A	A	E	E			E	E		E	E
Approach Delay (s)		11.1			62.2			70.5			65.2	
Approach LOS		B			E			E			E	

Intersection Summary			
HCM Average Control Delay	49.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

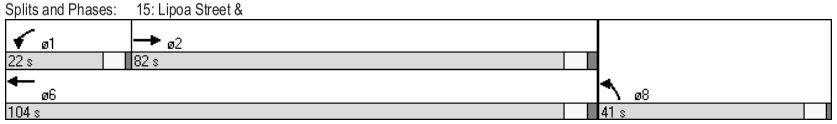
Timings
15: Lipoa Street &

7/7/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1405	95	3685	155
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	82.0	22.0	104.0	41.0
Total Split (%)	56.6%	15.2%	71.7%	28.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 43 (30%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1405	55	95	3685	155	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5056		1652	4746	1745	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5056		1652	4746	1745	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1527	60	103	4005	168	38
RTOR Reduction (vph)	2	0	0	0	6	0
Lane Group Flow (vph)	1585	0	103	4005	200	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	93.4		13.7	112.1	21.9	
Effective Green, g (s)	93.4		13.7	112.1	21.9	
Actuated g/C Ratio	0.64		0.09	0.77	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3257		156	3669	264	
v/s Ratio Prot	0.31		0.06	c0.84	c0.11	
v/s Ratio Perm						
v/c Ratio	0.49		0.66	1.09	0.76	
Uniform Delay, d1	13.4		63.4	16.5	59.0	
Progression Factor	1.07		1.10	0.42	1.00	
Incremental Delay, d2	0.5		4.8	43.8	11.7	
Delay (s)	14.8		74.4	50.7	70.8	
Level of Service	B		E	D	E	
Approach Delay (s)	14.8			51.2	70.8	
Approach LOS	B			D	E	

Intersection Summary			
HCM Average Control Delay	42.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	91.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

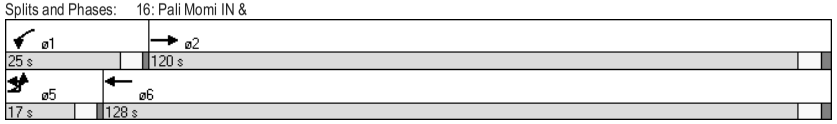
Timings
16: Pali Momi IN &

7/7/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	240	1155	120	3250
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	17.0	120.0	25.0	128.0
Total Split (%)	11.7%	82.8%	17.2%	88.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 126 (87%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	240	1155	30	120	3250	380	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4728		1652	4625							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4728		1652	4625							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	261	1255	33	130	3533	413	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	2	0	0	0	0	0	0	0
Lane Group Flow (vph)	261	1286	0	130	3944	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	12.0	117.9		16.1	122.0							
Effective Green, g (s)	12.0	117.9		16.1	122.0							
Actuated g/C Ratio	0.08	0.81		0.11	0.84							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	265	3844		183	3891							
v/s Ratio Prot	c0.08	0.27		0.08	c0.85							
v/s Ratio Perm												
v/c Ratio	0.98	0.33		0.71	1.01							
Uniform Delay, d1	66.4	3.5		62.2	11.5							
Progression Factor	0.99	0.60		1.08	0.44							
Incremental Delay, d2	47.6	0.2		3.0	10.6							
Delay (s)	113.5	2.3		69.9	15.7							
Level of Service	F	A		E	B							
Approach Delay (s)		21.0			17.4			0.0			0.0	
Approach LOS		C			B			A			A	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

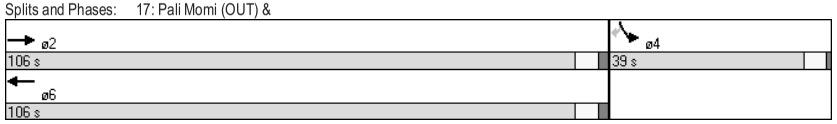
Timings
17: Pali Momi (OUT) &

7/7/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1155	3515	305	140
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	106.0	106.0	39.0	39.0
Total Split (%)	73.1%	73.1%	26.9%	26.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 135 (93%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1155	3515	0	305	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.87
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1330
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1330
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1255	3821	0	332	152
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1255	3821	0	332	152
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		111.8	111.8		22.2	22.2
Effective Green, g (s)		111.8	111.8		22.2	22.2
Actuated g/C Ratio		0.77	0.77		0.15	0.15
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3659	3659		508	204
v/s Ratio Prot		0.26	c0.81		0.10	
v/s Ratio Perm						c0.11
v/c Ratio		0.34	1.04		0.65	0.75
Uniform Delay, d1		5.2	16.6		57.8	58.7
Progression Factor		0.88	1.00		1.00	1.00
Incremental Delay, d2		0.2	28.1		3.0	13.7
Delay (s)		4.8	44.7		60.8	72.4
Level of Service		A	D		E	E
Approach Delay (s)		4.8	44.7		64.4	
Approach LOS		A	D		E	

Intersection Summary			
HCM Average Control Delay	37.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	104.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1655	25	0	1645	0	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1799	27	0	1788	0	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.75	
vC, conflicting volume			1826		2707	913
vC1, stage 1 conf vol					1812	
vC2, stage 2 conf vol					894	
vCu, unblocked vol			1826		2609	913
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	70
cM capacity (veh/h)			331		110	276

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1199	627	894	894	82
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	82
cSH	1700	1700	1700	1700	276
Volume to Capacity	0.71	0.37	0.53	0.53	0.30
Queue Length 95th (ft)	0	0	0	0	30
Control Delay (s)	0.0	0.0	0.0	0.0	23.4
Lane LOS					C
Approach Delay (s)	0.0		0.0		23.4
Approach LOS					C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	57.9%	ICU Level of Service	B
Analysis Period (min)	15		

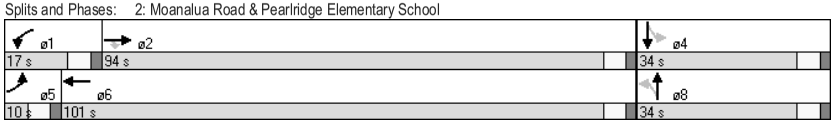
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	5	1605	125	60	1465	225	5	15	5
Turn Type	Prot		Perm	Prot		Perm		Perm	
Protected Phases	5	2		1	6		8		4
Permitted Phases			2			8		4	
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	10.0	94.0	94.0	17.0	101.0	34.0	34.0	34.0	34.0
Total Split (%)	6.9%	64.8%	64.8%	11.7%	69.7%	23.4%	23.4%	23.4%	23.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 52 (36%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1605	125	60	1465	15	225	5	80	15	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3534		1681	1593		1770	1650	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.74	0.85		0.46	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3534		1316	1383		855	1650	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1745	136	65	1592	16	245	5	87	16	5	16
RTOR Reduction (vph)	0	0	22	0	0	0	0	29	0	0	13	0
Lane Group Flow (vph)	5	1745	114	65	1608	0	174	134	0	16	8	0
Turn Type	Prot		Perm	Prot			Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		
Actuated Green, G (s)	0.8	95.4	95.4	8.3	102.9		23.3	23.3		23.3	23.3	
Effective Green, g (s)	0.8	95.4	95.4	8.3	102.9		23.3	23.3		23.3	23.3	
Actuated g/C Ratio	0.01	0.66	0.66	0.06	0.71		0.16	0.16		0.16	0.16	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	10	2328	1042	101	2508		211	222		137	265	
v/s Ratio Prot	0.00	c0.49		c0.04	c0.45						0.00	
v/s Ratio Perm			0.07				c0.13	0.10		0.02		
v/c Ratio	0.50	0.75	0.11	0.64	0.64		0.82	0.60		0.12	0.03	
Uniform Delay, d1	71.9	16.7	9.1	66.9	11.2		58.9	56.5		52.0	51.3	
Progression Factor	1.00	1.00	1.00	0.81	0.93		1.00	1.00		1.00	1.00	
Incremental Delay, d2	34.4	2.3	0.2	10.4	1.0		22.3	4.5		0.4	0.0	
Delay (s)	106.3	19.0	9.4	64.4	11.5		81.1	61.1		52.4	51.4	
Level of Service	F	B	A	E	B		F	E		D	D	
Approach Delay (s)		18.5			13.5			71.4			51.8	
Approach LOS		B			B			E			D	

Intersection Summary			
HCM Average Control Delay	21.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

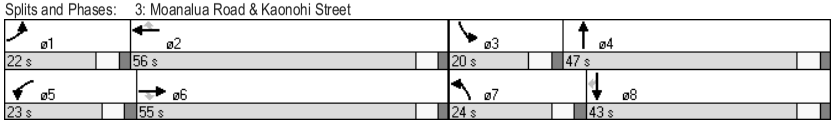
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	145	1200	350	200	1015	210	320	175	190	155	195
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	22.0	55.0	55.0	23.0	56.0	56.0	24.0	47.0	20.0	43.0	43.0
Total Split (%)	15.2%	37.9%	37.9%	15.9%	38.6%	38.6%	16.6%	32.4%	13.8%	29.7%	29.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 144 (99%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1200	350	200	1015	210	320	175	310	190	155	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3200		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3200		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	1304	380	217	1103	228	348	190	337	207	168	212
RTOR Reduction (vph)	0	0	180	0	0	114	0	197	0	0	0	185
Lane Group Flow (vph)	158	1304	200	217	1103	114	348	330	0	207	168	27
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	12.0	67.7	67.7	17.0	72.7	72.7	17.5	23.4		12.9	18.8	18.8
Effective Green, g (s)	12.0	67.7	67.7	17.0	72.7	72.7	17.5	23.4		12.9	18.8	18.8
Actuated g/C Ratio	0.08	0.47	0.47	0.12	0.50	0.50	0.12	0.16		0.09	0.13	0.13
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	284	1652	739	208	1774	794	414	516		305	242	205
v/s Ratio Prot	0.05	c0.37		c0.12	c0.31		c0.10	c0.10		0.06	0.09	
v/s Ratio Perm			0.13			0.07						0.02
v/c Ratio	0.56	0.79	0.27	1.04	0.62	0.14	0.84	0.64		0.68	0.69	0.13
Uniform Delay, d1	63.9	32.6	23.6	64.0	26.2	19.4	62.4	56.9		64.0	60.4	55.9
Progression Factor	1.39	0.53	0.30	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.6	2.7	0.6	74.2	1.7	0.4	14.2	2.6		5.9	8.3	0.3
Delay (s)	90.3	20.0	7.7	138.2	27.8	19.8	76.6	59.5		69.9	68.7	56.2
Level of Service	F	C	A	F	C	B	E	E		E	E	E
Approach Delay (s)		23.5			42.1			66.3			64.6	
Approach LOS		C			D			E			E	

Intersection Summary				
HCM Average Control Delay	42.1	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.87			
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	84.5%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	75	0	0	160	0	660	95	0	615	95
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	82	0	0	174	0	717	103	0	668	103
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	1073	1541	386	1185	1541	231	772			821		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1073	1541	386	1185	1541	231	772			821		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	87	100	100	77	100			100		
cM capacity (veh/h)	135	114	612	125	114	771	839			804		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	82	174	205	205	205	206	446	326
Volume Left	0	0	0	0	0	0	0	0
Volume Right	82	174	0	0	0	103	0	103
cSH	612	771	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.23	0.12	0.12	0.12	0.12	0.26	0.19
Queue Length 95th (ft)	11	22	0	0	0	0	0	0
Control Delay (s)	11.8	11.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	B						
Approach Delay (s)	11.8	11.0	0.0				0.0	
Approach LOS	B	B						

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	31.3%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	40	0	70	100	50	125	50	575	125	155	530	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	0	76	109	54	136	54	625	136	168	576	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.95	0.95		0.95	0.95	0.95				0.95		
vC, conflicting volume	1508	1793	299	1503	1736	380	598			761		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1435	1734	299	1429	1674	252	598			651		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	100	89	0	21	81	94			81		
cM capacity (veh/h)	21	63	697	66	69	713	975			888		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	43	76	163	136	54	417	344	168	384	214
Volume Left	43	0	109	0	54	0	0	168	0	0
Volume Right	0	76	0	136	0	0	136	0	0	22
cSH	21	697	67	713	975	1700	1700	888	1700	1700
Volume to Capacity	2.02	0.11	2.43	0.19	0.06	0.25	0.20	0.19	0.23	0.13
Queue Length 95th (ft)	141	9	396	17	4	0	0	17	0	0
Control Delay (s)	857.1	10.8	783.8	11.2	8.9	0.0	0.0	10.0	0.0	0.0
Lane LOS	F	B	F	B	A			B		
Approach Delay (s)	318.6		432.6		0.6			2.2		
Approach LOS	F		F							

Intersection Summary				
Average Delay		84.8		
Intersection Capacity Utilization		53.3%	ICU Level of Service	A
Analysis Period (min)		15		

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	35	10	190	55	205	560	145	550
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	47.0	47.0	47.0	47.0
Total Split (%)	41.3%	41.3%	41.3%	41.3%	58.8%	58.8%	58.8%	58.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 52.3
Natural Cycle: 65
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	10	140	190	55	135	205	560	220	145	550	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.89		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1602		1770	1664		1770	3390		1770	3525	
Flt Permitted	0.63	1.00		0.65	1.00		0.41	1.00		0.29	1.00	
Satd. Flow (perm)	1170	1602		1218	1664		763	3390		536	3525	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	11	152	207	60	147	223	609	239	158	598	16
RTOR Reduction (vph)	0	105	0	0	102	0	0	55	0	0	3	0
Lane Group Flow (vph)	38	58	0	207	105	0	223	793	0	158	611	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	15.6	15.6		15.6	15.6		25.3	25.3		25.3	25.3	
Effective Green, g (s)	15.6	15.6		15.6	15.6		25.3	25.3		25.3	25.3	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.50	0.50		0.50	0.50	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	359	491		373	510		379	1685		266	1752	
v/s Ratio Prot		0.04			0.06			0.23			0.17	
v/s Ratio Perm	0.03			c0.17			0.29			c0.29		
v/c Ratio	0.11	0.12		0.55	0.21		0.59	0.47		0.59	0.35	
Uniform Delay, d1	12.7	12.7		14.7	13.1		9.1	8.4		9.1	7.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		1.8	0.2		2.3	0.2		3.5	0.1	
Delay (s)	12.8	12.8		16.5	13.3		11.4	8.6		12.7	7.9	
Level of Service	B	B		B	B		B	A		B	A	
Approach Delay (s)		12.8			14.9			9.2			8.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	10.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	50.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	25	45	25	955	750	115
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	49	27	1038	815	125
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.91	0.91	0.91			
vC, conflicting volume	1451	470	940			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1293	212	730			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	80	93	97			
cM capacity (veh/h)	135	720	789			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	373	692	543	397
Volume Left	27	27	0	0	0
Volume Right	49	0	0	0	125
cSH	283	789	1700	1700	1700
Volume to Capacity	0.27	0.03	0.41	0.32	0.23
Queue Length 95th (ft)	26	3	0	0	0
Control Delay (s)	22.3	1.1	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	22.3	0.4		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	90	45	970	795	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	98	49	1054	864	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked						
vC, conflicting volume	1505	448	897			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1505	448	897			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	69	82	94			
cM capacity (veh/h)	105	558	753			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	130	400	703	576	321
Volume Left	33	49	0	0	0
Volume Right	98	0	0	0	33
cSH	268	753	1700	1700	1700
Volume to Capacity	0.49	0.06	0.41	0.34	0.19
Queue Length 95th (ft)	62	5	0	0	0
Control Delay (s)	30.6	2.0	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	30.6	0.7		0.0	
Approach LOS	D				

Intersection Summary				
Average Delay		2.2		
Intersection Capacity Utilization		68.3%	ICU Level of Service	C
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	80	920	85	45	745
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	87	1000	92	49	810
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1414	546			1092	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1414	546			1092	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	36	82			92	
cM capacity (veh/h)	119	482			635	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	163	667	426	211	324	324
Volume Left	76	0	0	49	0	0
Volume Right	87	0	92	0	0	0
cSH	198	1700	1700	635	1700	1700
Volume to Capacity	0.82	0.39	0.25	0.08	0.19	0.19
Queue Length 95th (ft)	148	0	0	6	0	0
Control Delay (s)	74.2	0.0	0.0	3.3	0.0	0.0
Lane LOS	F			A		
Approach Delay (s)	74.2	0.0		0.8		
Approach LOS	F					

Intersection Summary				
Average Delay		6.1		
Intersection Capacity Utilization		62.2%	ICU Level of Service	B
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	110	90	955	830	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	120	98	1038	902	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1652	336	902			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1652	336	902			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	37	82	87			
cM capacity (veh/h)	78	660	749			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	98	519	519	361	361	251
Volume Left	49	98	0	0	0	0	0
Volume Right	120	0	0	0	0	0	71
cSH	208	749	1700	1700	1700	1700	1700
Volume to Capacity	0.81	0.13	0.31	0.31	0.21	0.21	0.15
Queue Length 95th (ft)	147	11	0	0	0	0	0
Control Delay (s)	70.0	10.5	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	70.0	0.9			0.0		
Approach LOS	F						

Intersection Summary				
Average Delay		5.6		
Intersection Capacity Utilization		42.3%	ICU Level of Service	A
Analysis Period (min)		15		

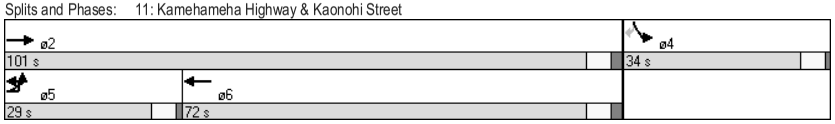
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	520	1740	1465	495	445
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	33.0	33.0
Total Split (s)	29.0	101.0	72.0	34.0	34.0
Total Split (%)	21.5%	74.8%	53.3%	25.2%	25.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 63 (47%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 120
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	520	1740	1465	525	495	445
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.96		0.98	0.89
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.96		0.96	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4549		3274	1288
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4549		3274	1288
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	565	1891	1592	571	538	484
RTOR Reduction (vph)	0	0	48	0	22	233
Lane Group Flow (vph)	565	1891	2115	0	681	86
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	24.0	95.0	66.0		29.0	29.0
Effective Green, g (s)	24.0	95.0	66.0		29.0	29.0
Actuated g/C Ratio	0.18	0.70	0.49		0.21	0.21
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	570	3340	2224		703	277
v/s Ratio Prot	c0.18	0.40	c0.46		c0.21	
v/s Ratio Perm						0.07
v/c Ratio	0.99	0.57	0.95		0.97	0.31
Uniform Delay, d1	55.4	9.9	33.0		52.6	44.6
Progression Factor	0.84	1.66	0.66		1.00	1.00
Incremental Delay, d2	31.6	0.6	8.8		26.0	0.6
Delay (s)	78.3	17.0	30.6		78.6	45.2
Level of Service	E	B	C		E	D
Approach Delay (s)		31.1	30.6		68.2	
Approach LOS		C	C		E	

Intersection Summary			
HCM Average Control Delay	37.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

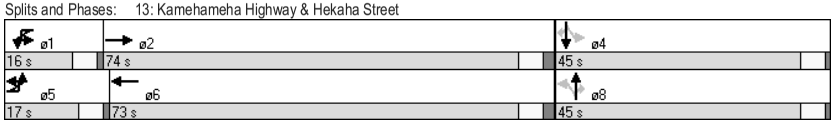
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	95	1735	220	1640	210	55	310	90	40	140
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	17.0	74.0	16.0	73.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	12.6%	54.8%	11.9%	54.1%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 33 (24%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	95	1735	285	220	1640	65	210	55	310	90	40	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4631		3204	4714			1699	1531		1680	1415
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.41	1.00
Satd. Flow (perm)	1652	4631		3204	4714			1095	1531		715	1415
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	103	1886	310	239	1783	71	228	60	337	98	43	152
RTOR Reduction (vph)	0	16	0	0	3	0	0	0	115	0	0	110
Lane Group Flow (vph)	103	2180	0	239	1851	0	0	288	222	0	141	42
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	11.3	70.3		11.0	70.0			37.7	37.7		37.7	37.7
Effective Green, g (s)	11.3	70.3		11.0	70.0			37.7	37.7		37.7	37.7
Actuated g/C Ratio	0.08	0.52		0.08	0.52			0.28	0.28		0.28	0.28
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	138	2412		261	2444			306	428		200	395
v/s Ratio Prot	0.06	c0.47		c0.07	0.39							
v/s Ratio Perm								c0.26	0.15		0.20	0.03
v/c Ratio	0.75	0.90		0.92	0.76			0.94	0.52		0.70	0.11
Uniform Delay, d1	60.4	29.3		61.5	25.8			47.6	41.0		43.7	36.1
Progression Factor	0.85	0.74		1.34	0.30			1.00	1.00		1.00	1.00
Incremental Delay, d2	10.6	3.3		27.8	1.7			36.0	1.1		10.7	0.1
Delay (s)	62.3	25.0		110.3	9.3			83.6	42.1		54.4	36.3
Level of Service	E	C		F	A			F	D		D	D
Approach Delay (s)		26.7			20.9			61.2			45.0	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM Average Control Delay	29.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	102.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

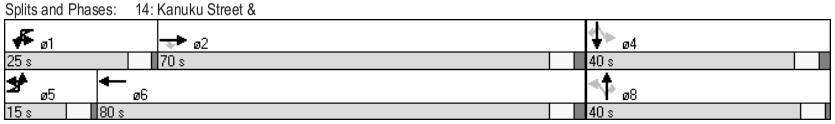
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	75	1875	105	105	1725	65	20	70	120	15	75
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	25.0	28.0	23.0	23.0	23.0	40.0	40.0	40.0
Total Split (s)	15.0	70.0	70.0	25.0	80.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	11.1%	51.9%	51.9%	18.5%	59.3%	29.6%	29.6%	29.6%	29.6%	29.6%	29.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 28 (21%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1875	105	105	1725	230	65	20	70	120	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4663			1734	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.57	1.00		0.65	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4663			1020	1531		1130	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	2038	114	114	1875	250	71	22	76	130	16	82
RTOR Reduction (vph)	0	0	23	0	10	0	0	0	63	0	0	69
Lane Group Flow (vph)	82	2038	91	114	2115	0	0	93	13	0	146	13
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	9.5	85.7	85.7	10.2	86.4			23.1	23.1		22.1	22.1
Effective Green, g (s)	9.5	85.7	85.7	10.2	86.4			23.1	23.1		22.1	22.1
Actuated g/C Ratio	0.07	0.63	0.63	0.08	0.64			0.17	0.17		0.16	0.16
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	116	3013	938	242	2984			175	262		185	242
v/s Ratio Prot	c0.05	0.43		0.04	c0.45							
v/s Ratio Perm			0.06					0.09	0.01		c0.13	0.01
v/c Ratio	0.71	0.68	0.10	0.47	0.71			0.53	0.05		0.79	0.06
Uniform Delay, d1	61.4	15.8	9.6	59.8	16.0			51.0	46.8		54.2	47.6
Progression Factor	0.84	0.95	1.45	1.22	0.40			1.00	1.00		1.00	1.00
Incremental Delay, d2	9.4	0.6	0.1	0.8	0.8			3.1	0.1		19.7	0.1
Delay (s)	60.7	15.6	14.0	73.9	7.2			54.1	46.9		73.9	47.7
Level of Service	E	B	B	E	A			D	D		E	D
Approach Delay (s)		17.1			10.6			50.8			64.5	
Approach LOS		B			B			D			E	

Intersection Summary			
HCM Average Control Delay	17.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

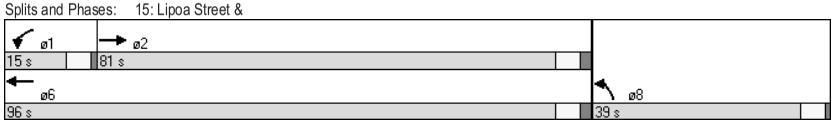
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1945	50	2030	160
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	81.0	15.0	96.0	39.0
Total Split (%)	60.0%	11.1%	71.1%	28.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 121 (90%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1945	65	50	2030	160	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4719		1652	4746	1670	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4719		1652	4746	1670	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2114	71	54	2207	174	76
RTOR Reduction (vph)	2	0	0	0	13	0
Lane Group Flow (vph)	2183	0	54	2207	237	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	87.1		7.6	99.7	24.3	
Effective Green, g (s)	87.1		7.6	99.7	24.3	
Actuated g/C Ratio	0.65		0.06	0.74	0.18	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3045		93	3505	301	
v/s Ratio Prot	c0.46		0.03	c0.46	c0.14	
v/s Ratio Perm						
v/c Ratio	0.72		0.58	0.63	0.79	
Uniform Delay, d1	15.8		62.1	8.6	52.9	
Progression Factor	0.93		1.27	0.40	1.00	
Incremental Delay, d2	1.1		6.6	0.6	12.7	
Delay (s)	15.7		85.7	4.1	65.6	
Level of Service	B		F	A	E	
Approach Delay (s)	15.7			6.1	65.6	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

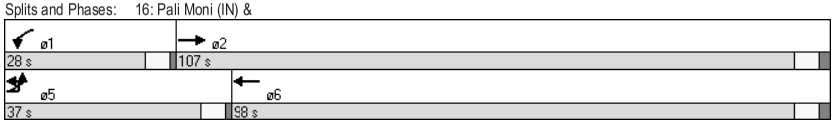
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	455	1470	145	1830
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	37.0	107.0	28.0	98.0
Total Split (%)	27.4%	79.3%	20.7%	72.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 94 (70%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	455	1470	50	145	1830	485	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4723		1652	4532							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4723		1652	4532							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	495	1598	54	158	1989	527	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	18	0	0	0	0	0	0	0
Lane Group Flow (vph)	495	1650	0	158	2498	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	26.0	106.2		17.8	98.0							
Effective Green, g (s)	26.0	106.2		17.8	98.0							
Actuated g/C Ratio	0.19	0.79		0.13	0.73							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	617	3715		218	3290							
v/s Ratio Prot	c0.15	0.35		0.10	c0.55							
v/s Ratio Perm												
v/c Ratio	0.80	0.44		0.72	0.76							
Uniform Delay, d1	52.0	4.7		56.2	11.3							
Progression Factor	0.68	1.21		1.08	0.43							
Incremental Delay, d2	5.3	0.3		9.1	1.3							
Delay (s)	40.6	6.0		69.8	6.2							
Level of Service	D	A		E	A							
Approach Delay (s)		14.0			9.9			0.0			0.0	
Approach LOS		B			A			A			A	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

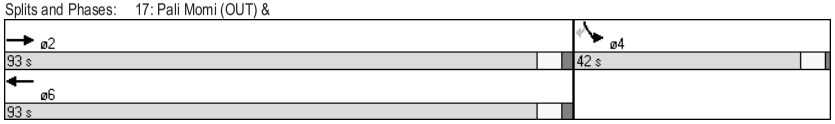
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1430	2115	340	185
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	93.0	93.0	42.0	42.0
Total Split (%)	68.9%	68.9%	31.1%	31.1%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 103 (76%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1430	2115	0	340	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1309
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1309
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1554	2299	0	370	201
RTOR Reduction (vph)	0	0	0	0	0	6
Lane Group Flow (vph)	0	1554	2299	0	370	195
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		98.5	98.5		25.5	25.5
Effective Green, g (s)		98.5	98.5		25.5	25.5
Actuated g/C Ratio		0.73	0.73		0.19	0.19
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3463	3463		627	247
v/s Ratio Prot		0.33	c0.48		0.11	
v/s Ratio Perm						c0.15
v/c Ratio		0.45	0.66		0.59	0.79
Uniform Delay, d1		7.3	9.6		50.0	52.2
Progression Factor		0.35	1.00		1.00	1.00
Incremental Delay, d2		0.4	1.0		1.5	15.2
Delay (s)		2.9	10.6		51.5	67.4
Level of Service		A	B		D	E
Approach Delay (s)		2.9	10.6		57.1	
Approach LOS		A	B		E	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Year 2017 with Project and Improvements

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1655	15	0	1155	0	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1799	16	0	1255	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.79	
vC, conflicting volume			1815		2435	908
vC1, stage 1 conf vol					1807	
vC2, stage 2 conf vol					628	
vCu, unblocked vol			1815		2287	908
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	84
cM capacity (veh/h)			334		112	278

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1199	616	628	628	43
Volume Left	0	0	0	0	0
Volume Right	0	16	0	0	43
cSH	1700	1700	1700	1700	278
Volume to Capacity	0.71	0.36	0.37	0.37	0.16
Queue Length 95th (ft)	0	0	0	0	14
Control Delay (s)	0.0	0.0	0.0	0.0	20.3
Lane LOS					C
Approach Delay (s)	0.0		0.0		20.3
Approach LOS					C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

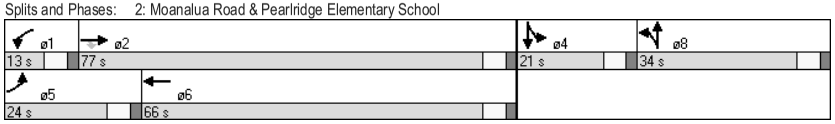
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	155	1465	100	50	820	70	5	130	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	24.0	77.0	77.0	13.0	66.0	34.0	34.0	21.0	21.0
Total Split (%)	16.6%	53.1%	53.1%	9.0%	45.5%	23.4%	23.4%	14.5%	14.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1465	100	50	820	205	70	5	35	130	5	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.90		1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3433		1681	1573		1770	1590	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3433		1681	1573		1770	1590	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	1592	109	54	891	223	76	5	38	141	5	207
RTOR Reduction (vph)	0	0	17	0	12	0	0	35	0	0	187	0
Lane Group Flow (vph)	168	1592	92	54	1102	0	62	22	0	141	25	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	16.8	90.4	90.4	5.6	79.2		10.7	10.7		14.3	14.3	
Effective Green, g (s)	16.8	90.4	90.4	5.6	79.2		10.7	10.7		14.3	14.3	
Actuated g/C Ratio	0.12	0.62	0.62	0.04	0.55		0.07	0.07		0.10	0.10	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	205	2206	987	68	1875		124	116		175	157	
v/s Ratio Prot	c0.09	c0.45		0.03	0.32		c0.04	0.01		c0.08	0.02	
v/s Ratio Perm			0.06									
v/c Ratio	0.82	0.72	0.09	0.79	0.59		0.50	0.19		0.81	0.16	
Uniform Delay, d1	62.6	18.7	10.9	69.1	22.0		64.6	63.1		64.0	59.9	
Progression Factor	1.00	1.00	1.00	1.03	0.60		1.00	1.00		1.00	1.00	
Incremental Delay, d2	21.9	2.1	0.2	42.7	1.2		3.1	0.8		23.0	0.5	
Delay (s)	84.5	20.8	11.1	114.2	14.4		67.7	63.9		87.0	60.3	
Level of Service	F	C	B	F	B		E	E		F	E	
Approach Delay (s)		25.9			19.0			65.9			71.0	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	29.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

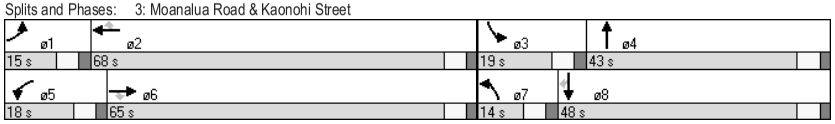
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	1230	200	125	745	95	85	85	280	255	235
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	15.0	65.0	65.0	18.0	68.0	68.0	14.0	43.0	19.0	48.0	48.0
Total Split (%)	10.3%	44.8%	44.8%	12.4%	46.9%	46.9%	9.7%	29.7%	13.1%	33.1%	33.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1230	200	125	745	95	85	85	125	280	255	235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3223		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3223		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1337	217	136	810	103	92	92	136	304	277	255
RTOR Reduction (vph)	0	0	103	0	0	49	0	115	0	0	0	169
Lane Group Flow (vph)	114	1337	114	136	810	54	92	113	0	304	277	86
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.7	73.2	73.2	12.0	76.5	76.5	7.7	22.8		13.0	28.1	28.1
Effective Green, g (s)	8.7	73.2	73.2	12.0	76.5	76.5	7.7	22.8		13.0	28.1	28.1
Actuated g/C Ratio	0.06	0.50	0.50	0.08	0.53	0.53	0.05	0.16		0.09	0.19	0.19
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	206	1787	799	146	1867	835	182	507		308	361	307
v/s Ratio Prot	0.03	c0.38		c0.08	c0.23		0.03	0.04		c0.09	c0.15	
v/s Ratio Perm			0.07			0.03						0.05
v/c Ratio	0.55	0.75	0.14	0.93	0.43	0.07	0.51	0.22		0.99	0.77	0.28
Uniform Delay, d1	66.3	28.6	19.2	66.1	21.0	16.8	66.8	53.4		65.9	55.4	49.8
Progression Factor	1.30	0.53	0.07	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.2	2.0	0.3	54.6	0.7	0.2	2.2	0.2		47.3	9.4	0.5
Delay (s)	88.7	17.1	1.5	120.7	21.7	16.9	69.0	53.6		113.2	64.8	50.3
Level of Service	F	B	A	F	C	B	E	D		F	E	D
Approach Delay (s)		20.0			34.1			58.0			78.0	
Approach LOS		C			C			E			E	

Intersection Summary				
HCM Average Control Delay	39.5	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.86			
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	78.5%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	15	0	0	10	0	295	20	0	535	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	16	0	0	11	0	321	22	0	582	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	705	957	323	639	978	91	647			342		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	705	957	323	639	978	91	647			342		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	100	100	99	100			100		
cM capacity (veh/h)	320	256	672	352	249	949	935			1213		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	16	11	92	92	92	68	388	259
Volume Left	0	0	0	0	0	0	0	0
Volume Right	16	11	0	0	0	22	0	65
cSH	672	949	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.01	0.05	0.05	0.05	0.04	0.23	0.15
Queue Length 95th (ft)	2	1	0	0	0	0	0	0
Control Delay (s)	10.5	8.8	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.5	8.8	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	26.7%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	5	20	15	0	30	35	280	15	30	495	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	5	22	16	0	33	38	304	16	33	538	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked												
vC, conflicting volume	870	1005	274	747	1003	160	549			321		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	870	1005	274	747	1003	160	549			321		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	98	97	94	100	96	96			97		
cM capacity (veh/h)	225	225	723	273	226	856	1017			1236		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	22	22	16	33	38	203	118	33	359	190
Volume Left	16	0	16	0	38	0	0	33	0	0
Volume Right	0	22	0	33	0	0	16	0	0	11
cSH	225	723	273	856	1017	1700	1700	1236	1700	1700
Volume to Capacity	0.10	0.03	0.06	0.04	0.04	0.12	0.07	0.03	0.21	0.11
Queue Length 95th (ft)	8	2	5	3	3	0	0	2	0	0
Control Delay (s)	22.7	10.1	19.0	9.4	8.7	0.0	0.0	8.0	0.0	0.0
Lane LOS	C	B	C	A	A			A		
Approach Delay (s)	16.4		12.6		0.9			0.4		
Approach LOS	C		B							

Intersection Summary			
Average Delay		1.9	
Intersection Capacity Utilization		35.1%	ICU Level of Service	A
Analysis Period (min)		15	

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	5	30	5	140	270	35	505
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	36.0	36.0	36.0	36.0	54.0	54.0	54.0	54.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 26.8
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	5	120	30	5	10	140	270	35	35	505	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.90		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1594		1770	1671		1770	3478		1770	3529	
Flt Permitted	0.82	1.00		0.82	1.00		0.44	1.00		0.55	1.00	
Satd. Flow (perm)	1521	1594		1521	1671		823	3478		1028	3529	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	5	130	33	5	11	152	293	38	38	549	11
RTOR Reduction (vph)	0	107	0	0	9	0	0	14	0	0	2	0
Lane Group Flow (vph)	43	28	0	33	7	0	152	317	0	38	558	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	4.9	4.9		4.9	4.9		12.5	12.5		12.5	12.5	
Effective Green, g (s)	4.9	4.9		4.9	4.9		12.5	12.5		12.5	12.5	
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.46	0.46		0.46	0.46	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	272	285		272	299		375	1587		469	1610	
v/s Ratio Prot		0.02			0.00			0.09			0.16	
v/s Ratio Perm	c0.03			0.02			c0.18			0.04		
v/c Ratio	0.16	0.10		0.12	0.02		0.41	0.20		0.08	0.35	
Uniform Delay, d1	9.5	9.4		9.4	9.3		5.0	4.5		4.2	4.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2		0.2	0.0		0.7	0.1		0.1	0.1	
Delay (s)	9.8	9.6		9.6	9.3		5.7	4.5		4.3	4.9	
Level of Service	A	A		A	A		A	A		A	A	
Approach Delay (s)		9.6			9.5			4.9			4.9	
Approach LOS		A			A			A			A	

Intersection Summary				
HCM Average Control Delay	5.7	HCM Level of Service	A	
HCM Volume to Capacity ratio	0.34			
Actuated Cycle Length (s)	27.4	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	49.7%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	30	20	415	570	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	33	22	451	620	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.95	0.95	0.95			
vC, conflicting volume	918	340	679			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	809	200	557			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	85	96	98			
cM capacity (veh/h)	295	767	959			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	172	301	413	266
Volume Left	43	22	0	0	0
Volume Right	33	0	0	0	60
cSH	401	959	1700	1700	1700
Volume to Capacity	0.19	0.02	0.18	0.24	0.16
Queue Length 95th (ft)	17	2	0	0	0
Control Delay (s)	16.1	1.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	16.1	0.5		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	50	20	420	600	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	54	22	457	652	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked						
vC, conflicting volume	927	329	658			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	927	329	658			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	92	98			
cM capacity (veh/h)	261	667	926			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	174	304	435	223
Volume Left	16	22	0	0	0
Volume Right	54	0	0	0	5
cSH	491	926	1700	1700	1700
Volume to Capacity	0.14	0.02	0.18	0.26	0.13
Queue Length 95th (ft)	12	2	0	0	0
Control Delay (s)	13.6	1.3	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	13.6	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		37.0%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	425	50	25	625
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	462	54	27	679
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	770	258			516	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	770	258			516	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	85	98			97	
cM capacity (veh/h)	328	741			1046	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	308	208	163	272	272
Volume Left	49	0	0	27	0	0
Volume Right	16	0	54	0	0	0
cSH	381	1700	1700	1046	1700	1700
Volume to Capacity	0.17	0.18	0.12	0.03	0.16	0.16
Queue Length 95th (ft)	15	0	0	2	0	0
Control Delay (s)	16.4	0.0	0.0	1.6	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	16.4	0.0		0.4		
Approach LOS	C					

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		39.3%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	80	150	55	390	645	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	87	163	60	424	701	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1052	253	701			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1052	253	701			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	58	78	93			
cM capacity (veh/h)	207	747	892			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	250	60	212	212	280	280	178
Volume Left	87	60	0	0	0	0	0
Volume Right	163	0	0	0	0	0	38
cSH	392	892	1700	1700	1700	1700	1700
Volume to Capacity	0.64	0.07	0.12	0.12	0.16	0.16	0.10
Queue Length 95th (ft)	107	5	0	0	0	0	0
Control Delay (s)	29.0	9.3	0.0	0.0	0.0	0.0	0.0
Lane LOS	D	A					
Approach Delay (s)	29.0	1.2			0.0		
Approach LOS	D						

Intersection Summary				
Average Delay		5.3		
Intersection Capacity Utilization		40.2%	ICU Level of Service	A
Analysis Period (min)		15		

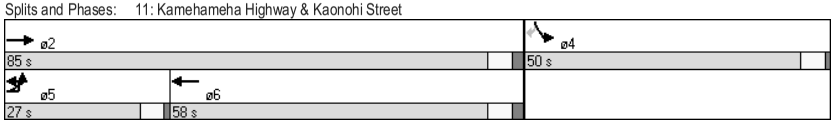
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	245	1690	790	645	160
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	27.0	85.0	58.0	50.0	50.0
Total Split (%)	20.0%	63.0%	43.0%	37.0%	37.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 84 (62%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	245	1690	790	225	645	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4664		3427	1333
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4664		3427	1333
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	1837	859	245	701	174
RTOR Reduction (vph)	0	0	36	0	1	105
Lane Group Flow (vph)	266	1837	1068	0	717	52
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	16.5	79.0	57.5		45.0	45.0
Effective Green, g (s)	16.5	79.0	57.5		45.0	45.0
Actuated g/C Ratio	0.12	0.59	0.43		0.33	0.33
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	392	2777	1987		1142	444
v/s Ratio Prot	0.08	c0.39	0.23		c0.21	
v/s Ratio Perm						0.04
v/c Ratio	0.68	0.66	0.54		0.63	0.12
Uniform Delay, d1	56.7	19.0	28.9		37.9	31.2
Progression Factor	1.16	0.27	0.63		1.00	1.00
Incremental Delay, d2	3.8	1.0	1.0		2.6	0.5
Delay (s)	69.7	6.2	19.2		40.6	31.8
Level of Service	E	A	B		D	C
Approach Delay (s)		14.2	19.2		39.0	
Approach LOS		B	B		D	

Intersection Summary			
HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

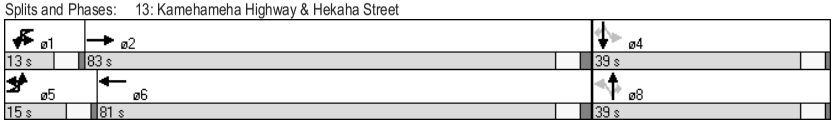
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1785	90	890	55	5	60	110	15	75
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	39.0	39.0	39.0
Total Split (s)	15.0	83.0	13.0	81.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	11.1%	61.5%	9.6%	60.0%	28.9%	28.9%	28.9%	28.9%	28.9%	28.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 105 (78%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1785	185	90	890	30	55	5	60	110	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.99		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4667		3204	4719			1720	1485		1641	1458
Flt Permitted	0.95	1.00		0.95	1.00			0.68	1.00		0.71	1.00
Satd. Flow (perm)	1652	4667		3204	4719			1219	1485		1208	1458
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1940	201	98	967	33	60	5	65	120	16	82
RTOR Reduction (vph)	0	9	0	0	3	0	0	0	49	0	0	61
Lane Group Flow (vph)	54	2132	0	98	997	0	0	65	16	0	136	21
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.6	77.2		7.8	77.4			34.0	34.0		34.0	34.0
Effective Green, g (s)	7.6	77.2		7.8	77.4			34.0	34.0		34.0	34.0
Actuated g/C Ratio	0.06	0.57		0.06	0.57			0.25	0.25		0.25	0.25
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	93	2669		185	2706			307	374		304	367
v/s Ratio Prot	c0.03	c0.46		0.03	0.21							
v/s Ratio Perm								0.05	0.01		c0.11	0.01
v/c Ratio	0.58	0.80		0.53	0.37			0.21	0.04		0.45	0.06
Uniform Delay, d1	62.1	22.8		61.8	15.6			39.9	38.2		42.6	38.3
Progression Factor	0.98	0.72		0.78	1.33			1.00	1.00		1.00	1.00
Incremental Delay, d2	6.9	2.0		2.6	0.4			1.6	0.2		4.7	0.3
Delay (s)	68.1	18.3		51.0	21.1			41.5	38.4		47.3	38.6
Level of Service	E	B		D	C			D	D		D	D
Approach Delay (s)		19.6			23.8			40.0			44.0	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM Average Control Delay	23.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

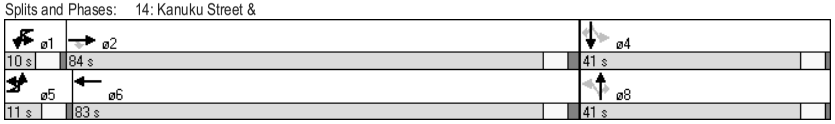
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	25	1835	20	20	955	5	5	15	140	10	40
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	39.0	39.0	39.0
Total Split (s)	11.0	84.0	84.0	10.0	83.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	8.1%	62.2%	62.2%	7.4%	61.5%	30.4%	30.4%	30.4%	30.4%	30.4%	30.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 128 (95%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	1835	20	20	955	65	5	5	15	140	10	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1449	3204	4695			1754	1531		1661	1453
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1449	3204	4695			1590	1531		1275	1453
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	1995	22	22	1038	71	5	5	16	152	11	43
RTOR Reduction (vph)	0	0	5	0	4	0	0	0	13	0	0	36
Lane Group Flow (vph)	27	1995	17	22	1105	0	0	10	3	0	163	7
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.6	93.4	93.4	3.0	92.8			22.6	22.6		22.6	22.6
Effective Green, g (s)	3.6	93.4	93.4	3.0	92.8			22.6	22.6		22.6	22.6
Actuated g/C Ratio	0.03	0.69	0.69	0.02	0.69			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	44	3284	1002	71	3227			266	256		213	243
v/s Ratio Prot	c0.02	c0.42		0.01	0.24							
v/s Ratio Perm			0.01					0.01	0.00		c0.13	0.00
v/c Ratio	0.61	0.61	0.02	0.31	0.34			0.04	0.01		0.77	0.03
Uniform Delay, d1	65.0	11.1	6.5	65.0	8.6			47.1	46.9		53.7	47.0
Progression Factor	1.33	0.20	0.03	0.72	1.67			1.00	1.00		1.00	1.00
Incremental Delay, d2	14.9	0.5	0.0	2.2	0.3			0.1	0.0		15.0	0.0
Delay (s)	101.2	2.7	0.2	48.8	14.7			47.1	46.9		68.7	47.1
Level of Service	F	A	A	D	B			D	D		E	D
Approach Delay (s)		4.0			15.3			47.0			64.2	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	63.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

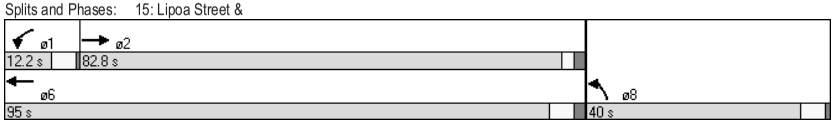
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2295	45	1015	70
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	82.8	12.2	95.0	40.0
Total Split (%)	61.3%	9.0%	70.4%	29.6%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2295	50	45	1015	70	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4731		1652	4746	1646	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4731		1652	4746	1646	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2495	54	49	1103	76	65
RTOR Reduction (vph)	1	0	0	0	28	0
Lane Group Flow (vph)	2548	0	49	1103	113	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	100.7		6.2	109.4	14.6	
Effective Green, g (s)	100.7		6.2	109.4	14.6	
Actuated g/C Ratio	0.75		0.05	0.81	0.11	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3529		76	3846	178	
v/s Ratio Prot	c0.54		c0.03	0.23	c0.07	
v/s Ratio Perm						
v/c Ratio	0.72		0.64	0.29	0.64	
Uniform Delay, d1	9.4		63.3	3.2	57.7	
Progression Factor	0.60		0.84	0.95	1.00	
Incremental Delay, d2	1.0		16.5	0.2	7.3	
Delay (s)	6.6		69.8	3.2	64.9	
Level of Service	A		E	A	E	
Approach Delay (s)	6.6			6.0	64.9	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	8.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

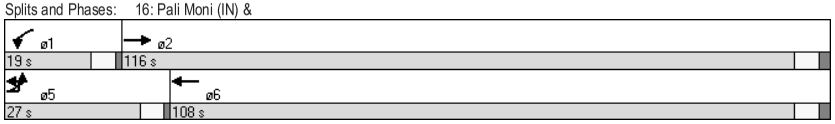
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	200	2190	45	1055
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	27.0	116.0	19.0	108.0
Total Split (%)	20.0%	85.9%	14.1%	80.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 118 (87%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	2190	15	45	1055	185	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4742		1652	4640							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4742		1652	4640							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	2380	16	49	1147	201	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	14	0	0	0	0	0	0	0
Lane Group Flow (vph)	217	2396	0	49	1334	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	14.4	115.8		8.2	109.6							
Effective Green, g (s)	14.4	115.8		8.2	109.6							
Actuated g/C Ratio	0.11	0.86		0.06	0.81							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	342	4068		100	3767							
v/s Ratio Prot	c0.07	c0.51		0.03	0.29							
v/s Ratio Perm												
v/c Ratio	0.63	0.59		0.49	0.35							
Uniform Delay, d1	57.8	2.8		61.4	3.4							
Progression Factor	0.82	0.65		0.94	0.45							
Incremental Delay, d2	2.7	0.5		3.5	0.2							
Delay (s)	50.0	2.2		61.2	1.7							
Level of Service	D	A		E	A							
Approach Delay (s)		6.2			3.8			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

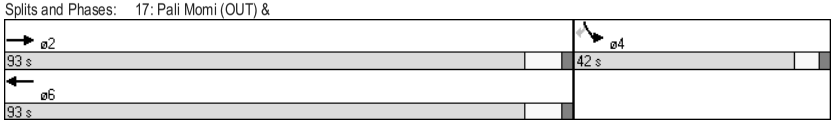
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	2080	1190	325	85
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	93.0	93.0	42.0	42.0
Total Split (%)	68.9%	68.9%	31.1%	31.1%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 4 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	2080	1190	0	325	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.93
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1425
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2261	1293	0	353	92
RTOR Reduction (vph)	0	0	0	0	0	51
Lane Group Flow (vph)	0	2261	1293	0	353	41
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		85.0	85.0		36.0	36.0
Effective Green, g (s)		85.0	85.0		36.0	36.0
Actuated g/C Ratio		0.63	0.63		0.27	0.27
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2988	2988		885	380
v/s Ratio Prot		c0.48	0.27		c0.11	
v/s Ratio Perm						0.03
v/c Ratio		0.76	0.43		0.40	0.11
Uniform Delay, d1		17.7	12.7		40.6	37.4
Progression Factor		0.28	1.00		1.00	1.00
Incremental Delay, d2		1.5	0.5		1.3	0.6
Delay (s)		6.5	13.2		42.0	37.9
Level of Service		A	B		D	D
Approach Delay (s)		6.5	13.2		41.1	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1260	25	0	2005	0	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1370	27	0	2179	0	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.51	
vC, conflicting volume			1397		2473	698
vC1, stage 1 conf vol					1383	
vC2, stage 2 conf vol					1090	
vCu, unblocked vol			1397		1965	698
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	94
cM capacity (veh/h)			485		180	383

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	913	484	1090	1090	22
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	22
cSH	1700	1700	1700	1700	383
Volume to Capacity	0.54	0.28	0.64	0.64	0.06
Queue Length 95th (ft)	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	15.0
Lane LOS					B
Approach Delay (s)	0.0		0.0		15.0
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		

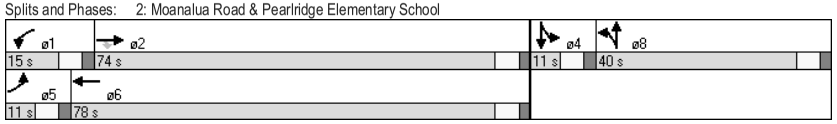
Timings
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	55	1170	75	50	1715	220	5	85	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	40.0	40.0	10.0	10.0
Total Split (s)	11.0	74.0	74.0	15.0	78.0	40.0	40.0	11.0	11.0
Total Split (%)	7.9%	52.9%	52.9%	10.7%	55.7%	28.6%	28.6%	7.9%	7.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 126 (90%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	1170	75	50	1715	80	220	5	60	85	5	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.94		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3516		1681	1612		1770	1603	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3516		1681	1612		1770	1603	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	1272	82	54	1864	87	239	5	65	92	5	65
RTOR Reduction (vph)	0	0	17	0	2	0	0	23	0	0	63	0
Lane Group Flow (vph)	60	1272	65	54	1949	0	158	128	0	92	7	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	5.0	85.3	85.3	7.0	87.3		18.7	18.7		5.0	5.0	
Effective Green, g (s)	5.0	85.3	85.3	7.0	87.3		18.7	18.7		5.0	5.0	
Actuated g/C Ratio	0.04	0.61	0.61	0.05	0.62		0.13	0.13		0.04	0.04	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	63	2156	964	89	2192		225	215		63	57	
v/s Ratio Prot	c0.03	0.36		0.03	c0.55		c0.09	0.08		c0.05	0.00	
v/s Ratio Perm			0.04									
v/c Ratio	0.95	0.59	0.07	0.61	0.89		0.70	0.60		1.46	0.13	
Uniform Delay, d1	67.4	16.7	11.1	65.2	22.3		58.0	57.1		67.5	65.4	
Progression Factor	1.00	1.00	1.00	1.12	0.55		1.00	1.00		1.00	1.00	
Incremental Delay, d2	96.0	1.2	0.1	7.3	3.9		9.5	4.4		275.3	1.0	
Delay (s)	163.3	17.9	11.3	79.9	16.1		67.5	61.5		342.8	66.4	
Level of Service	F	B	B	E	B		E	E		F	E	
Approach Delay (s)		23.7			17.8			64.6			223.4	
Approach LOS		C			B			E			F	

Intersection Summary			
HCM Average Control Delay	32.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

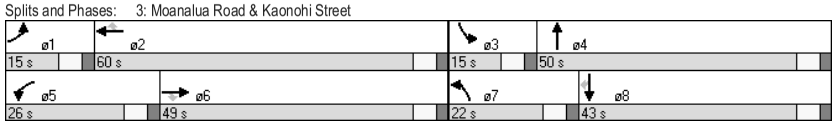
Timings
3: Moanalua Road & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	205	910	195	185	1385	285	315	165	125	110	140
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	15.0	49.0	49.0	26.0	60.0	60.0	22.0	50.0	15.0	43.0	43.0
Total Split (%)	10.7%	35.0%	35.0%	18.6%	42.9%	42.9%	15.7%	35.7%	10.7%	30.7%	30.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 135
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	910	195	185	1385	285	315	165	145	125	110	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3290		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3290		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	989	212	201	1505	310	342	179	158	136	120	152
RTOR Reduction (vph)	0	0	111	0	0	120	0	134	0	0	0	136
Lane Group Flow (vph)	223	989	101	201	1505	190	342	203	0	136	120	16
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	9.0	66.8	66.8	18.9	76.7	76.7	15.9	21.5		8.8	14.4	14.4
Effective Green, g (s)	9.0	66.8	66.8	18.9	76.7	76.7	15.9	21.5		8.8	14.4	14.4
Actuated g/C Ratio	0.06	0.48	0.48	0.13	0.55	0.55	0.11	0.15		0.06	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	221	1689	755	239	1939	867	390	505		216	192	163
v/s Ratio Prot	0.06	0.28		c0.11	c0.43		c0.10	0.06		0.04	c0.06	
v/s Ratio Perm			0.06			0.12						0.01
v/c Ratio	1.01	0.59	0.13	0.84	0.78	0.22	0.88	0.40		0.63	0.62	0.10
Uniform Delay, d1	65.5	26.6	20.4	59.1	24.9	16.3	61.1	53.5		64.0	60.2	56.9
Progression Factor	1.09	0.58	0.16	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	55.7	1.2	0.3	23.0	3.1	0.6	19.3	0.5		5.6	6.2	0.3
Delay (s)	126.8	16.6	3.6	82.1	28.0	16.8	80.4	54.0		69.7	66.4	57.2
Level of Service	F	B	A	F	C	B	F	D		E	E	E
Approach Delay (s)		31.9			31.7			67.3			64.0	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	40.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	90	0	0	70	0	555	40	0	420	65
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	98	0	0	76	0	603	43	0	457	71
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	719	1139	264	951	1152	173	527			647		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	719	1139	264	951	1152	173	527			647		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	87	100	100	91	100			100		
cM capacity (veh/h)	287	200	735	186	196	841	1036			935		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	98	76	172	172	172	130	304	223
Volume Left	0	0	0	0	0	0	0	0
Volume Right	98	76	0	0	0	43	0	71
cSH	735	841	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.09	0.10	0.10	0.10	0.08	0.18	0.13
Queue Length 95th (ft)	11	7	0	0	0	0	0	0
Control Delay (s)	10.6	9.7	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.6	9.7	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay		1.3		
Intersection Capacity Utilization	25.9%	ICU Level of Service	A	
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	5	80	105	55	135	50	455	75	90	415	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	5	87	114	60	147	54	495	82	98	451	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.97	0.97		0.97	0.97	0.97				0.97		
vC, conflicting volume	1188	1340	234	1155	1307	288	467			576		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1127	1285	234	1094	1251	198	467			496		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	57	96	89	9	58	81	95			91		
cM capacity (veh/h)	76	136	768	125	143	784	1090			1030		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	38	87	174	147	54	330	246	98	301	167
Volume Left	33	0	114	0	54	0	0	98	0	0
Volume Right	0	87	0	147	0	0	82	0	0	16
cSH	81	768	131	784	1090	1700	1700	1030	1700	1700
Volume to Capacity	0.47	0.11	1.33	0.19	0.05	0.19	0.14	0.09	0.18	0.10
Queue Length 95th (ft)	49	10	280	17	4	0	0	8	0	0
Control Delay (s)	83.9	10.3	255.2	10.6	8.5	0.0	0.0	8.9	0.0	0.0
Lane LOS	F	B	F	B	A			A		
Approach Delay (s)	32.7		143.3		0.7			1.5		
Approach LOS	D		F							

Intersection Summary				
Average Delay		31.3		
Intersection Capacity Utilization	45.3%	ICU Level of Service	A	
Analysis Period (min)		15		

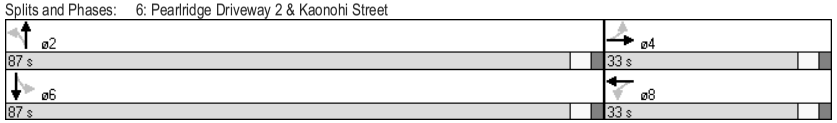
Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	35	5	155	35	225	470	60	520
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	87.0	87.0	87.0	87.0
Total Split (%)	27.5%	27.5%	27.5%	27.5%	72.5%	72.5%	72.5%	72.5%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 55.3
Natural Cycle: 65
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	5	165	155	35	80	225	470	90	60	520	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.85		1.00	0.90		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1591		1770	1668		1770	3454		1770	3515	
Flt Permitted	0.68	1.00		0.64	1.00		0.42	1.00		0.41	1.00	
Satd. Flow (perm)	1261	1591		1195	1668		782	3454		764	3515	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	5	179	168	38	87	245	511	98	65	565	27
RTOR Reduction (vph)	0	124	0	0	60	0	0	21	0	0	4	0
Lane Group Flow (vph)	38	60	0	168	65	0	245	588	0	65	588	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	16.5	16.5		16.5	16.5		27.6	27.6		27.6	27.6	
Effective Green, g (s)	16.5	16.5		16.5	16.5		27.6	27.6		27.6	27.6	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.51	0.51		0.51	0.51	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	385	485		364	509		399	1762		390	1793	
v/s Ratio Prot		0.04			0.04			0.17			0.17	
v/s Ratio Perm	0.03			c0.14			c0.31			0.09		
v/c Ratio	0.10	0.12		0.46	0.13		0.61	0.33		0.17	0.33	
Uniform Delay, d1	13.5	13.6		15.2	13.6		9.5	7.8		7.1	7.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		0.9	0.1		2.8	0.1		0.2	0.1	
Delay (s)	13.6	13.7		16.1	13.7		12.2	7.9		7.3	7.9	
Level of Service	B	B		B	B		B	A		A	A	
Approach Delay (s)		13.7			15.1			9.2			7.8	
Approach LOS		B			B			A			A	

Intersection Summary				
HCM Average Control Delay	10.1	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.56			
Actuated Cycle Length (s)	54.1	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	63.4%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	755	780	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	821	848	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	200	
pX, platoon unblocked	0.92	0.92	0.92			
vC, conflicting volume	1326	448	897			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1177	222	710			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	80	95	97			
cM capacity (veh/h)	164	718	813			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	295	547	565	332
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	268	813	1700	1700	1700
Volume to Capacity	0.24	0.03	0.32	0.33	0.20
Queue Length 95th (ft)	23	2	0	0	0
Control Delay (s)	22.7	1.0	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	22.7	0.3		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		45.4%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	755	795	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	821	864	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	0.99	0.99	0.99			
vC, conflicting volume	1340	443	886			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1331	430	875			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	90	96			
cM capacity (veh/h)	140	570	763			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	301	547	576	310
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	22
cSH	344	763	1700	1700	1700
Volume to Capacity	0.22	0.04	0.32	0.34	0.18
Queue Length 95th (ft)	21	3	0	0	0
Control Delay (s)	18.4	1.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	18.4	0.5		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		49.9%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/7/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	735	50	30	820
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	799	54	33	891
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1188	427			853	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1188	427			853	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	56	92			96	
cM capacity (veh/h)	173	576			782	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	533	321	211	357	357
Volume Left	76	0	0	33	0	0
Volume Right	49	0	54	0	0	0
cSH	239	1700	1700	782	1700	1700
Volume to Capacity	0.52	0.31	0.19	0.04	0.21	0.21
Queue Length 95th (ft)	69	0	0	3	0	0
Control Delay (s)	35.6	0.0	0.0	1.9	0.0	0.0
Lane LOS	E			A		
Approach Delay (s)	35.6	0.0		0.4		
Approach LOS	E					

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	110	125	760	830	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	120	136	826	902	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1617	331	902			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1617	331	902			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	51	82	82			
cM capacity (veh/h)	77	665	749			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	158	136	413	413	361	361	240
Volume Left	38	136	0	0	0	0	0
Volume Right	120	0	0	0	0	0	60
cSH	234	749	1700	1700	1700	1700	1700
Volume to Capacity	0.67	0.18	0.24	0.24	0.21	0.21	0.14
Queue Length 95th (ft)	107	16	0	0	0	0	0
Control Delay (s)	47.1	10.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	B					
Approach Delay (s)	47.1	1.5			0.0		
Approach LOS	E						

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		

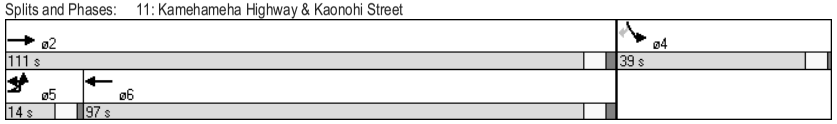
Timings
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	295	1240	3605	385	540
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	28.0	28.0	39.0	39.0
Total Split (s)	14.0	111.0	97.0	39.0	39.0
Total Split (%)	9.3%	74.0%	64.7%	26.0%	26.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 112 (75%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	295	1240	3605	585	385	540
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		0.94	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4716		3301	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4716		3301	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	321	1348	3918	636	418	587
RTOR Reduction (vph)	0	0	14	0	77	77
Lane Group Flow (vph)	321	1348	4540	0	611	240
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	9.0	107.2	93.2		31.8	31.8
Effective Green, g (s)	9.0	107.2	93.2		31.8	31.8
Actuated g/C Ratio	0.06	0.71	0.62		0.21	0.21
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	206	3634	2930		700	305
v/s Ratio Prot	c0.09	0.27	c0.96		c0.19	
v/s Ratio Perm						0.17
v/c Ratio	1.56	0.37	1.55		0.87	0.79
Uniform Delay, d1	70.5	8.3	28.4		57.1	55.9
Progression Factor	0.87	0.98	0.72		1.00	1.00
Incremental Delay, d2	272.5	0.3	247.4		11.6	12.5
Delay (s)	333.5	8.4	267.7		68.7	68.4
Level of Service	F	A	F		E	E
Approach Delay (s)		71.0	267.7		68.6	
Approach LOS		E	F		E	

Intersection Summary			
HCM Average Control Delay	194.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.39		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	127.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

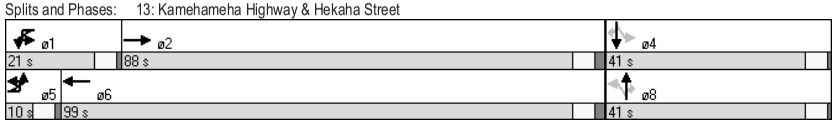
Timings
13: Kamehameha Highway & Hekaha Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1130	190	3015	235	45	230	65	45	100
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	33.0	10.0	33.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	10.0	88.0	21.0	99.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	6.7%	58.7%	14.0%	66.0%	27.3%	27.3%	27.3%	27.3%	27.3%	27.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 51 (34%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1130	150	190	3015	80	235	45	230	65	45	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4647		3204	4725			1728	1441		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.37	1.00
Satd. Flow (perm)	1652	4647		3204	4725			1117	1441		631	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1228	163	207	3277	87	255	49	250	71	49	109
RTOR Reduction (vph)	0	11	0	0	2	0	0	0	132	0	0	45
Lane Group Flow (vph)	54	1380	0	207	3362	0	0	304	118	0	120	64
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	83.8		14.2	93.0			36.0	36.0		36.0	36.0
Effective Green, g (s)	5.0	83.8		14.2	93.0			36.0	36.0		36.0	36.0
Actuated g/C Ratio	0.03	0.56		0.09	0.62			0.24	0.24		0.24	0.24
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	55	2596		303	2930			268	346		151	355
v/s Ratio Prot	0.03	0.30		c0.06	c0.71							
v/s Ratio Perm								c0.27	0.08		0.19	0.04
v/c Ratio	0.98	0.53		0.68	1.15			1.13	0.34		0.79	0.18
Uniform Delay, d1	72.5	20.8		65.7	28.5			57.0	47.2		53.5	45.3
Progression Factor	1.16	0.72		1.24	0.57			1.00	1.00		1.00	1.00
Incremental Delay, d2	107.2	0.7		0.6	66.8			96.1	0.6		24.3	0.2
Delay (s)	191.4	15.7		82.2	83.1			153.1	47.8		77.9	45.5
Level of Service	F	B		F	F			F	D		E	D
Approach Delay (s)		22.2			83.0			105.6			62.5	
Approach LOS		C			F			F			E	

Intersection Summary			
HCM Average Control Delay	69.2	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Timings
14: Kanuku Street &

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1290	75	90	3450	90	15	55	60	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	97.0	97.0	14.0	103.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	5.3%	64.7%	64.7%	9.3%	68.7%	26.0%	26.0%	26.0%	26.0%	26.0%	26.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 41 (27%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &

ø1	ø2	ø4
14 s	97 s	39 s
ø	ø6	ø8
8 s	103 s	39 s

HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1290	75	90	3450	220	90	15	55	60	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1430	3204	4697			1697	1531		1671	1427
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.66	1.00		0.56	1.00
Satd. Flow (perm)	1652	4746	1430	3204	4697			1164	1531		965	1427
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1402	82	98	3750	239	98	16	60	65	16	38
RTOR Reduction (vph)	0	0	23	0	3	0	0	0	52	0	0	30
Lane Group Flow (vph)	38	1402	59	98	3986	0	0	114	8	0	81	8
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	106.1	106.1	8.6	111.7			19.3	19.3		19.3	19.3
Effective Green, g (s)	3.0	106.1	106.1	8.6	111.7			19.3	19.3		19.3	19.3
Actuated g/C Ratio	0.02	0.71	0.71	0.06	0.74			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	33	3357	1011	184	3498			150	197		124	184
v/s Ratio Prot	c0.02	0.30		0.03	c0.85							
v/s Ratio Perm			0.04					c0.10	0.01		0.08	0.01
v/c Ratio	1.15	0.42	0.06	0.53	1.14			0.76	0.04		0.65	0.04
Uniform Delay, d1	73.5	9.1	6.7	68.7	19.1			63.1	57.2		62.2	57.2
Progression Factor	0.90	0.53	0.28	1.08	0.39			1.00	1.00		1.00	1.00
Incremental Delay, d2	192.6	0.3	0.1	0.3	63.1			20.0	0.1		11.7	0.1
Delay (s)	259.0	5.2	1.9	74.4	70.5			83.1	57.3		73.9	57.3
Level of Service	F	A	A	E	E			F	E		E	E
Approach Delay (s)		11.3			70.6			74.2			68.6	
Approach LOS		B			E			E			E	

Intersection Summary			
HCM Average Control Delay	55.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	105.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

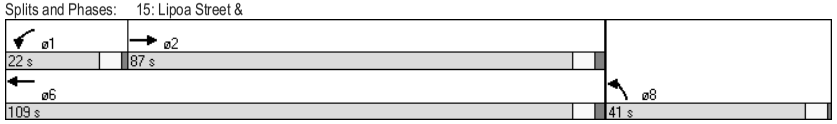
Timings
15: Lipoa Street &

7/7/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1440	95	3790	160
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	87.0	22.0	109.0	41.0
Total Split (%)	58.0%	14.7%	72.7%	27.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 46 (31%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1440	55	95	3790	160	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5057		1652	4746	1746	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5057		1652	4746	1746	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1565	60	103	4120	174	38
RTOR Reduction (vph)	2	0	0	0	6	0
Lane Group Flow (vph)	1623	0	103	4120	206	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	97.1		13.9	116.0	23.0	
Effective Green, g (s)	97.1		13.9	116.0	23.0	
Actuated g/C Ratio	0.65		0.09	0.77	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3274		153	3670	268	
v/s Ratio Prot	0.32		0.06	c0.87	c0.12	
v/s Ratio Perm						
v/c Ratio	0.50		0.67	1.12	0.77	
Uniform Delay, d1	13.7		65.9	17.0	60.9	
Progression Factor	1.14		1.09	0.40	1.00	
Incremental Delay, d2	0.5		4.8	57.0	12.5	
Delay (s)	16.1		76.8	63.8	73.4	
Level of Service	B		E	E	E	
Approach Delay (s)	16.1			64.1	73.4	
Approach LOS	B			E	E	

Intersection Summary			
HCM Average Control Delay	51.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

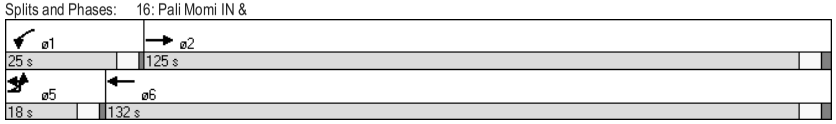
Timings
16: Pali Momi IN &

7/7/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	245	1185	120	3345
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	18.0	125.0	25.0	132.0
Total Split (%)	12.0%	83.3%	16.7%	88.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 133 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	245	1185	35	120	3345	390	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4726		1652	4624							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4726		1652	4624							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	1288	38	130	3636	424	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	266	1324	0	130	4057	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	13.0	122.7		16.3	126.0							
Effective Green, g (s)	13.0	122.7		16.3	126.0							
Actuated g/C Ratio	0.09	0.82		0.11	0.84							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	278	3866		180	3884							
v/s Ratio Prot	c0.08	0.28		0.08	c0.88							
v/s Ratio Perm												
v/c Ratio	0.96	0.34		0.72	1.04							
Uniform Delay, d1	68.2	3.5		64.7	12.0							
Progression Factor	0.97	0.58		1.06	0.45							
Incremental Delay, d2	38.8	0.2		1.3	21.0							
Delay (s)	105.3	2.2		69.9	26.5							
Level of Service	F	A		E	C							
Approach Delay (s)		19.4			27.8			0.0			0.0	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM Average Control Delay	25.5	HCM Level of Service	C
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	89.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

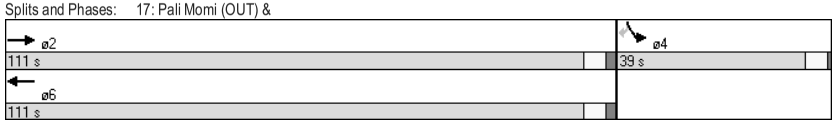
Timings
17: Pali Momi (OUT) &

7/7/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1185	3615	315	150
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	111.0	111.0	39.0	39.0
Total Split (%)	74.0%	74.0%	26.0%	26.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 142 (95%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1185	3615	0	315	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.86
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1324
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1324
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1288	3929	0	342	163
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1288	3929	0	342	163
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		115.1	115.1		23.9	23.9
Effective Green, g (s)		115.1	115.1		23.9	23.9
Actuated g/C Ratio		0.77	0.77		0.16	0.16
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3642	3642		529	211
v/s Ratio Prot		0.27	c0.83		0.10	
v/s Ratio Perm						c0.12
v/c Ratio		0.35	1.08		0.65	0.77
Uniform Delay, d1		5.6	17.5		59.1	60.4
Progression Factor		0.86	1.00		1.00	1.00
Incremental Delay, d2		0.3	41.3		2.7	16.0
Delay (s)		5.0	58.7		61.8	76.4
Level of Service		A	E		E	E
Approach Delay (s)		5.0	58.7		66.5	
Approach LOS		A	E		E	

Intersection Summary			
HCM Average Control Delay	47.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	106.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1700	25	0	1695	0	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1848	27	0	1842	0	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.70	
vC, conflicting volume			1875		2783	938
vC1, stage 1 conf vol					1861	
vC2, stage 2 conf vol					921	
vCu, unblocked vol			1875		2688	938
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	69
cM capacity (veh/h)			317		104	266

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1232	643	921	921	82
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	82
cSH	1700	1700	1700	1700	266
Volume to Capacity	0.72	0.38	0.54	0.54	0.31
Queue Length 95th (ft)	0	0	0	0	31
Control Delay (s)	0.0	0.0	0.0	0.0	24.4
Lane LOS					C
Approach Delay (s)	0.0		0.0		24.4
Approach LOS					C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

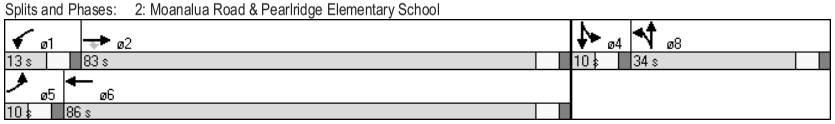
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	5	1660	115	55	1520	220	5	15	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	10.0	83.0	83.0	13.0	86.0	34.0	34.0	10.0	10.0
Total Split (%)	7.1%	59.3%	59.3%	9.3%	61.4%	24.3%	24.3%	7.1%	7.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 61 (44%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1660	115	55	1520	15	220	5	65	15	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.93		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3534		1681	1605		1770	1650	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3534		1681	1605		1770	1650	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1804	125	60	1652	16	239	5	71	16	5	16
RTOR Reduction (vph)	0	0	19	0	0	0	0	24	0	0	16	0
Lane Group Flow (vph)	5	1804	106	60	1668	0	163	128	0	16	5	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	0.8	89.0	89.0	5.6	93.8		19.0	19.0		2.4	2.4	
Effective Green, g (s)	0.8	89.0	89.0	5.6	93.8		19.0	19.0		2.4	2.4	
Actuated g/C Ratio	0.01	0.64	0.64	0.04	0.67		0.14	0.14		0.02	0.02	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	10	2250	1006	71	2368		228	218		30	28	
v/s Ratio Prot	0.00	c0.51		c0.03	c0.47		c0.10	0.08		c0.01	0.00	
v/s Ratio Perm			0.07									
v/c Ratio	0.50	0.80	0.11	0.85	0.70		0.71	0.59		0.53	0.19	
Uniform Delay, d1	69.4	18.9	10.0	66.8	14.4		57.9	56.8		68.2	67.8	
Progression Factor	1.00	1.00	1.00	0.86	0.77		1.00	1.00		1.00	1.00	
Incremental Delay, d2	34.4	3.1	0.2	44.6	1.3		10.2	4.0		17.0	3.3	
Delay (s)	103.8	22.1	10.2	102.2	12.4		68.1	60.8		85.2	71.1	
Level of Service	F	C	B	F	B		E	E		F	E	
Approach Delay (s)		21.5			15.5			64.6			77.2	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	22.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	30.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

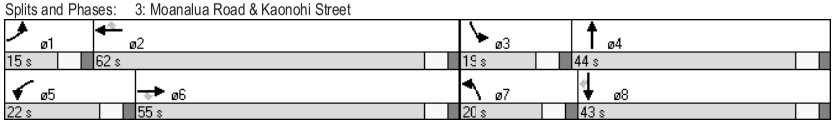
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	145	1225	360	200	1050	210	330	185	195	160	200
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	15.0	55.0	55.0	22.0	62.0	62.0	20.0	44.0	19.0	43.0	43.0
Total Split (%)	10.7%	39.3%	39.3%	15.7%	44.3%	44.3%	14.3%	31.4%	13.6%	30.7%	30.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 136 (97%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1225	360	200	1050	210	330	185	325	195	160	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3201		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3201		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	1332	391	217	1141	228	359	201	353	212	174	217
RTOR Reduction (vph)	0	0	195	0	0	113	0	136	0	0	0	128
Lane Group Flow (vph)	158	1332	196	217	1141	115	359	418	0	212	174	89
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.9	63.4	63.4	16.0	70.5	70.5	14.0	24.3		12.3	22.6	22.6
Effective Green, g (s)	8.9	63.4	63.4	16.0	70.5	70.5	14.0	24.3		12.3	22.6	22.6
Actuated g/C Ratio	0.06	0.45	0.45	0.11	0.50	0.50	0.10	0.17		0.09	0.16	0.16
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	218	1603	717	202	1782	797	343	556		302	301	256
v/s Ratio Prot	0.05	c0.38		c0.12	0.32		c0.10	c0.13		0.06	0.09	
v/s Ratio Perm			0.12			0.07						0.06
v/c Ratio	0.72	0.83	0.27	1.07	0.64	0.14	1.05	0.86dr		0.70	0.58	0.35
Uniform Delay, d1	64.3	33.6	23.9	62.0	25.5	18.6	63.0	55.0		62.1	54.3	52.1
Progression Factor	1.31	0.59	0.39	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	7.4	3.4	0.6	84.4	1.8	0.4	61.3	5.7		7.2	2.7	0.8
Delay (s)	91.9	23.2	9.9	146.4	27.2	19.0	124.3	60.7		69.3	57.0	53.0
Level of Service	F	C	A	F	C	B	F	E		E	E	D
Approach Delay (s)		26.2			42.4			85.7			59.8	
Approach LOS		C			D			F			E	

Intersection Summary				
HCM Average Control Delay	46.3	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.84			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	86.1%	ICU Level of Service	E	
Analysis Period (min)	15			

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	75	0	0	165	0	690	95	0	640	85
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	82	0	0	179	0	750	103	0	696	92
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	1109	1595	394	1231	1590	239	788			853		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1109	1595	394	1231	1590	239	788			853		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	87	100	100	76	100			100		
cM capacity (veh/h)	126	106	605	116	107	762	827			782		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	82	179	214	214	214	210	464	324
Volume Left	0	0	0	0	0	0	0	0
Volume Right	82	179	0	0	0	103	0	92
cSH	605	762	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.24	0.13	0.13	0.13	0.12	0.27	0.19
Queue Length 95th (ft)	12	23	0	0	0	0	0	0
Control Delay (s)	11.9	11.2	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	B						
Approach Delay (s)	11.9	11.2	0.0				0.0	
Approach LOS	B	B						

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	31.7%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	40	5	75	100	50	130	55	605	130	160	550	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	5	82	109	54	141	60	658	141	174	598	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.94	0.94		0.94	0.94	0.94				0.94		
vC, conflicting volume	1573	1875	310	1579	1815	399	620			799		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1484	1805	310	1490	1741	237	620			661		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	90	88	0	10	80	94			80		
cM capacity (veh/h)	13	55	686	53	61	720	957			869		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	49	82	163	141	60	438	361	174	399	221
Volume Left	43	0	109	0	60	0	0	174	0	0
Volume Right	0	82	0	141	0	0	141	0	0	22
cSH	14	686	56	720	957	1700	1700	869	1700	1700
Volume to Capacity	3.54	0.12	2.94	0.20	0.06	0.26	0.21	0.20	0.23	0.13
Queue Length 95th (ft)	Err	10	426	18	5	0	0	19	0	0
Control Delay (s)	Err	11.0	1030.7	11.2	9.0	0.0	0.0	10.2	0.0	0.0
Lane LOS	F	B	F	B	A			B		
Approach Delay (s)	3756.5		557.4		0.6			2.2		
Approach LOS	F		F							

Intersection Summary			
Average Delay	317.2		
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	45	10	195	55	225	580	150	570
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	47.0	47.0	47.0	47.0
Total Split (%)	41.3%	41.3%	41.3%	41.3%	58.8%	58.8%	58.8%	58.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 57.4
Natural Cycle: 70
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

ø2	ø4
47 s	33 s
ø6	ø8
47 s	33 s

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	10	175	195	55	140	225	580	225	150	570	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.89		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1599		1770	1662		1770	3391		1770	3521	
Flt Permitted	0.62	1.00		0.63	1.00		0.39	1.00		0.28	1.00	
Satd. Flow (perm)	1151	1599		1177	1662		727	3391		514	3521	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	11	190	212	60	152	245	630	245	163	620	22
RTOR Reduction (vph)	0	132	0	0	106	0	0	52	0	0	3	0
Lane Group Flow (vph)	49	69	0	212	106	0	245	823	0	163	639	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	17.1	17.1		17.1	17.1		29.0	29.0		29.0	29.0	
Effective Green, g (s)	17.1	17.1		17.1	17.1		29.0	29.0		29.0	29.0	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.52	0.52		0.52	0.52	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	351	487		359	507		376	1753		266	1820	
v/s Ratio Prot		0.04			0.06			0.24			0.18	
v/s Ratio Perm	0.04			c0.18			c0.34			0.32		
v/c Ratio	0.14	0.14		0.59	0.21		0.65	0.47		0.61	0.35	
Uniform Delay, d1	14.2	14.2		16.5	14.5		9.9	8.6		9.6	8.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.1		2.6	0.2		4.0	0.2		4.1	0.1	
Delay (s)	14.3	14.3		19.1	14.7		13.9	8.8		13.7	8.1	
Level of Service	B	B		B	B		B	A		B	A	
Approach Delay (s)		14.3			16.9			9.9			9.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	56.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	25	45	25	1000	805	120
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	49	27	1087	875	130
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.90	0.90	0.90			
vC, conflicting volume	1538	503	1005			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1383	238	794			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	77	93	96			
cM capacity (veh/h)	117	690	744			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	389	725	583	422
Volume Left	27	27	0	0	0
Volume Right	49	0	0	0	130
cSH	252	744	1700	1700	1700
Volume to Capacity	0.30	0.04	0.43	0.34	0.25
Queue Length 95th (ft)	31	3	0	0	0
Control Delay (s)	25.4	1.1	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	25.4	0.4		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	95	45	1015	845	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	103	49	1103	918	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	1.00	1.00	1.00			
vC, conflicting volume	1584	476	951			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1579	465	943			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	65	81	93			
cM capacity (veh/h)	93	542	720			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	136	417	736	612	339
Volume Left	33	49	0	0	0
Volume Right	103	0	0	0	33
cSH	251	720	1700	1700	1700
Volume to Capacity	0.54	0.07	0.43	0.36	0.20
Queue Length 95th (ft)	74	5	0	0	0
Control Delay (s)	35.1	2.0	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	35.1	0.7		0.0	
Approach LOS	E				

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	85	965	85	45	800
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	92	1049	92	49	870
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1483	571			1141	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1483	571			1141	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	29	80			92	
cM capacity (veh/h)	106	464			608	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	168	699	442	223	348	348
Volume Left	76	0	0	49	0	0
Volume Right	92	0	92	0	0	0
cSH	184	1700	1700	608	1700	1700
Volume to Capacity	0.91	0.41	0.26	0.08	0.20	0.20
Queue Length 95th (ft)	175	0	0	7	0	0
Control Delay (s)	96.8	0.0	0.0	3.3	0.0	0.0
Lane LOS	F			A		
Approach Delay (s)	96.8	0.0		0.8		
Approach LOS	F					

Intersection Summary			
Average Delay	7.6		
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	110	90	1000	885	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	120	98	1087	962	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1736	356	962			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1736	356	962			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	28	81	86			
cM capacity (veh/h)	68	640	711			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	98	543	543	385	385	263
Volume Left	49	98	0	0	0	0	0
Volume Right	120	0	0	0	0	0	71
cSH	185	711	1700	1700	1700	1700	1700
Volume to Capacity	0.91	0.14	0.32	0.32	0.23	0.23	0.15
Queue Length 95th (ft)	174	12	0	0	0	0	0
Control Delay (s)	95.6	10.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	95.6	0.9			0.0		
Approach LOS	F						

Intersection Summary			
Average Delay	7.2		
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		

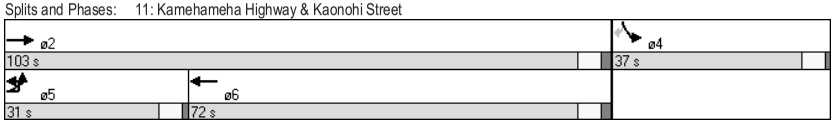
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	540	1775	1495	525	470
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	33.0	33.0
Total Split (s)	31.0	103.0	72.0	37.0	37.0
Total Split (%)	22.1%	73.6%	51.4%	26.4%	26.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 98 (70%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 120
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	540	1775	1495	545	525	470
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.96		0.97	0.89
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.96		0.96	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4539		3272	1283
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4539		3272	1283
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	587	1929	1625	592	571	511
RTOR Reduction (vph)	0	0	47	0	22	241
Lane Group Flow (vph)	587	1929	2170	0	723	96
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	26.0	97.0	66.0		32.0	32.0
Effective Green, g (s)	26.0	97.0	66.0		32.0	32.0
Actuated g/C Ratio	0.19	0.69	0.47		0.23	0.23
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	595	3288	2140		748	293
v/s Ratio Prot	c0.18	0.41	c0.48		c0.22	
v/s Ratio Perm						0.07
v/c Ratio	0.99	0.59	1.01		0.97	0.33
Uniform Delay, d1	56.8	11.1	37.0		53.5	45.0
Progression Factor	1.28	0.24	0.68		1.00	1.00
Incremental Delay, d2	29.1	0.6	20.5		24.8	0.7
Delay (s)	102.0	3.3	45.8		78.3	45.7
Level of Service	F	A	D		E	D
Approach Delay (s)		26.4	45.8		68.1	
Approach LOS		C	D		E	

Intersection Summary			
HCM Average Control Delay	41.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

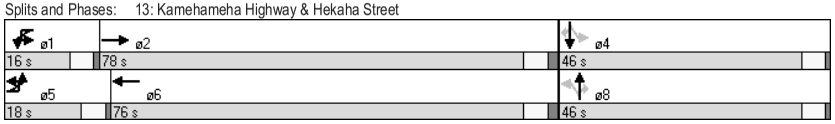
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	100	1785	225	1690	210	55	320	95	40	140
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	18.0	78.0	16.0	76.0	46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	12.9%	55.7%	11.4%	54.3%	32.9%	32.9%	32.9%	32.9%	32.9%	32.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 131 (94%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	1785	290	225	1690	65	210	55	320	95	40	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4632		3204	4714			1698	1531		1679	1414
Flt Permitted	0.95	1.00		0.95	1.00			0.61	1.00		0.40	1.00
Satd. Flow (perm)	1652	4632		3204	4714			1075	1531		693	1414
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1940	315	245	1837	71	228	60	348	103	43	152
RTOR Reduction (vph)	0	16	0	0	3	0	0	0	110	0	0	109
Lane Group Flow (vph)	109	2239	0	245	1905	0	0	288	238	0	146	43
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	12.2	73.7		11.0	72.5			39.3	39.3		39.3	39.3
Effective Green, g (s)	12.2	73.7		11.0	72.5			39.3	39.3		39.3	39.3
Actuated g/C Ratio	0.09	0.53		0.08	0.52			0.28	0.28		0.28	0.28
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	144	2438		252	2441			302	430		195	397
v/s Ratio Prot	0.07	c0.48		c0.08	0.40							
v/s Ratio Perm								c0.27	0.16		0.21	0.03
v/c Ratio	0.76	0.92		0.97	0.78			0.95	0.55		0.75	0.11
Uniform Delay, d1	62.5	30.4		64.3	27.3			49.5	42.9		45.9	37.3
Progression Factor	0.91	0.96		1.06	0.80			1.00	1.00		1.00	1.00
Incremental Delay, d2	10.7	3.7		40.7	1.9			39.2	1.5		14.5	0.1
Delay (s)	67.3	32.9		109.1	23.6			88.6	44.4		60.4	37.5
Level of Service	E	C		F	C			F	D		E	D
Approach Delay (s)		34.4			33.4			64.4			48.7	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM Average Control Delay	38.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	104.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

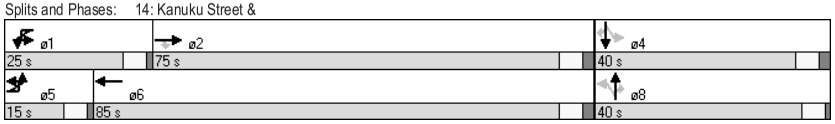
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	75	1930	105	110	1780	65	20	75	125	15	80
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	25.0	28.0	23.0	23.0	23.0	40.0	40.0	40.0
Total Split (s)	15.0	75.0	75.0	25.0	85.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	10.7%	53.6%	53.6%	17.9%	60.7%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 9 (6%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1930	105	110	1780	235	65	20	75	125	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4663			1734	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.55	1.00		0.65	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4663			988	1531		1122	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	2098	114	120	1935	255	71	22	82	136	16	87
RTOR Reduction (vph)	0	0	22	0	10	0	0	0	68	0	0	72
Lane Group Flow (vph)	82	2098	92	120	2180	0	0	93	14	0	152	15
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	9.6	88.9	88.9	10.6	89.9			24.5	24.5		23.5	23.5
Effective Green, g (s)	9.6	88.9	88.9	10.6	89.9			24.5	24.5		23.5	23.5
Actuated g/C Ratio	0.07	0.64	0.64	0.08	0.64			0.18	0.18		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	113	3014	939	243	2994			173	268		188	248
v/s Ratio Prot	c0.05	0.44		0.04	c0.47							
v/s Ratio Perm			0.06					0.09	0.01		c0.14	0.01
v/c Ratio	0.73	0.70	0.10	0.49	0.73			0.54	0.05		0.81	0.06
Uniform Delay, d1	63.9	16.7	9.9	62.1	16.8			52.6	48.1		56.1	49.0
Progression Factor	1.11	0.33	0.21	0.75	1.46			1.00	1.00		1.00	1.00
Incremental Delay, d2	10.4	0.6	0.1	0.7	0.7			3.2	0.1		21.9	0.1
Delay (s)	81.1	6.1	2.2	47.4	25.4			55.8	48.2		78.0	49.1
Level of Service	F	A	A	D	C			E	D		E	D
Approach Delay (s)		8.6			26.5			52.2			67.5	
Approach LOS		A			C			D			E	

Intersection Summary			
HCM Average Control Delay	21.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	72.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

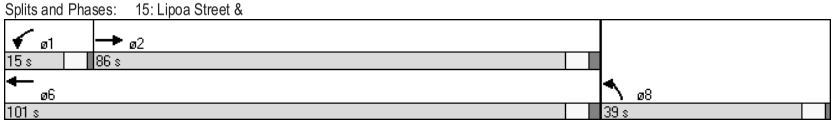
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2000	50	2085	165
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	86.0	15.0	101.0	39.0
Total Split (%)	61.4%	10.7%	72.1%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 21 (15%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2000	65	50	2085	165	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4720		1652	4746	1670	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4720		1652	4746	1670	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2174	71	54	2266	179	76
RTOR Reduction (vph)	2	0	0	0	11	0
Lane Group Flow (vph)	2243	0	54	2266	244	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	90.8		7.6	103.4	25.6	
Effective Green, g (s)	90.8		7.6	103.4	25.6	
Actuated g/C Ratio	0.65		0.05	0.74	0.18	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3061		90	3505	305	
v/s Ratio Prot	c0.48		0.03	c0.48	c0.15	
v/s Ratio Perm						
v/c Ratio	0.73		0.60	0.65	0.80	
Uniform Delay, d1	16.5		64.7	9.2	54.7	
Progression Factor	0.76		1.26	0.40	1.00	
Incremental Delay, d2	1.2		7.5	0.7	13.6	
Delay (s)	13.7		89.1	4.4	68.3	
Level of Service	B		F	A	E	
Approach Delay (s)	13.7			6.3	68.3	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

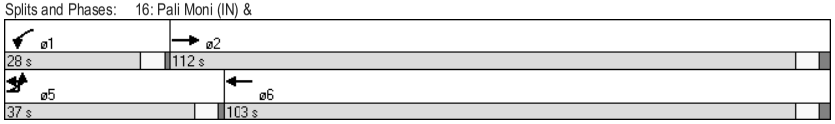
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	465	1515	150	1880
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	37.0	112.0	28.0	103.0
Total Split (%)	26.4%	80.0%	20.0%	73.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 135 (96%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	465	1515	55	150	1880	495	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	0.99		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4721		1652	4531							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4721		1652	4531							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	505	1647	60	163	2043	538	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	15	0	0	0	0	0	0	0
Lane Group Flow (vph)	505	1705	0	163	2566	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	26.9	110.6		18.4	102.1							
Effective Green, g (s)	26.9	110.6		18.4	102.1							
Actuated g/C Ratio	0.19	0.79		0.13	0.73							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	616	3730		217	3304							
v/s Ratio Prot	c0.16	0.36		0.10	c0.57							
v/s Ratio Perm												
v/c Ratio	0.82	0.46		0.75	0.78							
Uniform Delay, d1	54.2	4.8		58.6	11.8							
Progression Factor	0.69	1.25		1.07	0.42							
Incremental Delay, d2	5.8	0.3		10.8	1.4							
Delay (s)	43.2	6.3		73.7	6.4							
Level of Service	D	A		E	A							
Approach Delay (s)		14.7			10.4			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	12.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

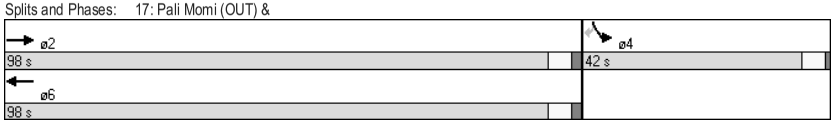
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1475	2170	355	190
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	98.0	98.0	42.0	42.0
Total Split (%)	70.0%	70.0%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 4 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1475	2170	0	355	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1301
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1301
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1603	2359	0	386	207
RTOR Reduction (vph)	0	0	0	0	0	6
Lane Group Flow (vph)	0	1603	2359	0	386	201
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		102.1	102.1		26.9	26.9
Effective Green, g (s)		102.1	102.1		26.9	26.9
Actuated g/C Ratio		0.73	0.73		0.19	0.19
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3461	3461		638	250
v/s Ratio Prot		0.34	c0.50		0.12	
v/s Ratio Perm						c0.15
v/c Ratio		0.46	0.68		0.61	0.80
Uniform Delay, d1		7.7	10.2		51.7	54.0
Progression Factor		0.30	1.00		1.00	1.00
Incremental Delay, d2		0.4	1.1		1.6	16.7
Delay (s)		2.7	11.3		53.3	70.7
Level of Service		A	B		D	E
Approach Delay (s)		2.7	11.3		59.4	
Approach LOS		A	B		E	

Intersection Summary			
HCM Average Control Delay	14.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Year 2019 with Project and Improvements

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1700	15	0	1195	0	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1848	16	0	1299	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.78	
vC, conflicting volume			1864		2505	932
vC1, stage 1 conf vol					1856	
vC2, stage 2 conf vol					649	
vCu, unblocked vol			1864		2366	932
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	84
cM capacity (veh/h)			320		106	268

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1232	632	649	649	43
Volume Left	0	0	0	0	0
Volume Right	0	16	0	0	43
cSH	1700	1700	1700	1700	268
Volume to Capacity	0.72	0.37	0.38	0.38	0.16
Queue Length 95th (ft)	0	0	0	0	14
Control Delay (s)	0.0	0.0	0.0	0.0	21.0
Lane LOS					C
Approach Delay (s)	0.0		0.0		21.0
Approach LOS					C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		

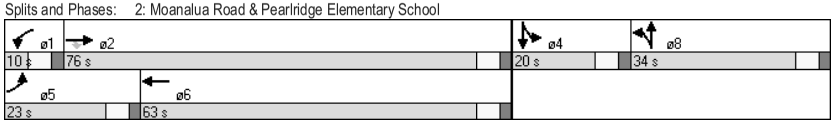
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	155	1495	110	50	840	85	5	130	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	23.0	76.0	76.0	10.0	63.0	34.0	34.0	20.0	20.0
Total Split (%)	16.4%	54.3%	54.3%	7.1%	45.0%	24.3%	24.3%	14.3%	14.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 139 (99%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1495	110	50	840	205	85	5	45	130	5	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.90		1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3435		1681	1566		1770	1590	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3435		1681	1566		1770	1590	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	1625	120	54	913	223	92	5	49	141	5	207
RTOR Reduction (vph)	0	0	19	0	12	0	0	45	0	0	187	0
Lane Group Flow (vph)	168	1625	101	54	1124	0	76	25	0	141	25	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	16.0	86.8	86.8	4.0	74.8		11.7	11.7		13.5	13.5	
Effective Green, g (s)	16.0	86.8	86.8	4.0	74.8		11.7	11.7		13.5	13.5	
Actuated g/C Ratio	0.11	0.62	0.62	0.03	0.53		0.08	0.08		0.10	0.10	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	202	2194	981	51	1835		140	131		171	153	
v/s Ratio Prot	c0.09	c0.46		0.03	0.33		c0.05	0.02		c0.08	0.02	
v/s Ratio Perm			0.06									
v/c Ratio	0.83	0.74	0.10	1.06	0.61		0.54	0.19		0.82	0.16	
Uniform Delay, d1	60.7	18.7	10.8	68.0	22.6		61.6	59.7		62.1	58.1	
Progression Factor	1.00	1.00	1.00	1.05	0.55		1.00	1.00		1.00	1.00	
Incremental Delay, d2	24.3	2.3	0.2	137.7	1.4		4.2	0.7		26.4	0.5	
Delay (s)	85.0	21.0	11.0	208.7	13.9		65.8	60.5		88.5	58.6	
Level of Service	F	C	B	F	B		E	E		F	E	
Approach Delay (s)		26.0			22.7			63.3			70.5	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	30.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

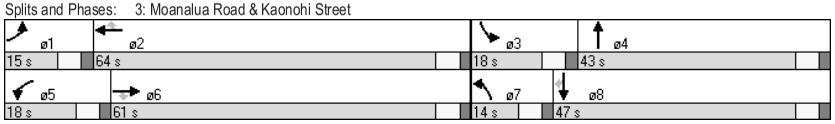
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	1265	205	130	760	100	85	90	285	265	240
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	15.0	61.0	61.0	18.0	64.0	64.0	14.0	43.0	18.0	47.0	47.0
Total Split (%)	10.7%	43.6%	43.6%	12.9%	45.7%	45.7%	10.0%	30.7%	12.9%	33.6%	33.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 136 (97%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 135
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1265	205	130	760	100	85	90	150	285	265	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3208		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3208		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1375	223	141	826	109	92	98	163	310	288	261
RTOR Reduction (vph)	0	0	108	0	0	53	0	119	0	0	0	167
Lane Group Flow (vph)	114	1375	115	141	826	56	92	142	0	310	288	94
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.6	68.1	68.1	12.0	71.5	71.5	7.7	23.9		12.0	28.2	28.2
Effective Green, g (s)	8.6	68.1	68.1	12.0	71.5	71.5	7.7	23.9		12.0	28.2	28.2
Actuated g/C Ratio	0.06	0.49	0.49	0.09	0.51	0.51	0.06	0.17		0.09	0.20	0.20
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	211	1721	770	152	1807	808	189	548		294	375	319
v/s Ratio Prot	0.03	c0.39		c0.08	c0.23		0.03	0.04		c0.09	c0.15	
v/s Ratio Perm			0.07			0.04						0.06
v/c Ratio	0.54	0.80	0.15	0.93	0.46	0.07	0.49	0.26		1.05	0.77	0.29
Uniform Delay, d1	63.8	30.2	19.9	63.6	21.9	17.4	64.2	50.4		64.0	52.8	47.5
Progression Factor	1.26	0.57	0.23	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.9	2.7	0.3	51.9	0.8	0.2	2.0	0.3		67.5	9.1	0.5
Delay (s)	82.3	19.8	4.9	115.5	22.7	17.5	66.2	50.6		131.5	61.9	48.0
Level of Service	F	B	A	F	C	B	E	D		F	E	D
Approach Delay (s)		22.0			34.3			54.7			82.8	
Approach LOS		C			C			D			F	

Intersection Summary				
HCM Average Control Delay	41.3	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.90			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	80.3%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	15	0	0	10	0	320	20	0	550	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	16	0	0	11	0	348	22	0	598	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	728	1000	332	674	1022	98	663			370		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	728	1000	332	674	1022	98	663			370		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	100	100	99	100			100		
cM capacity (veh/h)	307	242	664	332	235	939	922			1186		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	16	11	99	99	99	71	399	264
Volume Left	0	0	0	0	0	0	0	0
Volume Right	16	11	0	0	0	22	0	65
cSH	664	939	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.01	0.06	0.06	0.06	0.04	0.23	0.16
Queue Length 95th (ft)	2	1	0	0	0	0	0	0
Control Delay (s)	10.6	8.9	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.6	8.9	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	27.1%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	5	25	15	0	30	35	300	15	35	510	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	5	27	16	0	33	38	326	16	38	554	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked												
vC, conflicting volume	908	1054	283	793	1052	171	565			342		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	908	1054	283	793	1052	171	565			342		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	97	96	93	100	96	96			97		
cM capacity (veh/h)	210	209	714	249	210	843	1003			1213		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	22	27	16	33	38	217	125	38	370	196
Volume Left	16	0	16	0	38	0	0	38	0	0
Volume Right	0	27	0	33	0	0	16	0	0	11
cSH	210	714	249	843	1003	1700	1700	1213	1700	1700
Volume to Capacity	0.10	0.04	0.07	0.04	0.04	0.13	0.07	0.03	0.22	0.12
Queue Length 95th (ft)	9	3	5	3	3	0	0	2	0	0
Control Delay (s)	24.1	10.2	20.4	9.4	8.7	0.0	0.0	8.1	0.0	0.0
Lane LOS	C	B	C	A	A			A		
Approach Delay (s)	16.4		13.1		0.9			0.5		
Approach LOS	C		B							

Intersection Summary				
Average Delay		1.9		
Intersection Capacity Utilization		35.5%	ICU Level of Service	A
Analysis Period (min)		15		

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	55	10	30	5	150	275	35	520
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	36.0	36.0	36.0	36.0	54.0	54.0	54.0	54.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 28.4
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	10	160	30	5	10	150	275	40	35	520	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.90		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1600		1770	1671		1770	3472		1770	3525	
Flt Permitted	0.75	1.00		0.74	1.00		0.43	1.00		0.55	1.00	
Satd. Flow (perm)	1392	1600		1380	1671		807	3472		1017	3525	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	11	174	33	5	11	163	299	43	38	565	16
RTOR Reduction (vph)	0	142	0	0	9	0	0	15	0	0	3	0
Lane Group Flow (vph)	60	43	0	33	7	0	163	327	0	38	578	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	5.4	5.4		5.4	5.4		13.6	13.6		13.6	13.6	
Effective Green, g (s)	5.4	5.4		5.4	5.4		13.6	13.6		13.6	13.6	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.47	0.47		0.47	0.47	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	259	298		257	311		378	1628		477	1653	
v/s Ratio Prot		0.03			0.00			0.09			0.16	
v/s Ratio Perm	c0.04			0.02			c0.20			0.04		
v/c Ratio	0.23	0.15		0.13	0.02		0.43	0.20		0.08	0.35	
Uniform Delay, d1	10.0	9.9		9.8	9.6		5.1	4.5		4.2	4.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.2		0.2	0.0		0.8	0.1		0.1	0.1	
Delay (s)	10.5	10.1		10.1	9.7		5.9	4.6		4.3	5.0	
Level of Service	B	B		B	A		A	A		A	A	
Approach Delay (s)		10.2			9.9			5.0			5.0	
Approach LOS		B			A			A			A	

Intersection Summary				
HCM Average Control Delay	6.1	HCM Level of Service	A	
HCM Volume to Capacity ratio	0.37			
Actuated Cycle Length (s)	29.0	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	53.6%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	30	20	430	625	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	33	22	467	679	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.94	0.94	0.94			
vC, conflicting volume	986	370	739			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	864	210	602			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	84	96	98			
cM capacity (veh/h)	270	750	916			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	178	312	453	286
Volume Left	43	22	0	0	0
Volume Right	33	0	0	0	60
cSH	372	916	1700	1700	1700
Volume to Capacity	0.20	0.02	0.18	0.27	0.17
Queue Length 95th (ft)	19	2	0	0	0
Control Delay (s)	17.1	1.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	17.1	0.5		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	37.4%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	50	20	435	655	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	54	22	473	712	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked						
vC, conflicting volume	995	359	717			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	995	359	717			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	91	98			
cM capacity (veh/h)	236	638	879			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	179	315	475	243
Volume Left	16	22	0	0	0
Volume Right	54	0	0	0	5
cSH	458	879	1700	1700	1700
Volume to Capacity	0.15	0.02	0.19	0.28	0.14
Queue Length 95th (ft)	14	2	0	0	0
Control Delay (s)	14.3	1.3	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	14.3	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		37.3%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	440	55	25	680
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	478	60	27	739
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	809	269			538	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	809	269			538	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	84	98			97	
cM capacity (veh/h)	310	729			1026	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	319	219	175	296	296
Volume Left	49	0	0	27	0	0
Volume Right	16	0	60	0	0	0
cSH	362	1700	1700	1026	1700	1700
Volume to Capacity	0.18	0.19	0.13	0.03	0.17	0.17
Queue Length 95th (ft)	16	0	0	2	0	0
Control Delay (s)	17.1	0.0	0.0	1.5	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	17.1	0.0		0.4		
Approach LOS	C					

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		41.0%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	85	155	55	405	700	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	168	60	440	761	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1120	273	761			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1120	273	761			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	50	77	93			
cM capacity (veh/h)	186	725	847			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	261	60	220	220	304	304	190
Volume Left	92	60	0	0	0	0	0
Volume Right	168	0	0	0	0	0	38
cSH	358	847	1700	1700	1700	1700	1700
Volume to Capacity	0.73	0.07	0.13	0.13	0.18	0.18	0.11
Queue Length 95th (ft)	138	6	0	0	0	0	0
Control Delay (s)	37.7	9.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	A					
Approach Delay (s)	37.7	1.1			0.0		
Approach LOS	E						

Intersection Summary				
Average Delay		6.7		
Intersection Capacity Utilization		41.9%	ICU Level of Service	A
Analysis Period (min)		15		

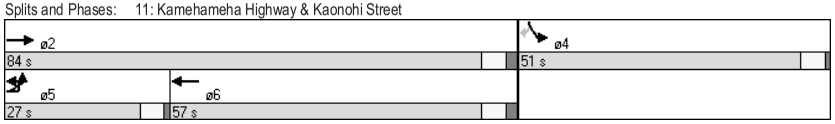
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	255	1725	805	685	175
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	27.0	84.0	57.0	51.0	51.0
Total Split (%)	20.0%	62.2%	42.2%	37.8%	37.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 85 (63%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	255	1725	805	235	685	175
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4660		3426	1333
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4660		3426	1333
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	1875	875	255	745	190
RTOR Reduction (vph)	0	0	36	0	1	113
Lane Group Flow (vph)	277	1875	1094	0	763	58
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	16.9	78.0	56.1		46.0	46.0
Effective Green, g (s)	16.9	78.0	56.1		46.0	46.0
Actuated g/C Ratio	0.13	0.58	0.42		0.34	0.34
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	401	2742	1936		1167	454
v/s Ratio Prot	0.09	c0.40	0.23		c0.22	
v/s Ratio Perm						0.04
v/c Ratio	0.69	0.68	0.56		0.65	0.13
Uniform Delay, d1	56.5	19.9	30.1		37.7	30.7
Progression Factor	1.15	0.28	0.64		1.00	1.00
Incremental Delay, d2	4.1	1.1	1.2		2.9	0.6
Delay (s)	69.4	6.7	20.4		40.6	31.3
Level of Service	E	A	C		D	C
Approach Delay (s)		14.8	20.4		38.9	
Approach LOS		B	C		D	

Intersection Summary			
HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

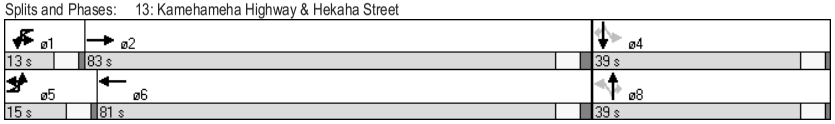
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1830	90	920	55	5	60	115	15	75
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	39.0	39.0	39.0
Total Split (s)	15.0	83.0	13.0	81.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	11.1%	61.5%	9.6%	60.0%	28.9%	28.9%	28.9%	28.9%	28.9%	28.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 106 (79%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1830	190	90	920	30	55	5	60	115	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.99		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4667		3204	4720			1720	1485		1641	1458
Flt Permitted	0.95	1.00		0.95	1.00			0.67	1.00		0.70	1.00
Satd. Flow (perm)	1652	4667		3204	4720			1203	1485		1206	1458
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1989	207	98	1000	33	60	5	65	125	16	82
RTOR Reduction (vph)	0	9	0	0	3	0	0	0	49	0	0	61
Lane Group Flow (vph)	54	2187	0	98	1030	0	0	65	16	0	141	21
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.6	77.2		7.8	77.4			34.0	34.0		34.0	34.0
Effective Green, g (s)	7.6	77.2		7.8	77.4			34.0	34.0		34.0	34.0
Actuated g/C Ratio	0.06	0.57		0.06	0.57			0.25	0.25		0.25	0.25
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	93	2669		185	2706			303	374		304	367
v/s Ratio Prot	c0.03	c0.47		0.03	0.22							
v/s Ratio Perm								0.05	0.01		c0.12	0.01
v/c Ratio	0.58	0.82		0.53	0.38			0.21	0.04		0.46	0.06
Uniform Delay, d1	62.1	23.3		61.8	15.7			39.9	38.2		42.8	38.3
Progression Factor	0.95	0.74		0.75	1.28			1.00	1.00		1.00	1.00
Incremental Delay, d2	6.8	2.2		2.6	0.4			1.6	0.2		5.0	0.3
Delay (s)	65.9	19.4		48.7	20.6			41.6	38.4		47.8	38.6
Level of Service	E	B		D	C			D	D		D	D
Approach Delay (s)		20.5			23.0			40.0			44.4	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	23.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

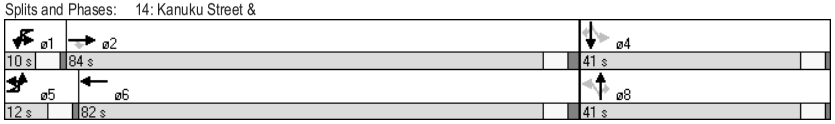
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	30	1880	20	20	990	5	5	15	140	10	45
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	39.0	39.0	39.0
Total Split (s)	12.0	84.0	84.0	10.0	82.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	8.9%	62.2%	62.2%	7.4%	60.7%	30.4%	30.4%	30.4%	30.4%	30.4%	30.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 132 (98%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	1880	20	20	990	65	5	5	15	140	10	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1449	3204	4697			1754	1531		1661	1453
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1449	3204	4697			1590	1531		1275	1453
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	2043	22	22	1076	71	5	5	16	152	11	49
RTOR Reduction (vph)	0	0	5	0	4	0	0	0	13	0	0	41
Lane Group Flow (vph)	33	2043	17	22	1143	0	0	10	3	0	163	8
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	4.2	93.4	93.4	3.0	92.2			22.6	22.6		22.6	22.6
Effective Green, g (s)	4.2	93.4	93.4	3.0	92.2			22.6	22.6		22.6	22.6
Actuated g/C Ratio	0.03	0.69	0.69	0.02	0.68			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	51	3284	1002	71	3208			266	256		213	243
v/s Ratio Prot	c0.02	c0.43		0.01	0.24							
v/s Ratio Perm			0.01					0.01	0.00		c0.13	0.01
v/c Ratio	0.65	0.62	0.02	0.31	0.36			0.04	0.01		0.77	0.03
Uniform Delay, d1	64.7	11.3	6.5	65.0	9.0			47.1	46.9		53.7	47.1
Progression Factor	1.35	0.19	0.02	0.74	1.54			1.00	1.00		1.00	1.00
Incremental Delay, d2	15.7	0.5	0.0	2.2	0.3			0.1	0.0		15.0	0.1
Delay (s)	103.1	2.7	0.2	50.2	14.1			47.1	46.9		68.7	47.1
Level of Service	F	A	A	D	B			D	D		E	D
Approach Delay (s)		4.3			14.8			47.0			63.7	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

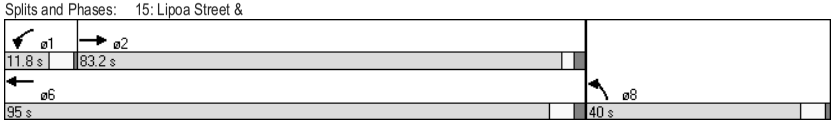
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2375	45	1040	75
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	83.2	11.8	95.0	40.0
Total Split (%)	61.6%	8.7%	70.4%	29.6%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2375	50	45	1040	75	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4732		1652	4746	1651	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4732		1652	4746	1651	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2582	54	49	1130	82	65
RTOR Reduction (vph)	1	0	0	0	26	0
Lane Group Flow (vph)	2635	0	49	1130	121	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	100.5		5.8	108.8	15.2	
Effective Green, g (s)	100.5		5.8	108.8	15.2	
Actuated g/C Ratio	0.74		0.04	0.81	0.11	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3523		71	3825	186	
v/s Ratio Prot	c0.56		c0.03	0.24	c0.07	
v/s Ratio Perm						
v/c Ratio	0.75		0.69	0.30	0.65	
Uniform Delay, d1	9.9		63.7	3.3	57.4	
Progression Factor	0.61		0.83	0.95	1.00	
Incremental Delay, d2	1.1		24.0	0.2	7.9	
Delay (s)	7.2		77.1	3.4	65.3	
Level of Service	A		E	A	E	
Approach Delay (s)	7.2			6.4	65.3	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	9.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

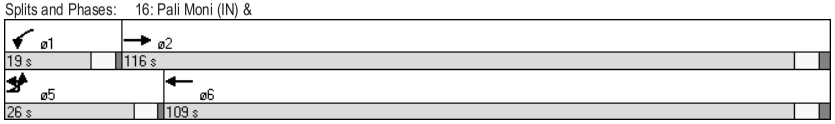
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	200	2265	45	1080
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	26.0	116.0	19.0	109.0
Total Split (%)	19.3%	85.9%	14.1%	80.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 119 (88%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	2265	15	45	1080	185	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4742		1652	4642							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4742		1652	4642							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	2462	16	49	1174	201	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	14	0	0	0	0	0	0	0
Lane Group Flow (vph)	217	2478	0	49	1361	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	14.4	115.8		8.2	109.6							
Effective Green, g (s)	14.4	115.8		8.2	109.6							
Actuated g/C Ratio	0.11	0.86		0.06	0.81							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	342	4068		100	3769							
v/s Ratio Prot	c0.07	c0.52		0.03	0.29							
v/s Ratio Perm												
v/c Ratio	0.63	0.61		0.49	0.36							
Uniform Delay, d1	57.8	2.9		61.4	3.4							
Progression Factor	0.83	0.63		0.94	0.44							
Incremental Delay, d2	2.6	0.5		3.5	0.2							
Delay (s)	50.5	2.3		61.4	1.7							
Level of Service	D	A		E	A							
Approach Delay (s)		6.2			3.8			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

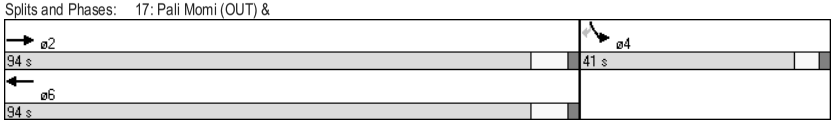
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	2150	1220	330	85
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	94.0	94.0	41.0	41.0
Total Split (%)	69.6%	69.6%	30.4%	30.4%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 5 (4%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	2150	1220	0	330	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.93
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1425
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2337	1326	0	359	92
RTOR Reduction (vph)	0	0	0	0	0	50
Lane Group Flow (vph)	0	2337	1326	0	359	42
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		86.0	86.0		35.0	35.0
Effective Green, g (s)		86.0	86.0		35.0	35.0
Actuated g/C Ratio		0.64	0.64		0.26	0.26
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3023	3023		860	369
v/s Ratio Prot		c0.49	0.28		c0.11	
v/s Ratio Perm						0.03
v/c Ratio		0.77	0.44		0.42	0.11
Uniform Delay, d1		17.5	12.3		41.5	38.2
Progression Factor		0.27	1.00		1.00	1.00
Incremental Delay, d2		1.6	0.5		1.5	0.6
Delay (s)		6.3	12.8		43.0	38.8
Level of Service		A	B		D	D
Approach Delay (s)		6.3	12.8		42.2	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1295	25	0	2055	0	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1408	27	0	2234	0	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.49	
vC, conflicting volume			1435		2538	717
vC1, stage 1 conf vol					1421	
vC2, stage 2 conf vol					1117	
vCu, unblocked vol			1435		2052	717
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	94
cM capacity (veh/h)			469		171	372

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	938	496	1117	1117	22
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	22
cSH	1700	1700	1700	1700	372
Volume to Capacity	0.55	0.29	0.66	0.66	0.06
Queue Length 95th (ft)	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	15.3
Lane LOS					C
Approach Delay (s)	0.0		0.0		15.3
Approach LOS					C

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

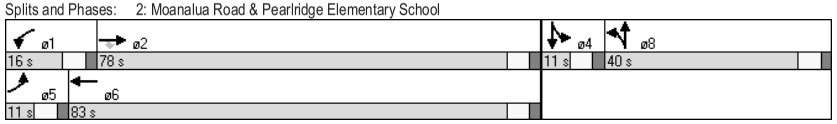
Timings
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	55	1190	85	55	1750	235	5	85	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	40.0	40.0	10.0	10.0
Total Split (s)	11.0	78.0	78.0	16.0	83.0	40.0	40.0	11.0	11.0
Total Split (%)	7.6%	53.8%	53.8%	11.0%	57.2%	27.6%	27.6%	7.6%	7.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 128 (88%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	1190	85	55	1750	80	235	5	65	85	5	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3516		1681	1610		1770	1603	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3516		1681	1610		1770	1603	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	1293	92	60	1902	87	255	5	71	92	5	65
RTOR Reduction (vph)	0	0	18	0	2	0	0	22	0	0	63	0
Lane Group Flow (vph)	60	1293	74	60	1987	0	171	138	0	92	7	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	5.0	88.0	88.0	7.7	90.7		20.3	20.3		5.0	5.0	
Effective Green, g (s)	5.0	88.0	88.0	7.7	90.7		20.3	20.3		5.0	5.0	
Actuated g/C Ratio	0.03	0.61	0.61	0.05	0.63		0.14	0.14		0.03	0.03	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	61	2148	961	94	2199		235	225		61	55	
v/s Ratio Prot	c0.03	0.37		0.03	c0.57		c0.10	0.09		c0.05	0.00	
v/s Ratio Perm			0.05									
v/c Ratio	0.98	0.60	0.08	0.64	0.90		0.73	0.61		1.51	0.13	
Uniform Delay, d1	70.0	17.7	11.7	67.3	23.4		59.7	58.6		70.0	67.9	
Progression Factor	1.00	1.00	1.00	1.08	0.57		1.00	1.00		1.00	1.00	
Incremental Delay, d2	108.8	1.3	0.2	8.5	4.3		10.7	4.9		296.3	1.1	
Delay (s)	178.8	18.9	11.9	81.5	17.7		70.4	63.5		366.3	69.0	
Level of Service	F	B	B	F	B		E	E		F	E	
Approach Delay (s)		25.1			19.6			67.1			237.8	
Approach LOS		C			B			E			F	

Intersection Summary			
HCM Average Control Delay	34.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

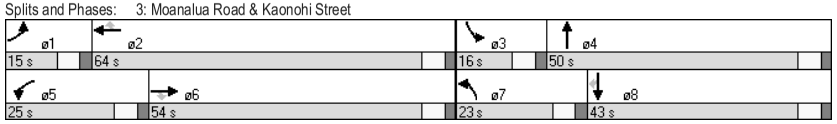
Timings
3: Moanalua Road & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	205	930	200	205	1420	290	325	175	125	115	145
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	15.0	54.0	54.0	25.0	64.0	64.0	23.0	50.0	16.0	43.0	43.0
Total Split (%)	10.3%	37.2%	37.2%	17.2%	44.1%	44.1%	15.9%	34.5%	11.0%	29.7%	29.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 144 (99%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	930	200	205	1420	290	325	175	155	125	115	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3290		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3290		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	1011	217	223	1543	315	353	190	168	136	125	158
RTOR Reduction (vph)	0	0	112	0	0	117	0	134	0	0	0	128
Lane Group Flow (vph)	223	1011	105	223	1543	198	353	224	0	136	125	30
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	9.0	70.0	70.0	19.0	80.0	80.0	16.8	22.4		9.6	15.2	15.2
Effective Green, g (s)	9.0	70.0	70.0	19.0	80.0	80.0	16.8	22.4		9.6	15.2	15.2
Actuated g/C Ratio	0.06	0.48	0.48	0.13	0.55	0.55	0.12	0.15		0.07	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	213	1708	764	232	1953	873	398	508		227	195	166
v/s Ratio Prot	0.06	0.29		c0.13	c0.44		c0.10	0.07		0.04	c0.07	
v/s Ratio Perm			0.07			0.13						0.02
v/c Ratio	1.05	0.59	0.14	0.96	0.79	0.23	0.89	0.44		0.60	0.64	0.18
Uniform Delay, d1	68.0	27.2	20.8	62.6	25.8	16.7	63.2	55.6		65.8	62.3	59.2
Progression Factor	1.13	0.56	0.14	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	66.7	1.2	0.3	48.2	3.3	0.6	20.4	0.6		4.2	7.0	0.5
Delay (s)	143.5	16.5	3.2	110.9	29.2	17.3	83.6	56.2		70.0	69.3	59.7
Level of Service	F	B	A	F	C	B	F	E		E	E	E
Approach Delay (s)		34.0			36.1			69.8			65.9	
Approach LOS		C			D			E			E	

Intersection Summary			
HCM Average Control Delay	43.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	80.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	90	0	0	75	0	575	40	0	440	65
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	98	0	0	82	0	625	43	0	478	71
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	751	1182	274	984	1196	178	549			668		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	751	1182	274	984	1196	178	549			668		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	86	100	100	90	100			100		
cM capacity (veh/h)	270	188	723	175	185	834	1017			917		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	98	82	179	179	179	133	319	230
Volume Left	0	0	0	0	0	0	0	0
Volume Right	98	82	0	0	0	43	0	71
cSH	723	834	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.10	0.11	0.11	0.11	0.08	0.19	0.14
Queue Length 95th (ft)	12	8	0	0	0	0	0	0
Control Delay (s)	10.8	9.8	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.8	9.8	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay		1.3		
Intersection Capacity Utilization	26.5%	ICU Level of Service	A	
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	5	80	105	55	140	60	465	75	95	435	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	5	87	114	60	152	65	505	82	103	473	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.95	0.95		0.95	0.95	0.95				0.95		
vC, conflicting volume	1253	1405	245	1209	1372	293	489			587		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1163	1323	245	1117	1289	155	489			463		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	51	96	88	2	54	81	94			90		
cM capacity (veh/h)	66	125	756	116	131	822	1070			1041		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	38	87	174	152	65	337	250	103	315	174
Volume Left	33	0	114	0	65	0	0	103	0	0
Volume Right	0	87	0	152	0	0	82	0	0	16
cSH	71	756	121	822	1070	1700	1700	1041	1700	1700
Volume to Capacity	0.53	0.12	1.44	0.19	0.06	0.20	0.15	0.10	0.19	0.10
Queue Length 95th (ft)	56	10	301	17	5	0	0	8	0	0
Control Delay (s)	102.9	10.4	303.8	10.4	8.6	0.0	0.0	8.8	0.0	0.0
Lane LOS	F	B	F	B	A			A		
Approach Delay (s)	38.5		166.9		0.9			1.5		
Approach LOS	E		F							

Intersection Summary				
Average Delay		35.8		
Intersection Capacity Utilization	45.9%	ICU Level of Service	A	
Analysis Period (min)		15		

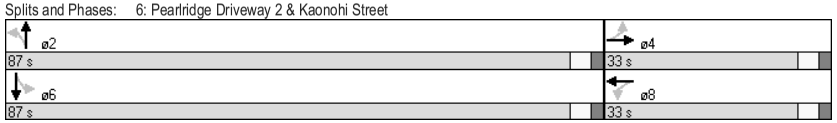
Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	10	160	40	270	485	60	530
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	87.0	87.0	87.0	87.0
Total Split (%)	27.5%	27.5%	27.5%	27.5%	72.5%	72.5%	72.5%	72.5%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 70.8
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	10	190	160	40	80	270	485	95	60	530	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.90		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1597		1770	1676		1770	3452		1770	3502	
Flt Permitted	0.67	1.00		0.58	1.00		0.39	1.00		0.39	1.00	
Satd. Flow (perm)	1255	1597		1083	1676		730	3452		719	3502	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	11	207	174	43	87	293	527	103	65	576	43
RTOR Reduction (vph)	0	139	0	0	53	0	0	20	0	0	7	0
Lane Group Flow (vph)	43	79	0	174	77	0	293	610	0	65	612	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	22.8	22.8		22.8	22.8		37.0	37.0		37.0	37.0	
Effective Green, g (s)	22.8	22.8		22.8	22.8		37.0	37.0		37.0	37.0	
Actuated g/C Ratio	0.33	0.33		0.33	0.33		0.53	0.53		0.53	0.53	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	410	522		354	547		387	1830		381	1856	
v/s Ratio Prot		0.05			0.05			0.18			0.17	
v/s Ratio Perm	0.03			c0.16			c0.40			0.09		
v/c Ratio	0.10	0.15		0.49	0.14		0.76	0.33		0.17	0.33	
Uniform Delay, d1	16.4	16.6		18.9	16.6		12.9	9.4		8.5	9.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		1.1	0.1		8.2	0.1		0.2	0.1	
Delay (s)	16.5	16.8		19.9	16.7		21.1	9.5		8.7	9.4	
Level of Service	B	B		B	B		C	A		A	A	
Approach Delay (s)		16.7			18.5			13.2			9.4	
Approach LOS		B			B			B			A	

Intersection Summary				
HCM Average Control Delay	13.2	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.66			
Actuated Cycle Length (s)	69.8	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	68.7%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	820	820	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	891	891	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	200	
pX, platoon unblocked	0.91	0.91	0.91			
vC, conflicting volume	1405	470	940			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1253	230	745			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	78	95	97			
cM capacity (veh/h)	146	706	784			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	319	594	594	346
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	241	784	1700	1700	1700
Volume to Capacity	0.27	0.03	0.35	0.35	0.20
Queue Length 95th (ft)	26	2	0	0	0
Control Delay (s)	25.3	1.0	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	25.3	0.3		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	825	835	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	897	908	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	0.96	0.96	0.96			
vC, conflicting volume	1421	465	929			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1364	373	854			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	90	96			
cM capacity (veh/h)	129	603	754			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	326	598	605	324
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	22
cSH	337	754	1700	1700	1700
Volume to Capacity	0.23	0.04	0.35	0.36	0.19
Queue Length 95th (ft)	21	3	0	0	0
Control Delay (s)	18.7	1.2	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	18.7	0.4		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/7/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	800	55	30	865
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	870	60	33	940
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1278	465			929	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1278	465			929	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	50	91			96	
cM capacity (veh/h)	151	544			732	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	580	350	221	376	376
Volume Left	76	0	0	33	0	0
Volume Right	49	0	60	0	0	0
cSH	210	1700	1700	732	1700	1700
Volume to Capacity	0.59	0.34	0.21	0.04	0.22	0.22
Queue Length 95th (ft)	84	0	0	3	0	0
Control Delay (s)	44.4	0.0	0.0	1.9	0.0	0.0
Lane LOS	E			A		
Approach Delay (s)	44.4	0.0		0.4		
Approach LOS	E					

Intersection Summary			
Average Delay	2.9		
Intersection Capacity Utilization	52.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	115	125	825	870	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	125	136	897	946	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1696	345	946			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1696	345	946			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	36	81	81			
cM capacity (veh/h)	68	651	721			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	136	448	448	378	378	249
Volume Left	43	136	0	0	0	0	0
Volume Right	125	0	0	0	0	0	60
cSH	202	721	1700	1700	1700	1700	1700
Volume to Capacity	0.83	0.19	0.26	0.26	0.22	0.22	0.15
Queue Length 95th (ft)	153	17	0	0	0	0	0
Control Delay (s)	75.2	11.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	75.2	1.5			0.0		
Approach LOS	F						

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		

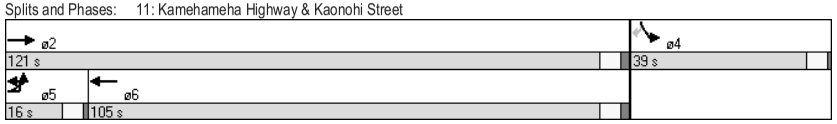
Timings
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	315	1265	3680	405	575
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	28.0	28.0	39.0	39.0
Total Split (s)	16.0	121.0	105.0	39.0	39.0
Total Split (%)	10.0%	75.6%	65.6%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 122 (76%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	315	1265	3680	625	405	575
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		0.94	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4702		3300	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4702		3300	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	342	1375	4000	679	440	625
RTOR Reduction (vph)	0	0	15	0	74	86
Lane Group Flow (vph)	342	1375	4664	0	654	251
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	11.0	115.4	99.4		33.6	33.6
Effective Green, g (s)	11.0	115.4	99.4		33.6	33.6
Actuated g/C Ratio	0.07	0.72	0.62		0.21	0.21
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	236	3668	2921		693	303
v/s Ratio Prot	c0.10	0.27	c0.99		c0.20	
v/s Ratio Perm						0.17
v/c Ratio	1.45	0.37	1.60		0.94	0.83
Uniform Delay, d1	74.5	8.5	30.3		62.3	60.4
Progression Factor	0.90	1.04	0.73		1.00	1.00
Incremental Delay, d2	223.1	0.3	268.7		21.3	16.7
Delay (s)	290.4	9.1	290.9		83.6	77.2
Level of Service	F	A	F		F	E
Approach Delay (s)		65.1	290.9		81.5	
Approach LOS		E	F		F	

Intersection Summary			
HCM Average Control Delay	209.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.43		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	131.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

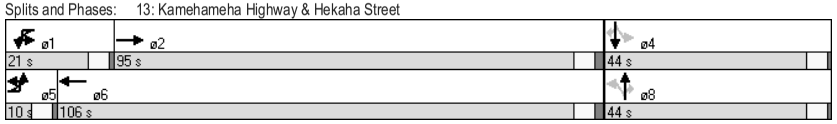
Timings
13: Kamehameha Highway & Hekaha Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1170	190	3100	240	45	235	65	45	100
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	33.0	10.0	33.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	10.0	95.0	21.0	106.0	44.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	6.3%	59.4%	13.1%	66.3%	27.5%	27.5%	27.5%	27.5%	27.5%	27.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 53 (33%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1170	155	190	3100	80	240	45	235	65	45	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4647		3204	4725			1728	1442		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.36	1.00
Satd. Flow (perm)	1652	4647		3204	4725			1108	1442		611	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1272	168	207	3370	87	261	49	255	71	49	109
RTOR Reduction (vph)	0	10	0	0	2	0	0	0	123	0	0	42
Lane Group Flow (vph)	54	1430	0	207	3456	0	0	310	132	0	120	67
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	90.5		14.5	100.0			39.0	39.0		39.0	39.0
Effective Green, g (s)	5.0	90.5		14.5	100.0			39.0	39.0		39.0	39.0
Actuated g/C Ratio	0.03	0.57		0.09	0.62			0.24	0.24		0.24	0.24
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	52	2628		290	2953			270	351		149	360
v/s Ratio Prot	0.03	0.31		c0.06	c0.73							
v/s Ratio Perm								c0.28	0.09		0.20	0.05
v/c Ratio	1.04	0.54		0.71	1.17			1.15	0.38		0.81	0.19
Uniform Delay, d1	77.5	21.8		70.7	30.0			60.5	50.4		56.9	47.9
Progression Factor	1.20	0.75		1.24	0.57			1.00	1.00		1.00	1.00
Incremental Delay, d2	127.3	0.7		0.8	77.0			100.8	0.7		26.2	0.3
Delay (s)	220.2	17.0		88.4	93.9			161.3	51.0		83.1	48.2
Level of Service	F	B		F	F			F	D		F	D
Approach Delay (s)		24.3			93.6			111.6			66.5	
Approach LOS		C			F			F			E	

Intersection Summary			
HCM Average Control Delay	76.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	104.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

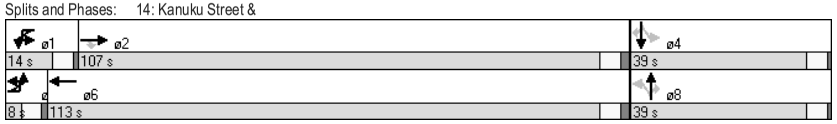
Timings
14: Kanuku Street &

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1330	75	90	3545	95	15	55	65	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	107.0	107.0	14.0	113.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	5.0%	66.9%	66.9%	8.8%	70.6%	24.4%	24.4%	24.4%	24.4%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 40 (25%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1330	75	90	3545	225	95	15	55	65	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1428	3204	4697			1695	1531		1670	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.63	1.00		0.53	1.00
Satd. Flow (perm)	1652	4746	1428	3204	4697			1111	1531		925	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1446	82	98	3853	245	103	16	60	71	16	38
RTOR Reduction (vph)	0	0	22	0	3	0	0	0	52	0	0	27
Lane Group Flow (vph)	38	1446	60	98	4095	0	0	119	8	0	87	11
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	113.9	113.9	8.7	119.6			21.4	21.4		21.4	21.4
Effective Green, g (s)	3.0	113.9	113.9	8.7	119.6			21.4	21.4		21.4	21.4
Actuated g/C Ratio	0.02	0.71	0.71	0.05	0.75			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	31	3379	1017	174	3511			149	205		124	191
v/s Ratio Prot	c0.02	0.30		0.03	c0.87							
v/s Ratio Perm			0.04					c0.11	0.01		0.09	0.01
v/c Ratio	1.23	0.43	0.06	0.56	1.17			0.80	0.04		0.70	0.06
Uniform Delay, d1	78.5	9.6	6.9	73.8	20.2			67.2	60.3		66.2	60.5
Progression Factor	0.93	0.49	0.16	1.06	0.44			1.00	1.00		1.00	1.00
Incremental Delay, d2	222.4	0.3	0.1	0.4	75.1			25.0	0.1		16.4	0.1
Delay (s)	295.5	5.1	1.2	78.8	84.1			92.2	60.4		82.7	60.6
Level of Service	F	A	A	E	F			F	E		F	E
Approach Delay (s)		11.9			84.0			81.6			76.0	
Approach LOS		B			F			F			E	

Intersection Summary				
HCM Average Control Delay	65.1	HCM Level of Service	E	
HCM Volume to Capacity ratio	1.11			
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	107.4%	ICU Level of Service	G	
Analysis Period (min)	15			
c Critical Lane Group				

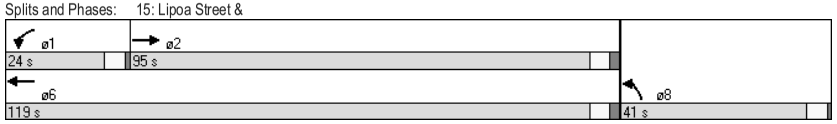
Timings
15: Lipoa Street &

7/7/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1475	100	3900	165
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	95.0	24.0	119.0	41.0
Total Split (%)	59.4%	15.0%	74.4%	25.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 48 (30%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1475	55	100	3900	165	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5058		1652	4746	1747	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5058		1652	4746	1747	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1603	60	109	4239	179	38
RTOR Reduction (vph)	2	0	0	0	5	0
Lane Group Flow (vph)	1661	0	109	4239	212	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	104.0		15.3	124.3	24.7	
Effective Green, g (s)	104.0		15.3	124.3	24.7	
Actuated g/C Ratio	0.65		0.10	0.78	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3288		158	3687	270	
v/s Ratio Prot	0.33		0.07	c0.89	c0.12	
v/s Ratio Perm						
v/c Ratio	0.51		0.69	1.15	0.78	
Uniform Delay, d1	14.6		70.1	17.9	65.1	
Progression Factor	1.15		1.12	0.48	1.00	
Incremental Delay, d2	0.5		4.7	68.7	13.9	
Delay (s)	17.3		82.9	77.3	79.0	
Level of Service	B		F	E	E	
Approach Delay (s)	17.3			77.5	79.0	
Approach LOS	B			E	E	

Intersection Summary			
HCM Average Control Delay	61.5	HCM Level of Service	E
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	95.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

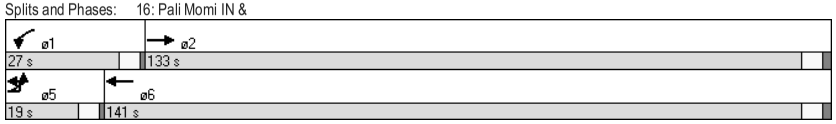
Timings
16: Pali Momi IN &

7/7/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	250	1215	125	3445
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	19.0	133.0	27.0	141.0
Total Split (%)	11.9%	83.1%	16.9%	88.1%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 157 (98%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	1215	35	125	3445	400	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4726		1652	4622							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4726		1652	4622							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	1321	38	136	3745	435	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	272	1357	0	136	4178	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	14.0	131.2		17.8	135.0							
Effective Green, g (s)	14.0	131.2		17.8	135.0							
Actuated g/C Ratio	0.09	0.82		0.11	0.84							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	280	3875		184	3900							
v/s Ratio Prot	c0.08	0.29		0.08	c0.90							
v/s Ratio Perm												
v/c Ratio	0.97	0.35		0.74	1.07							
Uniform Delay, d1	72.8	3.6		68.9	12.5							
Progression Factor	0.80	1.81		1.17	0.61							
Incremental Delay, d2	42.4	0.2		1.4	32.6							
Delay (s)	100.6	6.8		81.9	40.2							
Level of Service	F	A		F	D							
Approach Delay (s)		22.4			41.5			0.0			0.0	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	36.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

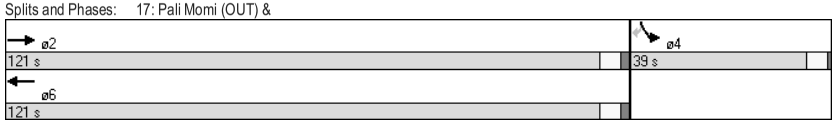
Timings
17: Pali Momi (OUT) &

7/7/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1215	3725	320	150
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	121.0	121.0	39.0	39.0
Total Split (%)	75.6%	75.6%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 156 (98%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1215	3725	0	320	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.86
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1311
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1311
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1321	4049	0	348	163
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1321	4049	0	348	163
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		123.8	123.8		25.2	25.2
Effective Green, g (s)		123.8	123.8		25.2	25.2
Actuated g/C Ratio		0.77	0.77		0.16	0.16
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3672	3672		523	206
v/s Ratio Prot		0.28	c0.85		0.10	
v/s Ratio Perm						c0.12
v/c Ratio		0.36	1.10		0.67	0.79
Uniform Delay, d1		5.7	18.1		63.4	64.9
Progression Factor		0.75	1.00		1.00	1.00
Incremental Delay, d2		0.3	51.0		3.2	18.4
Delay (s)		4.5	69.1		66.6	83.3
Level of Service		A	E		E	F
Approach Delay (s)		4.5	69.1		71.9	
Approach LOS		A	E		E	

Intersection Summary			
HCM Average Control Delay	54.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	108.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1740	25	0	1745	0	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1891	27	0	1897	0	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.71	
vC, conflicting volume			1918		2853	959
vC1, stage 1 conf vol					1905	
vC2, stage 2 conf vol					948	
vCu, unblocked vol			1918		2795	959
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	68
cM capacity (veh/h)			305		98	257

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1261	658	948	948	82
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	82
cSH	1700	1700	1700	1700	257
Volume to Capacity	0.74	0.39	0.56	0.56	0.32
Queue Length 95th (ft)	0	0	0	0	33
Control Delay (s)	0.0	0.0	0.0	0.0	25.4
Lane LOS					D
Approach Delay (s)	0.0		0.0		25.4
Approach LOS					D

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	60.2%	ICU Level of Service	B
Analysis Period (min)	15		

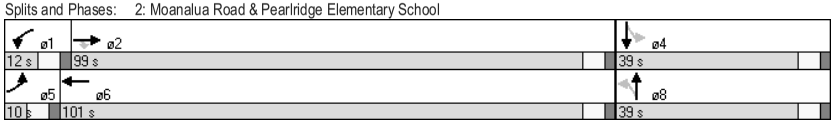
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	5	1675	145	65	1535	255	5	15	5
Turn Type	Prot		Perm	Prot		Perm		Perm	
Protected Phases	5	2		1	6		8		4
Permitted Phases			2			8		4	
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	10.0	99.0	99.0	12.0	101.0	39.0	39.0	39.0	39.0
Total Split (%)	6.7%	66.0%	66.0%	8.0%	67.3%	26.0%	26.0%	26.0%	26.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 52 (35%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1675	145	65	1535	15	255	5	95	15	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3534		1681	1589		1770	1650	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.74	0.85		0.42	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3534		1316	1386		786	1650	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1821	158	71	1668	16	277	5	103	16	5	16
RTOR Reduction (vph)	0	0	25	0	0	0	0	31	0	0	13	0
Lane Group Flow (vph)	5	1821	133	71	1684	0	199	155	0	16	8	0
Turn Type	Prot		Perm	Prot			Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8			4		
Actuated Green, G (s)	0.8	99.1	99.1	6.0	104.3		26.9	26.9		26.9	26.9	
Effective Green, g (s)	0.8	99.1	99.1	6.0	104.3		26.9	26.9		26.9	26.9	
Actuated g/C Ratio	0.01	0.66	0.66	0.04	0.70		0.18	0.18		0.18	0.18	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	9	2338	1046	71	2457		236	249		141	296	
v/s Ratio Prot	0.00	c0.51		c0.04	c0.48						0.00	
v/s Ratio Perm			0.08				c0.15	0.11		0.02		
v/c Ratio	0.56	0.78	0.13	1.00	0.69		0.84	0.62		0.11	0.03	
Uniform Delay, d1	74.4	17.8	9.4	72.0	13.3		59.5	56.9		51.6	50.8	
Progression Factor	1.00	1.00	1.00	0.83	0.85		1.00	1.00		1.00	1.00	
Incremental Delay, d2	58.1	2.6	0.3	89.5	1.1		23.0	4.8		0.4	0.0	
Delay (s)	132.5	20.4	9.7	149.5	12.4		82.5	61.6		51.9	50.8	
Level of Service	F	C	A	F	B		F	E		D	D	
Approach Delay (s)		19.9			18.0			72.4			51.3	
Approach LOS		B			B			E			D	

Intersection Summary			
HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

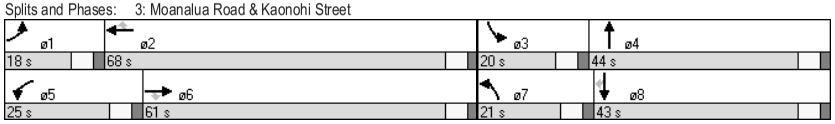
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	145	1260	365	220	1065	215	335	190	200	160	205
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	18.0	61.0	61.0	25.0	68.0	68.0	21.0	44.0	20.0	43.0	43.0
Total Split (%)	12.0%	40.7%	40.7%	16.7%	45.3%	45.3%	14.0%	29.3%	13.3%	28.7%	28.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 144 (96%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1260	365	220	1065	215	335	190	335	200	160	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3201		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3201		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	1370	397	239	1158	234	364	207	364	217	174	223
RTOR Reduction (vph)	0	0	185	0	0	115	0	153	0	0	0	150
Lane Group Flow (vph)	158	1370	212	239	1158	119	364	418	0	217	174	73
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	11.1	68.1	68.1	19.0	76.0	76.0	15.0	25.7		13.2	23.9	23.9
Effective Green, g (s)	11.1	68.1	68.1	19.0	76.0	76.0	15.0	25.7		13.2	23.9	23.9
Actuated g/C Ratio	0.07	0.45	0.45	0.13	0.51	0.51	0.10	0.17		0.09	0.16	0.16
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	254	1607	719	224	1793	802	343	548		302	297	252
v/s Ratio Prot	0.05	c0.39		c0.14	0.33		c0.11	c0.13		0.06	0.09	
v/s Ratio Perm			0.13			0.07						0.05
v/c Ratio	0.62	0.85	0.30	1.07	0.65	0.15	1.06	0.86dr		0.72	0.59	0.29
Uniform Delay, d1	67.4	36.5	25.8	65.5	27.1	19.7	67.5	59.2		66.6	58.5	55.6
Progression Factor	1.40	0.59	0.26	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.0	3.8	0.7	79.0	1.8	0.4	65.7	6.2		7.9	2.9	0.6
Delay (s)	97.4	25.3	7.4	144.5	28.9	20.1	133.2	65.4		74.5	61.4	56.2
Level of Service	F	C	A	F	C	C	F	E		E	E	E
Approach Delay (s)		27.5			44.6			91.8			64.2	
Approach LOS		C			D			F			E	

Intersection Summary				
HCM Average Control Delay	49.2	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.86			
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	88.8%	ICU Level of Service	E	
Analysis Period (min)	15			

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	80	0	0	165	0	715	95	0	650	110
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	87	0	0	179	0	777	103	0	707	120
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	1140	1647	413	1269	1655	246	826			880		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1140	1647	413	1269	1655	246	826			880		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	85	100	100	76	100			100		
cM capacity (veh/h)	119	98	588	107	97	754	800			763		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	87	179	222	222	222	214	471	355
Volume Left	0	0	0	0	0	0	0	0
Volume Right	87	179	0	0	0	103	0	120
cSH	588	754	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.15	0.24	0.13	0.13	0.13	0.13	0.28	0.21
Queue Length 95th (ft)	13	23	0	0	0	0	0	0
Control Delay (s)	12.2	11.3	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	B						
Approach Delay (s)	12.2	11.3	0.0				0.0	
Approach LOS	B	B						

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	33.1%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	45	5	75	105	50	135	60	625	130	165	565	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	5	82	114	54	147	65	679	141	179	614	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.93	0.93		0.93	0.93	0.93				0.93		
vC, conflicting volume	1628	1935	318	1630	1875	410	636			821		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1528	1857	318	1531	1793	222	636			662		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	89	88	0	1	80	93			79		
cM capacity (veh/h)	3	50	678	48	55	728	943			860		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	54	82	168	147	65	453	368	179	409	226
Volume Left	49	0	114	0	65	0	0	179	0	0
Volume Right	0	82	0	147	0	0	141	0	0	22
cSH	3	678	50	728	943	1700	1700	860	1700	1700
Volume to Capacity	17.34	0.12	3.37	0.20	0.07	0.27	0.22	0.21	0.24	0.13
Queue Length 95th (ft)	Err	10	Err	19	6	0	0	20	0	0
Control Delay (s)	Err	11.0	Err	11.2	9.1	0.0	0.0	10.3	0.0	0.0
Lane LOS	F	B	F	B	A			B		
Approach Delay (s)	4006.2		5349.5		0.7			2.3		
Approach LOS	F		F							

Intersection Summary			
Average Delay		1037.6	
Intersection Capacity Utilization		55.7%	ICU Level of Service	B
Analysis Period (min)		15	

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	55	15	200	60	255	590	150	580
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	47.0	47.0	47.0	47.0
Total Split (%)	41.3%	41.3%	41.3%	41.3%	58.8%	58.8%	58.8%	58.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 63.3
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

ø2	ø4
47 s	33 s
ø6	ø8
47 s	33 s

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	15	215	200	60	145	255	590	230	150	580	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.89		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1601		1770	1665		1770	3390		1770	3517	
Flt Permitted	0.58	1.00		0.54	1.00		0.38	1.00		0.27	1.00	
Satd. Flow (perm)	1087	1601		1011	1665		705	3390		500	3517	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	16	234	217	65	158	277	641	250	163	630	27
RTOR Reduction (vph)	0	158	0	0	109	0	0	51	0	0	4	0
Lane Group Flow (vph)	60	92	0	217	114	0	277	840	0	163	653	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	19.2	19.2		19.2	19.2		33.1	33.1		33.1	33.1	
Effective Green, g (s)	19.2	19.2		19.2	19.2		33.1	33.1		33.1	33.1	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.53	0.53		0.53	0.53	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	335	493		312	513		375	1801		266	1869	
v/s Ratio Prot		0.06			0.07			0.25			0.19	
v/s Ratio Perm	0.06			c0.21			c0.39			0.33		
v/c Ratio	0.18	0.19		0.70	0.22		0.74	0.47		0.61	0.35	
Uniform Delay, d1	15.8	15.8		19.0	16.0		11.3	9.1		10.1	8.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2		6.6	0.2		7.4	0.2		4.1	0.1	
Delay (s)	16.0	16.0		25.6	16.2		18.7	9.3		14.3	8.5	
Level of Service	B	B		C	B		B	A		B	A	
Approach Delay (s)		16.0			20.8			11.5			9.7	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	62.3	Sum of lost time (s)	10.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	50	25	1040	855	120
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	54	27	1130	929	130
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.90	0.90	0.90			
vC, conflicting volume	1614	530	1060			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1466	265	852			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	68	92	96			
cM capacity (veh/h)	103	662	707			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	87	404	754	620	440
Volume Left	33	27	0	0	0
Volume Right	54	0	0	0	130
cSH	218	707	1700	1700	1700
Volume to Capacity	0.40	0.04	0.44	0.36	0.26
Queue Length 95th (ft)	45	3	0	0	0
Control Delay (s)	32.0	1.2	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	32.0	0.4		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	95	50	1055	895	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	103	54	1147	973	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	0.98	0.98	0.98			
vC, conflicting volume	1671	503	1005			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1646	455	967			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	60	81	92			
cM capacity (veh/h)	82	542	695			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	136	437	764	649	357
Volume Left	33	54	0	0	0
Volume Right	103	0	0	0	33
cSH	230	695	1700	1700	1700
Volume to Capacity	0.59	0.08	0.45	0.38	0.21
Queue Length 95th (ft)	84	6	0	0	0
Control Delay (s)	40.9	2.3	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	40.9	0.8		0.0	
Approach LOS	E				

Intersection Summary				
Average Delay		2.8		
Intersection Capacity Utilization		73.8%	ICU Level of Service	D
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	85	1000	85	45	850
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	92	1087	92	49	924
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1539	590			1179	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1539	590			1179	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	22	80			92	
cM capacity (veh/h)	97	451			588	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	168	725	455	234	370	370
Volume Left	76	0	0	49	0	0
Volume Right	92	0	92	0	0	0
cSH	171	1700	1700	588	1700	1700
Volume to Capacity	0.99	0.43	0.27	0.08	0.22	0.22
Queue Length 95th (ft)	195	0	0	7	0	0
Control Delay (s)	119.6	0.0	0.0	3.3	0.0	0.0
Lane LOS	F			A		
Approach Delay (s)	119.6	0.0		0.8		
Approach LOS	F					

Intersection Summary				
Average Delay		9.0		
Intersection Capacity Utilization		66.3%	ICU Level of Service	C
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	115	95	1040	940	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	125	103	1130	1022	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1829	376	1022			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1829	376	1022			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	15	80	85			
cM capacity (veh/h)	58	622	675			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	174	103	565	565	409	409	275
Volume Left	49	103	0	0	0	0	0
Volume Right	125	0	0	0	0	0	71
cSH	166	675	1700	1700	1700	1700	1700
Volume to Capacity	1.05	0.15	0.33	0.33	0.24	0.24	0.16
Queue Length 95th (ft)	215	13	0	0	0	0	0
Control Delay (s)	140.0	11.3	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	140.0	0.9			0.0		
Approach LOS	F						

Intersection Summary				
Average Delay		10.2		
Intersection Capacity Utilization		45.0%	ICU Level of Service	A
Analysis Period (min)		15		

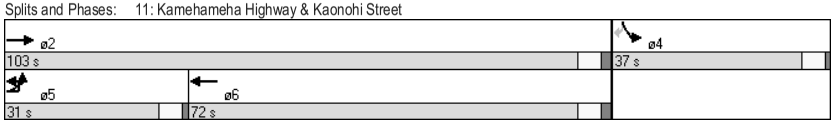
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	565	1810	1525	555	495
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	33.0	33.0
Total Split (s)	31.0	103.0	72.0	37.0	37.0
Total Split (%)	22.1%	73.6%	51.4%	26.4%	26.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 96 (69%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 130
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	565	1810	1525	565	555	495
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.96		0.98	0.89
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.96		0.97	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4534		3277	1283
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4534		3277	1283
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	614	1967	1658	614	603	538
RTOR Reduction (vph)	0	0	48	0	20	241
Lane Group Flow (vph)	614	1967	2224	0	761	119
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	26.0	97.0	66.0		32.0	32.0
Effective Green, g (s)	26.0	97.0	66.0		32.0	32.0
Actuated g/C Ratio	0.19	0.69	0.47		0.23	0.23
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	595	3288	2137		749	293
v/s Ratio Prot	c0.19	0.41	c0.49		c0.23	
v/s Ratio Perm						0.09
v/c Ratio	1.03	0.60	1.04		1.02	0.41
Uniform Delay, d1	57.0	11.3	37.0		54.0	45.9
Progression Factor	1.31	0.31	0.69		1.00	1.00
Incremental Delay, d2	40.9	0.6	28.7		36.9	0.9
Delay (s)	115.7	4.2	54.1		90.9	46.9
Level of Service	F	A	D		F	D
Approach Delay (s)		30.7	54.1		77.0	
Approach LOS		C	D		E	

Intersection Summary			
HCM Average Control Delay	48.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	98.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

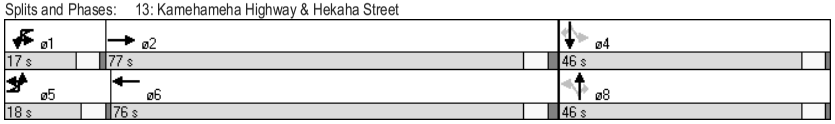
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	100	1830	230	1740	215	55	325	95	40	145
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	18.0	77.0	17.0	76.0	46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	12.9%	55.0%	12.1%	54.3%	32.9%	32.9%	32.9%	32.9%	32.9%	32.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 132 (94%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	1830	295	230	1740	65	215	55	325	95	40	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4632		3204	4715			1698	1531		1679	1414
Flt Permitted	0.95	1.00		0.95	1.00			0.61	1.00		0.39	1.00
Satd. Flow (perm)	1652	4632		3204	4715			1076	1531		685	1414
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1989	321	250	1891	71	234	60	353	103	43	158
RTOR Reduction (vph)	0	15	0	0	3	0	0	0	117	0	0	113
Lane Group Flow (vph)	109	2295	0	250	1959	0	0	294	236	0	146	45
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	12.2	72.3		12.0	72.1			39.7	39.7		39.7	39.7
Effective Green, g (s)	12.2	72.3		12.0	72.1			39.7	39.7		39.7	39.7
Actuated g/C Ratio	0.09	0.52		0.09	0.51			0.28	0.28		0.28	0.28
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	144	2392		275	2428			305	434		194	401
v/s Ratio Prot	0.07	c0.50		c0.08	0.42							
v/s Ratio Perm								c0.27	0.15		0.21	0.03
v/c Ratio	0.76	0.96		0.91	0.81			0.96	0.54		0.75	0.11
Uniform Delay, d1	62.5	32.4		63.5	28.2			49.4	42.5		45.7	37.1
Progression Factor	0.91	1.02		1.05	0.90			1.00	1.00		1.00	1.00
Incremental Delay, d2	10.0	6.1		24.3	2.1			41.5	1.4		15.2	0.1
Delay (s)	67.0	39.3		90.8	27.4			90.9	43.9		60.8	37.2
Level of Service	E	D		F	C			F	D		E	D
Approach Delay (s)		40.5			34.5			65.3			48.6	
Approach LOS		D			C			E			D	

Intersection Summary			
HCM Average Control Delay	41.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	105.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

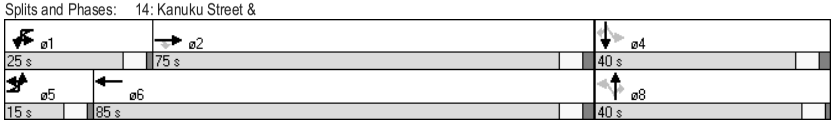
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	75	1980	110	110	1830	70	20	75	125	15	80
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	25.0	28.0	23.0	23.0	23.0	40.0	40.0	40.0
Total Split (s)	15.0	75.0	75.0	25.0	85.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	10.7%	53.6%	53.6%	17.9%	60.7%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 11 (8%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1980	110	110	1830	240	70	20	75	125	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4664			1733	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.55	1.00		0.63	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4664			987	1531		1101	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	2152	120	120	1989	261	76	22	82	136	16	87
RTOR Reduction (vph)	0	0	23	0	10	0	0	0	67	0	0	72
Lane Group Flow (vph)	82	2152	97	120	2240	0	0	98	15	0	152	15
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	9.6	88.6	88.6	10.6	89.6			24.8	24.8		23.8	23.8
Effective Green, g (s)	9.6	88.6	88.6	10.6	89.6			24.8	24.8		23.8	23.8
Actuated g/C Ratio	0.07	0.63	0.63	0.08	0.64			0.18	0.18		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	113	3004	935	243	2985			175	271		187	251
v/s Ratio Prot	c0.05	0.45		0.04	c0.48							
v/s Ratio Perm			0.07					0.10	0.01		c0.14	0.01
v/c Ratio	0.73	0.72	0.10	0.49	0.75			0.56	0.05		0.81	0.06
Uniform Delay, d1	63.9	17.3	10.1	62.1	17.5			52.6	47.9		56.0	48.7
Progression Factor	1.13	0.32	0.20	0.77	1.34			1.00	1.00		1.00	1.00
Incremental Delay, d2	9.2	0.6	0.1	0.6	0.7			4.1	0.1		22.9	0.1
Delay (s)	81.3	6.2	2.1	48.6	24.1			56.7	47.9		78.8	48.8
Level of Service	F	A	A	D	C			E	D		E	D
Approach Delay (s)		8.6			25.3			52.7			67.9	
Approach LOS		A			C			D			E	

Intersection Summary			
HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

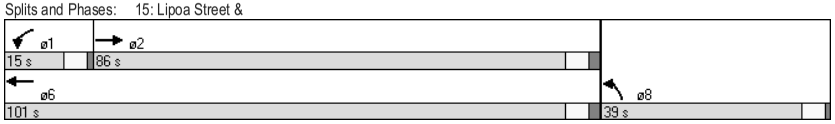
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2065	50	2135	165
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	86.0	15.0	101.0	39.0
Total Split (%)	61.4%	10.7%	72.1%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 26 (19%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2065	65	50	2135	165	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4721		1652	4746	1670	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4721		1652	4746	1670	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2245	71	54	2321	179	76
RTOR Reduction (vph)	2	0	0	0	11	0
Lane Group Flow (vph)	2314	0	54	2321	244	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	90.8		7.6	103.4	25.6	
Effective Green, g (s)	90.8		7.6	103.4	25.6	
Actuated g/C Ratio	0.65		0.05	0.74	0.18	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3062		90	3505	305	
v/s Ratio Prot	c0.49		0.03	c0.49	c0.15	
v/s Ratio Perm						
v/c Ratio	0.76		0.60	0.66	0.80	
Uniform Delay, d1	17.0		64.7	9.4	54.7	
Progression Factor	0.73		1.25	0.40	1.00	
Incremental Delay, d2	1.3		7.3	0.7	13.6	
Delay (s)	13.7		88.0	4.5	68.3	
Level of Service	B		F	A	E	
Approach Delay (s)	13.7			6.4	68.3	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

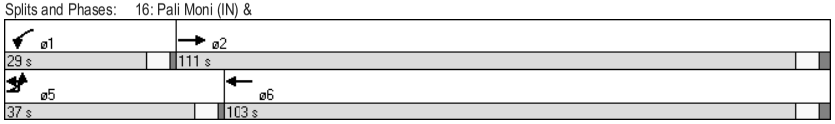
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	475	1570	155	1925
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	37.0	111.0	29.0	103.0
Total Split (%)	26.4%	79.3%	20.7%	73.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	475	1570	55	155	1925	505	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	0.99		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4722		1652	4531							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4722		1652	4531							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	516	1707	60	168	2092	549	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	14	0	0	0	0	0	0	0
Lane Group Flow (vph)	516	1765	0	168	2627	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	27.3	110.1		18.9	101.7							
Effective Green, g (s)	27.3	110.1		18.9	101.7							
Actuated g/C Ratio	0.20	0.79		0.13	0.73							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	625	3714		223	3291							
v/s Ratio Prot	c0.16	0.37		0.10	c0.58							
v/s Ratio Perm												
v/c Ratio	0.83	0.48		0.75	0.80							
Uniform Delay, d1	54.1	5.1		58.3	12.5							
Progression Factor	0.69	1.29		1.08	0.43							
Incremental Delay, d2	5.9	0.3		10.4	1.6							
Delay (s)	42.9	6.8		73.2	7.0							
Level of Service	D	A		E	A							
Approach Delay (s)		15.0			10.9			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

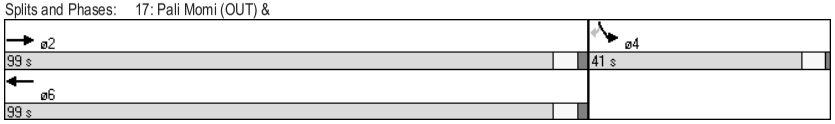
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1525	2225	360	195
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	99.0	99.0	41.0	41.0
Total Split (%)	70.7%	70.7%	29.3%	29.3%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 8 (6%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1525	2225	0	360	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1301
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1301
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1658	2418	0	391	212
RTOR Reduction (vph)	0	0	0	0	0	6
Lane Group Flow (vph)	0	1658	2418	0	391	206
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		101.9	101.9		27.1	27.1
Effective Green, g (s)		101.9	101.9		27.1	27.1
Actuated g/C Ratio		0.73	0.73		0.19	0.19
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3454	3454		642	252
v/s Ratio Prot		0.35	c0.51		0.12	
v/s Ratio Perm						c0.16
v/c Ratio		0.48	0.70		0.61	0.82
Uniform Delay, d1		8.0	10.6		51.6	54.1
Progression Factor		0.29	1.00		1.00	1.00
Incremental Delay, d2		0.4	1.2		1.6	18.3
Delay (s)		2.7	11.8		53.3	72.4
Level of Service		A	B		D	E
Approach Delay (s)		2.7	11.8		60.0	
Approach LOS		A	B		E	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	80.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Year 2021 with Project and Improvements

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1740	15	0	1235	0	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1891	16	0	1342	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.77	
vC, conflicting volume			1908		2571	954
vC1, stage 1 conf vol					1899	
vC2, stage 2 conf vol					671	
vCu, unblocked vol			1908		2444	954
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	83
cM capacity (veh/h)			308		100	259

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1261	647	671	671	43
Volume Left	0	0	0	0	0
Volume Right	0	16	0	0	43
cSH	1700	1700	1700	1700	259
Volume to Capacity	0.74	0.38	0.39	0.39	0.17
Queue Length 95th (ft)	0	0	0	0	15
Control Delay (s)	0.0	0.0	0.0	0.0	21.7
Lane LOS					C
Approach Delay (s)	0.0		0.0		21.7
Approach LOS					C

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization		58.6%	ICU Level of Service B
Analysis Period (min)		15	

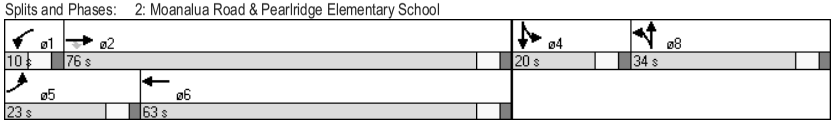
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	155	1525	115	50	855	105	5	130	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	23.0	76.0	76.0	10.0	63.0	34.0	34.0	20.0	20.0
Total Split (%)	16.4%	54.3%	54.3%	7.1%	45.0%	24.3%	24.3%	14.3%	14.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 135 (96%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1525	115	50	855	205	105	5	50	130	5	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.90		1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3436		1681	1574		1770	1590	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3436		1681	1574		1770	1590	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	1658	125	54	929	223	114	5	54	141	5	207
RTOR Reduction (vph)	0	0	23	0	12	0	0	49	0	0	187	0
Lane Group Flow (vph)	168	1658	102	54	1140	0	90	34	0	141	25	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	16.0	77.9	77.9	11.8	73.7		12.8	12.8		13.5	13.5	
Effective Green, g (s)	16.0	77.9	77.9	11.8	73.7		12.8	12.8		13.5	13.5	
Actuated g/C Ratio	0.11	0.56	0.56	0.08	0.53		0.09	0.09		0.10	0.10	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	202	1969	881	149	1809		154	144		171	153	
v/s Ratio Prot	c0.09	c0.47		0.03	0.33		c0.05	0.02		c0.08	0.02	
v/s Ratio Perm			0.06									
v/c Ratio	0.83	0.84	0.12	0.36	0.63		0.58	0.24		0.82	0.16	
Uniform Delay, d1	60.7	25.9	14.7	60.5	23.5		61.0	59.1		62.1	58.1	
Progression Factor	1.00	1.00	1.00	1.04	0.62		1.00	1.00		1.00	1.00	
Incremental Delay, d2	24.3	4.6	0.3	1.4	1.5		5.6	0.8		26.4	0.5	
Delay (s)	85.0	30.5	15.0	64.1	16.0		66.6	59.9		88.5	58.6	
Level of Service	F	C	B	E	B		E	E		F	E	
Approach Delay (s)		34.2			18.2			63.4			70.5	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	33.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	82.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

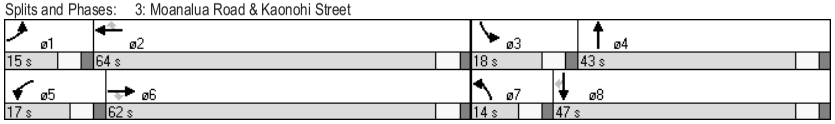
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	1300	210	130	775	100	85	90	290	270	245
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	15.0	62.0	62.0	17.0	64.0	64.0	14.0	43.0	18.0	47.0	47.0
Total Split (%)	10.7%	44.3%	44.3%	12.1%	45.7%	45.7%	10.0%	30.7%	12.9%	33.6%	33.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 135
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1300	210	130	775	100	85	90	165	290	270	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3196		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3196		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1413	228	141	842	109	92	98	179	315	293	266
RTOR Reduction (vph)	0	0	108	0	0	54	0	117	0	0	0	162
Lane Group Flow (vph)	114	1413	120	141	842	55	92	160	0	315	293	104
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.6	68.8	68.8	11.0	71.2	71.2	7.7	24.2		12.0	28.5	28.5
Effective Green, g (s)	8.6	68.8	68.8	11.0	71.2	71.2	7.7	24.2		12.0	28.5	28.5
Actuated g/C Ratio	0.06	0.49	0.49	0.08	0.51	0.51	0.06	0.17		0.09	0.20	0.20
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	211	1739	778	139	1800	805	189	552		294	379	322
v/s Ratio Prot	0.03	c0.40		c0.08	0.24		0.03	0.05		c0.09	c0.16	
v/s Ratio Perm			0.08			0.04						0.07
v/c Ratio	0.54	0.81	0.15	1.01	0.47	0.07	0.49	0.29		1.07	0.77	0.32
Uniform Delay, d1	63.8	30.1	19.6	64.5	22.2	17.5	64.2	50.4		64.0	52.7	47.5
Progression Factor	1.30	0.46	0.28	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	2.4	0.2	80.2	0.9	0.2	2.0	0.3		72.7	9.4	0.6
Delay (s)	84.6	16.3	5.6	144.7	23.1	17.7	66.2	50.7		136.7	62.1	48.1
Level of Service	F	B	A	F	C	B	E	D		F	E	D
Approach Delay (s)		19.4			38.2			54.6			84.7	
Approach LOS		B			D			D			F	

Intersection Summary				
HCM Average Control Delay	41.6	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.87			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	81.5%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	15	0	0	10	0	340	20	0	560	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	16	0	0	11	0	370	22	0	609	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	745	1033	337	701	1054	103	674			391		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	745	1033	337	701	1054	103	674			391		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	100	100	99	100			100		
cM capacity (veh/h)	299	231	659	317	224	932	913			1164		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	16	11	106	106	106	75	406	268
Volume Left	0	0	0	0	0	0	0	0
Volume Right	16	11	0	0	0	22	0	65
cSH	659	932	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.01	0.06	0.06	0.06	0.04	0.24	0.16
Queue Length 95th (ft)	2	1	0	0	0	0	0	0
Control Delay (s)	10.6	8.9	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.6	8.9	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay	0.2			
Intersection Capacity Utilization	27.4%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	5	25	15	0	30	40	320	15	35	520	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	5	27	16	0	33	43	348	16	38	565	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked												
vC, conflicting volume	940	1098	288	832	1095	182	576			364		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	940	1098	288	832	1095	182	576			364		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	97	96	93	100	96	96			97		
cM capacity (veh/h)	198	196	709	233	196	829	993			1191		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	27	27	16	33	43	232	132	38	377	199
Volume Left	22	0	16	0	43	0	0	38	0	0
Volume Right	0	27	0	33	0	0	16	0	0	11
cSH	197	709	233	829	993	1700	1700	1191	1700	1700
Volume to Capacity	0.14	0.04	0.07	0.04	0.04	0.14	0.08	0.03	0.22	0.12
Queue Length 95th (ft)	12	3	6	3	3	0	0	2	0	0
Control Delay (s)	26.1	10.3	21.6	9.5	8.8	0.0	0.0	8.1	0.0	0.0
Lane LOS	D	B	C	A	A			A		
Approach Delay (s)	18.2		13.6		0.9			0.5		
Approach LOS	C		B							

Intersection Summary				
Average Delay		2.1		
Intersection Capacity Utilization		36.1%	ICU Level of Service	A
Analysis Period (min)		15		

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	70	10	30	5	160	285	35	530
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	36.0	36.0	36.0	36.0	54.0	54.0	54.0	54.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 32.4
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	10	205	30	5	10	160	285	40	35	530	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.90		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1596		1770	1671		1770	3475		1770	3525	
Flt Permitted	0.75	1.00		0.61	1.00		0.43	1.00		0.54	1.00	
Satd. Flow (perm)	1392	1596		1142	1671		798	3475		1007	3525	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	76	11	223	33	5	11	174	310	43	38	576	16
RTOR Reduction (vph)	0	168	0	0	8	0	0	15	0	0	3	0
Lane Group Flow (vph)	76	66	0	33	8	0	174	338	0	38	589	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	7.9	7.9		7.9	7.9		13.9	13.9		13.9	13.9	
Effective Green, g (s)	7.9	7.9		7.9	7.9		13.9	13.9		13.9	13.9	
Actuated g/C Ratio	0.25	0.25		0.25	0.25		0.44	0.44		0.44	0.44	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	346	396		284	415		349	1519		440	1541	
v/s Ratio Prot		0.04			0.00			0.10			0.17	
v/s Ratio Perm	c0.05			0.03			c0.22			0.04		
v/c Ratio	0.22	0.17		0.12	0.02		0.50	0.22		0.09	0.38	
Uniform Delay, d1	9.5	9.4		9.2	9.0		6.4	5.6		5.2	6.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.2		0.2	0.0		1.1	0.1		0.1	0.2	
Delay (s)	9.8	9.6		9.4	9.0		7.6	5.7		5.3	6.2	
Level of Service	A	A		A	A		A	A		A	A	
Approach Delay (s)		9.6			9.3			6.3			6.2	
Approach LOS		A			A			A			A	

Intersection Summary				
HCM Average Control Delay	7.0	HCM Level of Service	A	
HCM Volume to Capacity ratio	0.40			
Actuated Cycle Length (s)	31.8	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	57.2%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	35	20	450	685	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	38	22	489	745	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.92	0.92	0.92			
vC, conflicting volume	1062	402	804			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	897	180	617			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	83	95	98			
cM capacity (veh/h)	251	766	884			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	82	185	326	496	308
Volume Left	43	22	0	0	0
Volume Right	38	0	0	0	60
cSH	366	884	1700	1700	1700
Volume to Capacity	0.22	0.02	0.19	0.29	0.18
Queue Length 95th (ft)	21	2	0	0	0
Control Delay (s)	17.6	1.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	17.6	0.5		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	38.2%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	50	20	455	715	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	54	22	495	777	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked						
vC, conflicting volume	1071	391	783			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1071	391	783			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	92	91	97			
cM capacity (veh/h)	210	608	831			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	187	330	518	264
Volume Left	16	22	0	0	0
Volume Right	54	0	0	0	5
cSH	423	831	1700	1700	1700
Volume to Capacity	0.17	0.03	0.19	0.30	0.16
Queue Length 95th (ft)	15	2	0	0	0
Control Delay (s)	15.2	1.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	15.2	0.5		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		37.9%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	460	55	25	740
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	500	60	27	804
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	852	280			560	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	852	280			560	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	83	98			97	
cM capacity (veh/h)	290	717			1007	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	333	226	188	322	322
Volume Left	49	0	0	27	0	0
Volume Right	16	0	60	0	0	0
cSH	341	1700	1700	1007	1700	1700
Volume to Capacity	0.19	0.20	0.13	0.03	0.19	0.19
Queue Length 95th (ft)	17	0	0	2	0	0
Control Delay (s)	18.0	0.0	0.0	1.5	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	18.0	0.0		0.3		
Approach LOS	C					

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		42.7%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	85	155	55	425	760	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	168	60	462	826	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1196	294	826			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1196	294	826			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	44	76	93			
cM capacity (veh/h)	166	702	800			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	261	60	231	231	330	330	203
Volume Left	92	60	0	0	0	0	0
Volume Right	168	0	0	0	0	0	38
cSH	327	800	1700	1700	1700	1700	1700
Volume to Capacity	0.80	0.07	0.14	0.14	0.19	0.19	0.12
Queue Length 95th (ft)	165	6	0	0	0	0	0
Control Delay (s)	48.2	9.9	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	A					
Approach Delay (s)	48.2	1.1			0.0		
Approach LOS	E						

Intersection Summary				
Average Delay		8.0		
Intersection Capacity Utilization		43.0%	ICU Level of Service	A
Analysis Period (min)		15		

Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	265	1760	825	730	190
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	26.0	86.0	60.0	54.0	54.0
Total Split (%)	18.6%	61.4%	42.9%	38.6%	38.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 84 (60%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	265	1760	825	245	730	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4653		3426	1329
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4653		3426	1329
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	288	1913	897	266	793	207
RTOR Reduction (vph)	0	0	37	0	1	121
Lane Group Flow (vph)	288	1913	1126	0	813	65
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	17.5	80.0	57.5		49.0	49.0
Effective Green, g (s)	17.5	80.0	57.5		49.0	49.0
Actuated g/C Ratio	0.12	0.57	0.41		0.35	0.35
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	401	2712	1911		1199	465
v/s Ratio Prot	0.09	c0.40	0.24		c0.24	
v/s Ratio Perm						0.05
v/c Ratio	0.72	0.71	0.59		0.68	0.14
Uniform Delay, d1	58.9	21.5	32.1		38.8	31.1
Progression Factor	1.14	0.31	0.66		1.00	1.00
Incremental Delay, d2	4.8	1.3	1.3		3.1	0.6
Delay (s)	71.8	7.9	22.3		41.9	31.7
Level of Service	E	A	C		D	C
Approach Delay (s)		16.2	22.3		40.0	
Approach LOS		B	C		D	

Intersection Summary			
HCM Average Control Delay	23.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

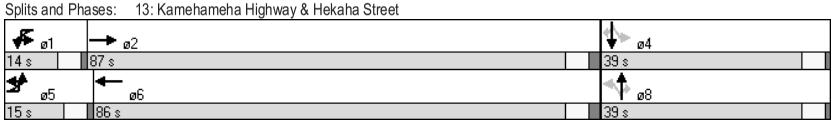
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1870	90	950	55	5	60	115	15	80
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	39.0	39.0	39.0
Total Split (s)	15.0	87.0	14.0	86.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	10.7%	62.1%	10.0%	61.4%	27.9%	27.9%	27.9%	27.9%	27.9%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 105 (75%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1870	195	90	950	30	55	5	60	115	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.98	1.00
Frt	1.00	0.99		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4666		3204	4721			1720	1484		1640	1458
Flt Permitted	0.95	1.00		0.95	1.00			0.65	1.00		0.70	1.00
Satd. Flow (perm)	1652	4666		3204	4721			1174	1484		1206	1458
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	2033	212	98	1033	33	60	5	65	125	16	87
RTOR Reduction (vph)	0	9	0	0	2	0	0	0	49	0	0	66
Lane Group Flow (vph)	54	2236	0	98	1064	0	0	65	16	0	141	21
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.6	81.5		8.5	82.4			34.0	34.0		34.0	34.0
Effective Green, g (s)	7.6	81.5		8.5	82.4			34.0	34.0		34.0	34.0
Actuated g/C Ratio	0.05	0.58		0.06	0.59			0.24	0.24		0.24	0.24
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	90	2716		195	2779			285	360		293	354
v/s Ratio Prot	c0.03	c0.48		0.03	0.23							
v/s Ratio Perm								0.06	0.01		c0.12	0.01
v/c Ratio	0.60	0.82		0.50	0.38			0.23	0.04		0.48	0.06
Uniform Delay, d1	64.7	23.5		63.7	15.3			42.5	40.6		45.4	40.7
Progression Factor	0.92	0.73		0.73	1.38			1.00	1.00		1.00	1.00
Incremental Delay, d2	7.8	2.2		1.9	0.4			1.9	0.2		5.6	0.3
Delay (s)	67.4	19.5		48.2	21.5			44.3	40.8		51.0	41.0
Level of Service	E	B		D	C			D	D		D	D
Approach Delay (s)		20.6			23.8			42.6			47.2	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	23.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

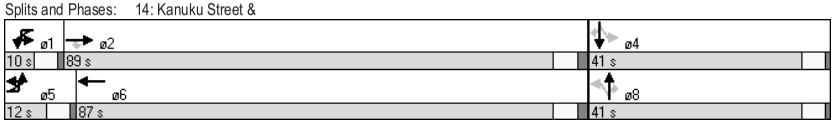
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	30	1920	20	20	1020	5	5	15	145	10	45
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	39.0	39.0	39.0
Total Split (s)	12.0	89.0	89.0	10.0	87.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	8.6%	63.6%	63.6%	7.1%	62.1%	29.3%	29.3%	29.3%	29.3%	29.3%	29.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 132 (94%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	1920	20	20	1020	70	5	5	15	145	10	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1449	3204	4695			1754	1531		1661	1453
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1449	3204	4695			1590	1531		1274	1453
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	2087	22	22	1109	76	5	5	16	158	11	49
RTOR Reduction (vph)	0	0	5	0	4	0	0	0	13	0	0	41
Lane Group Flow (vph)	33	2087	17	22	1181	0	0	10	3	0	169	8
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	4.2	97.1	97.1	3.0	95.9			23.9	23.9		23.9	23.9
Effective Green, g (s)	4.2	97.1	97.1	3.0	95.9			23.9	23.9		23.9	23.9
Actuated g/C Ratio	0.03	0.69	0.69	0.02	0.69			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	50	3292	1005	69	3216			271	261		217	248
v/s Ratio Prot	c0.02	c0.44		0.01	0.25							
v/s Ratio Perm			0.01					0.01	0.00		c0.13	0.01
v/c Ratio	0.66	0.63	0.02	0.32	0.37			0.04	0.01		0.78	0.03
Uniform Delay, d1	67.2	11.7	6.7	67.5	9.3			48.4	48.2		55.5	48.4
Progression Factor	1.35	0.20	0.02	0.75	1.42			1.00	1.00		1.00	1.00
Incremental Delay, d2	17.7	0.6	0.0	2.3	0.3			0.1	0.0		16.0	0.1
Delay (s)	108.4	2.9	0.2	53.3	13.5			48.5	48.2		71.6	48.5
Level of Service	F	A	A	D	B			D	D		E	D
Approach Delay (s)		4.5			14.2			48.3			66.4	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	11.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	65.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

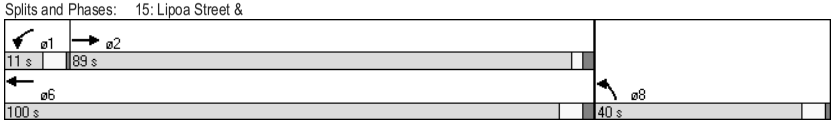
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2455	45	1070	75
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	89.0	11.0	100.0	40.0
Total Split (%)	63.6%	7.9%	71.4%	28.6%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 136 (97%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2455	50	45	1070	75	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4732		1652	4746	1643	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4732		1652	4746	1643	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2668	54	49	1163	82	71
RTOR Reduction (vph)	1	0	0	0	27	0
Lane Group Flow (vph)	2721	0	49	1163	126	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	105.3		5.2	113.0	16.0	
Effective Green, g (s)	105.3		5.2	113.0	16.0	
Actuated g/C Ratio	0.75		0.04	0.81	0.11	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3559		61	3831	188	
v/s Ratio Prot	c0.58		c0.03	0.25	c0.08	
v/s Ratio Perm						
v/c Ratio	0.76		0.80	0.30	0.67	
Uniform Delay, d1	10.1		66.9	3.4	59.5	
Progression Factor	0.60		0.83	0.96	1.00	
Incremental Delay, d2	1.2		49.7	0.2	9.1	
Delay (s)	7.2		105.2	3.5	68.6	
Level of Service	A		F	A	E	
Approach Delay (s)	7.2			7.6	68.6	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	9.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

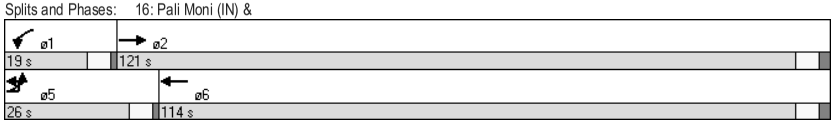
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	205	2345	45	1105
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	26.0	121.0	19.0	114.0
Total Split (%)	18.6%	86.4%	13.6%	81.4%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 123 (88%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	2345	15	45	1105	190	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4742		1652	4642							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4742		1652	4642							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	2549	16	49	1201	207	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	14	0	0	0	0	0	0	0
Lane Group Flow (vph)	223	2565	0	49	1394	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	15.0	120.6		8.4	114.0							
Effective Green, g (s)	15.0	120.6		8.4	114.0							
Actuated g/C Ratio	0.11	0.86		0.06	0.81							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	343	4085		99	3780							
v/s Ratio Prot	c0.07	c0.54		0.03	0.30							
v/s Ratio Perm												
v/c Ratio	0.65	0.63		0.49	0.37							
Uniform Delay, d1	60.0	2.9		63.7	3.5							
Progression Factor	0.88	0.48		0.96	0.43							
Incremental Delay, d2	2.9	0.5		3.6	0.3							
Delay (s)	55.8	1.9		64.5	1.7							
Level of Service	E	A		E	A							
Approach Delay (s)		6.2			3.9			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

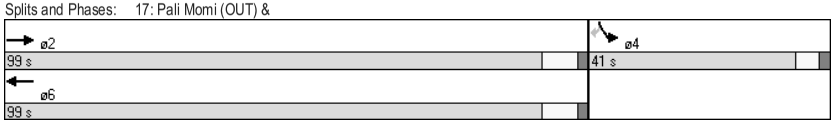
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	2230	1250	345	85
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	99.0	99.0	41.0	41.0
Total Split (%)	70.7%	70.7%	29.3%	29.3%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 4 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	2230	1250	0	345	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.93
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1421
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1421
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2424	1359	0	375	92
RTOR Reduction (vph)	0	0	0	0	0	50
Lane Group Flow (vph)	0	2424	1359	0	375	42
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		91.0	91.0		35.0	35.0
Effective Green, g (s)		91.0	91.0		35.0	35.0
Actuated g/C Ratio		0.65	0.65		0.25	0.25
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3085	3085		830	355
v/s Ratio Prot		c0.51	0.29		c0.11	
v/s Ratio Perm						0.03
v/c Ratio		0.79	0.44		0.45	0.12
Uniform Delay, d1		17.5	12.0		44.4	40.6
Progression Factor		0.26	1.00		1.00	1.00
Incremental Delay, d2		1.7	0.5		1.8	0.7
Delay (s)		6.2	12.5		46.2	41.2
Level of Service		A	B		D	D
Approach Delay (s)		6.2	12.5		45.2	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	83.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1335	25	0	2110	0	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1451	27	0	2293	0	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.43	
vC, conflicting volume			1478		2611	739
vC1, stage 1 conf vol					1465	
vC2, stage 2 conf vol					1147	
vCu, unblocked vol			1478		2086	739
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	94
cM capacity (veh/h)			452		160	360

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	967	511	1147	1147	22
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	22
cSH	1700	1700	1700	1700	360
Volume to Capacity	0.57	0.30	0.67	0.67	0.06
Queue Length 95th (ft)	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	15.6
Lane LOS					C
Approach Delay (s)	0.0		0.0		15.6
Approach LOS					C

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	61.7%	ICU Level of Service	B
Analysis Period (min)	15		

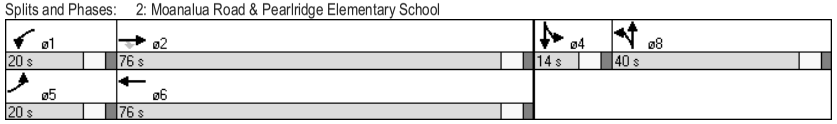
Timings
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	55	1220	100	60	1790	245	5	85	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	40.0	40.0	10.0	10.0
Total Split (s)	20.0	76.0	76.0	20.0	76.0	40.0	40.0	14.0	14.0
Total Split (%)	13.3%	50.7%	50.7%	13.3%	50.7%	26.7%	26.7%	9.3%	9.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 136 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	1220	100	60	1790	80	245	5	70	85	5	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3516		1681	1608		1770	1603	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3516		1681	1608		1770	1603	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	1326	109	65	1946	87	266	5	76	92	5	65
RTOR Reduction (vph)	0	0	20	0	2	0	0	21	0	0	62	0
Lane Group Flow (vph)	60	1326	89	65	2031	0	178	148	0	92	8	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	9.1	87.4	87.4	9.3	87.6		21.3	21.3		8.0	8.0	
Effective Green, g (s)	9.1	87.4	87.4	9.3	87.6		21.3	21.3		8.0	8.0	
Actuated g/C Ratio	0.06	0.58	0.58	0.06	0.58		0.14	0.14		0.05	0.05	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	107	2062	922	110	2053		239	228		94	85	
v/s Ratio Prot	0.03	0.37		c0.04	c0.58		c0.11	0.09		c0.05	0.01	
v/s Ratio Perm			0.06									
v/c Ratio	0.56	0.64	0.10	0.59	0.99		0.74	0.65		0.98	0.10	
Uniform Delay, d1	68.5	20.9	13.8	68.5	30.7		61.7	60.8		70.9	67.6	
Progression Factor	1.00	1.00	1.00	1.11	0.68		1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.6	1.6	0.2	4.9	12.9		11.9	6.2		84.9	0.5	
Delay (s)	75.1	22.4	14.0	80.7	33.8		73.6	67.0		155.9	68.1	
Level of Service	E	C	B	F	C		E	E		F	E	
Approach Delay (s)		23.9			35.3			70.4			117.9	
Approach LOS		C			D			E			F	

Intersection Summary			
HCM Average Control Delay	37.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

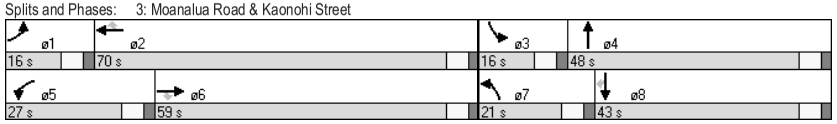
Timings
3: Moanalua Road & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	205	955	205	215	1455	295	330	175	130	115	145
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	16.0	59.0	59.0	27.0	70.0	70.0	21.0	48.0	16.0	43.0	43.0
Total Split (%)	10.7%	39.3%	39.3%	18.0%	46.7%	46.7%	14.0%	32.0%	10.7%	28.7%	28.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	955	205	215	1455	295	330	175	160	130	115	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3285		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3285		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	1038	223	234	1582	321	359	190	174	141	125	158
RTOR Reduction (vph)	0	0	112	0	0	112	0	132	0	0	0	131
Lane Group Flow (vph)	223	1038	111	234	1582	209	359	232	0	141	125	27
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	10.0	74.5	74.5	21.0	85.5	85.5	15.0	20.8		9.7	15.5	15.5
Effective Green, g (s)	10.0	74.5	74.5	21.0	85.5	85.5	15.0	20.8		9.7	15.5	15.5
Actuated g/C Ratio	0.07	0.50	0.50	0.14	0.57	0.57	0.10	0.14		0.06	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	229	1758	786	248	2017	902	343	456		222	193	164
v/s Ratio Prot	0.06	0.29		c0.13	c0.45		c0.10	c0.07		0.04	c0.07	
v/s Ratio Perm			0.07			0.13						0.02
v/c Ratio	0.97	0.59	0.14	0.94	0.78	0.23	1.05	0.51		0.64	0.65	0.17
Uniform Delay, d1	69.9	26.9	20.4	63.9	25.1	16.0	67.5	59.9		68.4	64.6	61.3
Progression Factor	1.13	0.53	0.23	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	44.3	1.1	0.3	41.9	3.1	0.6	61.3	0.9		5.8	7.3	0.5
Delay (s)	123.4	15.5	4.9	105.8	28.2	16.6	128.8	60.8		74.3	71.9	61.8
Level of Service	F	B	A	F	C	B	F	E		E	E	E
Approach Delay (s)		30.1			35.0			94.6			68.9	
Approach LOS		C			C			F			E	

Intersection Summary			
HCM Average Control Delay	45.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	90	0	0	75	0	590	40	0	460	65
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	98	0	0	82	0	641	43	0	500	71
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	777	1220	285	1011	1234	182	571			685		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	777	1220	285	1011	1234	182	571			685		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	86	100	100	90	100			100		
cM capacity (veh/h)	259	179	711	167	175	829	998			905		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	98	82	183	183	183	135	333	237
Volume Left	0	0	0	0	0	0	0	0
Volume Right	98	82	0	0	0	43	0	71
cSH	711	829	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.10	0.11	0.11	0.11	0.08	0.20	0.14
Queue Length 95th (ft)	12	8	0	0	0	0	0	0
Control Delay (s)	10.9	9.8	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.9	9.8	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay		1.3		
Intersection Capacity Utilization		27.0%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	5	85	110	55	145	70	480	75	95	455	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	5	92	120	60	158	76	522	82	103	495	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.94	0.94		0.94	0.94	0.94				0.94		
vC, conflicting volume	1310	1465	255	1264	1432	302	511			603		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1201	1366	255	1152	1332	129	511			450		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	44	95	88	0	50	81	93			90		
cM capacity (veh/h)	58	115	744	106	120	843	1051			1040		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	38	92	179	158	76	348	255	103	330	181
Volume Left	33	0	120	0	76	0	0	103	0	0
Volume Right	0	92	0	158	0	0	82	0	0	16
cSH	62	744	110	843	1051	1700	1700	1040	1700	1700
Volume to Capacity	0.61	0.12	1.63	0.19	0.07	0.20	0.15	0.10	0.19	0.11
Queue Length 95th (ft)	64	11	340	17	6	0	0	8	0	0
Control Delay (s)	128.9	10.5	387.8	10.2	8.7	0.0	0.0	8.8	0.0	0.0
Lane LOS	F	B	F	B	A			A		
Approach Delay (s)	45.0		211.2		1.0			1.5		
Approach LOS	E		F							

Intersection Summary				
Average Delay		44.6		
Intersection Capacity Utilization		46.6%	ICU Level of Service	A
Analysis Period (min)		15		

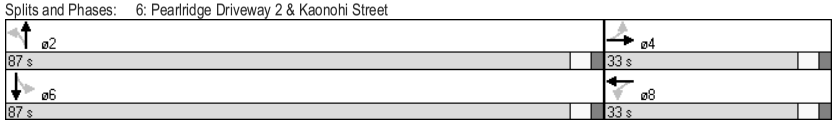
Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	45	10	165	45	310	500	60	545
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	87.0	87.0	87.0	87.0
Total Split (%)	27.5%	27.5%	27.5%	27.5%	72.5%	72.5%	72.5%	72.5%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 87.6
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	10	220	165	45	85	310	500	95	60	545	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.90		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1596		1770	1680		1770	3455		1770	3495	
Flt Permitted	0.67	1.00		0.52	1.00		0.37	1.00		0.37	1.00	
Satd. Flow (perm)	1243	1596		961	1680		690	3455		690	3495	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	11	239	179	49	92	337	543	103	65	592	54
RTOR Reduction (vph)	0	158	0	0	48	0	0	19	0	0	8	0
Lane Group Flow (vph)	49	92	0	179	93	0	337	627	0	65	638	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	29.5	29.5		29.5	29.5		47.6	47.6		47.6	47.6	
Effective Green, g (s)	29.5	29.5		29.5	29.5		47.6	47.6		47.6	47.6	
Actuated g/C Ratio	0.34	0.34		0.34	0.34		0.55	0.55		0.55	0.55	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	421	541		325	569		377	1888		377	1910	
v/s Ratio Prot		0.06			0.06			0.18			0.18	
v/s Ratio Perm	0.04			c0.19			c0.49			0.09		
v/c Ratio	0.12	0.17		0.55	0.16		0.89	0.33		0.17	0.33	
Uniform Delay, d1	19.8	20.2		23.4	20.2		17.5	10.9		9.9	11.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		2.0	0.1		22.5	0.1		0.2	0.1	
Delay (s)	20.0	20.4		25.4	20.3		40.0	11.0		10.1	11.1	
Level of Service	B	C		C	C		D	B		B	B	
Approach Delay (s)		20.3			23.2			21.0			11.0	
Approach LOS		C			C			C			B	

Intersection Summary				
HCM Average Control Delay	18.1	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.76			
Actuated Cycle Length (s)	87.1	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	73.8%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	880	865	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	957	940	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	200	
pX, platoon unblocked	0.91	0.91	0.91			
vC, conflicting volume	1486	495	989			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1335	244	788			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	75	95	97			
cM capacity (veh/h)	128	688	752			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	341	638	627	362
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	216	752	1700	1700	1700
Volume to Capacity	0.30	0.03	0.38	0.37	0.21
Queue Length 95th (ft)	31	2	0	0	0
Control Delay (s)	28.8	1.0	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	28.8	0.3		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	48.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	885	880	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	962	957	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	0.95	0.95	0.95			
vC, conflicting volume	1505	492	984			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1420	348	868			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	86	90	96			
cM capacity (veh/h)	116	613	730			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	348	641	638	346
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	27
cSH	320	730	1700	1700	1700
Volume to Capacity	0.24	0.04	0.38	0.38	0.20
Queue Length 95th (ft)	23	3	0	0	0
Control Delay (s)	19.7	1.2	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	19.7	0.4		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/7/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	860	55	35	910
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	935	60	38	989
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1370	497			995	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1370	497			995	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	41	91			94	
cM capacity (veh/h)	130	518			691	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	623	371	236	396	396
Volume Left	76	0	0	38	0	0
Volume Right	49	0	60	0	0	0
cSH	184	1700	1700	691	1700	1700
Volume to Capacity	0.68	0.37	0.22	0.06	0.23	0.23
Queue Length 95th (ft)	102	0	0	4	0	0
Control Delay (s)	58.4	0.0	0.0	2.2	0.0	0.0
Lane LOS	F			A		
Approach Delay (s)	58.4	0.0		0.5		
Approach LOS	F					

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	56.7%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	115	130	885	920	60
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	125	141	962	1000	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1796	366	1000			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1796	366	1000			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	24	80	79			
cM capacity (veh/h)	57	631	688			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	141	481	481	400	400	265
Volume Left	43	141	0	0	0	0	0
Volume Right	125	0	0	0	0	0	65
cSH	175	688	1700	1700	1700	1700	1700
Volume to Capacity	0.96	0.21	0.28	0.28	0.24	0.24	0.16
Queue Length 95th (ft)	189	19	0	0	0	0	0
Control Delay (s)	112.0	11.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	112.0	1.5			0.0		
Approach LOS	F						

Intersection Summary			
Average Delay	8.8		
Intersection Capacity Utilization	45.6%	ICU Level of Service	A
Analysis Period (min)	15		

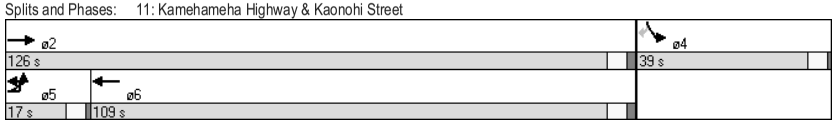
Timings
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	330	1295	3760	420	600
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	28.0	28.0	39.0	39.0
Total Split (s)	17.0	126.0	109.0	39.0	39.0
Total Split (%)	10.3%	76.4%	66.1%	23.6%	23.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 165
Actuated Cycle Length: 165
Offset: 126 (76%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	330	1295	3760	670	420	600
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		0.94	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4690		3299	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4690		3299	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	359	1408	4087	728	457	652
RTOR Reduction (vph)	0	0	15	0	72	91
Lane Group Flow (vph)	359	1408	4800	0	685	261
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	12.0	120.0	103.0		34.0	34.0
Effective Green, g (s)	12.0	120.0	103.0		34.0	34.0
Actuated g/C Ratio	0.07	0.73	0.62		0.21	0.21
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	250	3698	2928		680	297
v/s Ratio Prot	c0.10	0.28	c1.02		c0.21	
v/s Ratio Perm						0.18
v/c Ratio	1.44	0.38	1.64		1.01	0.88
Uniform Delay, d1	76.5	8.5	31.0		65.5	63.5
Progression Factor	0.92	1.31	0.73		1.00	1.00
Incremental Delay, d2	216.3	0.3	287.8		36.2	24.7
Delay (s)	287.0	11.4	310.5		101.7	88.2
Level of Service	F	B	F		F	F
Approach Delay (s)		67.4	310.5		97.5	
Approach LOS		E	F		F	

Intersection Summary			
HCM Average Control Delay	223.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.48		
Actuated Cycle Length (s)	165.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	135.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

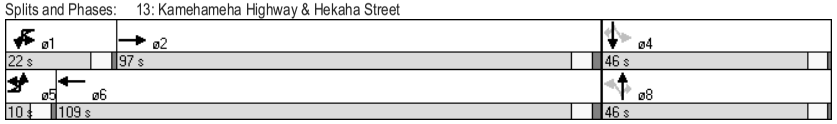
Timings
13: Kamehameha Highway & Hekaha Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1200	195	3180	245	45	240	65	45	100
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	33.0	10.0	33.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	10.0	97.0	22.0	109.0	46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	6.1%	58.8%	13.3%	66.1%	27.9%	27.9%	27.9%	27.9%	27.9%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 165
Actuated Cycle Length: 165
Offset: 52 (32%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1200	155	195	3180	80	245	45	240	65	45	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4649		3204	4726			1728	1443		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.61	1.00		0.35	1.00
Satd. Flow (perm)	1652	4649		3204	4726			1106	1443		607	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1304	168	212	3457	87	266	49	261	71	49	109
RTOR Reduction (vph)	0	10	0	0	2	0	0	0	124	0	0	40
Lane Group Flow (vph)	54	1462	0	212	3542	0	0	315	137	0	120	69
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	92.7		15.3	103.0			41.0	41.0		41.0	41.0
Effective Green, g (s)	5.0	92.7		15.3	103.0			41.0	41.0		41.0	41.0
Actuated g/C Ratio	0.03	0.56		0.09	0.62			0.25	0.25		0.25	0.25
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	50	2612		297	2950			275	359		151	367
v/s Ratio Prot	c0.03	0.31		0.07	c0.75							
v/s Ratio Perm								c0.28	0.09		0.20	0.05
v/c Ratio	1.08	0.56		0.71	1.20			1.15	0.38		0.79	0.19
Uniform Delay, d1	80.0	23.1		72.7	31.0			62.0	51.5		58.1	48.9
Progression Factor	1.16	0.77		1.24	0.61			1.00	1.00		1.00	1.00
Incremental Delay, d2	141.4	0.7		0.7	90.7			99.4	0.7		24.3	0.3
Delay (s)	234.2	18.6		91.0	109.5			161.4	52.2		82.4	49.1
Level of Service	F	B		F	F			F	D		F	D
Approach Delay (s)		26.2			108.5			111.9			66.6	
Approach LOS		C			F			F			E	

Intersection Summary			
HCM Average Control Delay	86.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	165.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	106.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

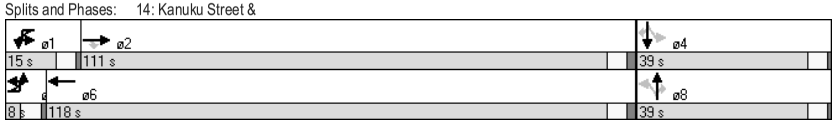
Timings
14: Kanuku Street &

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1365	80	95	3630	95	15	55	65	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	111.0	111.0	15.0	118.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	4.8%	67.3%	67.3%	9.1%	71.5%	23.6%	23.6%	23.6%	23.6%	23.6%	23.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 165
Actuated Cycle Length: 165
Offset: 41 (25%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1365	80	95	3630	230	95	15	55	65	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1427	3204	4697			1694	1531		1670	1424
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.62	1.00		0.53	1.00
Satd. Flow (perm)	1652	4746	1427	3204	4697			1102	1531		917	1424
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1484	87	103	3946	250	103	16	60	71	16	38
RTOR Reduction (vph)	0	0	22	0	3	0	0	0	52	0	0	26
Lane Group Flow (vph)	38	1484	65	103	4193	0	0	119	8	0	87	12
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	117.5	117.5	9.4	123.9			22.1	22.1		22.1	22.1
Effective Green, g (s)	3.0	117.5	117.5	9.4	123.9			22.1	22.1		22.1	22.1
Actuated g/C Ratio	0.02	0.71	0.71	0.06	0.75			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	30	3380	1016	183	3527			148	205		123	191
v/s Ratio Prot	c0.02	0.31		0.03	c0.89							
v/s Ratio Perm			0.05					c0.11	0.01		0.09	0.01
v/c Ratio	1.27	0.44	0.06	0.56	1.19			0.80	0.04		0.71	0.06
Uniform Delay, d1	81.0	9.9	7.2	75.8	20.5			69.3	62.2		68.4	62.4
Progression Factor	0.96	0.48	0.17	1.08	0.44			1.00	1.00		1.00	1.00
Incremental Delay, d2	238.8	0.3	0.1	0.4	85.2			26.2	0.1		16.9	0.1
Delay (s)	316.4	5.1	1.3	82.2	94.3			95.5	62.3		85.3	62.5
Level of Service	F	A	A	F	F			F	E		F	E
Approach Delay (s)		12.2			94.0			84.4			78.4	
Approach LOS		B			F			F			E	

Intersection Summary				
HCM Average Control Delay	72.2	HCM Level of Service	E	
HCM Volume to Capacity ratio	1.13			
Actuated Cycle Length (s)	165.0	Sum of lost time (s)	16.0	
Intersection Capacity Utilization	109.1%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

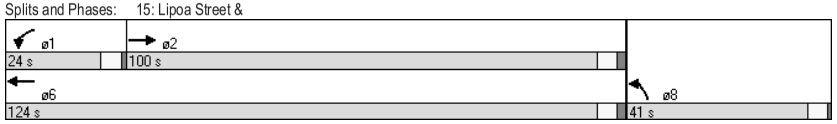
Timings
15: Lipoa Street &

7/7/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1515	100	4010	165
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	100.0	24.0	124.0	41.0
Total Split (%)	60.6%	14.5%	75.2%	24.8%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 165
Actuated Cycle Length: 165
Offset: 48 (29%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1515	55	100	4010	165	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5058		1652	4746	1747	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5058		1652	4746	1747	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1647	60	109	4359	179	38
RTOR Reduction (vph)	2	0	0	0	5	0
Lane Group Flow (vph)	1705	0	109	4359	212	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	108.2		15.5	128.7	25.3	
Effective Green, g (s)	108.2		15.5	128.7	25.3	
Actuated g/C Ratio	0.66		0.09	0.78	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3317		155	3702	268	
v/s Ratio Prot	0.34		0.07	c0.92	c0.12	
v/s Ratio Perm						
v/c Ratio	0.51		0.70	1.18	0.79	
Uniform Delay, d1	14.7		72.5	18.2	67.3	
Progression Factor	1.25		1.11	0.50	1.00	
Incremental Delay, d2	0.5		4.6	80.9	14.6	
Delay (s)	18.9		85.3	89.9	81.9	
Level of Service	B		F	F	F	
Approach Delay (s)	18.9			89.8	81.9	
Approach LOS	B			F	F	

Intersection Summary			
HCM Average Control Delay	70.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	165.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	97.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

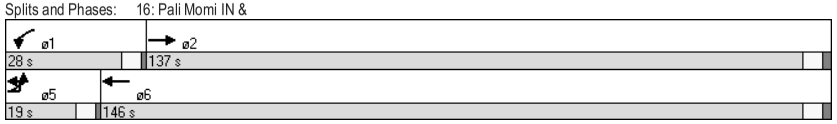
Timings
16: Pali Momi IN &

7/7/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	255	1250	125	3550
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	19.0	137.0	28.0	146.0
Total Split (%)	11.5%	83.0%	17.0%	88.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 165
Actuated Cycle Length: 165
Offset: 162 (98%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	255	1250	35	125	3550	415	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4727		1652	4620							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4727		1652	4620							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	1359	38	136	3859	451	0	0	0	0	0	0
RTOR Reduction (vph)	0	1	0	0	2	0	0	0	0	0	0	0
Lane Group Flow (vph)	277	1396	0	136	4308	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	14.0	135.7		18.3	140.0							
Effective Green, g (s)	14.0	135.7		18.3	140.0							
Actuated g/C Ratio	0.08	0.82		0.11	0.85							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	272	3888		183	3920							
v/s Ratio Prot	c0.09	0.30		0.08	c0.93							
v/s Ratio Perm												
v/c Ratio	1.02	0.36		0.74	1.10							
Uniform Delay, d1	75.5	3.7		71.1	12.5							
Progression Factor	0.77	1.79		1.06	0.48							
Incremental Delay, d2	55.6	0.2		1.5	45.0							
Delay (s)	113.9	6.8		76.9	51.1							
Level of Service	F	A		E	D							
Approach Delay (s)		24.5			51.8			0.0			0.0	
Approach LOS		C			D			A			A	

Intersection Summary			
HCM Average Control Delay	44.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	165.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

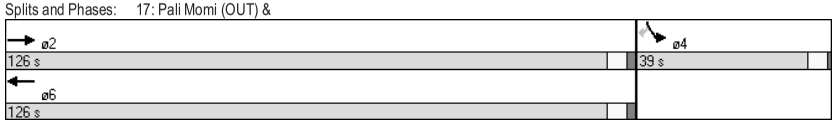
Timings
17: Pali Momi (OUT) &

7/7/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1250	3835	325	160
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	126.0	126.0	39.0	39.0
Total Split (%)	76.4%	76.4%	23.6%	23.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 165
Actuated Cycle Length: 165
Offset: 3 (2%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1250	3835	0	325	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1305
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1305
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1359	4168	0	353	174
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	1359	4168	0	353	174
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		127.4	127.4		26.6	26.6
Effective Green, g (s)		127.4	127.4		26.6	26.6
Actuated g/C Ratio		0.77	0.77		0.16	0.16
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3664	3664		535	210
v/s Ratio Prot		0.29	c0.88		0.11	
v/s Ratio Perm						c0.13
v/c Ratio		0.37	1.14		0.66	0.83
Uniform Delay, d1		6.0	18.8		65.0	67.0
Progression Factor		0.36	1.00		1.00	1.00
Incremental Delay, d2		0.3	65.7		2.9	22.8
Delay (s)		2.4	84.5		67.9	89.8
Level of Service		A	F		E	F
Approach Delay (s)		2.4	84.5		75.1	
Approach LOS		A	F		E	

Intersection Summary			
HCM Average Control Delay	65.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	165.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	111.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1785	25	0	1790	0	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1940	27	0	1946	0	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.65	
vC, conflicting volume			1967		2927	984
vC1, stage 1 conf vol					1954	
vC2, stage 2 conf vol					973	
vCu, unblocked vol			1967		2887	984
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	67
cM capacity (veh/h)			291		93	248

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1293	674	973	973	82
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	82
cSH	1700	1700	1700	1700	248
Volume to Capacity	0.76	0.40	0.57	0.57	0.33
Queue Length 95th (ft)	0	0	0	0	35
Control Delay (s)	0.0	0.0	0.0	0.0	26.5
Lane LOS					D
Approach Delay (s)	0.0		0.0		26.5
Approach LOS					D

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		

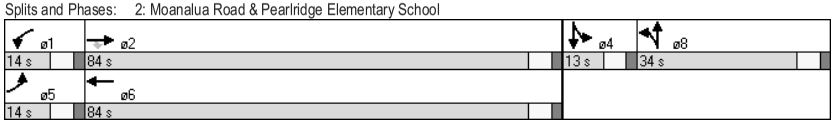
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	5	1715	155	70	1570	265	5	15	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	14.0	84.0	84.0	14.0	84.0	34.0	34.0	13.0	13.0
Total Split (%)	9.7%	57.9%	57.9%	9.7%	57.9%	23.4%	23.4%	9.0%	9.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 68 (47%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1715	155	70	1570	15	265	5	100	15	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3534		1681	1588		1770	1650	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3534		1681	1588		1770	1650	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1864	168	76	1707	16	288	5	109	16	5	16
RTOR Reduction (vph)	0	0	26	0	0	0	0	33	0	0	16	0
Lane Group Flow (vph)	5	1864	142	76	1723	0	207	162	0	16	5	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	1.4	86.3	86.3	8.0	92.9		22.6	22.6		4.1	4.1	
Effective Green, g (s)	1.4	86.3	86.3	8.0	92.9		22.6	22.6		4.1	4.1	
Actuated g/C Ratio	0.01	0.60	0.60	0.06	0.64		0.16	0.16		0.03	0.03	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	17	2106	942	98	2264		262	248		50	47	
v/s Ratio Prot	0.00	c0.53		c0.04	c0.49		c0.12	0.10		c0.01	0.00	
v/s Ratio Perm			0.09									
v/c Ratio	0.29	0.89	0.15	0.78	0.76		0.79	0.65		0.32	0.12	
Uniform Delay, d1	71.3	25.1	13.1	67.6	18.3		58.9	57.5		69.1	68.7	
Progression Factor	1.00	1.00	1.00	0.91	0.81		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.4	5.9	0.3	22.4	1.7		14.9	6.1		3.7	1.1	
Delay (s)	80.7	31.0	13.4	83.7	16.4		73.8	63.6		72.8	69.8	
Level of Service	F	C	B	F	B		E	E		E	E	
Approach Delay (s)		29.7			19.3			68.8			71.1	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	29.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	30.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

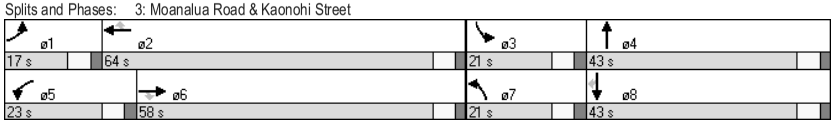
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	145	1290	375	230	1085	220	345	185	205	165	210
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	17.0	58.0	58.0	23.0	64.0	64.0	21.0	43.0	21.0	43.0	43.0
Total Split (%)	11.7%	40.0%	40.0%	15.9%	44.1%	44.1%	14.5%	29.7%	14.5%	29.7%	29.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 144 (99%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1290	375	230	1085	220	345	185	350	205	165	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3192		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3192		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	1402	408	250	1179	239	375	201	380	223	179	228
RTOR Reduction (vph)	0	0	194	0	0	123	0	138	0	0	0	139
Lane Group Flow (vph)	158	1402	214	250	1179	116	375	443	0	223	179	89
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	10.5	64.1	64.1	17.0	70.6	70.6	15.0	26.2		13.7	24.9	24.9
Effective Green, g (s)	10.5	64.1	64.1	17.0	70.6	70.6	15.0	26.2		13.7	24.9	24.9
Actuated g/C Ratio	0.07	0.44	0.44	0.12	0.49	0.49	0.10	0.18		0.09	0.17	0.17
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	249	1564	700	208	1723	771	355	577		324	320	272
v/s Ratio Prot	0.05	c0.40		c0.14	0.33		c0.11	c0.14		0.06	0.10	
v/s Ratio Perm			0.14			0.07						0.06
v/c Ratio	0.63	0.90	0.31	1.20	0.68	0.15	1.06	0.89dr		0.69	0.56	0.33
Uniform Delay, d1	65.4	37.4	26.1	64.0	28.6	20.6	65.0	56.5		63.6	55.0	52.7
Progression Factor	1.33	0.61	0.38	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.7	4.7	0.6	127.6	2.2	0.4	63.4	6.1		6.0	2.1	0.7
Delay (s)	89.9	27.4	10.4	191.6	30.9	21.0	128.4	62.6		69.6	57.1	53.4
Level of Service	F	C	B	F	C	C	F	E		E	E	D
Approach Delay (s)		28.9			53.5			88.4			60.2	
Approach LOS		C			D			F			E	

Intersection Summary			
HCM Average Control Delay	51.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	75	0	0	170	0	740	100	0	670	115
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	82	0	0	185	0	804	109	0	728	125
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	1177	1704	427	1304	1712	255	853			913		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1177	1704	427	1304	1712	255	853			913		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	86	100	100	75	100			100		
cM capacity (veh/h)	110	91	576	101	90	744	782			742		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	82	185	230	230	230	224	486	368
Volume Left	0	0	0	0	0	0	0	0
Volume Right	82	185	0	0	0	109	0	125
cSH	576	744	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.25	0.14	0.14	0.14	0.13	0.29	0.22
Queue Length 95th (ft)	12	24	0	0	0	0	0	0
Control Delay (s)	12.3	11.4	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	B						
Approach Delay (s)	12.3	11.4	0.0				0.0	
Approach LOS	B	B						

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	33.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	45	5	75	105	50	140	65	645	135	165	575	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	5	82	114	54	152	71	701	147	179	625	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.92	0.92		0.92	0.92	0.92				0.92		
vC, conflicting volume	1666	1984	323	1671	1921	424	647			848		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1548	1894	323	1554	1826	197	647			658		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	88	88	0	0	80	92			79		
cM capacity (veh/h)	0	46	672	45	51	745	935			850		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	54	82	168	152	71	467	380	179	417	230
Volume Left	49	0	114	0	71	0	0	179	0	0
Volume Right	0	82	0	152	0	0	147	0	0	22
cSH	0	672	47	745	935	1700	1700	850	1700	1700
Volume to Capacity	Err	0.12	3.61	0.20	0.08	0.27	0.22	0.21	0.25	0.14
Queue Length 95th (ft)	Err	10	Err	19	6	0	0	20	0	0
Control Delay (s)	Err	11.1	Err	11.1	9.2	0.0	0.0	10.4	0.0	0.0
Lane LOS	F	B	F	B	A			B		
Approach Delay (s)	Err		5259.0		0.7			2.2		
Approach LOS	F		F							

Intersection Summary			
Average Delay		Err	
Intersection Capacity Utilization		56.4%	ICU Level of Service	B
Analysis Period (min)		15	

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	65	25	200	60	270	605	155	585
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	47.0	47.0	47.0	47.0
Total Split (%)	41.3%	41.3%	41.3%	41.3%	58.8%	58.8%	58.8%	58.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 68.4
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	25	255	200	60	150	270	605	235	155	585	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.89		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1608		1770	1663		1770	3391		1770	3513	
Flt Permitted	0.57	1.00		0.46	1.00		0.37	1.00		0.26	1.00	
Satd. Flow (perm)	1059	1608		856	1663		684	3391		476	3513	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	27	277	217	65	163	293	658	255	168	636	33
RTOR Reduction (vph)	0	152	0	0	111	0	0	50	0	0	5	0
Lane Group Flow (vph)	71	152	0	217	117	0	293	863	0	168	664	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	21.7	21.7		21.7	21.7		36.0	36.0		36.0	36.0	
Effective Green, g (s)	21.7	21.7		21.7	21.7		36.0	36.0		36.0	36.0	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.53	0.53		0.53	0.53	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	339	515		274	533		364	1803		253	1868	
v/s Ratio Prot		0.09			0.07			0.25			0.19	
v/s Ratio Perm	0.07			c0.25			c0.43			0.35		
v/c Ratio	0.21	0.29		0.79	0.22		0.80	0.48		0.66	0.36	
Uniform Delay, d1	16.8	17.3		20.9	16.8		13.0	10.0		11.5	9.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.3		14.4	0.2		12.2	0.2		6.4	0.1	
Delay (s)	17.1	17.6		35.4	17.0		25.2	10.2		17.9	9.3	
Level of Service	B	B		D	B		C	B		B	A	
Approach Delay (s)		17.5			26.0			13.8			11.0	
Approach LOS		B			C			B			B	

Intersection Summary				
HCM Average Control Delay	15.4	HCM Level of Service	B	
HCM Volume to Capacity ratio	0.80			
Actuated Cycle Length (s)	67.7	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	77.6%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	50	25	1075	905	125
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	54	27	1168	984	136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.90	0.90	0.90			
vC, conflicting volume	1690	560	1120			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1543	286	909			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	64	91	96			
cM capacity (veh/h)	91	639	670			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	87	417	779	656	464
Volume Left	33	27	0	0	0
Volume Right	54	0	0	0	136
cSH	196	670	1700	1700	1700
Volume to Capacity	0.44	0.04	0.46	0.39	0.27
Queue Length 95th (ft)	52	3	0	0	0
Control Delay (s)	37.2	1.2	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	37.2	0.4		0.0	
Approach LOS	E				

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	100	50	1090	950	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	109	54	1185	1033	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	0.97	0.97	0.97			
vC, conflicting volume	1750	533	1065			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1706	445	997			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	48	80	92			
cM capacity (veh/h)	73	541	666			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	147	449	790	688	377
Volume Left	38	54	0	0	0
Volume Right	109	0	0	0	33
cSH	203	666	1700	1700	1700
Volume to Capacity	0.72	0.08	0.46	0.40	0.22
Queue Length 95th (ft)	117	7	0	0	0
Control Delay (s)	58.5	2.3	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	58.5	0.8		0.0	
Approach LOS	F				

Intersection Summary				
Average Delay		3.9		
Intersection Capacity Utilization		76.9%	ICU Level of Service	D
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	75	85	1035	90	45	900
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	92	1125	98	49	978
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1598	611			1223	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1598	611			1223	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	8	79			91	
cM capacity (veh/h)	89	436			566	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	174	750	473	245	391	391
Volume Left	82	0	0	49	0	0
Volume Right	92	0	98	0	0	0
cSH	154	1700	1700	566	1700	1700
Volume to Capacity	1.13	0.44	0.28	0.09	0.23	0.23
Queue Length 95th (ft)	236	0	0	7	0	0
Control Delay (s)	170.8	0.0	0.0	3.3	0.0	0.0
Lane LOS	F			A		
Approach Delay (s)	170.8	0.0		0.8		
Approach LOS	F					

Intersection Summary				
Average Delay		12.6		
Intersection Capacity Utilization		67.4%	ICU Level of Service	C
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	115	95	1075	990	70
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	125	103	1168	1076	76
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1905	397	1076			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1905	397	1076			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	4	79	84			
cM capacity (veh/h)	51	603	644			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	174	103	584	584	430	430	291
Volume Left	49	103	0	0	0	0	0
Volume Right	125	0	0	0	0	0	76
cSH	148	644	1700	1700	1700	1700	1700
Volume to Capacity	1.17	0.16	0.34	0.34	0.25	0.25	0.17
Queue Length 95th (ft)	246	14	0	0	0	0	0
Control Delay (s)	187.3	11.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	187.3	0.9			0.0		
Approach LOS	F						

Intersection Summary				
Average Delay		13.0		
Intersection Capacity Utilization		46.0%	ICU Level of Service	A
Analysis Period (min)		15		

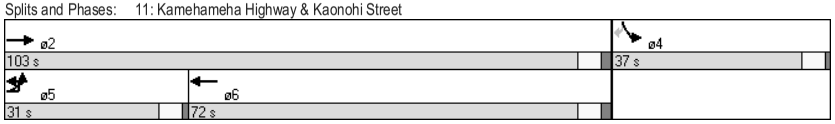
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	585	1850	1560	585	520
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	33.0	33.0
Total Split (s)	31.0	103.0	72.0	37.0	37.0
Total Split (%)	22.1%	73.6%	51.4%	26.4%	26.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 57 (41%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 140
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	585	1850	1560	585	585	520
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.96		0.98	0.89
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.96		0.97	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4531		3278	1283
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4531		3278	1283
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	636	2011	1696	636	636	565
RTOR Reduction (vph)	0	0	48	0	20	241
Lane Group Flow (vph)	636	2011	2284	0	802	138
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	26.0	97.0	66.0		32.0	32.0
Effective Green, g (s)	26.0	97.0	66.0		32.0	32.0
Actuated g/C Ratio	0.19	0.69	0.47		0.23	0.23
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	595	3288	2136		749	293
v/s Ratio Prot	c0.20	0.42	c0.50		c0.24	
v/s Ratio Perm						0.11
v/c Ratio	1.07	0.61	1.07		1.07	0.47
Uniform Delay, d1	57.0	11.5	37.0		54.0	46.7
Progression Factor	0.98	1.46	0.69		1.00	1.00
Incremental Delay, d2	52.0	0.6	38.8		53.5	1.2
Delay (s)	108.0	17.4	64.4		107.5	47.9
Level of Service	F	B	E		F	D
Approach Delay (s)		39.2	64.4		88.7	
Approach LOS		D	E		F	

Intersection Summary			
HCM Average Control Delay	58.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

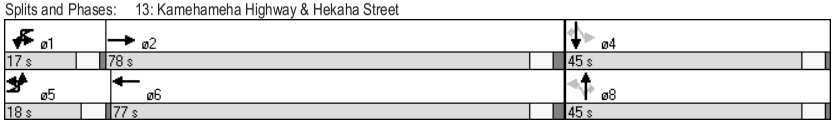
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	105	1875	235	1795	220	60	330	95	40	150
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	18.0	78.0	17.0	77.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	12.9%	55.7%	12.1%	55.0%	32.1%	32.1%	32.1%	32.1%	32.1%	32.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 131 (94%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1875	305	235	1795	65	220	60	330	95	40	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4631		3204	4716			1699	1531		1679	1414
Flt Permitted	0.95	1.00		0.95	1.00			0.61	1.00		0.38	1.00
Satd. Flow (perm)	1652	4631		3204	4716			1082	1531		664	1414
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	2038	332	255	1951	71	239	65	359	103	43	163
RTOR Reduction (vph)	0	16	0	0	3	0	0	0	115	0	0	116
Lane Group Flow (vph)	114	2354	0	255	2019	0	0	304	244	0	146	47
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	12.4	72.0		12.0	71.6			40.0	40.0		40.0	40.0
Effective Green, g (s)	12.4	72.0		12.0	71.6			40.0	40.0		40.0	40.0
Actuated g/C Ratio	0.09	0.51		0.09	0.51			0.29	0.29		0.29	0.29
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	146	2382		275	2412			309	437		190	404
v/s Ratio Prot	0.07	c0.51		c0.08	0.43							
v/s Ratio Perm								c0.28	0.16		0.22	0.03
v/c Ratio	0.78	0.99		0.93	0.84			0.98	0.56		0.77	0.12
Uniform Delay, d1	62.5	33.6		63.6	29.2			49.7	42.5		45.8	36.9
Progression Factor	0.89	0.75		1.03	0.90			1.00	1.00		1.00	1.00
Incremental Delay, d2	11.6	10.0		27.0	2.5			46.5	1.6		16.9	0.1
Delay (s)	67.0	35.1		92.2	28.9			96.1	44.0		62.6	37.1
Level of Service	E	D		F	C			F	D		E	D
Approach Delay (s)		36.6			36.0			67.9			49.2	
Approach LOS		D			D			E			D	

Intersection Summary			
HCM Average Control Delay	40.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	107.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

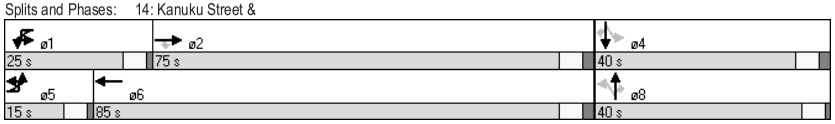
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	80	2030	110	115	1885	70	20	75	130	15	80
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	25.0	28.0	23.0	23.0	23.0	40.0	40.0	40.0
Total Split (s)	15.0	75.0	75.0	25.0	85.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	10.7%	53.6%	53.6%	17.9%	60.7%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 8 (6%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	2030	110	115	1885	245	70	20	75	130	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4664			1733	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.54	1.00		0.63	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4664			972	1531		1103	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	2207	120	125	2049	266	76	22	82	141	16	87
RTOR Reduction (vph)	0	0	22	0	10	0	0	0	67	0	0	72
Lane Group Flow (vph)	87	2207	98	125	2305	0	0	98	15	0	157	15
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	9.7	87.8	87.8	10.8	88.9			25.4	25.4		24.4	24.4
Effective Green, g (s)	9.7	87.8	87.8	10.8	88.9			25.4	25.4		24.4	24.4
Actuated g/C Ratio	0.07	0.63	0.63	0.08	0.64			0.18	0.18		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	114	2976	927	247	2962			176	278		192	258
v/s Ratio Prot	c0.05	0.46		0.04	c0.49							
v/s Ratio Perm			0.07					0.10	0.01		c0.14	0.01
v/c Ratio	0.76	0.74	0.11	0.51	0.78			0.56	0.05		0.82	0.06
Uniform Delay, d1	64.0	18.2	10.4	62.0	18.4			52.2	47.4		55.7	48.2
Progression Factor	1.10	0.35	0.22	1.08	0.37			1.00	1.00		1.00	1.00
Incremental Delay, d2	10.4	0.6	0.1	0.6	0.7			3.8	0.1		22.9	0.1
Delay (s)	80.6	7.0	2.4	67.7	7.6			56.0	47.4		78.5	48.3
Level of Service	F	A	A	E	A			E	D		E	D
Approach Delay (s)		9.4			10.6			52.1			67.8	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

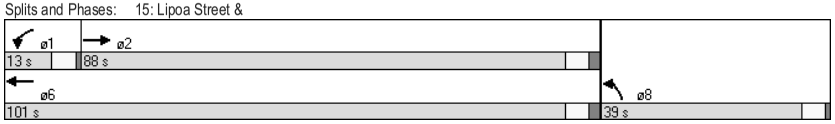
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2125	50	2185	170
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	88.0	13.0	101.0	39.0
Total Split (%)	62.9%	9.3%	72.1%	27.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 125 (89%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2125	70	50	2185	170	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4720		1652	4746	1672	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4720		1652	4746	1672	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2310	76	54	2375	185	76
RTOR Reduction (vph)	2	0	0	0	11	0
Lane Group Flow (vph)	2384	0	54	2375	250	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	91.7		6.4	103.1	25.9	
Effective Green, g (s)	91.7		6.4	103.1	25.9	
Actuated g/C Ratio	0.66		0.05	0.74	0.18	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3092		76	3495	309	
v/s Ratio Prot	c0.51		0.03	c0.50	c0.15	
v/s Ratio Perm						
v/c Ratio	0.77		0.71	0.68	0.81	
Uniform Delay, d1	16.8		65.9	9.7	54.7	
Progression Factor	0.93		1.24	0.38	1.00	
Incremental Delay, d2	1.3		18.8	0.7	14.3	
Delay (s)	17.0		100.3	4.4	68.9	
Level of Service	B		F	A	E	
Approach Delay (s)	17.0			6.6	68.9	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

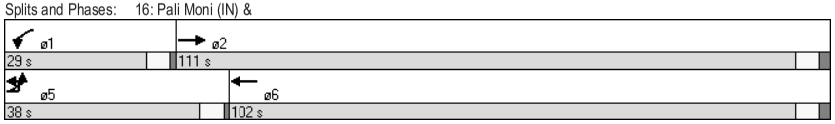
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	485	1615	155	1975
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	38.0	111.0	29.0	102.0
Total Split (%)	27.1%	79.3%	20.7%	72.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 100 (71%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	485	1615	55	155	1975	515	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4723		1652	4532							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4723		1652	4532							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	527	1755	60	168	2147	560	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	15	0	0	0	0	0	0	0
Lane Group Flow (vph)	527	1813	0	168	2692	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	27.9	110.1		18.9	101.1							
Effective Green, g (s)	27.9	110.1		18.9	101.1							
Actuated g/C Ratio	0.20	0.79		0.13	0.72							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	639	3714		223	3273							
v/s Ratio Prot	c0.16	0.38		0.10	c0.59							
v/s Ratio Perm												
v/c Ratio	0.82	0.49		0.75	0.82							
Uniform Delay, d1	53.7	5.2		58.3	13.3							
Progression Factor	0.71	1.18		1.07	0.43							
Incremental Delay, d2	5.6	0.3		10.1	1.8							
Delay (s)	43.5	6.4		72.3	7.5							
Level of Service	D	A		E	A							
Approach Delay (s)		14.7			11.3			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	73.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

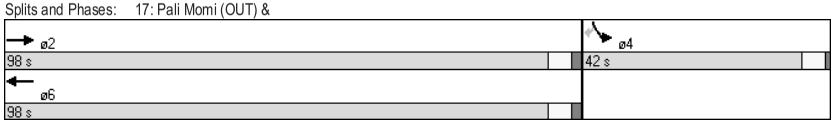
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1575	2280	365	200
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	98.0	98.0	42.0	42.0
Total Split (%)	70.0%	70.0%	30.0%	30.0%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 108 (77%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1575	2280	0	365	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1301
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1301
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1712	2478	0	397	217
RTOR Reduction (vph)	0	0	0	0	0	5
Lane Group Flow (vph)	0	1712	2478	0	397	212
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		101.2	101.2		27.8	27.8
Effective Green, g (s)		101.2	101.2		27.8	27.8
Actuated g/C Ratio		0.72	0.72		0.20	0.20
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3431	3431		659	258
v/s Ratio Prot		0.36	c0.52		0.12	
v/s Ratio Perm						c0.16
v/c Ratio		0.50	0.72		0.60	0.82
Uniform Delay, d1		8.4	11.2		51.1	53.7
Progression Factor		0.36	1.00		1.00	1.00
Incremental Delay, d2		0.5	1.3		1.6	18.7
Delay (s)		3.5	12.6		52.6	72.4
Level of Service		A	B		D	E
Approach Delay (s)		3.5	12.6		59.6	
Approach LOS		A	B		E	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	81.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Year 2019 with Project, Improvements and RT

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1305	15	0	1005	0	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1418	16	0	1092	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.82	
vC, conflicting volume			1435		1973	717
vC1, stage 1 conf vol					1427	
vC2, stage 2 conf vol					546	
vCu, unblocked vol			1435		1740	717
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	88
cM capacity (veh/h)			469		180	372

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	946	489	546	546	43
Volume Left	0	0	0	0	0
Volume Right	0	16	0	0	43
cSH	1700	1700	1700	1700	372
Volume to Capacity	0.56	0.29	0.32	0.32	0.12
Queue Length 95th (ft)	0	0	0	0	10
Control Delay (s)	0.0	0.0	0.0	0.0	16.0
Lane LOS					C
Approach Delay (s)	0.0		0.0		16.0
Approach LOS					C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		

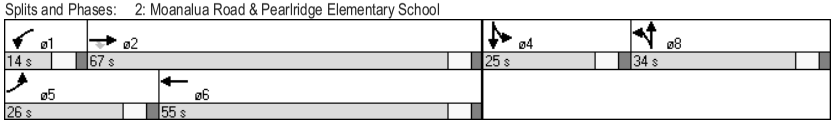
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	155	1120	110	50	705	80	5	130	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	26.0	67.0	67.0	14.0	55.0	34.0	34.0	25.0	25.0
Total Split (%)	18.6%	47.9%	47.9%	10.0%	39.3%	24.3%	24.3%	17.9%	17.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 10 (7%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1120	110	50	705	205	80	5	40	130	5	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.90		1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3420		1681	1573		1770	1590	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3420		1681	1573		1770	1590	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	1217	120	54	766	223	87	5	43	141	5	207
RTOR Reduction (vph)	0	0	25	0	15	0	0	40	0	0	184	0
Lane Group Flow (vph)	168	1217	95	54	974	0	70	25	0	141	28	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	17.3	82.7	82.7	6.4	71.8		11.2	11.2		15.7	15.7	
Effective Green, g (s)	17.3	82.7	82.7	6.4	71.8		11.2	11.2		15.7	15.7	
Actuated g/C Ratio	0.12	0.59	0.59	0.05	0.51		0.08	0.08		0.11	0.11	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	219	2091	935	81	1754		134	126		198	178	
v/s Ratio Prot	c0.09	c0.34		0.03	0.28		c0.04	0.02		c0.08	0.02	
v/s Ratio Perm			0.06									
v/c Ratio	0.77	0.58	0.10	0.67	0.56		0.52	0.20		0.71	0.16	
Uniform Delay, d1	59.4	17.9	12.5	65.8	23.2		61.8	60.2		60.0	56.2	
Progression Factor	1.00	1.00	1.00	1.19	0.63		1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.8	1.2	0.2	17.7	1.2		3.6	0.8		11.4	0.4	
Delay (s)	74.2	19.1	12.7	95.6	15.8		65.5	61.0		71.4	56.6	
Level of Service	E	B	B	F	B		E	E		E	E	
Approach Delay (s)		24.7			19.9			63.3			62.5	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

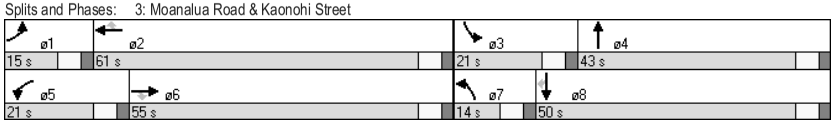
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	960	205	130	640	100	85	90	285	265	240
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	15.0	55.0	55.0	21.0	61.0	61.0	14.0	43.0	21.0	50.0	50.0
Total Split (%)	10.7%	39.3%	39.3%	15.0%	43.6%	43.6%	10.0%	30.7%	15.0%	35.7%	35.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	960	205	130	640	100	85	90	145	285	265	240
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3212		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3212		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1043	223	141	696	109	92	98	158	310	288	261
RTOR Reduction (vph)	0	0	118	0	0	53	0	134	0	0	0	193
Lane Group Flow (vph)	114	1043	105	141	696	56	92	122	0	310	288	68
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	8.6	65.7	65.7	14.3	71.4	71.4	7.7	21.2		14.8	28.3	28.3
Effective Green, g (s)	8.6	65.7	65.7	14.3	71.4	71.4	7.7	21.2		14.8	28.3	28.3
Actuated g/C Ratio	0.06	0.47	0.47	0.10	0.51	0.51	0.06	0.15		0.11	0.20	0.20
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	211	1661	743	181	1805	807	189	486		363	377	320
v/s Ratio Prot	0.03	c0.29		c0.08	c0.20		0.03	0.04		c0.09	c0.15	
v/s Ratio Perm			0.07			0.04						0.04
v/c Ratio	0.54	0.63	0.14	0.78	0.39	0.07	0.49	0.25		0.85	0.76	0.21
Uniform Delay, d1	63.8	28.0	21.1	61.3	20.9	17.4	64.2	52.4		61.5	52.7	46.6
Progression Factor	1.16	0.57	0.12	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.3	1.5	0.3	19.3	0.6	0.2	2.0	0.3		17.4	8.9	0.3
Delay (s)	76.4	17.4	2.9	80.6	21.5	17.6	66.2	52.7		79.0	61.6	46.9
Level of Service	E	B	A	F	C	B	E	D		E	E	D
Approach Delay (s)		20.0			29.9			56.2			63.4	
Approach LOS		B			C			E			E	

Intersection Summary				
HCM Average Control Delay	36.8	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.76			
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	71.9%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	15	0	0	10	0	315	20	0	550	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	16	0	0	11	0	342	22	0	598	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	727	995	332	668	1016	96	663			364		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	727	995	332	668	1016	96	663			364		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	100	100	99	100			100		
cM capacity (veh/h)	308	243	664	335	236	941	922			1191		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	16	11	98	98	98	71	399	264
Volume Left	0	0	0	0	0	0	0	0
Volume Right	16	11	0	0	0	22	0	65
cSH	664	941	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.01	0.06	0.06	0.06	0.04	0.23	0.16
Queue Length 95th (ft)	2	1	0	0	0	0	0	0
Control Delay (s)	10.6	8.9	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.6	8.9	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay	0.3			
Intersection Capacity Utilization	27.1%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	5	25	15	0	30	35	295	15	35	510	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	5	27	16	0	33	38	321	16	38	554	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked												
vC, conflicting volume	905	1049	283	788	1046	168	565			337		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	905	1049	283	788	1046	168	565			337		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	92	97	96	94	100	96	96			97		
cM capacity (veh/h)	211	211	714	252	212	846	1003			1219		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	22	27	16	33	38	214	123	38	370	196
Volume Left	16	0	16	0	38	0	0	38	0	0
Volume Right	0	27	0	33	0	0	16	0	0	11
cSH	211	714	252	846	1003	1700	1700	1219	1700	1700
Volume to Capacity	0.10	0.04	0.06	0.04	0.04	0.13	0.07	0.03	0.22	0.12
Queue Length 95th (ft)	8	3	5	3	3	0	0	2	0	0
Control Delay (s)	24.0	10.2	20.3	9.4	8.7	0.0	0.0	8.0	0.0	0.0
Lane LOS	C	B	C	A	A			A		
Approach Delay (s)	16.4		13.0		0.9			0.5		
Approach LOS	C		B							

Intersection Summary				
Average Delay		1.9		
Intersection Capacity Utilization		35.5%	ICU Level of Service	A
Analysis Period (min)		15		

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	50	10	30	5	150	275	35	520
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	36.0	36.0	36.0	36.0	54.0	54.0	54.0	54.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 28.2
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	10	140	30	5	10	150	275	40	35	520	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.90		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1602		1770	1671		1770	3472		1770	3525	
Flt Permitted	0.77	1.00		0.77	1.00		0.43	1.00		0.55	1.00	
Satd. Flow (perm)	1433	1602		1433	1671		807	3472		1017	3525	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	11	152	33	5	11	163	299	43	38	565	16
RTOR Reduction (vph)	0	124	0	0	9	0	0	15	0	0	3	0
Lane Group Flow (vph)	54	39	0	33	7	0	163	327	0	38	578	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	5.2	5.2		5.2	5.2		13.5	13.5		13.5	13.5	
Effective Green, g (s)	5.2	5.2		5.2	5.2		13.5	13.5		13.5	13.5	
Actuated g/C Ratio	0.18	0.18		0.18	0.18		0.47	0.47		0.47	0.47	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	260	290		260	303		380	1633		478	1658	
v/s Ratio Prot		0.02			0.00			0.09			0.16	
v/s Ratio Perm	c0.04			0.02			c0.20			0.04		
v/c Ratio	0.21	0.13		0.13	0.02		0.43	0.20		0.08	0.35	
Uniform Delay, d1	10.0	9.9		9.8	9.7		5.0	4.4		4.2	4.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	0.2		0.2	0.0		0.8	0.1		0.1	0.1	
Delay (s)	10.4	10.1		10.1	9.7		5.8	4.5		4.3	4.9	
Level of Service	B	B		B	A		A	A		A	A	
Approach Delay (s)		10.1			9.9			4.9			4.9	
Approach LOS		B			A			A			A	

Intersection Summary				
HCM Average Control Delay	5.9	HCM Level of Service	A	
HCM Volume to Capacity ratio	0.37			
Actuated Cycle Length (s)	28.7	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	52.3%	ICU Level of Service	A	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	30	20	430	610	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	33	22	467	663	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.94	0.94	0.94			
vC, conflicting volume	970	361	723			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	846	201	584			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	84	96	98			
cM capacity (veh/h)	277	760	930			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	178	312	442	281
Volume Left	43	22	0	0	0
Volume Right	33	0	0	0	60
cSH	381	930	1700	1700	1700
Volume to Capacity	0.20	0.02	0.18	0.26	0.17
Queue Length 95th (ft)	18	2	0	0	0
Control Delay (s)	16.8	1.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	16.8	0.5		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	37.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	50	20	435	640	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	54	22	473	696	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked						
vC, conflicting volume	978	351	701			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	978	351	701			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	92	98			
cM capacity (veh/h)	242	646	892			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	179	315	464	237
Volume Left	16	22	0	0	0
Volume Right	54	0	0	0	5
cSH	466	892	1700	1700	1700
Volume to Capacity	0.15	0.02	0.19	0.27	0.14
Queue Length 95th (ft)	13	2	0	0	0
Control Delay (s)	14.1	1.3	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	14.1	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		37.3%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	440	55	25	665
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	478	60	27	723
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	803	269			538	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	803	269			538	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	84	98			97	
cM capacity (veh/h)	312	729			1026	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	319	219	172	289	289
Volume Left	49	0	0	27	0	0
Volume Right	16	0	60	0	0	0
cSH	364	1700	1700	1026	1700	1700
Volume to Capacity	0.18	0.19	0.13	0.03	0.17	0.17
Queue Length 95th (ft)	16	0	0	2	0	0
Control Delay (s)	17.0	0.0	0.0	1.6	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	17.0	0.0		0.4		
Approach LOS	C					

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		40.7%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	85	155	55	405	685	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	168	60	440	745	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1103	267	745			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1103	267	745			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	52	77	93			
cM capacity (veh/h)	191	731	859			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	261	60	220	220	298	298	187
Volume Left	92	60	0	0	0	0	0
Volume Right	168	0	0	0	0	0	38
cSH	365	859	1700	1700	1700	1700	1700
Volume to Capacity	0.71	0.07	0.13	0.13	0.18	0.18	0.11
Queue Length 95th (ft)	133	6	0	0	0	0	0
Control Delay (s)	36.0	9.5	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	A					
Approach Delay (s)	36.0	1.1			0.0		
Approach LOS	E						

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

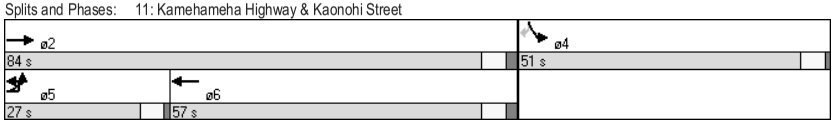
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	255	1450	785	670	170
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	27.0	84.0	57.0	51.0	51.0
Total Split (%)	20.0%	62.2%	42.2%	37.8%	37.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 88 (65%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	255	1450	785	235	670	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	0.92
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.97		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4655		3426	1333
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4655		3426	1333
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	1576	853	255	728	185
RTOR Reduction (vph)	0	0	37	0	1	109
Lane Group Flow (vph)	277	1576	1071	0	746	57
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	16.9	78.0	56.1		46.0	46.0
Effective Green, g (s)	16.9	78.0	56.1		46.0	46.0
Actuated g/C Ratio	0.13	0.58	0.42		0.34	0.34
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	401	2742	1934		1167	454
v/s Ratio Prot	c0.09	c0.33	0.23		c0.22	
v/s Ratio Perm						0.04
v/c Ratio	0.69	0.57	0.55		0.64	0.12
Uniform Delay, d1	56.5	18.0	29.9		37.5	30.6
Progression Factor	1.13	0.27	0.61		1.00	1.00
Incremental Delay, d2	4.4	0.8	1.1		2.7	0.6
Delay (s)	68.2	5.5	19.2		40.2	31.2
Level of Service	E	A	B		D	C
Approach Delay (s)		14.9	19.2		38.6	
Approach LOS		B	B		D	

Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

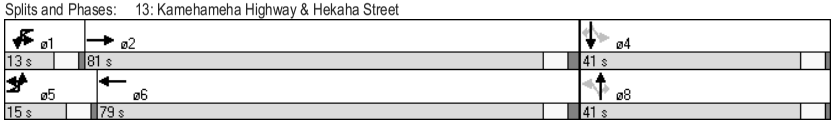
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1555	90	890	55	5	60	115	15	75
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	39.0	39.0	39.0
Total Split (s)	15.0	81.0	13.0	79.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	11.1%	60.0%	9.6%	58.5%	30.4%	30.4%	30.4%	30.4%	30.4%	30.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 113 (84%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1555	190	90	890	30	55	5	60	115	15	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4654		3204	4719			1720	1487		1641	1458
Flt Permitted	0.95	1.00		0.95	1.00			0.68	1.00		0.70	1.00
Satd. Flow (perm)	1652	4654		3204	4719			1224	1487		1206	1458
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1690	207	98	967	33	60	5	65	125	16	82
RTOR Reduction (vph)	0	11	0	0	3	0	0	0	48	0	0	60
Lane Group Flow (vph)	54	1886	0	98	997	0	0	65	17	0	141	22
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.6	75.2		7.8	75.4			36.0	36.0		36.0	36.0
Effective Green, g (s)	7.6	75.2		7.8	75.4			36.0	36.0		36.0	36.0
Actuated g/C Ratio	0.06	0.56		0.06	0.56			0.27	0.27		0.27	0.27
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	93	2592		185	2636			326	397		322	389
v/s Ratio Prot	c0.03	c0.41		0.03	0.21							
v/s Ratio Perm								0.05	0.01		c0.12	0.01
v/c Ratio	0.58	0.73		0.53	0.38			0.20	0.04		0.44	0.06
Uniform Delay, d1	62.1	22.3		61.8	16.7			38.3	36.7		41.1	36.9
Progression Factor	0.88	0.92		0.82	1.31			1.00	1.00		1.00	1.00
Incremental Delay, d2	7.4	1.5		2.6	0.4			1.4	0.2		4.3	0.3
Delay (s)	61.8	22.1		53.0	22.3			39.7	36.9		45.4	37.1
Level of Service	E	C		D	C			D	D		D	D
Approach Delay (s)		23.2			25.1			38.3			42.3	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	25.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

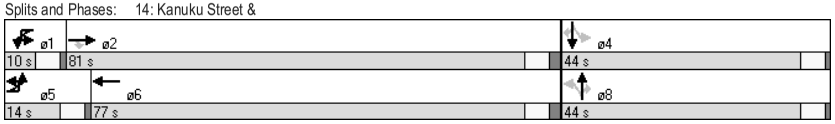
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	30	1600	20	20	960	5	5	15	140	10	45
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	39.0	39.0	39.0
Total Split (s)	14.0	81.0	81.0	10.0	77.0	44.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	10.4%	60.0%	60.0%	7.4%	57.0%	32.6%	32.6%	32.6%	32.6%	32.6%	32.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 4 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	1600	20	20	960	65	5	5	15	140	10	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1449	3204	4696			1754	1531		1661	1453
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1449	3204	4696			1590	1531		1275	1453
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	1739	22	22	1043	71	5	5	16	152	11	49
RTOR Reduction (vph)	0	0	5	0	4	0	0	0	13	0	0	41
Lane Group Flow (vph)	33	1739	17	22	1110	0	0	10	3	0	163	8
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	5.2	93.3	93.3	3.0	91.1			22.7	22.7		22.7	22.7
Effective Green, g (s)	5.2	93.3	93.3	3.0	91.1			22.7	22.7		22.7	22.7
Actuated g/C Ratio	0.04	0.69	0.69	0.02	0.67			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	64	3280	1001	71	3169			267	257		214	244
v/s Ratio Prot	c0.02	c0.37		0.01	0.24							
v/s Ratio Perm			0.01					0.01	0.00		c0.13	0.01
v/c Ratio	0.52	0.53	0.02	0.31	0.35			0.04	0.01		0.76	0.03
Uniform Delay, d1	63.7	10.2	6.5	65.0	9.3			47.0	46.8		53.6	47.0
Progression Factor	1.34	0.25	0.05	0.73	1.52			1.00	1.00		1.00	1.00
Incremental Delay, d2	4.9	0.4	0.0	2.2	0.3			0.1	0.0		14.7	0.1
Delay (s)	90.3	3.0	0.3	49.9	14.5			47.1	46.8		68.3	47.0
Level of Service	F	A	A	D	B			D	D		E	D
Approach Delay (s)		4.6			15.1			46.9			63.4	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

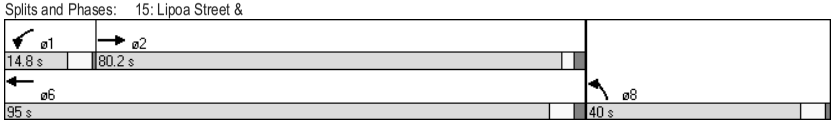
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2000	45	1015	75
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	80.2	14.8	95.0	40.0
Total Split (%)	59.4%	11.0%	70.4%	29.6%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 4 (3%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2000	50	45	1015	75	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4729		1652	4746	1651	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4729		1652	4746	1651	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2174	54	49	1103	82	65
RTOR Reduction (vph)	1	0	0	0	26	0
Lane Group Flow (vph)	2227	0	49	1103	121	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	98.7		7.6	108.8	15.2	
Effective Green, g (s)	98.7		7.6	108.8	15.2	
Actuated g/C Ratio	0.73		0.06	0.81	0.11	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3457		93	3825	186	
v/s Ratio Prot	c0.47		c0.03	0.23	c0.07	
v/s Ratio Perm						
v/c Ratio	0.64		0.53	0.29	0.65	
Uniform Delay, d1	9.2		62.0	3.3	57.4	
Progression Factor	0.90		0.87	0.95	1.00	
Incremental Delay, d2	0.8		5.1	0.2	7.9	
Delay (s)	9.1		58.9	3.3	65.3	
Level of Service	A		E	A	E	
Approach Delay (s)	9.1			5.7	65.3	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	10.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

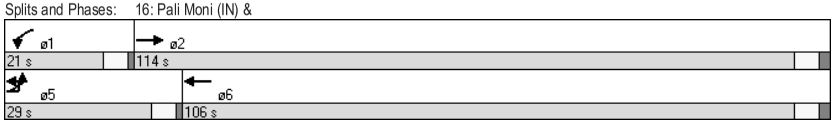
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	200	1910	45	1050
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	29.0	114.0	21.0	106.0
Total Split (%)	21.5%	84.4%	15.6%	78.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 121 (90%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	1910	15	45	1050	185	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4741		1652	4640							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4741		1652	4640							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	217	2076	16	49	1141	201	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	13	0	0	0	0	0	0	0
Lane Group Flow (vph)	217	2092	0	49	1329	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	14.4	115.7		8.3	109.6							
Effective Green, g (s)	14.4	115.7		8.3	109.6							
Actuated g/C Ratio	0.11	0.86		0.06	0.81							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	342	4063		102	3767							
v/s Ratio Prot	c0.07	c0.44		0.03	0.29							
v/s Ratio Perm												
v/c Ratio	0.63	0.51		0.48	0.35							
Uniform Delay, d1	57.8	2.5		61.3	3.3							
Progression Factor	0.84	0.65		0.94	0.41							
Incremental Delay, d2	3.0	0.4		3.3	0.2							
Delay (s)	51.4	2.0		60.7	1.6							
Level of Service	D	A		E	A							
Approach Delay (s)		6.6			3.7			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

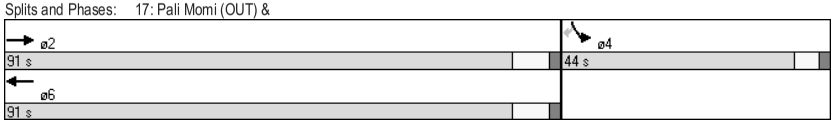
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1815	1185	330	85
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	91.0	91.0	44.0	44.0
Total Split (%)	67.4%	67.4%	32.6%	32.6%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 6 (4%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1815	1185	0	330	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.93
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1425
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1973	1288	0	359	92
RTOR Reduction (vph)	0	0	0	0	0	48
Lane Group Flow (vph)	0	1973	1288	0	359	44
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		83.0	83.0		38.0	38.0
Effective Green, g (s)		83.0	83.0		38.0	38.0
Actuated g/C Ratio		0.61	0.61		0.28	0.28
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2918	2918		934	401
v/s Ratio Prot		c0.42	0.27		c0.11	
v/s Ratio Perm						0.03
v/c Ratio		0.68	0.44		0.38	0.11
Uniform Delay, d1		17.1	13.7		39.1	36.0
Progression Factor		0.30	1.00		1.00	1.00
Incremental Delay, d2		1.1	0.5		1.2	0.6
Delay (s)		6.2	14.2		40.3	36.5
Level of Service		A	B		D	D
Approach Delay (s)		6.2	14.2		39.5	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1215	25	0	1745	0	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1321	27	0	1897	0	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.63	
vC, conflicting volume			1348		2283	674
vC1, stage 1 conf vol					1334	
vC2, stage 2 conf vol					948	
vCu, unblocked vol			1348		1852	674
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	95
cM capacity (veh/h)			507		196	397

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	880	467	948	948	22
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	22
cSH	1700	1700	1700	1700	397
Volume to Capacity	0.52	0.27	0.56	0.56	0.05
Queue Length 95th (ft)	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	14.6
Lane LOS					B
Approach Delay (s)	0.0		0.0		14.6
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	51.6%	ICU Level of Service	A
Analysis Period (min)	15		

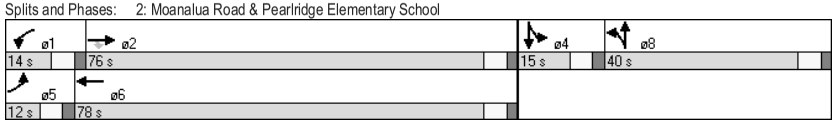
Timings
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	55	1120	80	55	1455	230	5	85	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	40.0	40.0	10.0	10.0
Total Split (s)	12.0	76.0	76.0	14.0	78.0	40.0	40.0	15.0	15.0
Total Split (%)	8.3%	52.4%	52.4%	9.7%	53.8%	27.6%	27.6%	10.3%	10.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 121 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	1120	80	55	1455	80	230	5	65	85	5	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.93		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3512		1681	1609		1770	1603	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3512		1681	1609		1770	1603	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	1217	87	60	1582	87	250	5	71	92	5	65
RTOR Reduction (vph)	0	0	19	0	2	0	0	22	0	0	61	0
Lane Group Flow (vph)	60	1217	68	60	1667	0	167	137	0	92	9	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	6.0	85.7	85.7	6.4	86.1		19.9	19.9		9.0	9.0	
Effective Green, g (s)	6.0	85.7	85.7	6.4	86.1		19.9	19.9		9.0	9.0	
Actuated g/C Ratio	0.04	0.59	0.59	0.04	0.59		0.14	0.14		0.06	0.06	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	73	2092	936	78	2085		231	221		110	99	
v/s Ratio Prot	c0.03	0.34		0.03	c0.47		c0.10	0.08		c0.05	0.01	
v/s Ratio Perm			0.04									
v/c Ratio	0.82	0.58	0.07	0.77	0.80		0.72	0.62		0.84	0.09	
Uniform Delay, d1	69.0	18.5	12.7	68.6	22.8		59.9	59.0		67.3	64.1	
Progression Factor	1.00	1.00	1.00	1.03	0.65		1.00	1.00		1.00	1.00	
Incremental Delay, d2	49.9	1.2	0.2	27.3	2.4		10.6	5.1		39.6	0.4	
Delay (s)	118.9	19.7	12.8	97.6	17.1		70.6	64.0		106.9	64.5	
Level of Service	F	B	B	F	B		E	E		F	E	
Approach Delay (s)		23.6			19.9			67.4			88.6	
Approach LOS		C			B			E			F	

Intersection Summary				
HCM Average Control Delay	28.7	HCM Level of Service	C	
HCM Volume to Capacity ratio	0.75			
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	18.0	
Intersection Capacity Utilization	70.9%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

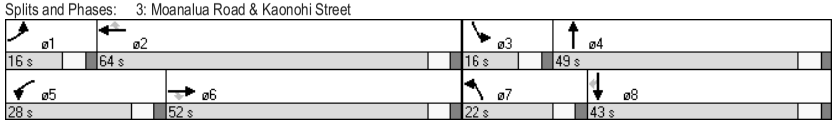
Timings
3: Moanalua Road & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	205	875	200	200	1195	290	325	170	125	115	145
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	16.0	52.0	52.0	28.0	64.0	64.0	22.0	49.0	16.0	43.0	43.0
Total Split (%)	11.0%	35.9%	35.9%	19.3%	44.1%	44.1%	15.2%	33.8%	11.0%	29.7%	29.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 144 (99%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	875	200	200	1195	290	325	170	155	125	115	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3287		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3287		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	951	217	217	1299	315	353	185	168	136	125	158
RTOR Reduction (vph)	0	0	114	0	0	139	0	136	0	0	0	142
Lane Group Flow (vph)	223	951	103	217	1299	176	353	217	0	136	125	16
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	10.0	69.1	69.1	20.8	79.9	79.9	16.0	21.5		9.6	15.1	15.1
Effective Green, g (s)	10.0	69.1	69.1	20.8	79.9	79.9	16.0	21.5		9.6	15.1	15.1
Actuated g/C Ratio	0.07	0.48	0.48	0.14	0.55	0.55	0.11	0.15		0.07	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	237	1687	754	254	1950	872	379	487		227	194	165
v/s Ratio Prot	0.06	0.27		c0.12	c0.37		c0.10	0.07		0.04	c0.07	
v/s Ratio Perm			0.07			0.11						0.01
v/c Ratio	0.94	0.56	0.14	0.85	0.67	0.20	0.93	0.45		0.60	0.64	0.10
Uniform Delay, d1	67.2	27.2	21.3	60.6	23.1	16.4	64.0	56.3		65.8	62.4	58.8
Progression Factor	1.22	0.53	0.08	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	37.4	1.1	0.3	23.8	1.8	0.5	29.4	0.7		4.2	7.1	0.3
Delay (s)	119.0	15.6	2.0	84.4	24.9	17.0	93.3	57.0		70.0	69.5	59.1
Level of Service	F	B	A	F	C	B	F	E		E	E	E
Approach Delay (s)		30.1			30.6			75.1			65.7	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	41.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	74.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	90	0	0	75	0	575	40	0	435	65
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	98	0	0	82	0	625	43	0	473	71
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	746	1177	272	981	1190	178	543			668		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	746	1177	272	981	1190	178	543			668		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	87	100	100	90	100			100		
cM capacity (veh/h)	273	190	726	176	186	834	1022			917		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	98	82	179	179	179	133	315	228
Volume Left	0	0	0	0	0	0	0	0
Volume Right	98	82	0	0	0	43	0	71
cSH	726	834	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.13	0.10	0.11	0.11	0.11	0.08	0.19	0.13
Queue Length 95th (ft)	12	8	0	0	0	0	0	0
Control Delay (s)	10.7	9.8	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.7	9.8	0.0				0.0	
Approach LOS	B	A						

Intersection Summary			
Average Delay		1.3	
Intersection Capacity Utilization		26.3%	ICU Level of Service A
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	5	80	105	55	140	55	465	75	95	430	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	5	87	114	60	152	60	505	82	103	467	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.95	0.95		0.95	0.95	0.95				0.95		
vC, conflicting volume	1236	1389	242	1196	1356	293	484			587		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1144	1304	242	1101	1270	152	484			460		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	53	96	89	5	56	82	94			90		
cM capacity (veh/h)	70	129	759	120	135	824	1075			1042		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	38	87	174	152	60	337	250	103	312	172
Volume Left	33	0	114	0	60	0	0	103	0	0
Volume Right	0	87	0	152	0	0	82	0	0	16
cSH	75	759	125	824	1075	1700	1700	1042	1700	1700
Volume to Capacity	0.51	0.11	1.39	0.18	0.06	0.20	0.15	0.10	0.18	0.10
Queue Length 95th (ft)	53	10	293	17	4	0	0	8	0	0
Control Delay (s)	94.7	10.4	283.4	10.4	8.5	0.0	0.0	8.8	0.0	0.0
Lane LOS	F	B	F	B	A			A		
Approach Delay (s)	36.0		156.0		0.8			1.6		
Approach LOS	E		F							

Intersection Summary			
Average Delay		33.7	
Intersection Capacity Utilization		45.9%	ICU Level of Service A
Analysis Period (min)		15	

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	40	10	160	40	250	485	60	525
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	87.0	87.0	87.0	87.0
Total Split (%)	27.5%	27.5%	27.5%	27.5%	72.5%	72.5%	72.5%	72.5%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 66.3
Natural Cycle: 70
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

ø2	ø4
87 s	33 s
ø6	ø8
87 s	33 s

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	10	190	160	40	80	250	485	95	60	525	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.90		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1597		1770	1676		1770	3452		1770	3506	
Flt Permitted	0.67	1.00		0.60	1.00		0.40	1.00		0.38	1.00	
Satd. Flow (perm)	1255	1597		1109	1676		738	3452		716	3506	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	43	11	207	174	43	87	272	527	103	65	571	38
RTOR Reduction (vph)	0	137	0	0	52	0	0	21	0	0	6	0
Lane Group Flow (vph)	43	81	0	174	78	0	272	609	0	65	603	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	22.2	22.2		22.2	22.2		33.2	33.2		33.2	33.2	
Effective Green, g (s)	22.2	22.2		22.2	22.2		33.2	33.2		33.2	33.2	
Actuated g/C Ratio	0.34	0.34		0.34	0.34		0.51	0.51		0.51	0.51	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	426	542		376	569		375	1752		363	1780	
v/s Ratio Prot		0.05			0.05			0.18			0.17	
v/s Ratio Perm	0.03			c0.16			c0.37			0.09		
v/c Ratio	0.10	0.15		0.46	0.14		0.73	0.35		0.18	0.34	
Uniform Delay, d1	14.8	15.0		16.9	15.0		12.5	9.6		8.7	9.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		0.9	0.1		6.8	0.1		0.2	0.1	
Delay (s)	14.9	15.2		17.8	15.1		19.4	9.7		9.0	9.7	
Level of Service	B	B		B	B		B	A		A	A	
Approach Delay (s)		15.1			16.7			12.6			9.6	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	65.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	795	815	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	864	886	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	200	
pX, platoon unblocked	0.91	0.91	0.91			
vC, conflicting volume	1386	467	935			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1228	220	733			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	78	95	97			
cM capacity (veh/h)	151	714	790			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	310	576	591	344
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	249	790	1700	1700	1700
Volume to Capacity	0.26	0.03	0.34	0.35	0.20
Queue Length 95th (ft)	25	2	0	0	0
Control Delay (s)	24.5	1.0	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	24.5	0.3		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		46.5%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	800	830	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	870	902	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	0.97	0.97	0.97			
vC, conflicting volume	1402	462	924			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1347	374	852			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	90	96			
cM capacity (veh/h)	133	602	756			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	317	580	601	322
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	22
cSH	342	756	1700	1700	1700
Volume to Capacity	0.22	0.04	0.34	0.35	0.19
Queue Length 95th (ft)	21	3	0	0	0
Control Delay (s)	18.5	1.2	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	18.5	0.4		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		0.9		
Intersection Capacity Utilization		51.1%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/7/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	775	55	30	860
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	842	60	33	935
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1249	451			902	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1249	451			902	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	52	91			96	
cM capacity (veh/h)	158	556			749	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	562	341	220	374	374
Volume Left	76	0	0	33	0	0
Volume Right	49	0	60	0	0	0
cSH	219	1700	1700	749	1700	1700
Volume to Capacity	0.57	0.33	0.20	0.04	0.22	0.22
Queue Length 95th (ft)	79	0	0	3	0	0
Control Delay (s)	41.2	0.0	0.0	1.9	0.0	0.0
Lane LOS	E			A		
Approach Delay (s)	41.2	0.0		0.4		
Approach LOS	E					

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	115	125	800	865	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	125	136	870	940	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1677	343	940			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1677	343	940			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	38	81	81			
cM capacity (veh/h)	70	653	725			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	136	435	435	376	376	248
Volume Left	43	136	0	0	0	0	0
Volume Right	125	0	0	0	0	0	60
cSH	207	725	1700	1700	1700	1700	1700
Volume to Capacity	0.81	0.19	0.26	0.26	0.22	0.22	0.15
Queue Length 95th (ft)	147	17	0	0	0	0	0
Control Delay (s)	70.6	11.1	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	70.6	1.5			0.0		
Approach LOS	F						

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

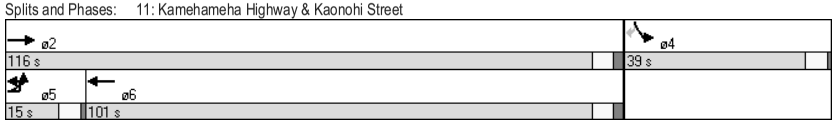
Timings
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	305	1230	3315	405	570
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	28.0	28.0	39.0	39.0
Total Split (s)	15.0	116.0	101.0	39.0	39.0
Total Split (%)	9.7%	74.8%	65.2%	25.2%	25.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 155
Actuated Cycle Length: 155
Offset: 111 (72%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	305	1230	3315	610	405	570
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		0.94	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4690		3300	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4690		3300	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	332	1337	3603	663	440	620
RTOR Reduction (vph)	0	0	17	0	75	82
Lane Group Flow (vph)	332	1337	4249	0	650	253
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	10.0	110.8	95.8		33.2	33.2
Effective Green, g (s)	10.0	110.8	95.8		33.2	33.2
Actuated g/C Ratio	0.06	0.71	0.62		0.21	0.21
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	221	3635	2899		707	309
v/s Ratio Prot	c0.10	0.26	c0.91		c0.20	
v/s Ratio Perm						0.18
v/c Ratio	1.50	0.37	1.47		0.92	0.82
Uniform Delay, d1	72.5	8.6	29.6		59.6	58.0
Progression Factor	0.88	0.98	0.72		1.00	1.00
Incremental Delay, d2	247.1	0.3	210.2		17.0	15.5
Delay (s)	310.8	8.7	231.6		76.6	73.5
Level of Service	F	A	F		E	E
Approach Delay (s)		68.8	231.6		75.6	
Approach LOS		E	F		E	

Intersection Summary			
HCM Average Control Delay	169.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	155.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	124.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

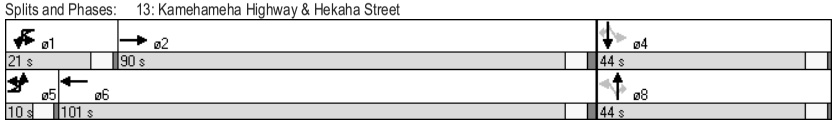
Timings
13: Kamehameha Highway & Hekaha Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1125	190	2810	240	45	235	65	45	100
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	33.0	10.0	33.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	10.0	90.0	21.0	101.0	44.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	6.5%	58.1%	13.5%	65.2%	28.4%	28.4%	28.4%	28.4%	28.4%	28.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 155
Actuated Cycle Length: 155
Offset: 47 (30%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1125	155	190	2810	80	240	45	235	65	45	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4644		3204	4723			1728	1444		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.38	1.00
Satd. Flow (perm)	1652	4644		3204	4723			1119	1444		651	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1223	168	207	3054	87	261	49	255	71	49	109
RTOR Reduction (vph)	0	11	0	0	2	0	0	0	128	0	0	43
Lane Group Flow (vph)	54	1380	0	207	3139	0	0	310	127	0	120	66
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	85.6		14.4	95.0			39.0	39.0		39.0	39.0
Effective Green, g (s)	5.0	85.6		14.4	95.0			39.0	39.0		39.0	39.0
Actuated g/C Ratio	0.03	0.55		0.09	0.61			0.25	0.25		0.25	0.25
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	53	2565		298	2895			282	363		164	372
v/s Ratio Prot	0.03	0.30		c0.06	c0.66							
v/s Ratio Perm								c0.28	0.09		0.18	0.04
v/c Ratio	1.02	0.54		0.69	1.08			1.10	0.35		0.73	0.18
Uniform Delay, d1	75.0	22.1		68.2	30.0			58.0	47.6		53.2	45.4
Progression Factor	1.20	0.74		1.23	0.57			1.00	1.00		1.00	1.00
Incremental Delay, d2	120.8	0.7		0.6	38.6			82.8	0.6		15.4	0.2
Delay (s)	211.2	17.0		84.3	55.7			140.8	48.2		68.6	45.6
Level of Service	F	B		F	E			F	D		E	D
Approach Delay (s)		24.3			57.5			99.0			57.7	
Approach LOS		C			E			F			E	

Intersection Summary			
HCM Average Control Delay	53.1	HCM Level of Service	D
HCM Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	155.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	98.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

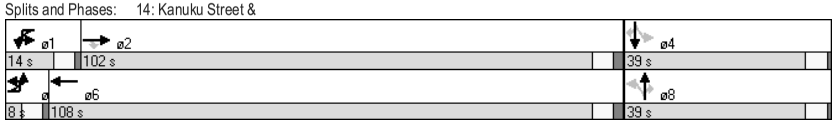
Timings
14: Kanuku Street &

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1285	75	90	3210	95	15	55	65	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	102.0	102.0	14.0	108.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	5.2%	65.8%	65.8%	9.0%	69.7%	25.2%	25.2%	25.2%	25.2%	25.2%	25.2%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 155
Actuated Cycle Length: 155
Offset: 34 (22%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1285	75	90	3210	225	95	15	55	65	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.97
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1429	3204	4693			1696	1531		1670	1426
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.63	1.00		0.54	1.00
Satd. Flow (perm)	1652	4746	1429	3204	4693			1121	1531		935	1426
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1397	82	98	3489	245	103	16	60	71	16	38
RTOR Reduction (vph)	0	0	23	0	4	0	0	0	52	0	0	29
Lane Group Flow (vph)	38	1397	59	98	3730	0	0	119	8	0	87	9
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	109.6	109.6	8.6	115.2			20.8	20.8		20.8	20.8
Effective Green, g (s)	3.0	109.6	109.6	8.6	115.2			20.8	20.8		20.8	20.8
Actuated g/C Ratio	0.02	0.71	0.71	0.06	0.74			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	32	3356	1010	178	3488			150	205		125	191
v/s Ratio Prot	c0.02	0.29		0.03	c0.79							
v/s Ratio Perm			0.04					c0.11	0.01		0.09	0.01
v/c Ratio	1.19	0.42	0.06	0.55	1.07			0.79	0.04		0.70	0.05
Uniform Delay, d1	76.0	9.4	6.9	71.3	19.9			65.0	58.4		64.1	58.5
Progression Factor	0.91	0.50	0.16	1.06	0.35			1.00	1.00		1.00	1.00
Incremental Delay, d2	207.2	0.3	0.1	0.3	31.9			24.3	0.1		15.5	0.1
Delay (s)	276.4	5.0	1.2	75.8	38.9			89.3	58.5		79.6	58.6
Level of Service	F	A	A	E	D			F	E		E	E
Approach Delay (s)		11.6			39.9			79.0			73.2	
Approach LOS		B			D			E			E	

Intersection Summary			
HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	155.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

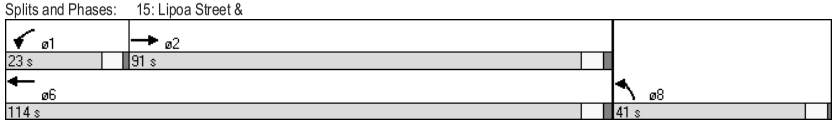
Timings
15: Lipoa Street &

7/7/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1435	100	3515	165
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	91.0	23.0	114.0	41.0
Total Split (%)	58.7%	14.8%	73.5%	26.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 155
Actuated Cycle Length: 155
Offset: 41 (26%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1435	55	100	3515	165	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5057		1652	4746	1747	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5057		1652	4746	1747	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1560	60	109	3821	179	38
RTOR Reduction (vph)	2	0	0	0	5	0
Lane Group Flow (vph)	1618	0	109	3821	212	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	100.1		14.8	119.9	24.1	
Effective Green, g (s)	100.1		14.8	119.9	24.1	
Actuated g/C Ratio	0.65		0.10	0.77	0.16	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3266		158	3671	272	
v/s Ratio Prot	0.32		0.07	c0.81	c0.12	
v/s Ratio Perm						
v/c Ratio	0.50		0.69	1.04	0.78	
Uniform Delay, d1	14.3		67.9	17.5	62.9	
Progression Factor	1.16		1.11	0.40	1.00	
Incremental Delay, d2	0.5		6.1	23.2	13.2	
Delay (s)	17.0		81.5	30.3	76.0	
Level of Service	B		F	C	E	
Approach Delay (s)	17.0			31.7	76.0	
Approach LOS	B			C	E	

Intersection Summary			
HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	155.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	88.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

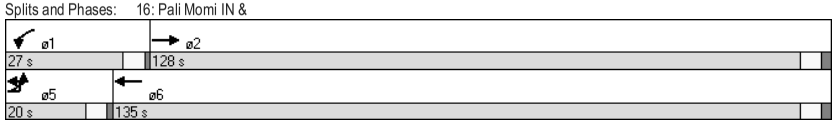
Timings
16: Pali Momi IN &

7/7/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	250	1185	125	3110
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	20.0	128.0	27.0	135.0
Total Split (%)	12.9%	82.6%	17.4%	87.1%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 155
Actuated Cycle Length: 155
Offset: 137 (88%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	250	1185	35	125	3110	400	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4726		1652	4612							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4726		1652	4612							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	272	1288	38	136	3380	435	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	4	0	0	0	0	0	0	0
Lane Group Flow (vph)	272	1324	0	136	3811	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	14.9	126.5		17.5	129.1							
Effective Green, g (s)	14.9	126.5		17.5	129.1							
Actuated g/C Ratio	0.10	0.82		0.11	0.83							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	308	3857		187	3841							
v/s Ratio Prot	c0.08	0.28		0.08	c0.83							
v/s Ratio Perm												
v/c Ratio	0.88	0.34		0.73	0.99							
Uniform Delay, d1	69.2	3.6		66.4	12.5							
Progression Factor	0.92	0.79		1.08	0.40							
Incremental Delay, d2	22.1	0.2		4.7	6.8							
Delay (s)	85.9	3.1		76.1	11.7							
Level of Service	F	A		E	B							
Approach Delay (s)		17.2			13.9			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	155.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

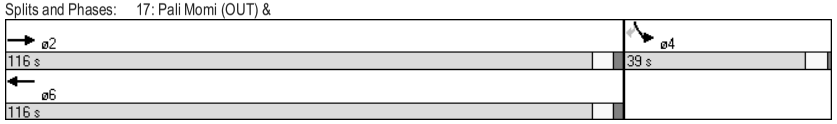
Timings
17: Pali Momi (OUT) &

7/7/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1185	3360	320	150
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	116.0	116.0	39.0	39.0
Total Split (%)	74.8%	74.8%	25.2%	25.2%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 155
Actuated Cycle Length: 155
Offset: 144 (93%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1185	3360	0	320	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.86
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1317
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1317
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1288	3652	0	348	163
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	0	1288	3652	0	348	162
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		119.5	119.5		24.5	24.5
Effective Green, g (s)		119.5	119.5		24.5	24.5
Actuated g/C Ratio		0.77	0.77		0.16	0.16
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3659	3659		525	208
v/s Ratio Prot		0.27	c0.77		0.10	
v/s Ratio Perm						c0.12
v/c Ratio		0.35	1.00		0.66	0.78
Uniform Delay, d1		5.6	17.6		61.4	62.7
Progression Factor		0.66	1.00		1.00	1.00
Incremental Delay, d2		0.3	14.4		3.1	16.7
Delay (s)		3.9	32.1		64.5	79.4
Level of Service		A	C		E	E
Approach Delay (s)		3.9	32.1		69.2	
Approach LOS		A	C		E	

Intersection Summary			
HCM Average Control Delay	28.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	155.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	101.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1570	25	0	1475	0	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1707	27	0	1603	0	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.78	
vC, conflicting volume			1734		2522	867
vC1, stage 1 conf vol					1720	
vC2, stage 2 conf vol					802	
vCu, unblocked vol			1734		2390	867
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	72
cM capacity (veh/h)			360		124	296

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1138	596	802	802	82
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	82
cSH	1700	1700	1700	1700	296
Volume to Capacity	0.67	0.35	0.47	0.47	0.28
Queue Length 95th (ft)	0	0	0	0	27
Control Delay (s)	0.0	0.0	0.0	0.0	21.7
Lane LOS					C
Approach Delay (s)	0.0		0.0		21.7
Approach LOS					C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	55.5%	ICU Level of Service	B
Analysis Period (min)	15		

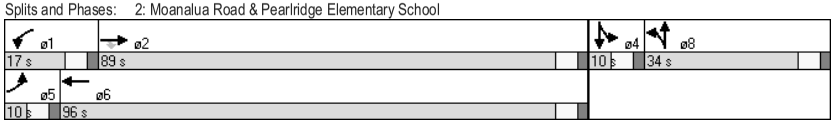
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	5	1500	145	65	1265	250	5	15	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	10.0	89.0	89.0	17.0	96.0	34.0	34.0	10.0	10.0
Total Split (%)	6.7%	59.3%	59.3%	11.3%	64.0%	22.7%	22.7%	6.7%	6.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 57 (38%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1500	145	65	1265	15	250	5	90	15	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3533		1681	1592		1770	1650	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3533		1681	1592		1770	1650	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1630	158	71	1375	16	272	5	98	16	5	16
RTOR Reduction (vph)	0	0	27	0	0	0	0	29	0	0	16	0
Lane Group Flow (vph)	5	1630	131	71	1391	0	193	153	0	16	5	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	0.8	91.7	91.7	9.9	100.8		22.0	22.0		2.4	2.4	
Effective Green, g (s)	0.8	91.7	91.7	9.9	100.8		22.0	22.0		2.4	2.4	
Actuated g/C Ratio	0.01	0.61	0.61	0.07	0.67		0.15	0.15		0.02	0.02	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	9	2164	968	117	2374		247	233		28	26	
v/s Ratio Prot	0.00	c0.46		c0.04	c0.39		c0.11	0.10		c0.01	0.00	
v/s Ratio Perm			0.08									
v/c Ratio	0.56	0.75	0.14	0.61	0.59		0.78	0.66		0.57	0.20	
Uniform Delay, d1	74.4	21.0	12.4	68.2	13.3		61.7	60.4		73.3	72.9	
Progression Factor	1.00	1.00	1.00	0.85	0.84		1.00	1.00		1.00	1.00	
Incremental Delay, d2	58.1	2.5	0.3	6.8	0.8		14.8	6.5		25.2	3.8	
Delay (s)	132.5	23.5	12.6	64.7	12.0		76.4	67.0		98.5	76.7	
Level of Service	F	C	B	E	B		E	E		F	E	
Approach Delay (s)		22.8			14.5			71.8			86.1	
Approach LOS		C			B			E			F	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	30.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

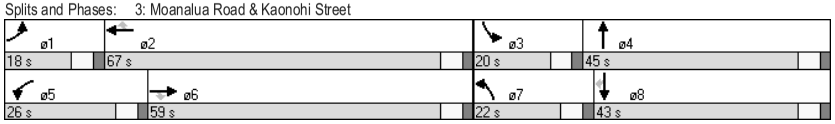
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	145	1135	365	215	895	215	335	185	200	160	205
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	18.0	59.0	59.0	26.0	67.0	67.0	22.0	45.0	20.0	43.0	43.0
Total Split (%)	12.0%	39.3%	39.3%	17.3%	44.7%	44.7%	14.7%	30.0%	13.3%	28.7%	28.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow
Natural Cycle: 135
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1135	365	215	895	215	335	185	335	200	160	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3197		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3197		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	1234	397	234	973	234	364	201	364	217	174	223
RTOR Reduction (vph)	0	0	201	0	0	114	0	169	0	0	0	165
Lane Group Flow (vph)	158	1234	196	234	973	120	364	396	0	217	174	58
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	11.1	67.9	67.9	20.0	76.8	76.8	16.0	24.9		13.2	22.1	22.1
Effective Green, g (s)	11.1	67.9	67.9	20.0	76.8	76.8	16.0	24.9		13.2	22.1	22.1
Actuated g/C Ratio	0.07	0.45	0.45	0.13	0.51	0.51	0.11	0.17		0.09	0.15	0.15
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	254	1602	717	236	1812	810	366	531		302	274	233
v/s Ratio Prot	0.05	c0.35		c0.13	0.27		c0.11	c0.12		0.06	0.09	
v/s Ratio Perm			0.12			0.08						0.04
v/c Ratio	0.62	0.77	0.27	0.99	0.54	0.15	0.99	0.75		0.72	0.64	0.25
Uniform Delay, d1	67.4	34.5	25.6	64.9	24.6	19.3	67.0	59.5		66.6	60.2	56.6
Progression Factor	1.40	0.50	0.52	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.3	2.6	0.7	56.1	1.1	0.4	45.3	5.6		7.9	4.8	0.6
Delay (s)	97.5	19.9	14.1	121.0	25.8	19.7	112.3	65.2		74.5	64.9	57.2
Level of Service	F	B	B	F	C	B	F	E		E	E	E
Approach Delay (s)		25.4			40.3			83.6			65.5	
Approach LOS		C			D			F			E	

Intersection Summary				
HCM Average Control Delay	46.4	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.85			
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	84.9%	ICU Level of Service	E	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	75	0	0	165	0	710	95	0	650	105
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	82	0	0	179	0	772	103	0	707	114
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	1136	1639	410	1258	1644	245	821			875		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1136	1639	410	1258	1644	245	821			875		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	86	100	100	76	100			100		
cM capacity (veh/h)	120	99	590	110	99	756	804			767		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	82	179	220	220	220	214	471	350
Volume Left	0	0	0	0	0	0	0	0
Volume Right	82	179	0	0	0	103	0	114
cSH	590	756	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.24	0.13	0.13	0.13	0.13	0.28	0.21
Queue Length 95th (ft)	12	23	0	0	0	0	0	0
Control Delay (s)	12.1	11.2	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	B						
Approach Delay (s)	12.1	11.2	0.0				0.0	
Approach LOS	B	B						

Intersection Summary				
Average Delay	1.5			
Intersection Capacity Utilization	32.6%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	40	5	70	105	50	135	55	620	130	165	560	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	5	76	114	54	147	60	674	141	179	609	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.93	0.93		0.93	0.93	0.93				0.93		
vC, conflicting volume	1609	1913	315	1606	1853	408	630			815		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1509	1835	315	1506	1771	221	630			658		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	90	89	0	5	80	94			79		
cM capacity (veh/h)	8	52	681	51	57	730	948			864		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	49	76	168	147	60	449	366	179	406	225
Volume Left	43	0	114	0	60	0	0	179	0	0
Volume Right	0	76	0	147	0	0	141	0	0	22
cSH	8	681	53	730	948	1700	1700	864	1700	1700
Volume to Capacity	5.78	0.11	3.18	0.20	0.06	0.26	0.22	0.21	0.24	0.13
Queue Length 95th (ft)	Err	9	Err	19	5	0	0	19	0	0
Control Delay (s)	Err	11.0	Err	11.2	9.1	0.0	0.0	10.3	0.0	0.0
Lane LOS	F	B	F	B	A			B		
Approach Delay (s)	3919.3		5349.5		0.6			2.3		
Approach LOS	F		F							

Intersection Summary			
Average Delay		1025.2	
Intersection Capacity Utilization		55.5%	ICU Level of Service	B
Analysis Period (min)		15	

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	55	15	200	60	245	585	150	575
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	47.0	47.0	47.0	47.0
Total Split (%)	41.3%	41.3%	41.3%	41.3%	58.8%	58.8%	58.8%	58.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 61.8
Natural Cycle: 70
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	15	210	200	60	145	245	585	230	150	575	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.89		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1602		1770	1665		1770	3389		1770	3517	
Flt Permitted	0.59	1.00		0.56	1.00		0.38	1.00		0.27	1.00	
Satd. Flow (perm)	1097	1602		1038	1665		710	3389		502	3517	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	16	228	217	65	158	266	636	250	163	625	27
RTOR Reduction (vph)	0	157	0	0	109	0	0	52	0	0	4	0
Lane Group Flow (vph)	60	87	0	217	114	0	266	834	0	163	648	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	18.8	18.8		18.8	18.8		31.8	31.8		31.8	31.8	
Effective Green, g (s)	18.8	18.8		18.8	18.8		31.8	31.8		31.8	31.8	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.52	0.52		0.52	0.52	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	340	497		322	517		373	1778		263	1846	
v/s Ratio Prot		0.05			0.07			0.25			0.18	
v/s Ratio Perm	0.05			c0.21			c0.37			0.32		
v/c Ratio	0.18	0.17		0.67	0.22		0.71	0.47		0.62	0.35	
Uniform Delay, d1	15.3	15.2		18.2	15.5		10.9	9.1		10.1	8.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.2		5.5	0.2		6.3	0.2		4.3	0.1	
Delay (s)	15.5	15.4		23.7	15.7		17.3	9.3		14.5	8.5	
Level of Service	B	B		C	B		B	A		B	A	
Approach Delay (s)		15.4			19.6			11.1			9.7	
Approach LOS		B			B			B			A	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	60.6	Sum of lost time (s)	10.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	50	25	1030	845	120
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	54	27	1120	918	130
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.90	0.90	0.90			
vC, conflicting volume	1598	524	1049			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1448	260	840			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	69	92	96			
cM capacity (veh/h)	106	668	714			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	87	400	746	612	437
Volume Left	33	27	0	0	0
Volume Right	54	0	0	0	130
cSH	224	714	1700	1700	1700
Volume to Capacity	0.39	0.04	0.44	0.36	0.26
Queue Length 95th (ft)	43	3	0	0	0
Control Delay (s)	31.0	1.2	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	31.0	0.4		0.0	
Approach LOS	D				

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	95	50	1045	885	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	103	54	1136	962	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	0.99	0.99	0.99			
vC, conflicting volume	1655	497	995			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1635	460	964			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	61	81	92			
cM capacity (veh/h)	83	540	699			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	136	433	757	641	353
Volume Left	33	54	0	0	0
Volume Right	103	0	0	0	33
cSH	233	699	1700	1700	1700
Volume to Capacity	0.58	0.08	0.45	0.38	0.21
Queue Length 95th (ft)	82	6	0	0	0
Control Delay (s)	39.9	2.3	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	39.9	0.8		0.0	
Approach LOS	E				

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	85	990	85	45	840
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	92	1076	92	49	913
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1524	584			1168	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1524	584			1168	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	24	80			92	
cM capacity (veh/h)	100	455			594	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	168	717	451	232	365	365
Volume Left	76	0	0	49	0	0
Volume Right	92	0	92	0	0	0
cSH	174	1700	1700	594	1700	1700
Volume to Capacity	0.97	0.42	0.27	0.08	0.21	0.21
Queue Length 95th (ft)	190	0	0	7	0	0
Control Delay (s)	113.1	0.0	0.0	3.3	0.0	0.0
Lane LOS	F			A		
Approach Delay (s)	113.1	0.0		0.8		
Approach LOS	F					

Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	115	95	1030	930	65
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	125	103	1120	1011	71
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1812	372	1011			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1812	372	1011			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	17	80	85			
cM capacity (veh/h)	59	625	681			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	174	103	560	560	404	404	273
Volume Left	49	103	0	0	0	0	0
Volume Right	125	0	0	0	0	0	71
cSH	169	681	1700	1700	1700	1700	1700
Volume to Capacity	1.03	0.15	0.33	0.33	0.24	0.24	0.16
Queue Length 95th (ft)	209	13	0	0	0	0	0
Control Delay (s)	131.4	11.2	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	131.4	0.9			0.0		
Approach LOS	F						

Intersection Summary				
Average Delay		9.7		
Intersection Capacity Utilization		44.7%	ICU Level of Service	A
Analysis Period (min)		15		

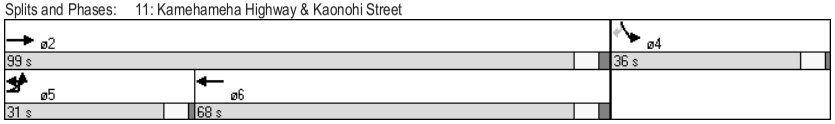
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	555	1665	1405	550	490
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	33.0	33.0
Total Split (s)	31.0	99.0	68.0	36.0	36.0
Total Split (%)	23.0%	73.3%	50.4%	26.7%	26.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 112 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 120
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	555	1665	1405	560	550	490
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.96		0.98	0.89
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.96		0.97	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4520		3280	1288
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4520		3280	1288
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	1810	1527	609	598	533
RTOR Reduction (vph)	0	0	53	0	21	252
Lane Group Flow (vph)	603	1810	2083	0	753	105
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	26.0	93.0	62.0		31.0	31.0
Effective Green, g (s)	26.0	93.0	62.0		31.0	31.0
Actuated g/C Ratio	0.19	0.69	0.46		0.23	0.23
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	617	3269	2076		753	296
v/s Ratio Prot	c0.19	0.38	c0.46		c0.23	
v/s Ratio Perm						0.08
v/c Ratio	0.98	0.55	1.00		1.00	0.36
Uniform Delay, d1	54.2	10.6	36.5		52.0	43.6
Progression Factor	0.72	1.76	0.67		1.00	1.00
Incremental Delay, d2	26.9	0.6	18.4		32.9	0.7
Delay (s)	66.0	19.1	42.9		84.9	44.3
Level of Service	E	B	D		F	D
Approach Delay (s)		30.9	42.9		72.1	
Approach LOS		C	D		E	

Intersection Summary			
HCM Average Control Delay	43.6	HCM Level of Service	D
HCM Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

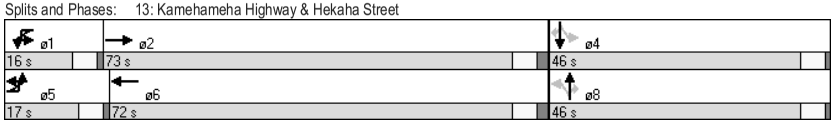
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	100	1690	230	1595	215	55	325	95	40	145
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	17.0	73.0	16.0	72.0	46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	12.6%	54.1%	11.9%	53.3%	34.1%	34.1%	34.1%	34.1%	34.1%	34.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 98 (73%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	1690	295	230	1595	65	215	55	325	95	40	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4625		3204	4713			1699	1531		1679	1415
Flt Permitted	0.95	1.00		0.95	1.00			0.61	1.00		0.40	1.00
Satd. Flow (perm)	1652	4625		3204	4713			1084	1531		701	1415
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	109	1837	321	250	1734	71	234	60	353	103	43	158
RTOR Reduction (vph)	0	18	0	0	3	0	0	0	115	0	0	113
Lane Group Flow (vph)	109	2140	0	250	1802	0	0	294	238	0	146	45
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	11.5	69.3		11.0	68.8			38.7	38.7		38.7	38.7
Effective Green, g (s)	11.5	69.3		11.0	68.8			38.7	38.7		38.7	38.7
Actuated g/C Ratio	0.09	0.51		0.08	0.51			0.29	0.29		0.29	0.29
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	141	2374		261	2402			311	439		201	406
v/s Ratio Prot	0.07	c0.46		c0.08	0.38							
v/s Ratio Perm								c0.27	0.16		0.21	0.03
v/c Ratio	0.77	0.90		0.96	0.75			0.95	0.54		0.73	0.11
Uniform Delay, d1	60.5	29.8		61.8	26.3			47.1	40.7		43.4	35.5
Progression Factor	0.85	0.76		1.30	0.41			1.00	1.00		1.00	1.00
Incremental Delay, d2	12.3	3.2		36.7	1.7			36.5	1.4		12.3	0.1
Delay (s)	63.9	25.7		116.9	12.5			83.6	42.0		55.7	35.6
Level of Service	E	C		F	B			F	D		E	D
Approach Delay (s)		27.6			25.2			60.9			45.2	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM Average Control Delay	31.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	103.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

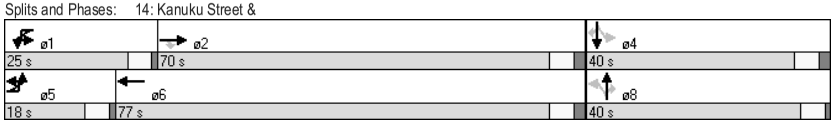
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	75	1825	110	110	1675	70	20	75	125	15	80
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	25.0	28.0	23.0	23.0	23.0	40.0	40.0	40.0
Total Split (s)	18.0	70.0	70.0	25.0	77.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	13.3%	51.9%	51.9%	18.5%	57.0%	29.6%	29.6%	29.6%	29.6%	29.6%	29.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 104 (77%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	75	1825	110	110	1675	240	70	20	75	125	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4657			1733	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.55	1.00		0.64	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4657			999	1531		1110	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	82	1984	120	120	1821	261	76	22	82	136	16	87
RTOR Reduction (vph)	0	0	25	0	11	0	0	0	67	0	0	72
Lane Group Flow (vph)	82	1984	95	120	2071	0	0	98	15	0	152	15
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	11.0	84.6	84.6	10.4	84.0			24.0	24.0		23.0	23.0
Effective Green, g (s)	11.0	84.6	84.6	10.4	84.0			24.0	24.0		23.0	23.0
Actuated g/C Ratio	0.08	0.63	0.63	0.08	0.62			0.18	0.18		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	135	2974	926	247	2898			178	272		189	252
v/s Ratio Prot	c0.05	0.42		0.04	c0.44							
v/s Ratio Perm			0.06					0.10	0.01		c0.14	0.01
v/c Ratio	0.61	0.67	0.10	0.49	0.71			0.55	0.05		0.80	0.06
Uniform Delay, d1	59.9	16.2	10.1	59.7	17.3			50.6	46.1		53.8	46.9
Progression Factor	0.98	0.64	0.83	1.25	0.65			1.00	1.00		1.00	1.00
Incremental Delay, d2	3.8	0.6	0.1	0.7	0.7			3.7	0.1		21.4	0.1
Delay (s)	62.5	11.0	8.5	75.3	12.0			54.2	46.2		75.2	47.0
Level of Service	E	B	A	E	B			D	D		E	D
Approach Delay (s)		12.8			15.5			50.6			65.0	
Approach LOS		B			B			D			E	

Intersection Summary			
HCM Average Control Delay	18.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

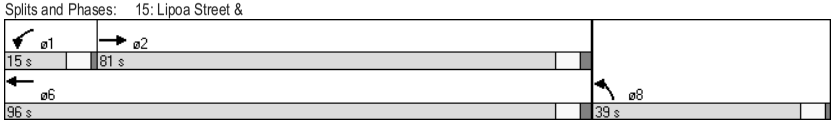
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1890	50	1970	165
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	81.0	15.0	96.0	39.0
Total Split (%)	60.0%	11.1%	71.1%	28.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 28 (21%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1890	65	50	1970	165	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4719		1652	4746	1672	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4719		1652	4746	1672	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2054	71	54	2141	179	76
RTOR Reduction (vph)	2	0	0	0	12	0
Lane Group Flow (vph)	2123	0	54	2141	243	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	86.6		7.6	99.2	24.8	
Effective Green, g (s)	86.6		7.6	99.2	24.8	
Actuated g/C Ratio	0.64		0.06	0.73	0.18	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3027		93	3487	307	
v/s Ratio Prot	c0.45		0.03	c0.45	c0.15	
v/s Ratio Perm						
v/c Ratio	0.70		0.58	0.61	0.79	
Uniform Delay, d1	15.8		62.1	8.6	52.6	
Progression Factor	0.75		1.19	0.53	1.00	
Incremental Delay, d2	1.0		6.6	0.6	13.0	
Delay (s)	12.9		80.5	5.2	65.6	
Level of Service	B		F	A	E	
Approach Delay (s)	12.9			7.0	65.6	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

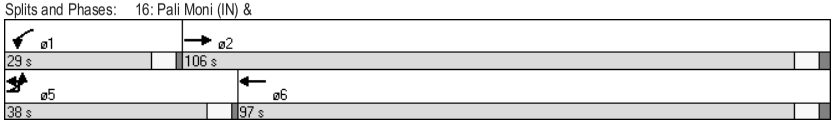
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	475	1435	155	1780
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	38.0	106.0	29.0	97.0
Total Split (%)	28.1%	78.5%	21.5%	71.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 8 (6%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	475	1435	55	155	1780	505	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.98							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	0.99		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4720		1652	4520							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4720		1652	4520							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	516	1560	60	168	1935	549	0	0	0	0	0	0
RTOR Reduction (vph)	0	3	0	0	18	0	0	0	0	0	0	0
Lane Group Flow (vph)	516	1617	0	168	2466	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	26.9	105.5		18.5	97.1							
Effective Green, g (s)	26.9	105.5		18.5	97.1							
Actuated g/C Ratio	0.20	0.78		0.14	0.72							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	638	3689		226	3251							
v/s Ratio Prot	c0.16	0.34		0.10	c0.55							
v/s Ratio Perm												
v/c Ratio	0.81	0.44		0.74	0.76							
Uniform Delay, d1	51.6	4.9		56.0	11.7							
Progression Factor	0.84	0.84		1.09	0.45							
Incremental Delay, d2	5.5	0.3		10.2	1.4							
Delay (s)	48.8	4.4		70.9	6.7							
Level of Service	D	A		E	A							
Approach Delay (s)		15.1			10.8			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	12.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

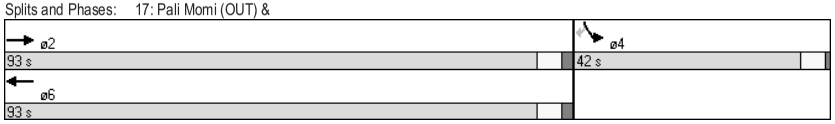
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1395	2055	360	195
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	93.0	93.0	42.0	42.0
Total Split (%)	68.9%	68.9%	31.1%	31.1%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 16 (12%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1395	2055	0	360	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1309
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1309
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1516	2234	0	391	212
RTOR Reduction (vph)	0	0	0	0	0	7
Lane Group Flow (vph)	0	1516	2234	0	391	205
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		97.5	97.5		26.5	26.5
Effective Green, g (s)		97.5	97.5		26.5	26.5
Actuated g/C Ratio		0.72	0.72		0.20	0.20
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3428	3428		652	257
v/s Ratio Prot		0.32	c0.47		0.12	
v/s Ratio Perm						c0.16
v/c Ratio		0.44	0.65		0.60	0.80
Uniform Delay, d1		7.7	9.8		49.4	51.7
Progression Factor		0.21	1.00		1.00	1.00
Incremental Delay, d2		0.4	1.0		1.5	15.6
Delay (s)		2.0	10.8		50.9	67.3
Level of Service		A	B		D	E
Approach Delay (s)		2.0	10.8		56.7	
Approach LOS		A	B		E	

Intersection Summary			
HCM Average Control Delay	14.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Year 2021 with Project, Improvements and RT

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1335	15	0	1045	0	40
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1451	16	0	1136	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.81	
vC, conflicting volume			1467		2027	734
vC1, stage 1 conf vol					1459	
vC2, stage 2 conf vol					568	
vCu, unblocked vol			1467		1796	734
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	88
cM capacity (veh/h)			456		173	363

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	967	500	568	568	43
Volume Left	0	0	0	0	0
Volume Right	0	16	0	0	43
cSH	1700	1700	1700	1700	363
Volume to Capacity	0.57	0.29	0.33	0.33	0.12
Queue Length 95th (ft)	0	0	0	0	10
Control Delay (s)	0.0	0.0	0.0	0.0	16.3
Lane LOS					C
Approach Delay (s)	0.0		0.0		16.3
Approach LOS					C

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	47.4%	ICU Level of Service	A
Analysis Period (min)	15		

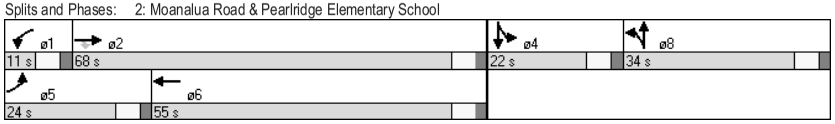
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	155	1145	115	50	720	95	5	130	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	24.0	68.0	68.0	11.0	55.0	34.0	34.0	22.0	22.0
Total Split (%)	17.8%	50.4%	50.4%	8.1%	40.7%	25.2%	25.2%	16.3%	16.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 125 (93%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	1145	115	50	720	205	95	5	50	130	5	190
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.97		1.00	0.90		1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3422		1681	1567		1770	1590	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.99		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3422		1681	1567		1770	1590	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	168	1245	125	54	783	223	103	5	54	141	5	207
RTOR Reduction (vph)	0	0	30	0	15	0	0	49	0	0	185	0
Lane Group Flow (vph)	168	1245	95	54	991	0	84	29	0	141	27	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	16.3	74.2	74.2	10.3	68.2		12.1	12.1		14.4	14.4	
Effective Green, g (s)	16.3	74.2	74.2	10.3	68.2		12.1	12.1		14.4	14.4	
Actuated g/C Ratio	0.12	0.55	0.55	0.08	0.51		0.09	0.09		0.11	0.11	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	214	1945	870	135	1729		151	140		189	170	
v/s Ratio Prot	c0.09	c0.35		0.03	0.29		c0.05	0.02		c0.08	0.02	
v/s Ratio Perm			0.06									
v/c Ratio	0.79	0.64	0.11	0.40	0.57		0.56	0.21		0.75	0.16	
Uniform Delay, d1	57.6	21.1	14.6	59.4	23.3		58.9	57.0		58.5	54.8	
Progression Factor	1.00	1.00	1.00	1.11	0.62		1.00	1.00		1.00	1.00	
Incremental Delay, d2	17.0	1.6	0.3	1.8	1.3		4.4	0.7		14.8	0.4	
Delay (s)	74.7	22.8	14.8	67.8	15.7		63.3	57.7		73.3	55.2	
Level of Service	E	C	B	E	B		E	E		E	E	
Approach Delay (s)		27.8			18.4			60.6			62.5	
Approach LOS		C			B			E			E	

Intersection Summary			
HCM Average Control Delay	30.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	24.0
Intersection Capacity Utilization	71.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

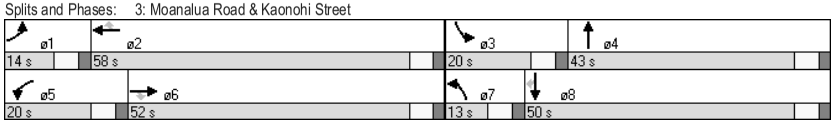
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	105	985	210	130	655	100	85	90	290	270	245
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	14.0	52.0	52.0	20.0	58.0	58.0	13.0	43.0	20.0	50.0	50.0
Total Split (%)	10.4%	38.5%	38.5%	14.8%	43.0%	43.0%	9.6%	31.9%	14.8%	37.0%	37.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 128 (95%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	985	210	130	655	100	85	90	155	290	270	245
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3204		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3204		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1071	228	141	712	109	92	98	168	315	293	266
RTOR Reduction (vph)	0	0	122	0	0	54	0	130	0	0	0	179
Lane Group Flow (vph)	114	1071	106	141	712	55	92	136	0	315	293	87
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	7.8	62.8	62.8	13.4	68.4	68.4	6.9	20.8		14.0	27.9	27.9
Effective Green, g (s)	7.8	62.8	62.8	13.4	68.4	68.4	6.9	20.8		14.0	27.9	27.9
Actuated g/C Ratio	0.06	0.47	0.47	0.10	0.51	0.51	0.05	0.15		0.10	0.21	0.21
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	198	1646	736	176	1793	802	175	494		356	385	327
v/s Ratio Prot	0.03	c0.30		c0.08	c0.20		0.03	0.04		c0.09	c0.16	
v/s Ratio Perm			0.07			0.03						0.05
v/c Ratio	0.58	0.65	0.14	0.80	0.40	0.07	0.53	0.27		0.88	0.76	0.27
Uniform Delay, d1	62.0	27.7	20.7	59.5	20.6	17.0	62.5	50.4		59.7	50.4	44.9
Progression Factor	1.25	0.49	0.12	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.1	1.6	0.3	23.0	0.7	0.2	2.8	0.3		22.0	8.6	0.4
Delay (s)	80.4	15.2	2.8	82.4	21.2	17.2	65.3	50.7		81.7	59.0	45.4
Level of Service	F	B	A	F	C	B	E	D		F	E	D
Approach Delay (s)		18.5			29.7			54.5			63.1	
Approach LOS		B			C			D			E	

Intersection Summary				
HCM Average Control Delay	35.9	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.78			
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	30.0	
Intersection Capacity Utilization	72.8%	ICU Level of Service	C	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	15	0	0	10	0	335	20	0	560	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	16	0	0	11	0	364	22	0	609	65
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	743	1027	337	696	1049	102	674			386		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	743	1027	337	696	1049	102	674			386		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	98	100	100	99	100			100		
cM capacity (veh/h)	300	233	659	320	226	933	913			1169		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	16	11	104	104	104	74	406	268
Volume Left	0	0	0	0	0	0	0	0
Volume Right	16	11	0	0	0	22	0	65
cSH	659	933	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.02	0.01	0.06	0.06	0.06	0.04	0.24	0.16
Queue Length 95th (ft)	2	1	0	0	0	0	0	0
Control Delay (s)	10.6	8.9	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.6	8.9	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay	0.2			
Intersection Capacity Utilization	27.4%	ICU Level of Service	A	
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	5	25	15	0	30	40	315	15	35	520	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	5	27	16	0	33	43	342	16	38	565	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked												
vC, conflicting volume	938	1092	288	826	1090	179	576			359		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	938	1092	288	826	1090	179	576			359		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	97	96	93	100	96	96			97		
cM capacity (veh/h)	199	197	709	235	198	833	993			1197		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	27	27	16	33	43	228	130	38	377	199
Volume Left	22	0	16	0	43	0	0	38	0	0
Volume Right	0	27	0	33	0	0	16	0	0	11
cSH	198	709	235	833	993	1700	1700	1197	1700	1700
Volume to Capacity	0.14	0.04	0.07	0.04	0.04	0.13	0.08	0.03	0.22	0.12
Queue Length 95th (ft)	12	3	6	3	3	0	0	2	0	0
Control Delay (s)	26.0	10.3	21.5	9.5	8.8	0.0	0.0	8.1	0.0	0.0
Lane LOS	D	B	C	A	A			A		
Approach Delay (s)	18.1		13.5		1.0			0.5		
Approach LOS	C		B							

Intersection Summary				
Average Delay		2.1		
Intersection Capacity Utilization		36.1%	ICU Level of Service	A
Analysis Period (min)		15		

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	65	10	30	5	160	285	35	530
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	36.0	36.0	36.0	36.0	54.0	54.0	54.0	54.0
Total Split (%)	40.0%	40.0%	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 30
Natural Cycle: 60
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	10	185	30	5	10	160	285	40	35	530	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.90		1.00	0.98		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1598		1770	1671		1770	3475		1770	3525	
Flt Permitted	0.75	1.00		0.69	1.00		0.43	1.00		0.54	1.00	
Satd. Flow (perm)	1392	1598		1285	1671		798	3475		1007	3525	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	11	201	33	5	11	174	310	43	38	576	16
RTOR Reduction (vph)	0	163	0	0	9	0	0	14	0	0	3	0
Lane Group Flow (vph)	71	49	0	33	7	0	174	339	0	38	589	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	5.8	5.8		5.8	5.8		14.5	14.5		14.5	14.5	
Effective Green, g (s)	5.8	5.8		5.8	5.8		14.5	14.5		14.5	14.5	
Actuated g/C Ratio	0.19	0.19		0.19	0.19		0.48	0.48		0.48	0.48	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	266	306		246	320		382	1663		482	1687	
v/s Ratio Prot		0.03			0.00			0.10			0.17	
v/s Ratio Perm	c0.05			0.03			c0.22			0.04		
v/c Ratio	0.27	0.16		0.13	0.02		0.46	0.20		0.08	0.35	
Uniform Delay, d1	10.4	10.2		10.2	9.9		5.3	4.6		4.3	4.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	0.2		0.2	0.0		0.9	0.1		0.1	0.1	
Delay (s)	11.0	10.5		10.4	10.0		6.1	4.6		4.4	5.1	
Level of Service	B	B		B	A		A	A		A	A	
Approach Delay (s)		10.6			10.3			5.1			5.0	
Approach LOS		B			B			A			A	

Intersection Summary				
HCM Average Control Delay	6.3	HCM Level of Service	A	
HCM Volume to Capacity ratio	0.40			
Actuated Cycle Length (s)	30.3	Sum of lost time (s)	10.0	
Intersection Capacity Utilization	56.0%	ICU Level of Service	B	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	35	20	450	660	55
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	38	22	489	717	60
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.94	0.94	0.94			
vC, conflicting volume	1035	389	777			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	905	215	629			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	83	95	98			
cM capacity (veh/h)	253	740	890			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	82	185	326	478	299
Volume Left	43	22	0	0	0
Volume Right	38	0	0	0	60
cSH	365	890	1700	1700	1700
Volume to Capacity	0.22	0.02	0.19	0.28	0.18
Queue Length 95th (ft)	21	2	0	0	0
Control Delay (s)	17.7	1.3	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	17.7	0.5		0.0	
Approach LOS	C				

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	38.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	50	20	455	690	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	54	22	495	750	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked						
vC, conflicting volume	1043	378	755			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1043	378	755			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	91	97			
cM capacity (veh/h)	219	620	851			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	71	187	330	500	255
Volume Left	16	22	0	0	0
Volume Right	54	0	0	0	5
cSH	436	851	1700	1700	1700
Volume to Capacity	0.16	0.03	0.19	0.29	0.15
Queue Length 95th (ft)	14	2	0	0	0
Control Delay (s)	14.9	1.3	0.0	0.0	0.0
Lane LOS	B	A			
Approach Delay (s)	14.9	0.5		0.0	
Approach LOS	B				

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		37.9%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	15	460	55	25	715
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	16	500	60	27	777
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	843	280			560	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	843	280			560	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	83	98			97	
cM capacity (veh/h)	294	717			1007	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	65	333	226	183	311	311
Volume Left	49	0	0	27	0	0
Volume Right	16	0	60	0	0	0
cSH	345	1700	1700	1007	1700	1700
Volume to Capacity	0.19	0.20	0.13	0.03	0.18	0.18
Queue Length 95th (ft)	17	0	0	2	0	0
Control Delay (s)	17.8	0.0	0.0	1.5	0.0	0.0
Lane LOS	C			A		
Approach Delay (s)	17.8	0.0		0.3		
Approach LOS	C					

Intersection Summary				
Average Delay		1.0		
Intersection Capacity Utilization		42.2%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	85	155	55	425	735	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	92	168	60	462	799	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1168	285	799			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1168	285	799			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	47	76	93			
cM capacity (veh/h)	173	711	819			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	261	60	231	231	320	320	198
Volume Left	92	60	0	0	0	0	0
Volume Right	168	0	0	0	0	0	38
cSH	338	819	1700	1700	1700	1700	1700
Volume to Capacity	0.77	0.07	0.14	0.14	0.19	0.19	0.12
Queue Length 95th (ft)	154	6	0	0	0	0	0
Control Delay (s)	43.9	9.7	0.0	0.0	0.0	0.0	0.0
Lane LOS	E	A					
Approach Delay (s)	43.9	1.1			0.0		
Approach LOS	E						

Intersection Summary				
Average Delay		7.4		
Intersection Capacity Utilization		42.6%	ICU Level of Service	A
Analysis Period (min)		15		

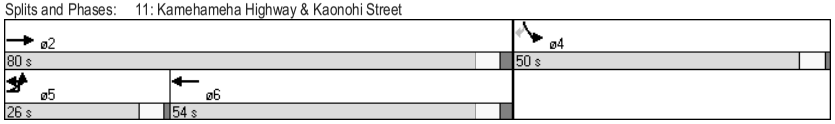
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	265	1480	800	715	185
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	27.0	39.0	39.0
Total Split (s)	26.0	80.0	54.0	50.0	50.0
Total Split (%)	20.0%	61.5%	41.5%	38.5%	38.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 85 (65%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	265	1480	800	245	715	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	0.93
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.96		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	3204	4746	4653		3427	1336
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	3204	4746	4653		3427	1336
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	288	1609	870	266	777	201
RTOR Reduction (vph)	0	0	40	0	1	118
Lane Group Flow (vph)	288	1609	1096	0	796	63
Confl. Peds. (#/hr)				38		54
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	16.8	74.0	52.2		45.0	45.0
Effective Green, g (s)	16.8	74.0	52.2		45.0	45.0
Actuated g/C Ratio	0.13	0.57	0.40		0.35	0.35
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	414	2702	1868		1186	462
v/s Ratio Prot	c0.09	c0.34	0.24		c0.23	
v/s Ratio Perm						0.05
v/c Ratio	0.70	0.60	0.59		0.67	0.14
Uniform Delay, d1	54.2	18.2	30.5		36.2	29.2
Progression Factor	1.16	0.29	0.61		1.00	1.00
Incremental Delay, d2	4.3	0.8	1.3		3.0	0.6
Delay (s)	67.1	6.2	19.8		39.2	29.8
Level of Service	E	A	B		D	C
Approach Delay (s)		15.4	19.8		37.5	
Approach LOS		B	B		D	

Intersection Summary			
HCM Average Control Delay	22.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	70.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

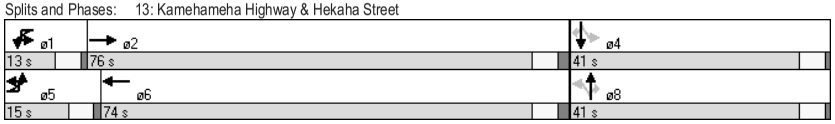
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1590	90	920	55	5	60	115	15	80
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	8.0	28.0	8.0	33.0	28.0	28.0	28.0	39.0	39.0	39.0
Total Split (s)	15.0	76.0	13.0	74.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	11.5%	58.5%	10.0%	56.9%	31.5%	31.5%	31.5%	31.5%	31.5%	31.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 108 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1590	195	90	920	30	55	5	60	115	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.97		1.00	0.99
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4654		3204	4720			1720	1488		1642	1458
Flt Permitted	0.95	1.00		0.95	1.00			0.68	1.00		0.70	1.00
Satd. Flow (perm)	1652	4654		3204	4720			1229	1488		1207	1458
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1728	212	98	1000	33	60	5	65	125	16	87
RTOR Reduction (vph)	0	11	0	0	3	0	0	0	47	0	0	63
Lane Group Flow (vph)	54	1929	0	98	1030	0	0	65	18	0	141	24
Confl. Peds. (#/hr)			9			2	1		15	15		1
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.5	70.3		7.7	70.5			36.0	36.0		36.0	36.0
Effective Green, g (s)	7.5	70.3		7.7	70.5			36.0	36.0		36.0	36.0
Actuated g/C Ratio	0.06	0.54		0.06	0.54			0.28	0.28		0.28	0.28
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	95	2517		190	2560			340	412		334	404
v/s Ratio Prot	c0.03	c0.41		0.03	0.22							
v/s Ratio Perm								0.05	0.01		c0.12	0.02
v/c Ratio	0.57	0.77		0.52	0.40			0.19	0.04		0.42	0.06
Uniform Delay, d1	59.7	23.4		59.3	17.4			35.9	34.4		38.5	34.6
Progression Factor	0.87	0.93		0.75	1.10			1.00	1.00		1.00	1.00
Incremental Delay, d2	6.2	1.9		2.3	0.5			1.2	0.2		3.9	0.3
Delay (s)	58.0	23.7		46.5	19.6			37.1	34.6		42.4	34.8
Level of Service	E	C		D	B			D	C		D	C
Approach Delay (s)		24.6			22.0			35.9			39.5	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

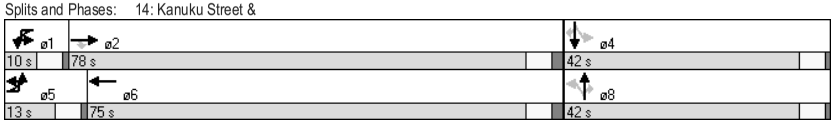
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	30	1635	20	20	985	5	5	15	145	10	45
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	10.0	28.0	24.0	24.0	24.0	39.0	39.0	39.0
Total Split (s)	13.0	78.0	78.0	10.0	75.0	42.0	42.0	42.0	42.0	42.0	42.0
Total Split (%)	10.0%	60.0%	60.0%	7.7%	57.7%	32.3%	32.3%	32.3%	32.3%	32.3%	32.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 6 (5%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	30	1635	20	20	985	70	5	5	15	145	10	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00			1.00	1.00		1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.98	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1450	3204	4694			1754	1531		1661	1453
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.88	1.00		0.73	1.00
Satd. Flow (perm)	1652	4746	1450	3204	4694			1589	1531		1274	1453
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	1777	22	22	1071	76	5	5	16	158	11	49
RTOR Reduction (vph)	0	0	5	0	4	0	0	0	13	0	0	40
Lane Group Flow (vph)	33	1777	17	22	1143	0	0	10	3	0	169	9
Confl. Peds. (#/hr)			4			3	4					4
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	4.8	88.4	88.4	3.0	86.6			22.6	22.6		22.6	22.6
Effective Green, g (s)	4.8	88.4	88.4	3.0	86.6			22.6	22.6		22.6	22.6
Actuated g/C Ratio	0.04	0.68	0.68	0.02	0.67			0.17	0.17		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	61	3227	986	74	3127			276	266		221	253
v/s Ratio Prot	c0.02	c0.37		0.01	0.24							
v/s Ratio Perm			0.01					0.01	0.00		c0.13	0.01
v/c Ratio	0.54	0.55	0.02	0.30	0.37			0.04	0.01		0.76	0.03
Uniform Delay, d1	61.5	10.6	6.7	62.5	9.6			44.6	44.4		51.2	44.6
Progression Factor	1.39	0.21	0.02	0.74	1.56			1.00	1.00		1.00	1.00
Incremental Delay, d2	6.5	0.5	0.0	2.0	0.3			0.1	0.0		14.5	0.1
Delay (s)	91.9	2.6	0.2	48.2	15.2			44.7	44.5		65.7	44.7
Level of Service	F	A	A	D	B			D	D		E	D
Approach Delay (s)		4.2			15.9			44.6			61.0	
Approach LOS		A			B			D			E	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

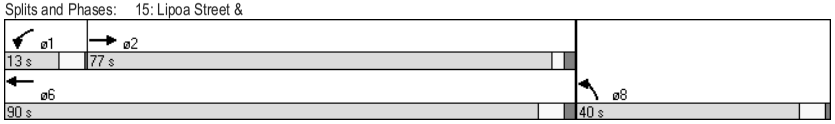
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	2075	45	1040	75
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	31.0	9.5	33.0	40.0
Total Split (s)	77.0	13.0	90.0	40.0
Total Split (%)	59.2%	10.0%	69.2%	30.8%
Yellow Time (s)	2.0	4.0	4.0	4.0
All-Red Time (s)	2.0	0.5	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.5	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 5 (4%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	2075	50	45	1040	75	65
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	4.0		4.5	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.94	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4730		1652	4746	1647	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4730		1652	4746	1647	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2255	54	49	1130	82	71
RTOR Reduction (vph)	1	0	0	0	29	0
Lane Group Flow (vph)	2308	0	49	1130	124	0
Confl. Peds. (#/hr)			2			50
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	94.8		6.7	104.0	15.0	
Effective Green, g (s)	94.8		6.7	104.0	15.0	
Actuated g/C Ratio	0.73		0.05	0.80	0.12	
Clearance Time (s)	4.0		4.5	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3449		85	3797	190	
v/s Ratio Prot	c0.49		c0.03	0.24	c0.08	
v/s Ratio Perm						
v/c Ratio	0.67		0.58	0.30	0.65	
Uniform Delay, d1	9.3		60.3	3.4	55.0	
Progression Factor	0.80		0.84	0.94	1.00	
Incremental Delay, d2	0.8		8.7	0.2	7.8	
Delay (s)	8.3		59.6	3.4	62.8	
Level of Service	A		E	A	E	
Approach Delay (s)	8.3			5.7	62.8	
Approach LOS	A			A	E	

Intersection Summary			
HCM Average Control Delay	9.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	73.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

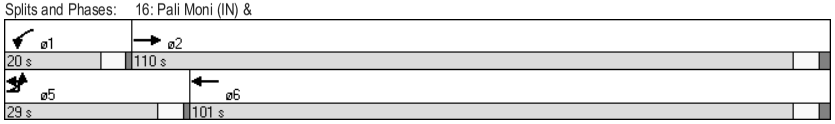
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	205	1980	45	1075
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	40.0	10.0	40.0
Total Split (s)	29.0	110.0	20.0	101.0
Total Split (%)	22.3%	84.6%	15.4%	77.7%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 119 (92%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 50
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	1980	15	45	1075	190	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4741		1652	4639							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4741		1652	4639							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	2152	16	49	1168	207	0	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	14	0	0	0	0	0	0	0
Lane Group Flow (vph)	223	2168	0	49	1361	0	0	0	0	0	0	0
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	14.3	110.9		8.1	104.7							
Effective Green, g (s)	14.3	110.9		8.1	104.7							
Actuated g/C Ratio	0.11	0.85		0.06	0.81							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	352	4044		103	3736							
v/s Ratio Prot	c0.07	c0.46		0.03	0.29							
v/s Ratio Perm												
v/c Ratio	0.63	0.54		0.48	0.36							
Uniform Delay, d1	55.3	2.6		58.9	3.5							
Progression Factor	0.82	0.79		0.93	0.45							
Incremental Delay, d2	2.9	0.4		3.2	0.3							
Delay (s)	48.0	2.4		57.9	1.8							
Level of Service	D	A		E	A							
Approach Delay (s)		6.7			3.7			0.0			0.0	
Approach LOS		A			A			A			A	

Intersection Summary			
HCM Average Control Delay	5.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	5.0
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

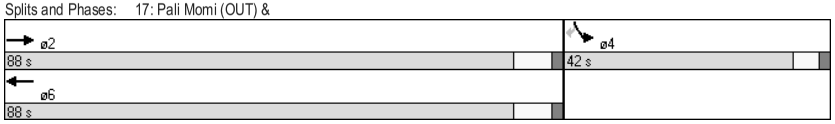
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1885	1215	345	85
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	5.0	5.0	5.0
Minimum Split (s)	28.0	26.0	40.0	40.0
Total Split (s)	88.0	88.0	42.0	42.0
Total Split (%)	67.7%	67.7%	32.3%	32.3%
Yellow Time (s)	6.0	6.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	8.0	8.0	6.0	6.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	Max	Max

Intersection Summary
Cycle Length: 130
Actuated Cycle Length: 130
Offset: 8 (6%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1885	1215	0	345	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		8.0	8.0		6.0	6.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.93
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1428
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1428
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2049	1321	0	375	92
RTOR Reduction (vph)	0	0	0	0	0	45
Lane Group Flow (vph)	0	2049	1321	0	375	47
Confl. Peds. (#/hr)						49
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		80.0	80.0		36.0	36.0
Effective Green, g (s)		80.0	80.0		36.0	36.0
Actuated g/C Ratio		0.62	0.62		0.28	0.28
Clearance Time (s)		8.0	8.0		6.0	6.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		2921	2921		919	395
v/s Ratio Prot		c0.43	0.28		c0.11	
v/s Ratio Perm						0.03
v/c Ratio		0.70	0.45		0.41	0.12
Uniform Delay, d1		16.9	13.3		38.3	35.1
Progression Factor		0.29	1.00		1.00	1.00
Incremental Delay, d2		1.2	0.5		1.3	0.6
Delay (s)		6.1	13.8		39.7	35.8
Level of Service		A	B		D	D
Approach Delay (s)		6.1	13.8		38.9	
Approach LOS		A	B		D	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1250	25	0	1790	0	20
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1359	27	0	1946	0	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.61	
vC, conflicting volume			1386		2345	693
vC1, stage 1 conf vol					1372	
vC2, stage 2 conf vol					973	
vCu, unblocked vol			1386		1926	693
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	94
cM capacity (veh/h)			490		186	386

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	906	480	973	973	22
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	22
cSH	1700	1700	1700	1700	386
Volume to Capacity	0.53	0.28	0.57	0.57	0.06
Queue Length 95th (ft)	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	14.9
Lane LOS					B
Approach Delay (s)	0.0		0.0		14.9
Approach LOS					B

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	52.8%	ICU Level of Service	A
Analysis Period (min)	15		

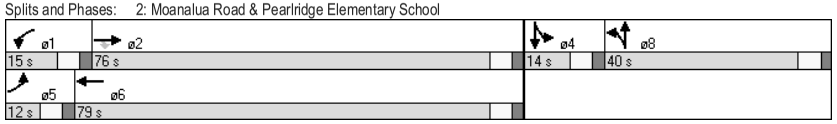
Timings
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	55	1145	90	60	1490	245	5	85	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	40.0	40.0	10.0	10.0
Total Split (s)	12.0	76.0	76.0	15.0	79.0	40.0	40.0	14.0	14.0
Total Split (%)	8.3%	52.4%	52.4%	10.3%	54.5%	27.6%	27.6%	9.7%	9.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 121 (83%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 135
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	1145	90	60	1490	80	245	5	65	85	5	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	0.99		1.00	0.94		1.00	0.86	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3512		1681	1612		1770	1603	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.97		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3512		1681	1612		1770	1603	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	60	1245	98	65	1620	87	266	5	71	92	5	65
RTOR Reduction (vph)	0	0	21	0	2	0	0	21	0	0	61	0
Lane Group Flow (vph)	60	1245	77	65	1705	0	176	145	0	92	9	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	6.0	85.2	85.2	7.2	86.4		20.6	20.6		8.0	8.0	
Effective Green, g (s)	6.0	85.2	85.2	7.2	86.4		20.6	20.6		8.0	8.0	
Actuated g/C Ratio	0.04	0.59	0.59	0.05	0.60		0.14	0.14		0.06	0.06	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	73	2079	930	88	2093		239	229		98	88	
v/s Ratio Prot	0.03	0.35		c0.04	c0.49		c0.10	0.09		c0.05	0.01	
v/s Ratio Perm			0.05									
v/c Ratio	0.82	0.60	0.08	0.74	0.81		0.74	0.63		0.94	0.10	
Uniform Delay, d1	69.0	19.0	13.0	68.0	23.0		59.6	58.7		68.3	65.1	
Progression Factor	1.00	1.00	1.00	1.04	0.64		1.00	1.00		1.00	1.00	
Incremental Delay, d2	49.9	1.3	0.2	20.1	2.6		11.2	5.7		70.4	0.5	
Delay (s)	118.9	20.3	13.1	90.7	17.2		70.8	64.3		138.6	65.6	
Level of Service	F	C	B	F	B		E	E		F	E	
Approach Delay (s)		24.0			19.9			67.6			107.1	
Approach LOS		C			B			E			F	

Intersection Summary			
HCM Average Control Delay	29.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

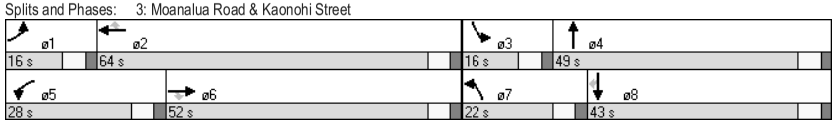
Timings
3: Moanalua Road & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	205	900	205	210	1225	295	330	170	130	115	145
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	16.0	52.0	52.0	28.0	64.0	64.0	22.0	49.0	16.0	43.0	43.0
Total Split (%)	11.0%	35.9%	35.9%	19.3%	44.1%	44.1%	15.2%	33.8%	11.0%	29.7%	29.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 145
Actuated Cycle Length: 145
Offset: 144 (99%), Referenced to phase 2:WBT and 6:EBT, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	900	205	210	1225	295	330	170	160	130	115	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3282		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3282		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	223	978	223	228	1332	321	359	185	174	141	125	158
RTOR Reduction (vph)	0	0	117	0	0	138	0	141	0	0	0	142
Lane Group Flow (vph)	223	978	106	228	1332	183	359	218	0	141	125	16
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	10.0	68.7	68.7	21.2	79.9	79.9	16.0	21.5		9.6	15.1	15.1
Effective Green, g (s)	10.0	68.7	68.7	21.2	79.9	79.9	16.0	21.5		9.6	15.1	15.1
Actuated g/C Ratio	0.07	0.47	0.47	0.15	0.55	0.55	0.11	0.15		0.07	0.10	0.10
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	237	1677	750	259	1950	872	379	487		227	194	165
v/s Ratio Prot	0.06	0.28		c0.13	c0.38		c0.10	0.07		0.04	c0.07	
v/s Ratio Perm			0.07			0.12						0.01
v/c Ratio	0.94	0.58	0.14	0.88	0.68	0.21	0.95	0.45		0.62	0.64	0.10
Uniform Delay, d1	67.2	27.7	21.5	60.7	23.4	16.5	64.1	56.3		65.9	62.4	58.8
Progression Factor	1.21	0.53	0.09	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	36.9	1.2	0.3	27.9	2.0	0.5	32.5	0.7		5.2	7.1	0.3
Delay (s)	117.9	15.8	2.3	88.5	25.4	17.1	96.6	57.0		71.1	69.5	59.1
Level of Service	F	B	A	F	C	B	F	E		E	E	E
Approach Delay (s)		29.7			31.6			76.8			66.2	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM Average Control Delay	41.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	75.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	90	0	0	75	0	590	40	0	455	65
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	98	0	0	82	0	641	43	0	495	71
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	772	1215	283	1008	1228	182	565			685		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	772	1215	283	1008	1228	182	565			685		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	86	100	100	90	100			100		
cM capacity (veh/h)	261	180	714	168	177	829	1003			905		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	98	82	183	183	183	135	330	236
Volume Left	0	0	0	0	0	0	0	0
Volume Right	98	82	0	0	0	43	0	71
cSH	714	829	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.10	0.11	0.11	0.11	0.08	0.19	0.14
Queue Length 95th (ft)	12	8	0	0	0	0	0	0
Control Delay (s)	10.8	9.8	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	A						
Approach Delay (s)	10.8	9.8	0.0				0.0	
Approach LOS	B	A						

Intersection Summary				
Average Delay		1.3		
Intersection Capacity Utilization		26.9%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	5	80	110	55	145	65	480	75	95	450	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	5	87	120	60	158	71	522	82	103	489	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.94	0.94		0.94	0.94	0.94				0.94		
vC, conflicting volume	1293	1448	253	1245	1416	302	505			603		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1178	1343	253	1126	1308	119	505			441		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	47	95	88	0	52	82	93			90		
cM capacity (veh/h)	62	119	747	112	125	853	1055			1045		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	38	87	179	158	71	348	255	103	326	179
Volume Left	33	0	120	0	71	0	0	103	0	0
Volume Right	0	87	0	158	0	0	82	0	0	16
cSH	66	747	116	853	1055	1700	1700	1045	1700	1700
Volume to Capacity	0.57	0.12	1.55	0.18	0.07	0.20	0.15	0.10	0.19	0.11
Queue Length 95th (ft)	60	10	327	17	5	0	0	8	0	0
Control Delay (s)	115.7	10.5	351.1	10.2	8.7	0.0	0.0	8.8	0.0	0.0
Lane LOS	F	B	F	B	A			A		
Approach Delay (s)	42.5		191.6		0.9			1.5		
Approach LOS	E		F							

Intersection Summary				
Average Delay		40.9		
Intersection Capacity Utilization		46.6%	ICU Level of Service	A
Analysis Period (min)		15		

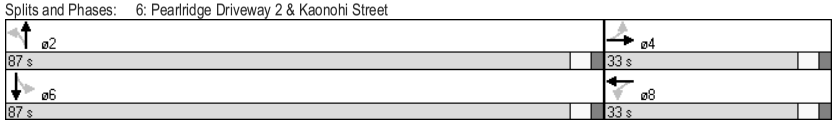
Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	45	10	165	40	290	495	60	540
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	87.0	87.0	87.0	87.0
Total Split (%)	27.5%	27.5%	27.5%	27.5%	72.5%	72.5%	72.5%	72.5%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 120
Actuated Cycle Length: 82.7
Natural Cycle: 80
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	45	10	220	165	40	85	290	495	95	60	540	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.90		1.00	0.98		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1596		1770	1672		1770	3454		1770	3498	
Flt Permitted	0.67	1.00		0.53	1.00		0.37	1.00		0.37	1.00	
Satd. Flow (perm)	1249	1596		991	1672		693	3454		688	3498	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	49	11	239	179	43	92	315	538	103	65	587	49
RTOR Reduction (vph)	0	154	0	0	54	0	0	20	0	0	8	0
Lane Group Flow (vph)	49	96	0	179	81	0	315	621	0	65	628	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	29.4	29.4		29.4	29.4		42.8	42.8		42.8	42.8	
Effective Green, g (s)	29.4	29.4		29.4	29.4		42.8	42.8		42.8	42.8	
Actuated g/C Ratio	0.36	0.36		0.36	0.36		0.52	0.52		0.52	0.52	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	447	571		354	598		361	1798		358	1821	
v/s Ratio Prot		0.06			0.05			0.18			0.18	
v/s Ratio Perm	0.04			c0.18			c0.45			0.09		
v/c Ratio	0.11	0.17		0.51	0.14		0.87	0.35		0.18	0.35	
Uniform Delay, d1	17.6	18.0		20.7	17.8		17.3	11.5		10.4	11.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.1		1.1	0.1		20.0	0.1		0.2	0.1	
Delay (s)	17.8	18.2		21.8	17.9		37.3	11.6		10.7	11.6	
Level of Service	B	B		C	B		D	B		B	B	
Approach Delay (s)		18.1			20.2			20.1			11.5	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM Average Control Delay	17.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	82.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	72.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	30	20	850	855	45
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	33	22	924	929	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				726	200	
pX, platoon unblocked	0.91	0.91	0.91			
vC, conflicting volume	1459	489	978			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1300	229	769			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	76	95	97			
cM capacity (veh/h)	135	701	762			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	65	330	616	620	359
Volume Left	33	22	0	0	0
Volume Right	33	0	0	0	49
cSH	226	762	1700	1700	1700
Volume to Capacity	0.29	0.03	0.36	0.36	0.21
Queue Length 95th (ft)	29	2	0	0	0
Control Delay (s)	27.3	1.0	0.0	0.0	0.0
Lane LOS	D	A			
Approach Delay (s)	27.3	0.3		0.0	
Approach LOS	D				

Intersection Summary				
Average Delay		1.1		
Intersection Capacity Utilization		48.0%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	55	25	855	870	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	60	27	929	946	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	0.95	0.95	0.95			
vC, conflicting volume	1478	486	973			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1390	341	856			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	90	96			
cM capacity (veh/h)	121	619	737			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	76	337	620	630	342
Volume Left	16	27	0	0	0
Volume Right	60	0	0	0	27
cSH	329	737	1700	1700	1700
Volume to Capacity	0.23	0.04	0.36	0.37	0.20
Queue Length 95th (ft)	22	3	0	0	0
Control Delay (s)	19.2	1.2	0.0	0.0	0.0
Lane LOS	C	A			
Approach Delay (s)	19.2	0.4		0.0	
Approach LOS	C				

Intersection Summary				
Average Delay		0.9		
Intersection Capacity Utilization		52.6%	ICU Level of Service	A
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/7/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	70	45	830	55	35	900
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	49	902	60	38	978
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1334	481			962	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1334	481			962	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	45	91			95	
cM capacity (veh/h)	137	531			711	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	125	601	361	234	391	391
Volume Left	76	0	0	38	0	0
Volume Right	49	0	60	0	0	0
cSH	193	1700	1700	711	1700	1700
Volume to Capacity	0.65	0.35	0.21	0.05	0.23	0.23
Queue Length 95th (ft)	95	0	0	4	0	0
Control Delay (s)	52.4	0.0	0.0	2.2	0.0	0.0
Lane LOS	F			A		
Approach Delay (s)	52.4	0.0		0.5		
Approach LOS	F					

Intersection Summary				
Average Delay		3.4		
Intersection Capacity Utilization		56.6%	ICU Level of Service	B
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/7/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	115	130	855	910	60
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	125	141	929	989	65
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1769	362	989			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1769	362	989			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	27	80	80			
cM capacity (veh/h)	59	634	695			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	168	141	465	465	396	396	263
Volume Left	43	141	0	0	0	0	0
Volume Right	125	0	0	0	0	0	65
cSH	181	695	1700	1700	1700	1700	1700
Volume to Capacity	0.93	0.20	0.27	0.27	0.23	0.23	0.15
Queue Length 95th (ft)	180	19	0	0	0	0	0
Control Delay (s)	101.3	11.5	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	101.3	1.5			0.0		
Approach LOS	F						

Intersection Summary				
Average Delay		8.1		
Intersection Capacity Utilization		45.4%	ICU Level of Service	A
Analysis Period (min)		15		

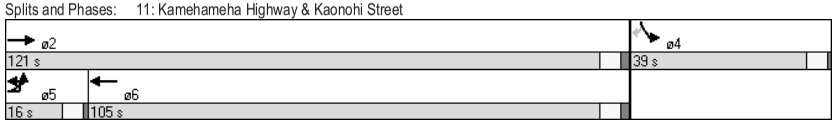
Timings
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	325	1255	3385	415	595
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	11.0	28.0	28.0	39.0	39.0
Total Split (s)	16.0	121.0	105.0	39.0	39.0
Total Split (%)	10.0%	75.6%	65.6%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 138 (86%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	325	1255	3385	650	415	595
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.98		1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.98		0.94	0.85
Flt Protected	0.95	1.00	1.00		0.97	1.00
Satd. Flow (prot)	3433	5085	4679		3299	1441
Flt Permitted	0.95	1.00	1.00		0.97	1.00
Satd. Flow (perm)	3433	5085	4679		3299	1441
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	353	1364	3679	707	451	647
RTOR Reduction (vph)	0	0	18	0	75	86
Lane Group Flow (vph)	353	1364	4368	0	674	263
Confl. Peds. (#/hr)				66	53	
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	11.0	115.0	99.0		34.0	34.0
Effective Green, g (s)	11.0	115.0	99.0		34.0	34.0
Actuated g/C Ratio	0.07	0.72	0.62		0.21	0.21
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	236	3655	2895		701	306
v/s Ratio Prot	c0.10	0.27	c0.93		c0.20	
v/s Ratio Perm						0.18
v/c Ratio	1.50	0.37	1.51		0.96	0.86
Uniform Delay, d1	74.5	8.6	30.5		62.4	60.7
Progression Factor	0.89	1.07	0.72		1.00	1.00
Incremental Delay, d2	243.0	0.3	229.5		24.8	21.0
Delay (s)	309.0	9.5	251.5		87.1	81.7
Level of Service	F	A	F		F	F
Approach Delay (s)		71.1	251.5		85.4	
Approach LOS		E	F		F	

Intersection Summary			
HCM Average Control Delay	183.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	127.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

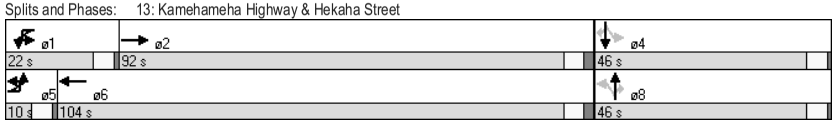
Timings
13: Kamehameha Highway & Hekaha Street

7/7/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	50	1165	195	2885	245	45	240	65	45	100
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	3.0	20.0	3.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	10.0	33.0	10.0	33.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (s)	10.0	92.0	22.0	104.0	46.0	46.0	46.0	46.0	46.0	46.0
Total Split (%)	6.3%	57.5%	13.8%	65.0%	28.8%	28.8%	28.8%	28.8%	28.8%	28.8%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 73 (46%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	50	1165	155	195	2885	80	245	45	240	65	45	100
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	0.94		1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		0.99	1.00
Frt	1.00	0.98		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4647		3204	4724			1728	1445		1664	1478
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.38	1.00
Satd. Flow (perm)	1652	4647		3204	4724			1117	1445		646	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	54	1266	168	212	3136	87	266	49	261	71	49	109
RTOR Reduction (vph)	0	10	0	0	2	0	0	0	128	0	0	42
Lane Group Flow (vph)	54	1424	0	212	3221	0	0	315	133	0	120	67
Confl. Peds. (#/hr)			10			2			38	38		
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	5.0	87.9		15.1	98.0			41.0	41.0		41.0	41.0
Effective Green, g (s)	5.0	87.9		15.1	98.0			41.0	41.0		41.0	41.0
Actuated g/C Ratio	0.03	0.55		0.09	0.61			0.26	0.26		0.26	0.26
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	52	2553		302	2893			286	370		166	379
v/s Ratio Prot	0.03	0.31		c0.07	c0.68							
v/s Ratio Perm								c0.28	0.09		0.19	0.05
v/c Ratio	1.04	0.56		0.70	1.11			1.10	0.36		0.72	0.18
Uniform Delay, d1	77.5	23.4		70.3	31.0			59.5	48.7		54.3	46.4
Progression Factor	1.18	0.75		1.22	0.58			1.00	1.00		1.00	1.00
Incremental Delay, d2	126.9	0.8		0.7	51.6			83.1	0.6		14.4	0.2
Delay (s)	218.6	18.4		86.2	69.4			142.6	49.3		68.7	46.6
Level of Service	F	B		F	E			F	D		E	D
Approach Delay (s)		25.6			70.5			100.4			58.2	
Approach LOS		C			E			F			E	

Intersection Summary			
HCM Average Control Delay	61.3	HCM Level of Service	E
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

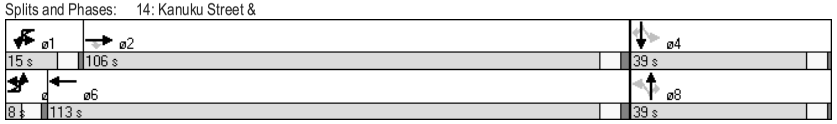
Timings
14: Kanuku Street &

7/7/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	35	1325	80	95	3290	95	15	55	65	15	35
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	8.0	28.0	8.0	8.0	8.0	39.0	39.0	39.0
Total Split (s)	8.0	106.0	106.0	15.0	113.0	39.0	39.0	39.0	39.0	39.0	39.0
Total Split (%)	5.0%	66.3%	66.3%	9.4%	70.6%	24.4%	24.4%	24.4%	24.4%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 58 (36%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1325	80	95	3290	230	95	15	55	65	15	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1428	3204	4693			1695	1531		1670	1425
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.63	1.00		0.53	1.00
Satd. Flow (perm)	1652	4746	1428	3204	4693			1111	1531		925	1425
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	1440	87	103	3576	250	103	16	60	71	16	38
RTOR Reduction (vph)	0	0	23	0	4	0	0	0	52	0	0	28
Lane Group Flow (vph)	38	1440	64	103	3822	0	0	119	8	0	87	10
Confl. Peds. (#/hr)			10			5	17					17
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	3.0	113.2	113.2	9.4	119.6			21.4	21.4		21.4	21.4
Effective Green, g (s)	3.0	113.2	113.2	9.4	119.6			21.4	21.4		21.4	21.4
Actuated g/C Ratio	0.02	0.71	0.71	0.06	0.75			0.13	0.13		0.13	0.13
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	31	3358	1010	188	3508			149	205		124	191
v/s Ratio Prot	c0.02	0.30		0.03	c0.81							
v/s Ratio Perm			0.04					c0.11	0.01		0.09	0.01
v/c Ratio	1.23	0.43	0.06	0.55	1.09			0.80	0.04		0.70	0.05
Uniform Delay, d1	78.5	9.8	7.2	73.2	20.2			67.2	60.3		66.2	60.5
Progression Factor	0.91	0.49	0.15	1.07	0.36			1.00	1.00		1.00	1.00
Incremental Delay, d2	222.1	0.3	0.1	0.3	40.9			25.0	0.1		16.4	0.1
Delay (s)	293.5	5.2	1.2	78.9	48.1			92.2	60.4		82.7	60.6
Level of Service	F	A	A	E	D			F	E		F	E
Approach Delay (s)		11.9			48.9			81.6			76.0	
Approach LOS		B			D			F			E	

Intersection Summary			
HCM Average Control Delay	40.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

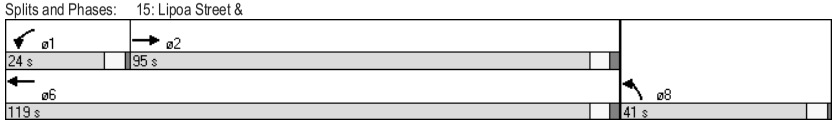
Timings
15: Lipoa Street &

7/7/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1470	100	3615	165
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	5.0
Minimum Split (s)	33.0	11.0	28.0	41.0
Total Split (s)	95.0	24.0	119.0	41.0
Total Split (%)	59.4%	15.0%	74.4%	25.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 64 (40%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/7/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1470	55	100	3615	165	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	12	12	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frt	0.99		1.00	1.00	0.98	
Flt Protected	1.00		0.95	1.00	0.96	
Satd. Flow (prot)	5058		1652	4746	1747	
Flt Permitted	1.00		0.95	1.00	0.96	
Satd. Flow (perm)	5058		1652	4746	1747	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1598	60	109	3929	179	38
RTOR Reduction (vph)	2	0	0	0	5	0
Lane Group Flow (vph)	1656	0	109	3929	212	0
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	104.0		15.3	124.3	24.7	
Effective Green, g (s)	104.0		15.3	124.3	24.7	
Actuated g/C Ratio	0.65		0.10	0.78	0.15	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3288		158	3687	270	
v/s Ratio Prot	0.33		0.07	c0.83	c0.12	
v/s Ratio Perm						
v/c Ratio	0.50		0.69	1.07	0.78	
Uniform Delay, d1	14.6		70.1	17.9	65.1	
Progression Factor	1.18		1.14	0.52	1.00	
Incremental Delay, d2	0.5		5.6	32.8	13.9	
Delay (s)	17.7		85.2	42.1	79.0	
Level of Service	B		F	D	E	
Approach Delay (s)	17.7			43.3	79.0	
Approach LOS	B			D	E	

Intersection Summary			
HCM Average Control Delay	37.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

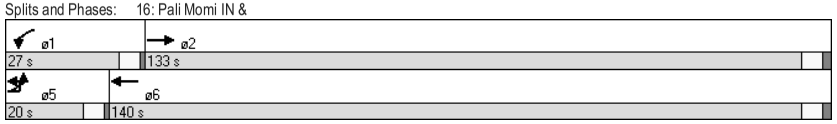
Timings
16: Pali Momi IN &

7/7/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	255	1210	125	3200
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	10.0	27.0	10.0	27.0
Total Split (s)	20.0	133.0	27.0	140.0
Total Split (%)	12.5%	83.1%	16.9%	87.5%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 19 (12%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Momi IN &



HCM Signalized Intersection Capacity Analysis
16: Pali Momi IN &

7/7/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	255	1210	35	125	3200	415	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	1.00		1.00	0.98							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4726		1652	4609							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4726		1652	4609							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	277	1315	38	136	3478	451	0	0	0	0	0	0
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	277	1351	0	136	3926	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						33						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	15.0	131.2		17.8	134.0							
Effective Green, g (s)	15.0	131.2		17.8	134.0							
Actuated g/C Ratio	0.09	0.82		0.11	0.84							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	300	3875		184	3860							
v/s Ratio Prot	c0.09	0.29		0.08	c0.85							
v/s Ratio Perm												
v/c Ratio	0.92	0.35		0.74	1.02							
Uniform Delay, d1	71.9	3.6		68.9	13.0							
Progression Factor	0.76	1.71		1.06	0.43							
Incremental Delay, d2	29.7	0.2		4.1	12.3							
Delay (s)	84.5	6.4		77.4	17.9							
Level of Service	F	A		E	B							
Approach Delay (s)		19.7			19.9			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

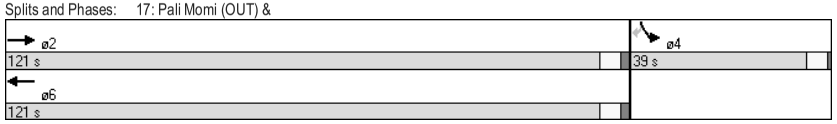
Timings
17: Pali Momi (OUT) &

7/7/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1210	3460	325	160
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	10.0	15.0	15.0
Minimum Split (s)	26.0	24.0	39.0	39.0
Total Split (s)	121.0	121.0	39.0	39.0
Total Split (%)	75.6%	75.6%	24.4%	24.4%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 26 (16%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



HCM Signalized Intersection Capacity Analysis
17: Pali Momi (OUT) &

7/7/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1210	3460	0	325	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.86
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1311
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1311
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1315	3761	0	353	174
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	0	1315	3761	0	353	173
Confl. Peds. (#/hr)						95
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		123.0	123.0		26.0	26.0
Effective Green, g (s)		123.0	123.0		26.0	26.0
Actuated g/C Ratio		0.77	0.77		0.16	0.16
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3648	3648		539	213
v/s Ratio Prot		0.28	c0.79		0.11	
v/s Ratio Perm						c0.13
v/c Ratio		0.36	1.03		0.65	0.81
Uniform Delay, d1		5.9	18.5		62.8	64.7
Progression Factor		0.32	1.00		1.00	1.00
Incremental Delay, d2		0.3	23.6		2.9	20.5
Delay (s)		2.1	42.1		65.7	85.2
Level of Service		A	D		E	F
Approach Delay (s)		2.1	42.1		72.1	
Approach LOS		A	D		E	

Intersection Summary			
HCM Average Control Delay	35.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	103.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
1: Moanalua Road & Harbor Pointe

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1610	25	0	1515	0	75
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1750	27	0	1647	0	82
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	TWLTL			None		
Median storage veh)	2					
Upstream signal (ft)				254		
pX, platoon unblocked					0.77	
vC, conflicting volume			1777		2587	889
vC1, stage 1 conf vol					1764	
vC2, stage 2 conf vol					823	
vCu, unblocked vol			1777		2465	889
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	72
cM capacity (veh/h)			346		118	286

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	1167	611	823	823	82
Volume Left	0	0	0	0	0
Volume Right	0	27	0	0	82
cSH	1700	1700	1700	1700	286
Volume to Capacity	0.69	0.36	0.48	0.48	0.28
Queue Length 95th (ft)	0	0	0	0	29
Control Delay (s)	0.0	0.0	0.0	0.0	22.5
Lane LOS					C
Approach Delay (s)	0.0		0.0		22.5
Approach LOS					C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		

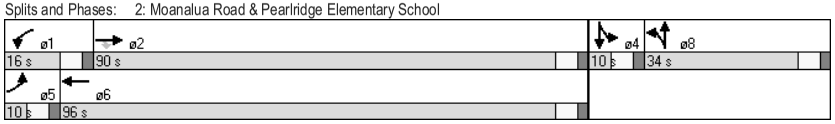
Timings
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Volume (vph)	5	1535	150	65	1295	265	5	15	5
Turn Type	Prot		Perm	Prot		Split		Split	
Protected Phases	5	2		1	6	8	8	4	4
Permitted Phases			2						
Detector Phase	5	2	2	1	6	8	8	4	4
Switch Phase									
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	24.0	24.0	10.0	24.0	34.0	34.0	10.0	10.0
Total Split (s)	10.0	90.0	90.0	16.0	96.0	34.0	34.0	10.0	10.0
Total Split (%)	6.7%	60.0%	60.0%	10.7%	64.0%	22.7%	22.7%	6.7%	6.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag				
Lead-Lag Optimize?									
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 55 (37%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 110
Control Type: Actuated-Coordinated

Splits and Phases: 2: Moanalua Road & Pearlridge Elementary School



HCM Signalized Intersection Capacity Analysis
2: Moanalua Road & Pearlridge Elementary School

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1535	150	65	1295	15	265	5	95	15	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95		0.95	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3533		1681	1592		1770	1650	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	0.98		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3533		1681	1592		1770	1650	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1668	163	71	1408	16	288	5	103	16	5	16
RTOR Reduction (vph)	0	0	28	0	0	0	0	29	0	0	16	0
Lane Group Flow (vph)	5	1668	135	71	1424	0	204	163	0	16	5	0
Turn Type	Prot		Perm	Prot			Split			Split		
Protected Phases	5	2		1	6		8	8		4	4	
Permitted Phases			2									
Actuated Green, G (s)	0.8	91.4	91.4	9.3	99.9		22.9	22.9		2.4	2.4	
Effective Green, g (s)	0.8	91.4	91.4	9.3	99.9		22.9	22.9		2.4	2.4	
Actuated g/C Ratio	0.01	0.61	0.61	0.06	0.67		0.15	0.15		0.02	0.02	
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		6.0	6.0		6.0	6.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	9	2156	965	110	2353		257	243		28	26	
v/s Ratio Prot	0.00	c0.47		c0.04	c0.40		c0.12	0.10		c0.01	0.00	
v/s Ratio Perm			0.09									
v/c Ratio	0.56	0.77	0.14	0.65	0.61		0.79	0.67		0.57	0.20	
Uniform Delay, d1	74.4	21.7	12.5	68.7	14.0		61.3	60.0		73.3	72.9	
Progression Factor	1.00	1.00	1.00	0.86	0.87		1.00	1.00		1.00	1.00	
Incremental Delay, d2	58.1	2.8	0.3	10.0	0.9		15.4	7.1		25.2	3.8	
Delay (s)	132.5	24.4	12.8	68.8	13.1		76.7	67.1		98.5	76.7	
Level of Service	F	C	B	E	B		E	E		F	E	
Approach Delay (s)		23.7			15.7			72.0			86.1	
Approach LOS		C			B			E			F	

Intersection Summary			
HCM Average Control Delay	26.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	30.0
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

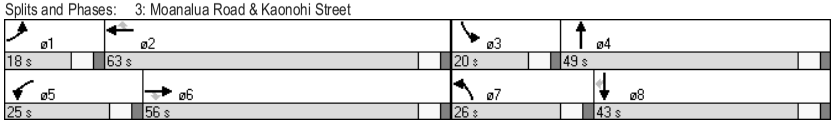
Timings
3: Moanalua Road & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	145	1160	375	225	915	220	345	185	205	165	210
Turn Type	Prot		Perm	Prot		Perm	Prot		Prot		Perm
Protected Phases	1	6		5	2		7	4	3	8	
Permitted Phases			6			2					8
Detector Phase	1	6	6	5	2	2	7	4	3	8	8
Switch Phase											
Minimum Initial (s)	5.0	20.0	20.0	5.0	20.0	20.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	11.0	38.0	38.0	11.0	38.0	38.0	11.0	43.0	11.0	43.0	43.0
Total Split (s)	18.0	56.0	56.0	25.0	63.0	63.0	26.0	49.0	20.0	43.0	43.0
Total Split (%)	12.0%	37.3%	37.3%	16.7%	42.0%	42.0%	17.3%	32.7%	13.3%	28.7%	28.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None	None	None	None

Intersection Summary
Cycle Length: 150
Actuated Cycle Length: 150
Offset: 148 (99%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow
Natural Cycle: 145
Control Type: Actuated-Coordinated

Splits and Phases: 3: Moanalua Road & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
3: Moanalua Road & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	145	1160	375	225	915	220	345	185	350	205	165	210
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	0.97	0.95		0.97	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	1770	3539	1583	3433	3192		3433	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	1770	3539	1583	3433	3192		3433	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	158	1261	408	245	995	239	375	201	380	223	179	228
RTOR Reduction (vph)	0	0	197	0	0	119	0	162	0	0	0	168
Lane Group Flow (vph)	158	1261	211	245	995	120	375	419	0	223	179	60
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		Perm
Protected Phases	1	6		5	2		7	4		3	8	
Permitted Phases			6			2						8
Actuated Green, G (s)	11.1	67.3	67.3	19.0	75.2	75.2	19.3	26.4		13.3	20.4	20.4
Effective Green, g (s)	11.1	67.3	67.3	19.0	75.2	75.2	19.3	26.4		13.3	20.4	20.4
Actuated g/C Ratio	0.07	0.45	0.45	0.13	0.50	0.50	0.13	0.18		0.09	0.14	0.14
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0		6.0	6.0	6.0
Vehicle Extension (s)	3.0	5.0	5.0	3.5	5.0	5.0	3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	254	1588	710	224	1774	794	442	562		304	253	215
v/s Ratio Prot	0.05	c0.36		c0.14	0.28		c0.11	c0.13		0.06	0.10	
v/s Ratio Perm			0.13			0.08						0.04
v/c Ratio	0.62	0.79	0.30	1.09	0.56	0.15	0.85	0.86dr		0.73	0.71	0.28
Uniform Delay, d1	67.4	35.4	26.3	65.5	25.9	20.2	63.9	58.6		66.6	61.9	58.2
Progression Factor	1.39	0.51	0.42	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	3.2	2.9	0.7	87.4	1.3	0.4	14.1	5.4		8.8	8.7	0.7
Delay (s)	97.1	20.9	11.7	152.9	27.2	20.6	78.0	64.0		75.5	70.7	58.9
Level of Service	F	C	B	F	C	C	E	E		E	E	E
Approach Delay (s)		25.4			47.0			69.5			68.1	
Approach LOS		C			D			E			E	

Intersection Summary				
HCM Average Control Delay	46.0	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.86			
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	24.0	
Intersection Capacity Utilization	86.8%	ICU Level of Service	E	
Analysis Period (min)	15			

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
4: RIRO Driveway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	75	0	0	170	0	735	100	0	670	110
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	82	0	0	185	0	799	109	0	728	120
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								723			212	
pX, platoon unblocked												
vC, conflicting volume	1173	1696	424	1299	1701	254	848			908		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1173	1696	424	1299	1701	254	848			908		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	86	100	100	75	100			100		
cM capacity (veh/h)	111	92	579	102	91	745	785			746		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2
Volume Total	82	185	228	228	228	223	486	362
Volume Left	0	0	0	0	0	0	0	0
Volume Right	82	185	0	0	0	109	0	120
cSH	579	745	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.14	0.25	0.13	0.13	0.13	0.13	0.29	0.21
Queue Length 95th (ft)	12	24	0	0	0	0	0	0
Control Delay (s)	12.2	11.4	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B	B						
Approach Delay (s)	12.2	11.4	0.0				0.0	
Approach LOS	B	B						

Intersection Summary				
Average Delay	1.5			
Intersection Capacity Utilization	33.3%	ICU Level of Service		A
Analysis Period (min)	15			

HCM Unsignalized Intersection Capacity Analysis
5: Pearlridge Driveway 1 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	40	5	70	105	50	140	60	645	135	165	570	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	5	76	114	54	152	65	701	147	179	620	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								283			652	
pX, platoon unblocked	0.92	0.92		0.92	0.92	0.92				0.92		
vC, conflicting volume	1649	1967	321	1652	1905	424	641			848		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1526	1873	321	1529	1805	189	641			651		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	0	89	89	0	0	80	93			79		
cM capacity (veh/h)	0	48	675	48	53	753	939			853		

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	49	76	168	152	65	467	380	179	413	228
Volume Left	43	0	114	0	65	0	0	179	0	0
Volume Right	0	76	0	152	0	0	147	0	0	22
cSH	0	675	49	753	939	1700	1700	853	1700	1700
Volume to Capacity	Err	0.11	3.43	0.20	0.07	0.27	0.22	0.21	0.24	0.13
Queue Length 95th (ft)	Err	9	Err	19	6	0	0	20	0	0
Control Delay (s)	Err	11.0	Err	11.0	9.1	0.0	0.0	10.3	0.0	0.0
Lane LOS	F	B	F	B	A			B		
Approach Delay (s)	Err		5258.9		0.7			2.3		
Approach LOS	F		F							

Intersection Summary			
Average Delay		Err	
Intersection Capacity Utilization		56.4%	ICU Level of Service	B
Analysis Period (min)		15	

Timings
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Volume (vph)	65	25	200	60	260	605	155	580
Turn Type	Perm		Perm		Perm		Perm	
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	6
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	33.0	33.0	33.0	33.0	23.0	23.0	23.0	23.0
Total Split (s)	33.0	33.0	33.0	33.0	47.0	47.0	47.0	47.0
Total Split (%)	41.3%	41.3%	41.3%	41.3%	58.8%	58.8%	58.8%	58.8%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	None	None	None

Intersection Summary
Cycle Length: 80
Actuated Cycle Length: 66.9
Natural Cycle: 75
Control Type: Actuated-Uncoordinated

Splits and Phases: 6: Pearlridge Driveway 2 & Kaonohi Street

HCM Signalized Intersection Capacity Analysis
6: Pearlridge Driveway 2 & Kaonohi Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	25	250	200	60	150	260	605	235	155	580	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	0.95		1.00	0.95	
Frt	1.00	0.86		1.00	0.89		1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1609		1770	1663		1770	3391		1770	3513	
Flt Permitted	0.57	1.00		0.47	1.00		0.37	1.00		0.25	1.00	
Satd. Flow (perm)	1068	1609		879	1663		690	3391		474	3513	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	27	272	217	65	163	283	658	255	168	630	33
RTOR Reduction (vph)	0	154	0	0	110	0	0	51	0	0	5	0
Lane Group Flow (vph)	71	145	0	217	118	0	283	862	0	168	658	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6	6	
Actuated Green, G (s)	21.4	21.4		21.4	21.4		34.8	34.8		34.8	34.8	
Effective Green, g (s)	21.4	21.4		21.4	21.4		34.8	34.8		34.8	34.8	
Actuated g/C Ratio	0.32	0.32		0.32	0.32		0.53	0.53		0.53	0.53	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	345	520		284	538		363	1783		249	1847	
v/s Ratio Prot		0.09			0.07			0.25			0.19	
v/s Ratio Perm	0.07			c0.25			c0.41			0.35		
v/c Ratio	0.21	0.28		0.76	0.22		0.78	0.48		0.67	0.36	
Uniform Delay, d1	16.2	16.7		20.1	16.3		12.6	10.0		11.5	9.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	0.3		11.6	0.2		10.2	0.2		7.0	0.1	
Delay (s)	16.5	17.0		31.7	16.5		22.8	10.2		18.6	9.3	
Level of Service	B	B		C	B		C	B		B	A	
Approach Delay (s)		16.9			23.9			13.2			11.2	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	66.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
7: Westridge (north) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	50	25	1065	895	125
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	54	27	1158	973	136
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				743	183	
pX, platoon unblocked	0.90	0.90	0.90			
vC, conflicting volume	1674	554	1109			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1525	281	897			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	65	92	96			
cM capacity (veh/h)	94	644	677			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	87	413	772	649	460
Volume Left	33	27	0	0	0
Volume Right	54	0	0	0	136
cSH	201	677	1700	1700	1700
Volume to Capacity	0.43	0.04	0.45	0.38	0.27
Queue Length 95th (ft)	50	3	0	0	0
Control Delay (s)	35.9	1.2	0.0	0.0	0.0
Lane LOS	E	A			
Approach Delay (s)	35.9	0.4		0.0	
Approach LOS	E				

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	58.7%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Westridge (south) & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	100	50	1080	940	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	109	54	1174	1022	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				422	504	
pX, platoon unblocked	0.97	0.97	0.97			
vC, conflicting volume	1734	527	1054			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1693	448	992			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	49	80	92			
cM capacity (veh/h)	75	541	671			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	147	446	783	681	373
Volume Left	38	54	0	0	0
Volume Right	109	0	0	0	33
cSH	207	671	1700	1700	1700
Volume to Capacity	0.71	0.08	0.46	0.40	0.22
Queue Length 95th (ft)	114	7	0	0	0
Control Delay (s)	56.3	2.3	0.0	0.0	0.0
Lane LOS	F	A			
Approach Delay (s)	56.3	0.8		0.0	
Approach LOS	F				

Intersection Summary				
Average Delay		3.8		
Intersection Capacity Utilization		76.3%	ICU Level of Service	D
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
9: Ana Miller's Driveway & Kaonohi Street

7/8/2011

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	75	85	1025	90	45	890
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	92	1114	98	49	967
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			318			608
pX, platoon unblocked						
vC, conflicting volume	1583	606			1212	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1583	606			1212	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	10	79			91	
cM capacity (veh/h)	91	440			571	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	174	743	469	242	387	387
Volume Left	82	0	0	49	0	0
Volume Right	92	0	98	0	0	0
cSH	157	1700	1700	571	1700	1700
Volume to Capacity	1.11	0.44	0.28	0.09	0.23	0.23
Queue Length 95th (ft)	230	0	0	7	0	0
Control Delay (s)	161.9	0.0	0.0	3.3	0.0	0.0
Lane LOS	F			A		
Approach Delay (s)	161.9	0.0		0.8		
Approach LOS	F					

Intersection Summary				
Average Delay		12.1		
Intersection Capacity Utilization		67.2%	ICU Level of Service	C
Analysis Period (min)		15		

HCM Unsignalized Intersection Capacity Analysis
10: Moanalua Loop & Kaonohi Street

7/8/2011

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	115	95	1065	980	70
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	125	103	1158	1065	76
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				219	707	
pX, platoon unblocked						
vC, conflicting volume	1889	393	1065			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1889	393	1065			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	6	79	84			
cM capacity (veh/h)	52	606	650			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	174	103	579	579	426	426	289
Volume Left	49	103	0	0	0	0	0
Volume Right	125	0	0	0	0	0	76
cSH	152	650	1700	1700	1700	1700	1700
Volume to Capacity	1.14	0.16	0.34	0.34	0.25	0.25	0.17
Queue Length 95th (ft)	239	14	0	0	0	0	0
Control Delay (s)	176.3	11.6	0.0	0.0	0.0	0.0	0.0
Lane LOS	F	B					
Approach Delay (s)	176.3	0.9			0.0		
Approach LOS	F						

Intersection Summary			
Average Delay	12.4		
Intersection Capacity Utilization	45.7%	ICU Level of Service	A
Analysis Period (min)	15		

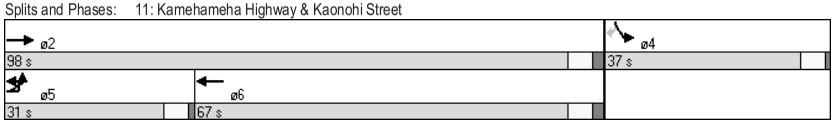
Timings
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Lane Group	EBL	EBT	WBT	SBL	SBR
Lane Configurations					
Volume (vph)	575	1700	1435	580	515
Turn Type	Prot				Perm
Protected Phases	5	2	6	4	
Permitted Phases					4
Detector Phase	5	2	6	4	4
Switch Phase					
Minimum Initial (s)	5.0	20.0	20.0	5.0	5.0
Minimum Split (s)	10.0	28.0	28.0	33.0	33.0
Total Split (s)	31.0	98.0	67.0	37.0	37.0
Total Split (%)	23.0%	72.6%	49.6%	27.4%	27.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	5.0
Lead/Lag	Lead		Lag		
Lead-Lag Optimize?					
Recall Mode	None	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 93 (69%), Referenced to phase 2:EBT and 6:WBT, Start of Yellow
Natural Cycle: 130
Control Type: Actuated-Coordinated

Splits and Phases: 11: Kamehameha Highway & Kaonohi Street



HCM Signalized Intersection Capacity Analysis
11: Kamehameha Highway & Kaonohi Street

7/8/2011

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	575	1700	1435	580	580	515
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	11	11	12	12
Total Lost time (s)	5.0	6.0	6.0		5.0	5.0
Lane Util. Factor	0.97	0.91	0.91		0.97	0.91
Frpb, ped/bikes	1.00	1.00	0.96		0.98	0.89
Flpb, ped/bikes	1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.96		0.97	0.85
Flt Protected	0.95	1.00	1.00		0.96	1.00
Satd. Flow (prot)	3204	4746	4517		3280	1288
Flt Permitted	0.95	1.00	1.00		0.96	1.00
Satd. Flow (perm)	3204	4746	4517		3280	1288
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	625	1848	1560	630	630	560
RTOR Reduction (vph)	0	0	54	0	21	252
Lane Group Flow (vph)	625	1848	2136	0	794	123
Confl. Peds. (#/hr)				70		64
Turn Type	Prot					Perm
Protected Phases	5	2	6		4	
Permitted Phases						4
Actuated Green, G (s)	26.0	92.0	61.0		32.0	32.0
Effective Green, g (s)	26.0	92.0	61.0		32.0	32.0
Actuated g/C Ratio	0.19	0.68	0.45		0.24	0.24
Clearance Time (s)	5.0	6.0	6.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	617	3234	2041		777	305
v/s Ratio Prot	c0.20	0.39	c0.47		c0.24	
v/s Ratio Perm						0.10
v/c Ratio	1.01	0.57	1.05		1.02	0.40
Uniform Delay, d1	54.5	11.2	37.0		51.5	43.5
Progression Factor	0.72	1.78	0.65		1.00	1.00
Incremental Delay, d2	35.6	0.6	31.3		37.8	0.9
Delay (s)	74.8	20.6	55.4		89.3	44.3
Level of Service	E	C	E		F	D
Approach Delay (s)		34.3	55.4		75.1	
Approach LOS		C	E		E	

Intersection Summary			
HCM Average Control Delay	50.5	HCM Level of Service	D
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	97.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

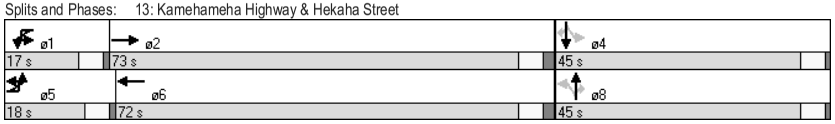
Timings
13: Kamehameha Highway & Hekaha Street

7/8/2011

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Volume (vph)	105	1730	235	1645	220	60	330	95	40	150
Turn Type	Prot		Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2	1	6		8			4	
Permitted Phases					8		8	4		4
Detector Phase	5	2	1	6	8	8	8	4	4	4
Switch Phase										
Minimum Initial (s)	4.0	20.0	4.0	20.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	9.0	28.0	9.0	33.0	10.0	10.0	10.0	39.0	39.0	39.0
Total Split (s)	18.0	73.0	17.0	72.0	45.0	45.0	45.0	45.0	45.0	45.0
Total Split (%)	13.3%	54.1%	12.6%	53.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag	Lead	Lag	Lead	Lag						
Lead-Lag Optimize?										
Recall Mode	None	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 80 (59%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated

Splits and Phases: 13: Kamehameha Highway & Hekaha Street



HCM Signalized Intersection Capacity Analysis
13: Kamehameha Highway & Hekaha Street

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	1730	305	235	1645	65	220	60	330	95	40	150
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Lane Util. Factor	1.00	0.91		0.97	0.91			1.00	1.00		1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00			1.00	1.00		1.00	0.96
Flpb, ped/bikes	1.00	1.00		1.00	1.00			0.98	1.00		1.00	1.00
Frt	1.00	0.98		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)	1652	4624		3204	4714			1700	1531		1679	1415
Flt Permitted	0.95	1.00		0.95	1.00			0.62	1.00		0.39	1.00
Satd. Flow (perm)	1652	4624		3204	4714			1090	1531		680	1415
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	1880	332	255	1788	71	239	65	359	103	43	163
RTOR Reduction (vph)	0	18	0	0	3	0	0	0	123	0	0	116
Lane Group Flow (vph)	114	2194	0	255	1856	0	0	304	236	0	146	47
Confl. Peds. (#/hr)			6			4	26					26
Turn Type	Prot			Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	12.2	68.0		12.0	67.8			39.0	39.0		39.0	39.0
Effective Green, g (s)	12.2	68.0		12.0	67.8			39.0	39.0		39.0	39.0
Actuated g/C Ratio	0.09	0.50		0.09	0.50			0.29	0.29		0.29	0.29
Clearance Time (s)	5.0	6.0		5.0	6.0			5.0	5.0		5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	149	2329		285	2367			315	442		196	409
v/s Ratio Prot	0.07	c0.47		c0.08	0.39							
v/s Ratio Perm								c0.28	0.15		0.21	0.03
v/c Ratio	0.77	0.94		0.89	0.78			0.97	0.53		0.74	0.12
Uniform Delay, d1	60.0	31.6		60.9	27.6			47.3	40.4		43.5	35.3
Progression Factor	0.86	0.81		1.31	0.42			1.00	1.00		1.00	1.00
Incremental Delay, d2	10.6	5.0		22.1	2.0			41.0	1.2		14.2	0.1
Delay (s)	62.2	30.6		101.5	13.6			88.3	41.6		57.7	35.4
Level of Service	E	C		F	B			F	D		E	D
Approach Delay (s)		32.2			24.2			63.0			46.0	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM Average Control Delay	33.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	104.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

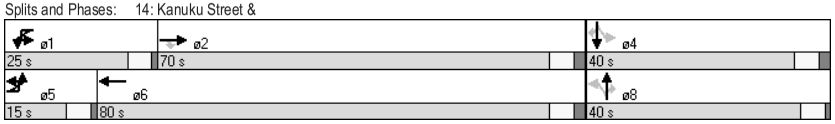
Timings
14: Kanuku Street &

7/8/2011

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Volume (vph)	80	1870	110	115	1730	70	20	75	130	15	80
Turn Type	Prot		Perm	Prot		Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6		8			4	
Permitted Phases			2			8		8	4		4
Detector Phase	5	2	2	1	6	8	8	8	4	4	4
Switch Phase											
Minimum Initial (s)	3.0	20.0	20.0	3.0	20.0	3.0	3.0	3.0	3.0	3.0	3.0
Minimum Split (s)	8.0	28.0	28.0	25.0	28.0	23.0	23.0	23.0	40.0	40.0	40.0
Total Split (s)	15.0	70.0	70.0	25.0	80.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	11.1%	51.9%	51.9%	18.5%	59.3%	29.6%	29.6%	29.6%	29.6%	29.6%	29.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	6.0	5.0	6.0	5.0	5.0	5.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag						
Lead-Lag Optimize?											
Recall Mode	None	C-Max	C-Max	None	C-Max	None	None	None	None	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 87 (64%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated

Splits and Phases: 14: Kanuku Street &



HCM Signalized Intersection Capacity Analysis
14: Kanuku Street &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	1870	110	115	1730	245	70	20	75	130	15	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	10	10	10
Total Lost time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Lane Util. Factor	1.00	0.91	1.00	0.97	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.98			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00			0.96	1.00		0.96	1.00
Satd. Flow (prot)	1652	4746	1478	3204	4658			1733	1531		1664	1478
Flt Permitted	0.95	1.00	1.00	0.95	1.00			0.55	1.00		0.64	1.00
Satd. Flow (perm)	1652	4746	1478	3204	4658			984	1531		1112	1478
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	2033	120	125	1880	266	76	22	82	141	16	87
RTOR Reduction (vph)	0	0	25	0	11	0	0	0	67	0	0	72
Lane Group Flow (vph)	87	2033	95	125	2135	0	0	98	15	0	157	15
Turn Type	Prot		Perm	Prot			Perm		Perm	Perm		Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases			2				8		8	4		4
Actuated Green, G (s)	9.6	83.8	83.8	10.6	84.8			24.6	24.6		23.6	23.6
Effective Green, g (s)	9.6	83.8	83.8	10.6	84.8			24.6	24.6		23.6	23.6
Actuated g/C Ratio	0.07	0.62	0.62	0.08	0.63			0.18	0.18		0.17	0.17
Clearance Time (s)	5.0	6.0	6.0	5.0	6.0			5.0	5.0		6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0			3.0	3.0		3.0	3.0
Lane Grp Cap (vph)	117	2946	917	252	2926			179	279		194	258
v/s Ratio Prot	c0.05	0.43		0.04	c0.46							
v/s Ratio Perm			0.06					0.10	0.01		c0.14	0.01
v/c Ratio	0.74	0.69	0.10	0.50	0.73			0.55	0.05		0.81	0.06
Uniform Delay, d1	61.5	17.0	10.4	59.6	17.2			50.1	45.6		53.5	46.4
Progression Factor	0.96	0.64	0.82	1.23	0.67			1.00	1.00		1.00	1.00
Incremental Delay, d2	10.7	0.6	0.1	0.6	0.6			3.4	0.1		21.4	0.1
Delay (s)	69.6	11.4	8.6	73.8	12.1			53.5	45.7		75.0	46.5
Level of Service	E	B	A	E	B			D	D		E	D
Approach Delay (s)		13.5			15.5			50.0			64.8	
Approach LOS		B			B			D			E	

Intersection Summary			
HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

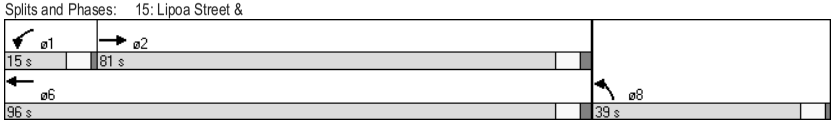
Timings
15: Lipoa Street &

7/8/2011

Lane Group	EBT	WBL	WBT	NBL
Lane Configurations				
Volume (vph)	1945	50	2020	170
Turn Type		Prot		
Protected Phases	2	1	6	8
Permitted Phases				
Detector Phase	2	1	6	8
Switch Phase				
Minimum Initial (s)	20.0	5.0	20.0	2.0
Minimum Split (s)	33.0	10.0	33.0	39.0
Total Split (s)	81.0	15.0	96.0	39.0
Total Split (%)	60.0%	11.1%	71.1%	28.9%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	1.0	2.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	5.0	6.0	5.0
Lead/Lag	Lag	Lead		
Lead-Lag Optimize?				
Recall Mode	C-Max	None	C-Max	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 8 (6%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated

Splits and Phases: 15: Lipoa Street &



HCM Signalized Intersection Capacity Analysis
15: Lipoa Street &

7/8/2011

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1945	70	50	2020	170	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	12	12
Total Lost time (s)	6.0		5.0	6.0	5.0	
Lane Util. Factor	0.91		1.00	0.91	1.00	
Frpb, ped/bikes	1.00		1.00	1.00	0.97	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.99		1.00	1.00	0.96	
Flt Protected	1.00		0.95	1.00	0.97	
Satd. Flow (prot)	4717		1652	4746	1674	
Flt Permitted	1.00		0.95	1.00	0.97	
Satd. Flow (perm)	4717		1652	4746	1674	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	2114	76	54	2196	185	76
RTOR Reduction (vph)	2	0	0	0	12	0
Lane Group Flow (vph)	2188	0	54	2196	249	0
Confl. Peds. (#/hr)		2				82
Turn Type			Prot			
Protected Phases	2		1	6	8	
Permitted Phases						
Actuated Green, G (s)	86.2		7.6	98.8	25.2	
Effective Green, g (s)	86.2		7.6	98.8	25.2	
Actuated g/C Ratio	0.64		0.06	0.73	0.19	
Clearance Time (s)	6.0		5.0	6.0	5.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	3012		93	3473	312	
v/s Ratio Prot	c0.46		0.03	c0.46	c0.15	
v/s Ratio Perm						
v/c Ratio	0.73		0.58	0.63	0.80	
Uniform Delay, d1	16.4		62.1	9.0	52.5	
Progression Factor	0.61		1.12	0.63	1.00	
Incremental Delay, d2	1.1		6.5	0.6	13.2	
Delay (s)	11.1		76.0	6.3	65.7	
Level of Service	B		E	A	E	
Approach Delay (s)	11.1			8.0	65.7	
Approach LOS	B			A	E	

Intersection Summary			
HCM Average Control Delay	12.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	17.0
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

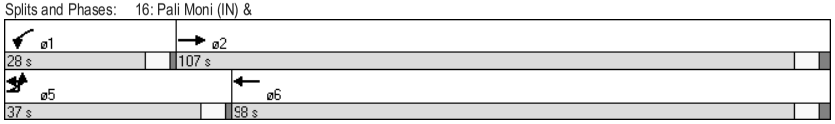
Timings
16: Pali Moni (IN) &

7/8/2011

Lane Group	EBL	EBT	WBL	WBT
Lane Configurations				
Volume (vph)	485	1480	155	1825
Turn Type	Prot		Prot	
Protected Phases	5	2	1	6
Permitted Phases				
Detector Phase	5	2	1	6
Switch Phase				
Minimum Initial (s)	3.0	20.0	3.0	20.0
Minimum Split (s)	8.0	26.0	8.0	26.0
Total Split (s)	37.0	107.0	28.0	98.0
Total Split (%)	27.4%	79.3%	20.7%	72.6%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	6.0	5.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?				
Recall Mode	None	C-Max	None	C-Max

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 127 (94%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated

Splits and Phases: 16: Pali Moni (IN) &



HCM Signalized Intersection Capacity Analysis
16: Pali Moni (IN) &

7/8/2011

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	485	1480	55	155	1825	515	0	0	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10	11	11	11	11	11	11
Total Lost time (s)	5.0	6.0		5.0	6.0							
Lane Util. Factor	0.97	0.91		1.00	0.91							
Frpb, ped/bikes	1.00	1.00		1.00	0.99							
Flpb, ped/bikes	1.00	1.00		1.00	1.00							
Frt	1.00	0.99		1.00	0.97							
Flt Protected	0.95	1.00		0.95	1.00							
Satd. Flow (prot)	3204	4721		1652	4521							
Flt Permitted	0.95	1.00		0.95	1.00							
Satd. Flow (perm)	3204	4721		1652	4521							
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	527	1609	60	168	1984	560	0	0	0	0	0	0
RTOR Reduction (vph)	0	3	0	0	15	0	0	0	0	0	0	0
Lane Group Flow (vph)	527	1666	0	168	2529	0	0	0	0	0	0	0
Confl. Peds. (#/hr)						24						
Turn Type	Prot			Prot								
Protected Phases	5	2		1	6							
Permitted Phases												
Actuated Green, G (s)	27.0	105.7		18.3	97.0							
Effective Green, g (s)	27.0	105.7		18.3	97.0							
Actuated g/C Ratio	0.20	0.78		0.14	0.72							
Clearance Time (s)	5.0	6.0		5.0	6.0							
Vehicle Extension (s)	3.0	3.0		3.0	3.0							
Lane Grp Cap (vph)	641	3696		224	3248							
v/s Ratio Prot	c0.16	0.35		0.10	c0.56							
v/s Ratio Perm												
v/c Ratio	0.82	0.45		0.75	0.78							
Uniform Delay, d1	51.7	4.9		56.1	12.1							
Progression Factor	0.90	0.67		1.08	0.44							
Incremental Delay, d2	5.9	0.3		10.6	1.5							
Delay (s)	52.2	3.6		71.0	6.9							
Level of Service	D	A		E	A							
Approach Delay (s)		15.3			10.9			0.0			0.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	70.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

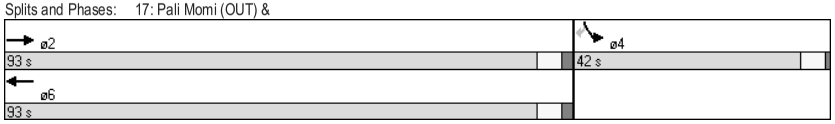
Timings
17: Pali Momi (OUT) &

7/8/2011

Lane Group	EBT	WBT	SBL	SBR
Lane Configurations				
Volume (vph)	1440	2105	365	200
Turn Type				Perm
Protected Phases	2	6	4	
Permitted Phases				4
Detector Phase	2	6	4	4
Switch Phase				
Minimum Initial (s)	20.0	20.0	5.0	5.0
Minimum Split (s)	26.0	26.0	39.0	39.0
Total Split (s)	93.0	93.0	42.0	42.0
Total Split (%)	68.9%	68.9%	31.1%	31.1%
Yellow Time (s)	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	5.0	5.0
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	C-Max	C-Max	None	None

Intersection Summary
Cycle Length: 135
Actuated Cycle Length: 135
Offset: 1 (1%), Referenced to phase 2:EBT and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated

Splits and Phases: 17: Pali Momi (OUT) &



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	0	1440	2105	0	365	200
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	11	11
Total Lost time (s)		6.0	6.0		5.0	5.0
Lane Util. Factor		0.91	0.91		0.97	1.00
Frpb, ped/bikes		1.00	1.00		1.00	0.85
Flpb, ped/bikes		1.00	1.00		1.00	1.00
Frt		1.00	1.00		1.00	0.85
Flt Protected		1.00	1.00		0.95	1.00
Satd. Flow (prot)		4746	4746		3319	1309
Flt Permitted		1.00	1.00		0.95	1.00
Satd. Flow (perm)		4746	4746		3319	1309
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	1565	2288	0	397	217
RTOR Reduction (vph)	0	0	0	0	0	6
Lane Group Flow (vph)	0	1565	2288	0	397	211
Confl. Peds. (#/hr)						114
Turn Type						Perm
Protected Phases		2	6		4	
Permitted Phases						4
Actuated Green, G (s)		97.0	97.0		27.0	27.0
Effective Green, g (s)		97.0	97.0		27.0	27.0
Actuated g/C Ratio		0.72	0.72		0.20	0.20
Clearance Time (s)		6.0	6.0		5.0	5.0
Vehicle Extension (s)		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		3410	3410		664	262
v/s Ratio Prot		0.33	c0.48		0.12	
v/s Ratio Perm						c0.16
v/c Ratio		0.46	0.67		0.60	0.80
Uniform Delay, d1		8.0	10.3		49.1	51.5
Progression Factor		0.19	1.00		1.00	1.00
Incremental Delay, d2		0.4	1.1		1.5	16.2
Delay (s)		1.9	11.4		50.5	67.7
Level of Service		A	B		D	E
Approach Delay (s)		1.9	11.4		56.6	
Approach LOS		A	B		E	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	11.0
Intersection Capacity Utilization	78.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Appendix F

Acoustic Study

ACOUSTIC STUDY FOR THE LIVE, WORK, PLAY AIEA PROJECT AIEA, HAWAII

Prepared for:

PBR HAWAII

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OCTOBER 2011

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CHAPTER I. SUMMARY

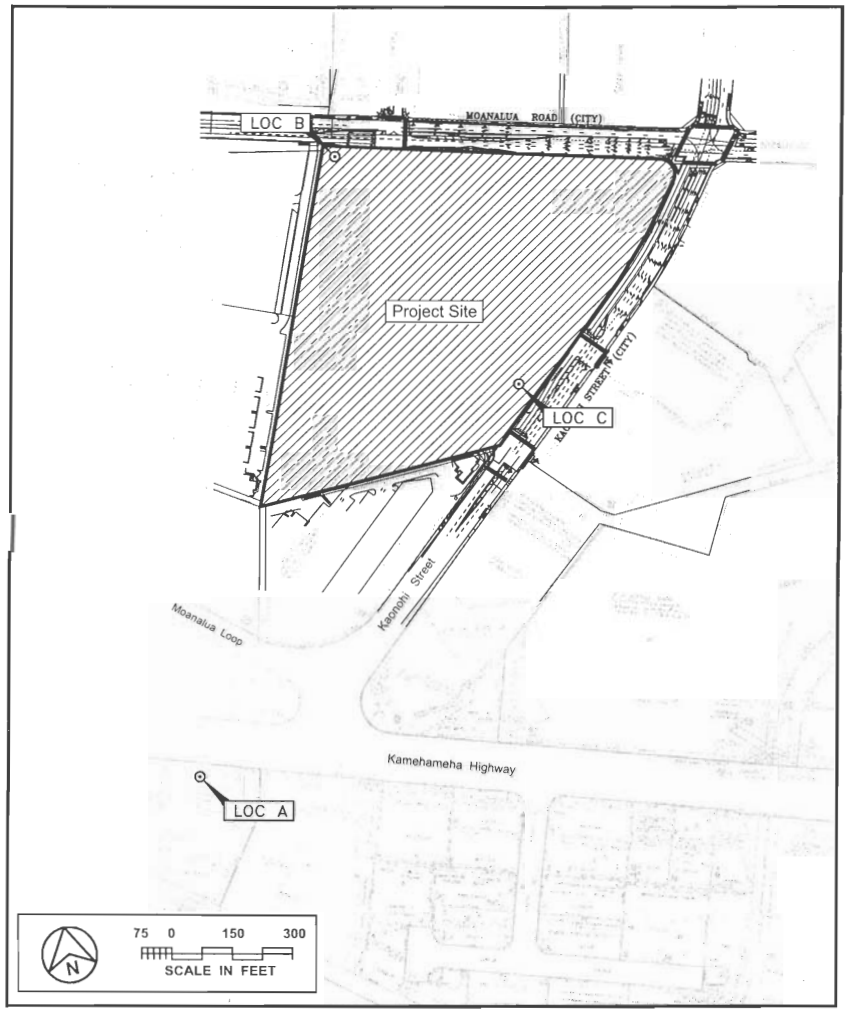
The existing and future traffic noise levels in the vicinity of the proposed Live, Work and Play Aiea project in Aiea were evaluated for their potential impacts and their relationship to current Federal Housing Administration (FHA) / Housing and Urban Development (HUD) noise standards for residences. The traffic noise level increases along the 3 major roadways bordering the project site (see Figure 1) were calculated. No significant traffic noise impacts are predicted to occur as a result of project traffic following project build-out by CY 2021.

Along Moanalua Road, traffic noise levels are expected to remain at 72 DNL at 50 foot distance from the roadway's centerline in CY 2021. Along Kaonohi Street, traffic noise levels are expected to increase by 0.9 to 2.1 DNL by CY 2021 as a result of project and non-project traffic. Project traffic will add less than 0.1 additional DNL units of noise along Kamehameha Highway. These traffic noise level increases resulting from project generated traffic are not considered to be significant. The predicted increases in traffic noise levels are not expected to generate adverse noise impacts by CY 2021.

Residential units on the north (mauka) face of the Residential Building 1 are expected to be exposed to traffic noise levels greater than 65 DNL, and are expected to be in the "Significant Exposure, Normally Unacceptable" noise exposure category in respect to the FHA/HUD noise standard for residences. However, residential units located at the interior locations on the project site are predicted to experience traffic noise levels less than 65 DNL due to the beneficial shielding effects of the project's tower buildings. Upper floor units of Residential Buildings 2 and 3 are predicted to experience traffic noise levels greater than 65 DNL due to the combined influences of traffic noise from Kaonohi Street as well as those from H-1 Freeway. Traffic noise mitigation measures in the form of closure and air conditioning of the affected mid and high rise residential units should be considered. Alternatively, increasing the setback distances of the affected residential units from Moanalua Road and Kaonohi Street could also be considered to mitigate traffic noise.

Unavoidable, but temporary, noise impacts may occur during construction of the proposed project, particularly during the excavation and potential pile driving activities on the project site. Because construction activities are predicted to be audible within the project site and at adjoining properties, the quality of the acoustic environment may be degraded to levels exceeding 60 dBA during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases, but the use of quiet equipment is recommended as a standard mitigation measure.

Because of the presence of low and mid-rise buildings near the project site and the potential of vibration during potential pile driving operations, vibration monitoring is recommended during close-in pile driving operations (if pile driving is necessary) where vibration levels are expected to exceed 0.2 inches/second.



PROJECT LOCATION MAP AND NOISE MEASUREMENT LOCATIONS

FIGURE 1

CHAPTER II. PURPOSE

The primary objective of this study was to describe the existing and future traffic noise environment in the environs of the proposed Live, Work, Play Aiea Project at the former Kamehameha Drive-In site on the island of Oahu. Traffic forecasts from the project traffic study for 2021 were used. Traffic noise level increases and impacts associated with the proposed development were to be determined within the project site as well as along the public roadways which are expected to service the project traffic. A specific objective was to determine future traffic noise level increases both with and without the project, and the potential noise impacts associated with these increases.

Impacts from short term construction noise at the project site were also included as noise study objectives. Recommendations for minimizing construction noise impacts are also provided.

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies (such as FHA/HUD) to assess environmental noise is the Day-Night Average Sound Level (Ldn or DNL). This descriptor incorporates a 24-hour average of instantaneous A-Weighted Sound Levels as read on a standard Sound Level Meter. By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. A more complete list of noise descriptors is provided in Appendix B to this report.

Table 1, derived from Reference 1, presents current federal noise standards and acceptability criteria for residential land uses. Land use compatibility guidelines for various levels of environmental noise as measured by the DNL descriptor system are shown in Figure 2. As a general rule, noise levels of 55 DNL or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the roadway is a high speed freeway. In the project area, traffic noise levels associated with Moanalua Road, Kaonohi Street, and Kamehameha Highway are typically greater than 65 DNL along their Rights-of-Way due to the large volumes of traffic on those major thoroughfares.

For purposes of determining noise acceptability for funding assistance from federal agencies (FHA/HUD and VA), an exterior noise level of 65 DNL or less is considered acceptable for residences. This standard is applied nationally (Reference 2), including Hawaii. Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. Because of these factors, and as recommended in Reference 3, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise. However, after considering the cost and feasibility of applying the lower level of 55 DNL, government agencies such as FHA/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 DNL are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 DNL.

On the island of Oahu, the State Department of Health (DOH) regulates noise from construction activities, through the issuance of permits for allowing excessive

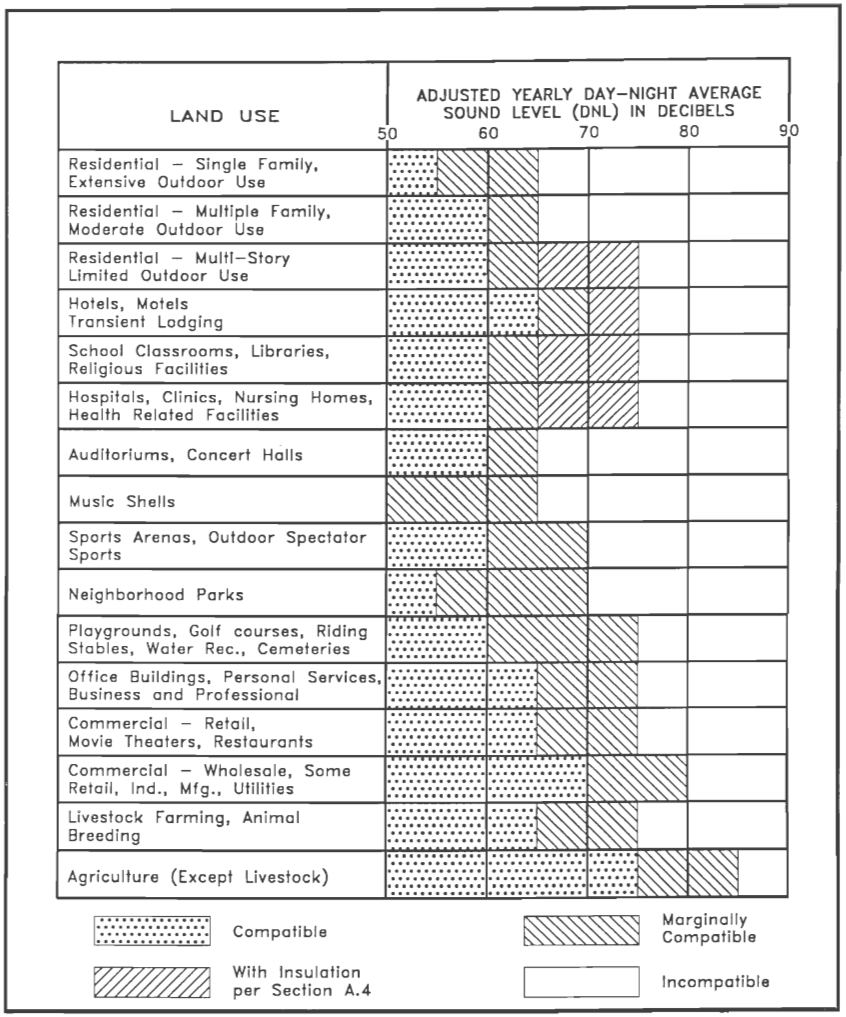
TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY–NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL (1) STANDARD
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL But Not Above 65 DNL	Above 55 Leq But Not Above 65 Leq	Acceptable(2)
Significant Exposure	Above 65 DNL But Not Above 75 DNL	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 DNL	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.



LAND USE COMPATIBILITY WITH YEARLY AVERAGE DAY–NIGHT AVERAGE SOUND LEVEL (DNL) AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED.
(Source: American National Standards Institute S12.9–1998/Part 5)

FIGURE 2

noise during limited time periods. State DOH noise regulations are expressed in maximum allowable property line noise limits rather than DNL (see Reference 4). Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for residential, commercial, and industrial lands equate to approximately 55, 60, and 76 DNL, respectively.

It should be noted that the noise compatibility guidelines and relationships to the DNL noise descriptor may not be applicable to impulsive noise sources such as pile drivers. The use of penalty factors (such as adding 10 dB to measured sound levels or the use of C-Weighting filters) have been proposed. However, the relationships between levels of impulsive noise sources and land use compatibility have not been as firmly established as have the relationships for non-impulsive sources. The State DOH limits for impulsive sounds which exceed 120 impulses in any 20 minute period are 10 dB above the limits for non-impulsive sounds. If impulsive sounds do not exceed 120 impulses in any 20 minute time period, there are no regulatory limits on their sound levels under the State DOH regulations.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing traffic noise levels were measured at three locations (A, B, and C) in the project environs to provide a basis for developing the project's traffic noise contributions along the roadways which will service the proposed development. The locations of the measurement sites are shown in Figure 1. Traffic noise measurements were performed during the month of August 2011. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used. The traffic noise measurement results, and their comparisons with computer model predictions of existing traffic noise levels are summarized in Table 2.

Traffic noise calculations for the existing conditions as well as noise predictions for 2021 were performed using the Federal Highway Administration (FHWA) Traffic Noise Model (Reference 5). Traffic data entered into the noise prediction model were: roadway and receiver locations; hourly traffic volumes, average vehicle speeds; estimates of traffic mix; and "Pavement" propagation loss factor. The traffic data and forecasts for the project (Reference 6), plus the spot traffic counts obtained during the noise measurement periods were the primary sources of data inputs to the model. Appendix C summarizes the AM and PM peak hour traffic volumes for CY 2011 and 2021, which were used to model existing and future traffic noise along the streets surrounding the project site. Year 2009 and 2029 traffic data along H-1 Freeway from Reference 7 was used to model existing and future traffic noise levels along H-1 Freeway. For existing and future traffic along the streets surrounding the project site, it was assumed that the average noise levels, or Leq(h), during the PM peak traffic hour were approximately 1.0 dB less than the 24-hour DNL. This Leq(h) to DNL conversion factor was obtained from calculations of traffic noise levels along Moanalua Road and Kamehameha Highway (see Figures 3 and 4) based on 24-hour traffic counts provided in References 8 and 9.

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level and elevated receptors with and without the benefit of shielding from the proposed residential buildings. Traffic noise levels were also calculated for future conditions with and without the proposed project. The forecasted changes in traffic noise levels over existing levels were calculated with and without the project, and noise impact risks evaluated. The relative contributions of non-project and project traffic to the total noise levels were also calculated, and an evaluation of possible traffic noise impacts was made.

Calculations of average exterior and interior noise levels from construction activities were performed for typical naturally ventilated and air conditioned dwellings. Predicted noise levels were compared with existing background ambient noise levels, and the potential for noise impacts was assessed. Potential noise impacts from pile driving operations were also discussed, and mitigation measures recommended.

FIGURE 3

HOURLY VARIATIONS OF TRAFFIC NOISE AT 88 FT SETBACK DISTANCE FROM THE CENTERLINE OF KAMEHAMEHA HIGHWAY, KAAHUMANU ST. TO KAONOHI ST. (STA. B72009901966; JULY 29, 2009)

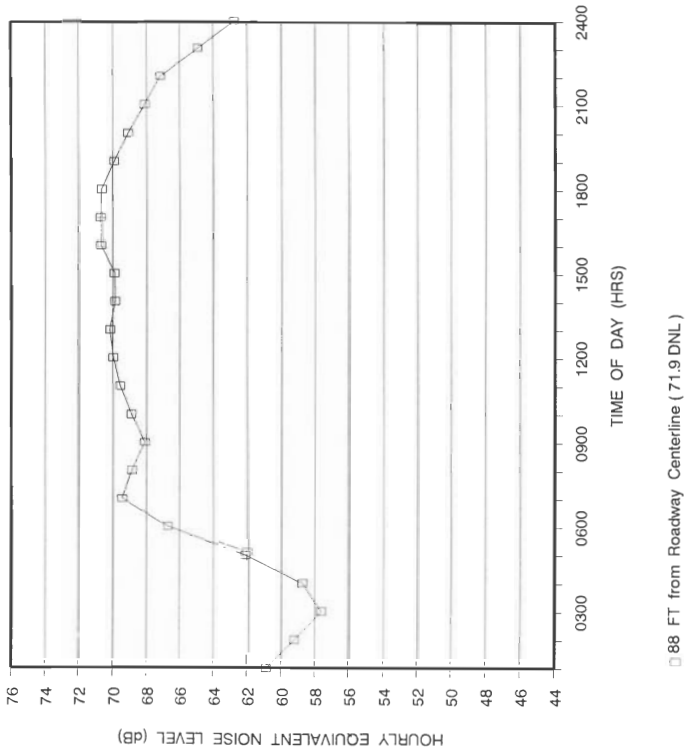


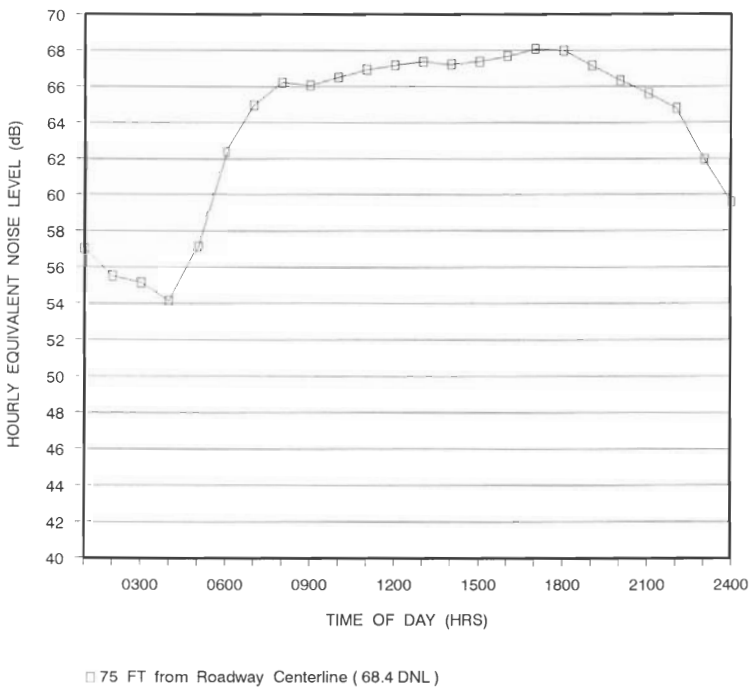
TABLE 2

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	Hourly Traffic Volume AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
A. 100 FT makai of the center of the median of Kamehameha Hwy. (8/2/11)	0626 TO 0726	47	2,694	47	49	70.8	70.8
B. 75 FT from the center-line of Moanalua Road (8/2/11)	0740 TO 0840	39	1,772	16	13	66.7	66.8
C. 89 FT from the center-line of Kaonohi St. (8/2/11)	0848 TO 0948	44	614	9	8	63.2	63.1
C. 89 FT from the center-line of Kaonohi St. (8/2/11)	1322 TO 1422	45	845	5	7	64.3	64.3
B. 75 FT from the center-line of Moanalua Road (8/2/11)	1430 TO 1530	39	2,331	13	13	67.4	67.5
A. 100 FT makai of the center of the median of Kamehameha Hwy. (8/2/11)	1541 TO 1641	45	3,450	25	34	70.6	70.6

FIGURE 4

HOURLY VARIATIONS OF TRAFFIC NOISE AT 75 FT SETBACK DISTANCE FROM THE CENTERLINE OF MOANALUA ROAD, MOANALUA LP. TO KAONOHI ST. (STA. B72721000177; JUNE 9, 2009)



V. EXISTING ACOUSTICAL ENVIRONMENT

The existing background ambient noise levels within the project area at ground level are controlled by traffic along Moanalua Road and Kaonohi Street. At ground level, traffic noise from H-1 Freeway and Kamehameha Highway are shielded from the project site by terrain features and by existing buildings. At the higher elevations over the project site, traffic along H-1 Freeway and Kamehameha Highway also contribute traffic noise to the total background noise levels at the project site. This is the result of decreased noise shielding effects by terrain features and existing buildings as the receptor elevations increase at the project site.

The results of the traffic and background ambient noise measurements are summarized in Table 2, with measurement locations identified in Figure 1. The measurement Sites A and B were located at nearby street level, and the ground at Location C was elevated above Kaonohi Street by approximately 68 feet. As shown in Table 2, correlation between measured and predicted traffic noise levels was good. The traffic noise model's "Pavement" propagation loss factor was used to obtain the good correlation.

The existing traffic noise levels in the project environs along Moanalua Road, Kaonohi Street, and Kamehameha Highway are in the "Significant Exposure, Normally Unacceptable" category by current federal standards for residences, and greater than 65 DNL within 50 feet of the roadways' centerlines. Table 3 presents the results of calculations of existing traffic noise levels along Moanalua Road, Kaonohi Street, and Kamehameha Highway during the PM peak hour at 50, 100 and 200 feet from the roadways' centerlines. Existing DNL values are between 0.5 to 1.0 dB higher than the PM peak hour Leq's shown in Table 3. Table 4 presents the existing setback distances to the 65 and 70 DNL contours from the various sections of Moanalua Road, Kaonohi Street, and Kamehameha Highway. The results shown in Tables 3 and 4 are worst case conditions, since they do not include the beneficial effects of noise shielding from terrain features or existing buildings.

Table 5 presents the calculations of existing traffic noise levels in DNL at various locations on the project site at ground level as well as for various receptor ear elevations up to 345 feet above ground level. The beneficial effects of shielding from existing terrain features and buildings, as well as the additive noise contributions from the adjoining streets, are included in the existing sound level predictions shown in Table 5. Figure 5 depicts the various receptor locations of Table 5 within the project site and in relationship to the planned low, mid, and high rise buildings of the project. The results of the calculations shown in Table 5 also include the traffic noise contributions from H-1 Freeway, which affect the results at the higher elevations.

As indicated in Table 5, the existing noise levels over the project site are higher at locations near Moanalua Road and Kaonohi Street, and are lower near the western corner of the project site. Existing traffic noise levels at the high elevations typically

TABLE 4

EXISTING AND CY 2021 DISTANCES TO 65 AND 70 DNL CONTOURS

STREET SECTION	65 DNL SETBACK (FT)		70 DNL SETBACK (FT)	
	EXISTING	CY 2021	EXISTING	CY 2021
Moanalua Rd. West of Pearlridge Elementary	181	188	67	71
Moanalua Rd. Between Pearlridge & Kaonohi	181	188	68	71
Moanalua Rd. East of Kaonohi St.	167	181	63	68
Kaonohi St. North of Moanalua Rd.	98	115	38	45
Kaonohi St. Between Moanalua & Access 2	104	124	41	47
Kaonohi St. Between Access 2 & Access 3	102	124	40	48
Kaonohi St. Between Access 3 & Kamehameha	106	161	41	61
Kamehameha Hwy. Between Pali Momi & Kaonohi	465	510	182	200
Kamehameha Hwy. Between Kaonohi & Kanuku	473	520	186	204
Kamehameha Hwy. Between Kanuku & Hekaha	431	473	169	186
Kamehameha Hwy. West of Hekaha St.	408	456	160	179

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLES 3 and 6 for traffic volume, speed, and mix assumptions.
(3) Setback distances are for ground level receptors.
(4) "Pavement" conditions assumed along all roadways.

TABLE 3

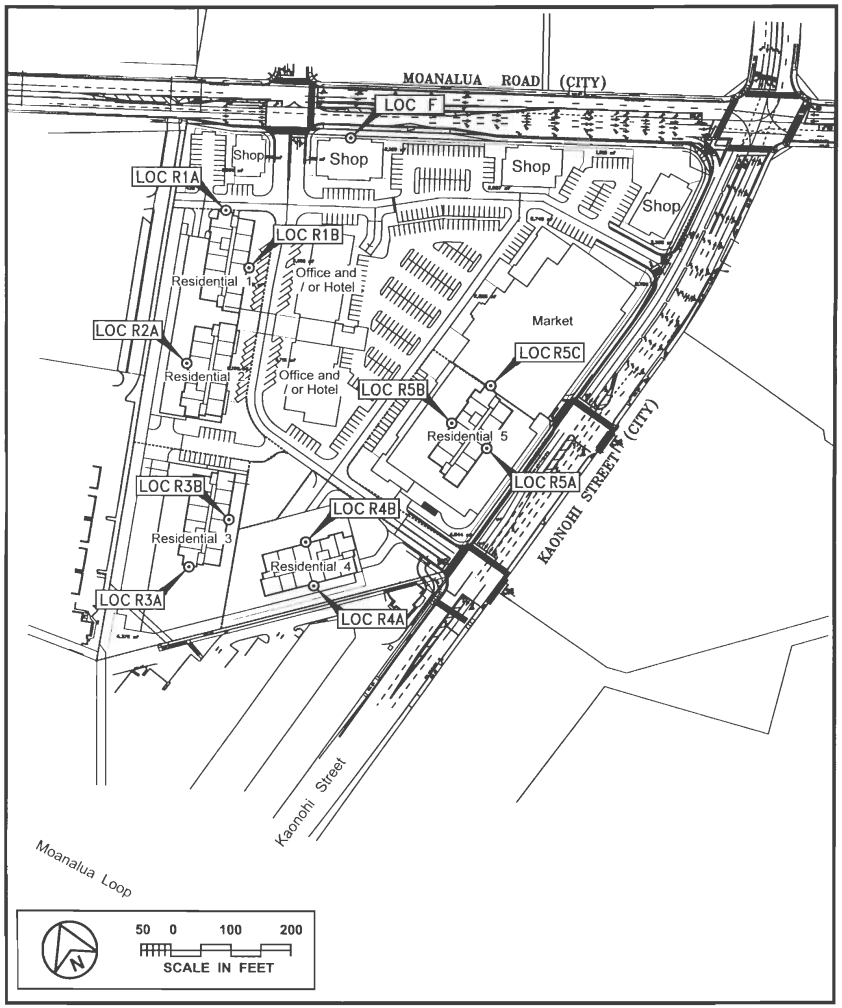
EXISTING (CY 2011) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (PM PEAK HOUR)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ********			50' Leq	100' Leq	200' Leq
			AUTOS	M TRUCKS	H TRUCKS			
Moanalua Rd. West of Pearlridge Elementary	39	2,899	2,859	20	20	71.1	67.4	64.0
Moanalua Rd. Between Pearlridge & Kaonohi	39	2,926	2,886	20	20	71.1	67.5	64.0
Moanalua Rd. East of Kaonohi St.	39	2,662	2,624	19	19	70.7	67.1	63.6
Kaonohi St. North of Moanalua Rd.	45	907	889	9	9	68.1	64.4	60.9
Kaonohi St. Between Moanalua & Access 2	45	964	944	10	10	68.4	64.7	61.2
Kaonohi St. Between Access 2 & Access 3	45	948	930	9	9	68.3	64.6	61.1
Kaonohi St. Between Access 3 & Kamehameha	45	995	975	10	10	68.5	64.8	61.3
Kamehameha Hwy. Between Pali Momi & Kaonohi	46	4,652	4,531	56	65	77.2	72.2	68.5
Kamehameha Hwy. Between Kaonohi & Kanuku	46	4,749	4,626	57	66	77.3	72.3	68.6
Kamehameha Hwy. Between Kanuku & Hekaha	46	4,208	4,099	50	59	76.8	71.8	68.1
Kamehameha Hwy. West of Hekaha St.	46	3,947	3,845	47	55	76.5	71.5	67.8

TABLE 5

EXISTING AND 2021 TRAFFIC NOISE LEVELS
(VARIOUS ELEVATIONS, DNL)

RECEPTOR LOCATION	SETBACK DIST. FROM EXIST. C/L	RECEPTOR ELEVATION	EXISTING (CY 2011) DNL	FUTURE (CY 2021) LEVELS NO BUILD DNL	BUILD DNL
Location F	71 FT from Moanalua Rd.	5 FT Above Ground	72	72	72
Location R1A	185 FT from Moanalua Rd.	5 FT Above Ground	66	66	66
Location R1A	185 FT from Moanalua Rd.	70 FT Above Ground	67	68	67
Location R1A	185 FT from Moanalua Rd.	105 FT Above Ground	68	69	69
Location R1A	185 FT from Moanalua Rd.	145 FT Above Ground	69	70	69
Location R1B	282 FT from Moanalua Rd.	5 FT Above Ground	63	64	61
Location R1B	282 FT from Moanalua Rd.	70 FT Above Ground	66	66	63
Location R1B	282 FT from Moanalua Rd.	105 FT Above Ground	67	68	64
Location R1B	282 FT from Moanalua Rd.	145 FT Above Ground	68	69	65
Location R2A	443 FT from Moanalua Rd.	5 FT Above Ground	61	62	59
Location R2A	443 FT from Moanalua Rd.	70 FT Above Ground	64	65	62
Location R2A	443 FT from Moanalua Rd.	105 FT Above Ground	66	66	63
Location R2A	443 FT from Moanalua Rd.	145 FT Above Ground	67	67	65
Location R3A	404 FT from Kaonohi St.	5 FT Above Ground	58	61	53
Location R3A	404 FT from Kaonohi St.	70 FT Above Ground	64	65	61
Location R3A	404 FT from Kaonohi St.	200 FT Above Ground	66	67	62
Location R3A	404 FT from Kaonohi St.	345 FT Above Ground	67	68	64
Location R3B	398 FT from Kaonohi St.	5 FT Above Ground	59	61	56
Location R3B	398 FT from Kaonohi St.	70 FT Above Ground	64	65	61
Location R3B	398 FT from Kaonohi St.	200 FT Above Ground	67	67	63
Location R3B	398 FT from Kaonohi St.	345 FT Above Ground	67	68	64
Location R4A	218 FT from Kaonohi St.	345 FT Above Ground	60	62	60
Location R4A	218 FT from Kaonohi St.	70 FT Above Ground	65	66	64
Location R4A	218 FT from Kaonohi St.	200 FT Above Ground	67	67	64
Location R4A	218 FT from Kaonohi St.	345 FT Above Ground	67	68	64
Location R4B	272 FT from Kaonohi St.	5 FT Above Ground	61	62	55
Location R4B	272 FT from Kaonohi St.	70 FT Above Ground	65	66	59
Location R4B	272 FT from Kaonohi St.	200 FT Above Ground	67	67	63
Location R4B	272 FT from Kaonohi St.	345 FT Above Ground	67	68	66
Location R5A	110 FT from Kaonohi St.	5 FT Above Ground	62	64	61
Location R5A	110 FT from Kaonohi St.	70 FT Above Ground	67	67	66
Location R5A	110 FT from Kaonohi St.	200 FT Above Ground	68	69	66
Location R5A	110 FT from Kaonohi St.	345 FT Above Ground	69	69	66
Location R5B	187 FT from Kaonohi St.	5 FT Above Ground	62	63	58
Location R5B	187 FT from Kaonohi St.	70 FT Above Ground	66	67	60
Location R5B	187 FT from Kaonohi St.	200 FT Above Ground	68	68	65
Location R5B	187 FT from Kaonohi St.	345 FT Above Ground	68	69	67
Location R5C	162 FT from Kaonohi St.	5 FT Above Ground	62	63	61
Location R5C	162 FT from Kaonohi St.	70 FT Above Ground	66	67	65
Location R5C	162 FT from Kaonohi St.	200 FT Above Ground	68	69	68
Location R5C	162 FT from Kaonohi St.	345 FT Above Ground	69	69	69



LOCATIONS OF TRAFFIC NOISE CALCULATIONS

FIGURE 5

exceed 65 DNL at the planned locations of the residential buildings of the project due to traffic noise contributions from H-1 Freeway. At ground level, where traffic noise contributions from H-1 Freeway are typically less than 60 DNL, existing traffic noise levels exceed 65 DNL primarily along Moanalua Road.

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of References 6 and 7 for CY 2021 with and without the proposed project. The future projections of project plus non-project traffic noise levels on the roadways which would service the project are shown in Table 6 for the PM peak hour of traffic, under the Build Alternative. Table 7 presents the calculations of future traffic noise level changes along sections of Moanalua Road, Kaonohi Street, and Kamehameha Highway associated with project and non-project traffic. Table 4 presents the future setback distances to the 65 and 70 DNL traffic noise contours under the Build Alternative for unobstructed line-of-site conditions.

Essentially no significant increases in traffic noise levels are expected in the project environs between CY 2011 and 2021, with or without the project. Traffic noise levels along Moanalua Road are predicted to decrease slightly (by 0.1 to 0.3 dB) as a result of the project (see Appendix C, where Moanalua Road traffic volumes in 2021 are lower with the project than without the project). The greatest traffic noise level increases (of 0.3 to 2.1 dB) are predicted to occur along Kaonohi Street. As indicated in Table 5, traffic noise levels at the proposed Residential Buildings 3, 4, and 5 should typically decrease due to the traffic noise shielding effects of the residential tower buildings. Exceptions to this occur at receptor locations R1A, R4A, and R5A, whose building walls front Moanalua Road or Kaonohi Street.

The dominant traffic noise source in the project area will continue to be traffic noise from Moanalua Road and Kaonohi Street at the lower elevation receptors, and traffic noise contributions from H-1 Freeway at the higher elevation receptors. Table 5 shows the predicted future traffic noise levels at the faces of the proposed residential tower buildings on the project site following project build-out in CY 2021 for ground level and elevated receptors. The beneficial effects of shielding from existing terrain features, existing buildings, and from the proposed residential tower buildings, as well as the additive noise contributions from the adjoining streets, Kamehameha Highway and H-1 Freeway are included in the sound level predictions shown in Table 5. As indicated in the table, residential units on the north (mauka) face of Residential Building 1 are expected to be exposed to traffic noise levels greater than 65 DNL, and are expected to be in the "Significant Exposure, Normally Unacceptable" noise exposure category in respect to the FHA/HUD noise standard for residences. However, residential units located at the interior locations on the project site are predicted to experience traffic noise levels less than 65 DNL due to the beneficial shielding effects of the project's buildings. Upper floor units of Residential Buildings 4 and 5 are predicted to experience traffic noise levels greater than 65 DNL due to the combined influences of traffic noise from Kaonohi Street as well as those from H-1 Freeway.

TABLE 7

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2021) (PM PEAK HOUR LEQ OR DNL)

STREET SECTION	NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Moanalua Rd. West of Pearlridge Elementary	0.5	-0.2
Moanalua Rd. Between Pearlridge & Kaonohi	0.5	-0.3
Moanalua Rd. East of Kaonohi St.	0.5	-0.1
Kaonohi St. North of Moanalua Rd.	0.5	0.3
Kaonohi St. Between Moanalua & Access 2	0.5	0.4
Kaonohi St. Between Access 2 & Access 3	0.5	0.5
Kaonohi St. Between Access 3 & Kamehameha	0.0	2.1
Kamehameha Hwy. Between Pali Momi & Kaonohi	0.6	-0.1
Kamehameha Hwy. Between Kaonohi & Kanuku	0.5	0.0
Kamehameha Hwy. Between Kanuku & Hekaha	0.5	0.0
Kamehameha Hwy. West of Hekaha St.	0.5	0.1

TABLE 6

FUTURE (CY 2021) TRAFFIC VOLUMES AND NOISE LEVELS ALONG ROADWAYS IN PROJECT AREA (PM PEAK HOUR, BUILD)

LOCATION	SPEED (MPH)	TOTAL VPH	****** VOLUMES (VPH) ******** AUTOS	M TRUCKS	H TRUCKS	50' Leq	100' Leq	200' Leq
Moanalua Rd. West of Pearlridge Elementary	39	3,065	3,023	21	21	71.4	67.7	64.2
Moanalua Rd. Between Pearlridge & Kaonohi	39	3,045	3,003	21	21	71.3	67.7	64.2
Moanalua Rd. East of Kaonohi St.	39	2,920	2,880	20	20	71.1	67.5	64.0
Kaonohi St. North of Moanalua Rd.	45	1,100	1,078	11	11	68.9	65.2	61.7
Kaonohi St. Between Moanalua & Access 2	45	1,188	1,164	12	12	69.2	65.6	62.1
Kaonohi St. Between Access 2 & Access 3	45	1,195	1,171	12	12	69.3	65.6	62.1
Kaonohi St. Between Access 3 & Kamehameha	45	1,623	1,591	16	16	70.6	66.9	63.4
Kamehameha Hwy. Between Pali Momi & Kaonohi	46	5,185	5,050	62	73	77.7	72.7	69.0
Kamehameha Hwy. Between Kaonohi & Kanuku	46	5,310	5,172	64	74	77.8	72.8	69.1
Kamehameha Hwy. Between Kanuku & Hekaha	46	4,760	4,636	57	67	77.4	72.3	68.6
Kamehameha Hwy. West of Hekaha St.	46	4,508	4,391	54	63	77.1	72.1	68.4

CHAPTER VII. DISCUSSION OF PROJECT-RELATED NOISE AND VIBRATION IMPACTS AND POSSIBLE MITIGATION MEASURES

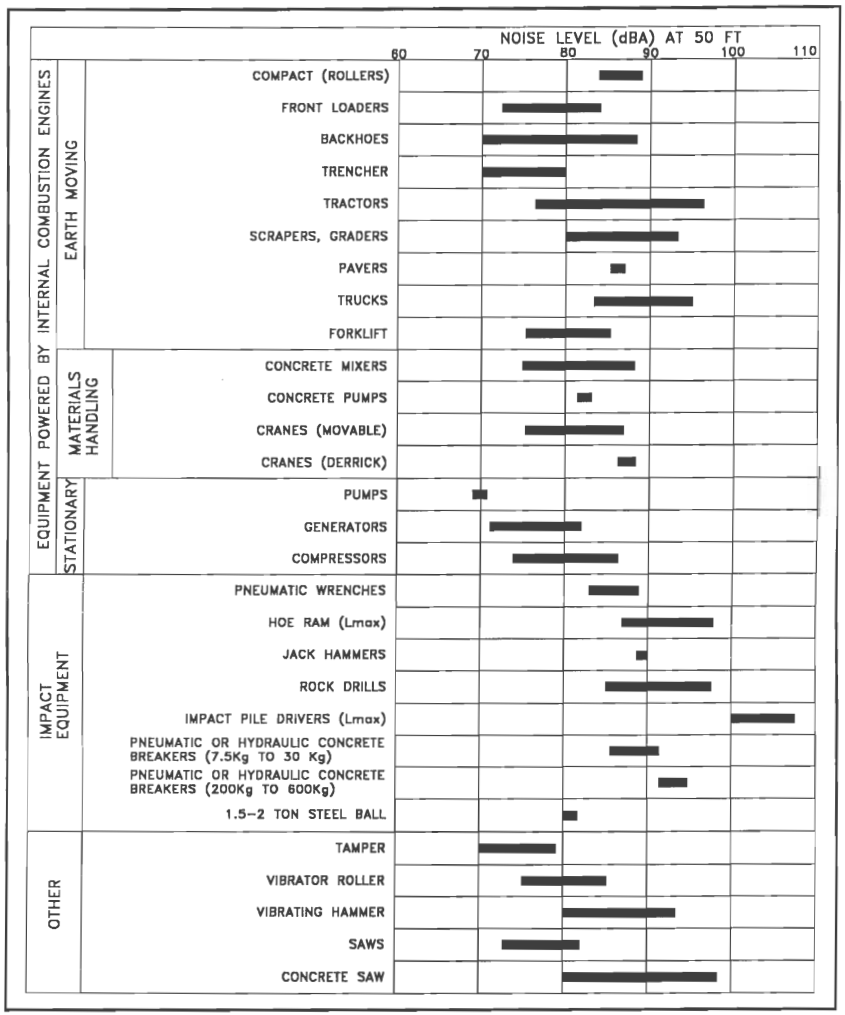
Traffic Noise. Noise impacts from project related traffic along the surrounding roadways which are expected to service the project are not expected since traffic noise increases associated with project traffic are not significant. At some of the residential units in the proposed residential buildings of the project, predicted traffic noise levels exceed the 65 DNL FHA/HUD standard for residences, and traffic noise mitigation measures should be considered. The primary contributors to these high traffic noise levels are existing and future traffic along Moanalua Road, Kaonohi Street, and H-1 Freeway.

Traffic noise mitigation measures are recommended for proposed residential units on the north face of the Residential Mid-Rise 1 building and on the upper floors of the Residential Tower 3 building. Traffic noise mitigation measures in the form of closure and air conditioning of the residential units should be considered.

General Construction Noise. Audible construction noise will probably be unavoidable during the entire project construction period. The total time period for construction is unknown, but it is anticipated that the actual work will be moving from one location on the project site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be less than the total construction period for the entire project. Figure 6 depicts the range of noise levels of various types of construction equipment when measured at 50 FT distance from the equipment. Typical levels of exterior noise from construction activity (excluding pile driving activity) at various distances from the job site are shown in Figure 7. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in Figure 7, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in the figure.

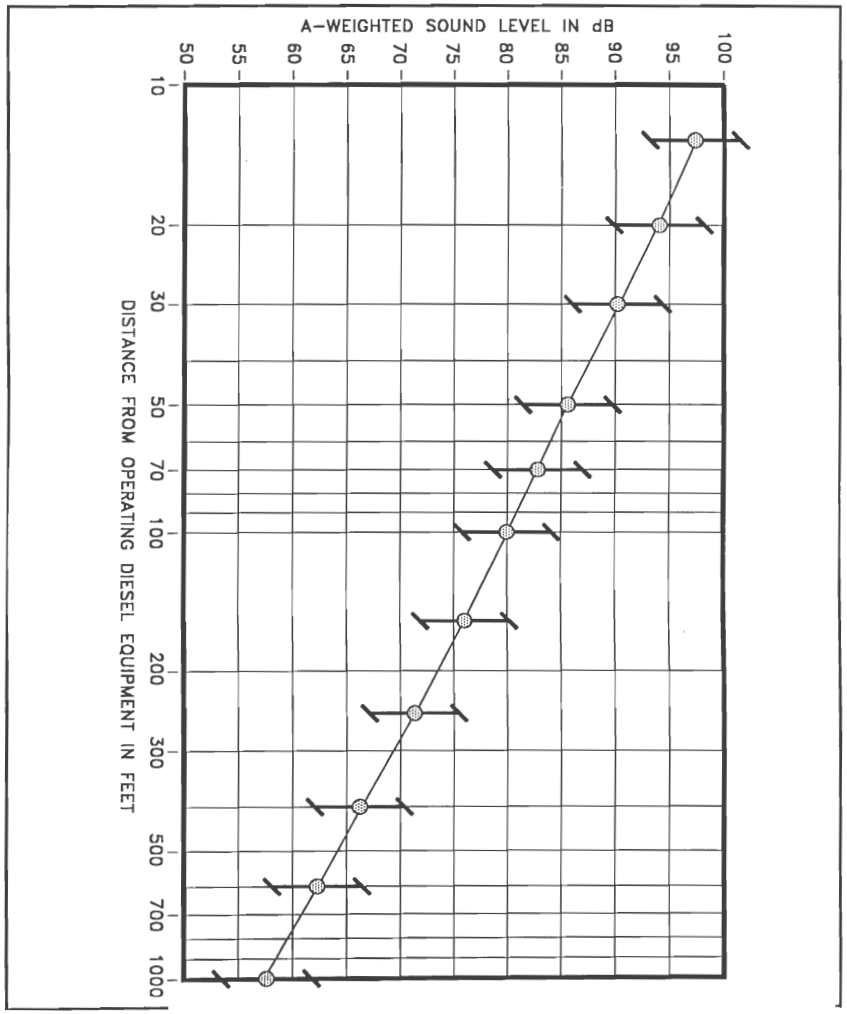
Figure 7 is useful for predicting exterior noise levels at short distances (within 100 FT) from the work when visual line of sight exists between the construction equipment and the receptor. Direct line-of-sight distances from the construction equipment to existing residential and commercial buildings will range from 50 FT to 1,300 FT, with corresponding average noise levels of 86 to 55 dBA (plus or minus 5 dBA). For receptors along a cross-street, the construction noise level vs. distance curve of Figure 7 should be reduced by approximately 8 dBA when the work is occurring at the intersection with the cross street, and should be reduced by 15 dBA when work is occurring at least 100 FT from the intersection (and the visual line-of-sight is blocked by intervening buildings). Typical levels of construction noise inside naturally ventilated and air conditioned structures are approximately 10 and 20 dB less, respectively, than the levels shown in Figure 7.

The existing mid-rise residential buildings along the west property boundary are



RANGES OF CONSTRUCTION EQUIPMENT NOISE LEVELS

FIGURE 6



ANTICIPATED RANGE OF CONSTRUCTION NOISE LEVELS VS. DISTANCE

FIGURE 7

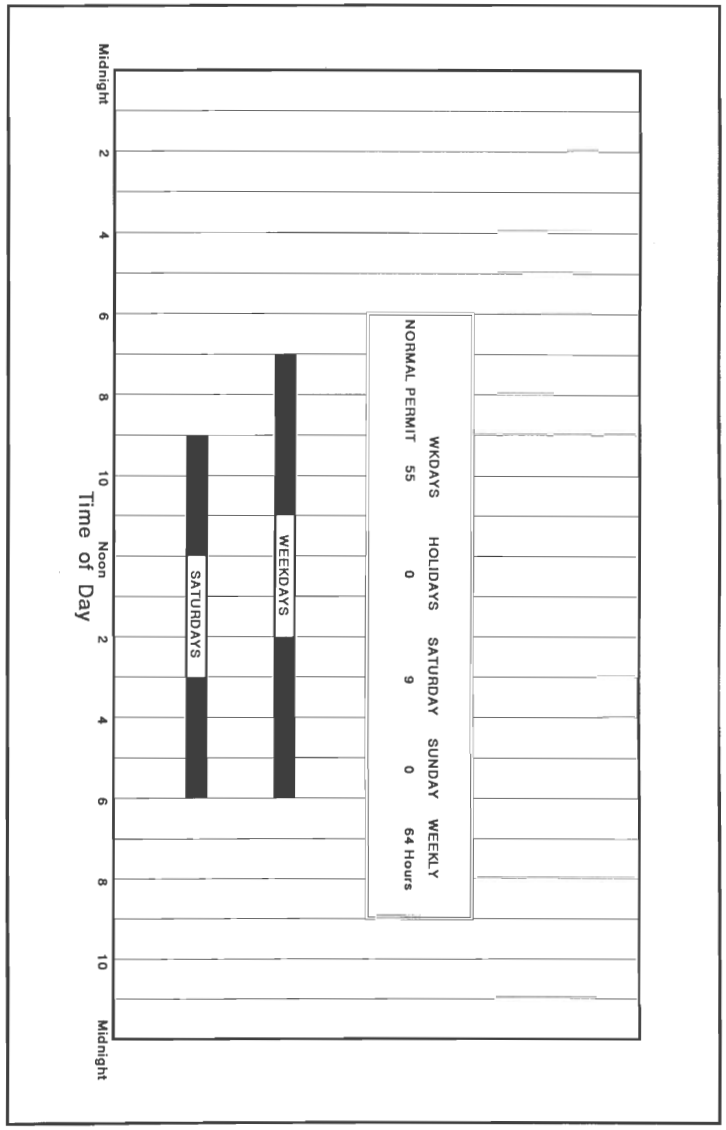
predicted to experience the highest noise levels during construction activities due to their close proximity to the construction sites. Noise from construction is not expected to adversely affect public health and welfare due to the temporary nature of the work, the business/commercial character of the areas to the east and south, and due to the administrative controls available for regulation of construction noise. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site. Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dB at 50 FT distance), and due to the exterior nature of the work (pile driving, grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site.

Peak airborne noise levels from pile diving may be as much as 15 dBA greater than noise levels shown in Figure 7 for non-impulsive (steady) construction noise sources. Although the pile driving can produce more intense noise levels, each pulse is of short individual duration (less than one second). Therefore, its impact on speech communication is not as severe as that of a steady source of the same noise level.

Severe noise impacts are not expected to occur inside air conditioned structures which are within 50 to 450 FT of the project construction site. Inside naturally ventilated structures, interior noise levels (with windows or doors opened) are estimated to range between 55 to 76 dBA at 50 FT to 450 FT distances from the construction site. Closure of all doors and windows facing the construction site would generally reduce interior noise levels by an additional 5 to 10 dBA.

The incorporation of State Department of Health construction noise limits and curfew times, which are applicable throughout the State of Hawaii (Reference 4), is another noise mitigation measure which is normally applied to construction activities. Figure 8 depicts the normally permitted hours of construction. Noisy construction activities are not allowed on Sundays and holidays, during the early morning, and during the late evening and nighttime periods under the DOH permit procedures.

Vibration from Pile Driving. Pile driving may be necessary to implant piles into the ground over the project site. Impact driven concrete and sheet piles may both be used on the project site. Induced ground vibrations from the pile driving operations may occur, therefore, a monitoring program is recommended during close-in pile driving operations where vibration levels are expected to exceed 0.2 inches/second.



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

FIGURE 8

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) "Environmental Criteria and Standards, Noise Abatement and Control, 24 FR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, l979.

(3) "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety;" Environmental Protection Agency (EPA 550/9-74-004); March 1974.

(4) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(5) "FHWA Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(6) Existing and Future Traffic Turning Movements; Live, Work and Play Aiea Project; Austin, Tsutsumi & Associates; July 14, 2011.

(7) CY 2009 and 2029 Traffic Volumes Along H-1 Freeway at Pearl Harbor Interchange; Hawaii State Department of Transportation; May 27, 2009.

(8) 24-Hour Traffic Counts At Station B72721000177, Moanalua Road Between Moanalua Loop and Kaonohi Street; Hawaii State Department of Transportation, Highways Division; June 9, 2009.

(9) 24-Hour Traffic Counts At Station B72009901966, Kamehameha Highway Between Kaahumanu Street and Kaonohi Street; Hawaii State Department of Transportation, Highways Division; July 29, 2009.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level[4] Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND YEAR 2021 TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2011 ***** AM VPH	PM VPH	CY 2021 (NO BUILD) AM VPH	PM VPH	CY 2021 (BUILD) AM VPH	PM VPH
Moanalua Rd. W. of Pearlridge Elem. (EB)	1,458	1,130	1,640	1,270	1,350	1,275
Moanalua Rd. W. of Pearlridge Elem. (WB)	1,032	1,769	1,160	1,985	1,045	1,790
Two-Way	2,490	2,899	2,800	3,255	2,395	3,065
Moanalua Rd. Btwn. Pearlridge School & Kaonohi (EB)	1,454	1,160	1,625	1,305	1,358	1,300
Moanalua Rd. Btwn. Pearlridge School & Kaonohi (WB)	1,003	1,767	1,128	1,985	1,015	1,745
Two-Way	2,457	2,926	2,753	3,290	2,373	3,045
Moanalua Rd. E. of Kaonohi St. (EB)	1,445	1,027	1,625	1,160	1,430	1,190
Moanalua Rd. E. of Kaonohi St. (WB)	832	1,635	940	1,840	885	1,730
Two-Way	2,277	2,662	2,565	3,000	2,315	2,920
Kaonohi St. N. of Moanalua Rd. (NB)	258	582	295	655	295	670
Kaonohi St. N. of Moanalua Rd. (SB)	673	325	760	370	805	390
Two-Way	931	907	1,055	1,025	1,100	1,060
Kaonohi St. Btwn. Moanalua Rd. and Access 2 (NB)	227	601	258	678	338	663
Kaonohi St. Btwn. Moanalua Rd. and Access 2 (SB)	466	363	528	413	615	525
Two-Way	692	964	785	1,090	953	1,188
Kaonohi St. Btwn. Access 2 and Access 3 (NB)	245	582	278	658	360	643
Kaonohi St. Btwn. Access 2 and Access 3 (SB)	468	366	528	415	570	553
Two-Way	712	948	805	1,073	930	1,195
Kaonohi St. Btwn. Access3 and Kam. Hwy. (NB)	251	524	265	550	440	798
Kaonohi St. Btwn. Access3 and Kam. Hwy. (SB)	523	471	505	435	730	825
Two-Way	773	995	770	985	1,170	1,623
Kamehameha Hwy. Btwn. Kaonohi and Pali Momi (EB)	2,090	1,334	2,345	1,500	2,190	1,568
Kamehameha Hwy. Btwn. Kaonohi and Pali Momi (WB)	903	3,319	1,018	3,725	1,060	3,618
Two-Way	2,993	4,652	3,363	5,225	3,250	5,185
Kamehameha Hwy. Btwn. Kaonohi and Kanuku (EB)	1,710	1,292	1,923	1,455	1,770	1,513
Kamehameha Hwy. Btwn. Kaonohi and Kanuku (WB)	878	3,458	993	3,883	1,030	3,798
Two-Way	2,588	4,749	2,915	5,338	2,800	5,310

APPENDIX C (CONTINUED)

SUMMARY OF BASE YEAR AND YEAR 2021 TRAFFIC VOLUMES

ROADWAY LANES	**** CY 2011 *****		CY 2021 (NO BUILD)		CY 2021 (BUILD)	
	AM VPH	PM VPH	AM VPH	PM VPH	AM VPH	PM VPH
Kamehameha Hwy. Btwn. Kanuku and Hekaha (EB)	1,670	1,238	1,878	1,408	1,725	1,470
Kamehameha Hwy. Btwn. Kanuku and Hekaha (WB)	887	2,970	1,000	3,333	1,038	3,290
Two-Way	2,557	4,208	2,878	4,740	2,763	4,760
Kamehameha Hwy. W. of Hekaha St. (EB)	1,777	1,170	2,000	1,318	1,873	1,388
Kamehameha Hwy. W. of Hekaha St. (WB)	860	2,777	973	3,120	1,015	3,120
Two-Way	2,637	3,947	2,973	4,438	2,888	4,508
Moanalua Loop W. of Kaonohi St. (EB)	210	133	240	155	240	155
Moanalua Loop W. of Kaonohi St. (WB)	78	162	90	190	90	190
Two-Way	288	295	330	345	330	345
Kanuku St. N. of Kamehameha Hwy. (NB)	86	244	105	280	105	280
Kanuku St. N. of Kamehameha Hwy. (SB)	169	96	200	115	200	115
Two-Way	255	340	305	395	305	395
Hekaha St. N. of Kamehameha Hwy. (NB)	71	153	85	175	85	175
Hekaha St. N. of Kamehameha Hwy. (SB)	182	184	210	210	210	210
Two-Way	253	337	295	385	295	385

Appendix G

Air Quality Study

AIR QUALITY STUDY

FOR

LIVE-WORK-PLAY ‘AIEA

‘AIEA, OAHU, HAWAII

Prepared for:

PBR Hawaii, Inc.

October 2011

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5 Estimated Worst-Case 1-Hour Carbon Monoxide Concentrations Along Roadways Near Live-Work-Play ʻAiea

6 Estimated Worst-Case 8-Hour Carbon Monoxide Concentrations Along Roadways Near Live-Work-Play ʻAiea

7 Estimated Indirect Air Pollution Emissions from Live-Work-Play ʻAiea Electrical Demand

8 Estimated Indirect Air Pollution Emissions from Live-Work-Play ʻAiea Waste Disposal Demand

1.0 SUMMARY

CP Kam Properties LLC is proposing to develop the Live-Work-Play ʻAiea Project at ʻAiea, Oahu. The proposed project will consist of residential, retail, office facilities and potentially a small kamaaina hotel (current and proposed zoning does not allow hotel use at this time) on approximately 14 acres of land formerly used for the Kamehameha Drive In. The project is expected to be completed and fully occupied by 2021. This study: 1) examines the potential short- and long-term air quality impacts that could occur as a result of construction and use of the proposed facilities; and 2) suggests mitigation measures to reduce any potential air quality impacts where possible and appropriate.

Both federal and state standards have been established to maintain ambient air quality. At the present time, seven parameters are regulated including: particulate matter, sulfur dioxide, hydrogen sulfide, nitrogen dioxide, carbon monoxide, ozone and lead. Hawaii air quality standards are generally comparable to the national standards although the state standards for carbon monoxide are more stringent than the national standards.

Regional and local climate together with the amount and type of human activity generally dictate the air quality of a given location. The climate of the ''Aiea area is very much affected by its leeward and coastal situation. Winds are predominantly trade winds from the east northeast except for occasional periods when kona storms may generate strong winds from the south or when the trade winds are weak and landbreeze-seabreeze circulations may develop. Wind speeds typically vary between about 5 and 15 miles per hour providing relatively good ventilation much of the time.

Temperatures in the project area are generally very moderate with average daily temperatures ranging from about 70°F to 84°F. The extreme minimum temperature recorded at the nearby Honolulu International Airport is 53°F, while the extreme maximum temperature is 95°F. This area of Oahu is one of the drier locations in the state with rainfall often highly variable from one year to the next. Average annual rainfall amounts to about 18 inches with summer months being the driest.

The present air quality of the project area appears to be reasonably good based on nearby air quality monitoring data. Air quality data from the nearest monitoring stations operated by the Hawaii Department of Health suggest that all national air quality standards are currently being met. It is possible, however, that occasional exceedances of the more stringent state standards for carbon monoxide may occur near congested roadway intersections.

If the proposed project is given the necessary approvals to proceed, it may be inevitable that some short- and/or long-term impacts on air quality will occur either directly or indirectly as a consequence of project construction and use. Short-term impacts from fugitive dust will likely occur during project construction phases. To a lesser extent, exhaust emissions from stationary and mobile construction equipment, from the disruption of traffic, and from workers' vehicles may also affect air quality during the period of construction. State air pollution control regulations require that there be no visible fugitive dust emissions at the property line. Hence, an effective dust control plan must be implemented to ensure compliance with state regulations. Fugitive dust emissions can be controlled to a large extent by watering of active work areas, using wind screens, keeping adjacent paved

roads clean, and by covering of open-bodied trucks. Other dust control measures could include limiting the area that can be disturbed at any given time and/or mulching or chemically stabilizing inactive areas that have been worked. Paving and landscaping of project areas early in the construction schedule will also reduce dust emissions. Monitoring dust at the project boundary during the period of construction could be considered as a means to evaluate the effectiveness of the project dust control program. Exhaust emissions can be mitigated by moving construction equipment and workers to and from the project site during off-peak traffic hours.

After construction, motor vehicles coming to and from the proposed development will result in a long-term increase in air pollution emissions in the project area. To assess the impact of emissions from these vehicles, a computer modeling study was undertaken to estimate current ambient concentrations of carbon monoxide at intersections in the project vicinity and to predict future levels both with and without the proposed project. During worst-case traffic and atmospheric dispersion conditions, model results indicated that present 1-hour and 8-hour carbon monoxide concentrations are within both the state and the national ambient air quality standards. In the year 2021 without the project, carbon monoxide concentrations were predicted to generally decrease (improve) somewhat in the project area, and worst-case concentrations should remain well within air quality standards. With the project in the year 2021, project-related traffic would result in slightly higher carbon monoxide concentrations compared to the without-project case at some locations, but worst-case concentrations should remain well within air quality standards. Therefore, implementing mitigation measures for traffic-related air quality impacts is unnecessary and unwarranted.

Depending on the demand levels, long-term impacts on air quality are also possible due to indirect emissions associated with a development's electrical power and solid waste disposal requirements. Quantitative estimates of these potential impacts were not made, but based on the estimated demand levels and emission rates involved, any impacts will likely be negligible. Nevertheless, incorporating energy conservation design features and promoting conservation and recycling programs within the proposed development could serve to further reduce any associated impacts.

2.0 INTRODUCTION

CP Kam Properties LLC is proposing to develop the Live-Work-Play ʻAiea Project on approximately 14 acres of land which was formerly the site of the Kamehameha Drive-In. The project site is bound be Moanalua Road to the north, Kaonohi Street to the east, Westridge Shopping Center to the south, and the Harbor Pointe condominium project and St. Timothy's Episcopal Church to the west (see Figure 1 for project location). The development will include up to 1,500 residential units; commercial space for retail shops, restaurants and offices; and potentially a 150-room small kamaaina hotel current and proposed zoning does not allow hotel use at this time). Construction of the project is expected to occur in phases commencing during 2013 and full build out is anticipated by 2021.

The purpose of this study is to: 1) describe existing air quality in the project area; and 2) to assess the potential short- and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities as

planned. Measures to mitigate potential project impacts are suggested where possible and appropriate.

3.0 AMBIENT AIR QUALITY STANDARDS

Ambient concentrations of air pollution are regulated by both national and state ambient air quality standards (AAQS). National AAQS are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, national and state AAQS have been established for particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. The state has also set a standard for hydrogen sulfide. National AAQS are stated in terms of both primary and secondary standards for most of the regulated air pollutants. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated air pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given air pollutant for one or more averaging times to prevent harmful effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow a specified number of exceedances each year.

The Hawaii AAQS are in some cases considerably more stringent than the comparable national AAQS. In particular, the Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit. On the other hand, the current Hawaii AAQS for sulfur dioxide are probably less stringent than the national standards. During the early part of 2010, the national primary annual and 24-hour standards for sulfur dioxide were revoked in favor of a new national 1-hour standard which is considered to be more stringent than the Hawaii short-term standards. The Hawaii AAQS for sulfur dioxide have not yet been updated to bring them in line with the national standards.

In 1993, the state revised its particulate standards to follow those set by the federal government. During 1997, the federal government again revised its standards for particulate, but the new standards were challenged in federal court. A Supreme Court ruling was issued during February 2001, and as a result, the new standards for particulate were finally implemented during 2005.

To date, the Hawaii Department of Health has not updated the state particulate standards.

In September 2001, the state vacated the state 1-hour standard for ozone and an 8-hour standard was adopted that was the same as the national standard. During 2008, the national standard for ozone was again revised and made more stringent. The Hawaii standard for ozone has not yet been amended to follow the national standard.

During the latter part of 2008, EPA revised the standard for lead making the standard more stringent. So far, the Hawaii Department of Health has not revised the corresponding state standard for lead.

During early 2010, a national 1-hour primary standard for nitrogen dioxide was implemented. To date, Hawaii has not promulgated a 1-hour standard for nitrogen dioxide, but the Hawaii annual standard for this pollutant is more stringent than the national annual standard.

4.0 REGIONAL AND LOCAL CLIMATOLOGY

Regional and local climatology significantly affects the air quality of a given location. Wind, temperature, atmospheric turbulence, mixing height and rainfall all influence air quality. Although the climate of Hawaii is relatively moderate throughout most of the state, significant differences in these parameters may occur from one location to another. Most differences in regional

and local climates within the state are caused by the mountainous topography.

Hawaii lies well within the belt of northeasterly trade winds generated by the semi-permanent Pacific high pressure cell to the north and east. On the island of Oahu, the Koolau and Waianae Mountain Ranges are oriented almost perpendicular to the trade winds, which accounts for much of the variation in the local climatology of the island. The site of the proposed project is located on the leeward side of the Koolau Range and adjacent to Pearl Harbor.

Wind frequency data for Honolulu International Airport (HIA), which is located about 4 miles to the south of the project site, are given in Table 2. These data can be expected to be semi representative of the project area. Wind frequency for HIA show that the annual prevailing wind direction for this area of Oahu is east northeast. On an annual basis, 34.7 percent of the time the wind is from this direction, and more than 70 percent of the time the wind is in the northeast quadrant. Winds from the south are infrequent occurring only a few days during the year and mostly in winter in association with kona storms. Wind speeds average about 10 knots (12 mph) and mostly vary between about 5 and 15 knots (6 and 17 mph).

Air pollution emissions from motor vehicles, the formation of photochemical smog and smoke plume rise all depend in part on air temperature. Colder temperatures tend to result in higher emissions of contaminants from automobiles but lower concentrations of photochemical smog and ground-level concentra-

tions of air pollution from elevated plumes. In Hawaii, the annual and daily variation of temperature depend to a large degree on elevation above sea level, distance inland and exposure to the trade winds. Average temperatures at locations near sea level generally are warmer than those at higher elevations. Areas exposed to the trade winds tend to have the least temperature variation, while inland and leeward areas often have the most. The project's near coastal, leeward location results in a relatively moderate temperature profile compared to other locations around Oahu and the state. Based on more than 30 years of data collected at Honolulu International Airport, average annual daily minimum and maximum temperatures in the project area are 70°F and 84°F, respectively [1]. The extreme minimum temperature on record is 53°F, and the extreme maximum is 95°F.

Small scale, random motions in the atmosphere (turbulence) cause air pollutants to be dispersed as a function of distance or time from the point of emission. Turbulence is caused by both mechanical and thermal forces in the atmosphere. Mechanical forces occur when the air moves over or around surface roughness elements. Thermal forces occur due to heating or cooling of the air at the earth’s surface. Turbulence is oftentimes measured and described in terms of Pasquill-Gifford stability class. Stability class 1 is the most turbulent and class 6 the least. Thus, air pollution dissipates the best during stability class 1 conditions and the worst when stability class 6 prevails. In the ‘Aiea area, stability class 5 or 6 is generally the highest stability class that occurs, developing during clear, calm nighttime or early morning hours when temperature inversions form due to radiational cooling. Stability classes 1 through 4 occur during the daytime, depending mainly on the amount of cloud cover and incoming solar radiation and the onset and extent of the sea breeze.

Mixing height is defined as the height above the surface through which relatively vigorous vertical mixing occurs. Mixing heights in Hawaii typically are above 3000 feet (1000 meters). Low mixing heights can result in high ground-level air pollution concentrations because contaminants emitted from or near the surface can become trapped within the mixing layer. In Hawaii, mixing heights tend to be high because of mechanical mixing caused by the trade winds and because of the temperature moderating effect of the surrounding ocean. However, low mixing heights may sometimes occur at inland locations and even at times along coastal areas early in the morning following a clear, cool, windless night. Coastal areas also may experience low mixing levels during sea breeze conditions when cooler ocean air rushes in over warmer land.

Rainfall can have a beneficial affect on the air quality of an area in that it helps to suppress fugitive dust emissions, and it also may "washout" gaseous contaminants that are water soluble. Rainfall in Hawaii is highly variable depending on elevation and on location with respect to the trade wind. The ʻAiea area is moderately dry due to its leeward and near sea level location. Average annual rainfall at nearby Honolulu International Airport amounts to about 18 inches [1]. Most of the rainfall usually occurs during the winter months. Monthly rainfall may vary from as little as a trace to as much as 15 inches or more.

5.0 PRESENT AIR QUALITY

Present air quality in the project area is mostly affected by air pollutants from motor vehicles, industrial sources, and to a lesser extent by natural sources. Table 3 presents an air pollutant emission summary for the island of Oahu for calendar year 1993. This is the most recent information available. The emission rates shown in the table pertain to manmade emissions only, i.e., emissions from natural sources are not included. As suggested in the table, much of the particulate emissions on Oahu originate from area sources, such as the mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively by point sources, such as power plants and refineries. Nitrogen oxides emissions emanate predominantly from industrial point sources, although area sources (mostly motor vehicle traffic) also contribute a significant share. The majority of carbon monoxide emissions occur from area sources (motor vehicle traffic), while hydrocarbons are emitted mainly from point sources. Based on previous emission inventories that have been reported for Oahu, emissions of particulate and nitrogen oxides may have increased during the past several years, while emissions of sulfur oxides, carbon monoxide and hydrocarbons probably have declined.

There are several major arterial roadways in the vicinity of the project area. These include the H-1 Freeway, Kamehameha Highway and Moanalua Road. These roadways carry heavy levels of vehicle traffic during peak traffic hours, and emissions from motor vehicles using these roadways, primarily nitrogen oxides and carbon monoxide, may affect air quality in the project area at times.

The nearest major industrial source of air pollution is the Hawaiian Electric Waiau Power Plant located along Kamehameha Highway about 1 mile west of the project site. Several large sources of industrial air pollution are also located in the Campbell Industrial Park, which is located about 11 miles to the southwest of the project site at Barbers Point. Industries currently operating there include the Chevron and BHP refineries, H-Power, Kalaeloa Partners, Applied Energy Services, Hawaiian Cement and others. These industries emit large amounts of sulfur dioxide, nitrogen oxides, particulate matter, carbon monoxide and other air pollutants. Prevailing winds from the east or northeast will carry these emissions away from the area most of the time.

Until a few years ago, air pollution in the project area originating from agricultural sources could mainly be attributed to sugar cane operations occurring on the Ewa Plain. Emissions from both the sugar mill and the canefield operations in the area have now been eliminated with the closure of the Oahu Sugar Company and much of the former sugarcane lands are currently being used as pastureland, for diversified agriculture or for urban and suburban development.

Natural sources of air pollution emissions that also could affect the project area but cannot be quantified very accurately include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps volcanoes on the island of Hawaii.

The State Department of Health operates a network of air quality monitoring stations at various locations on Oahu. Each station,

however, typically does not monitor the full complement of air quality parameters. Table 4 shows annual summaries of air quality measurements that were made nearest to the project area for several of the regulated air pollutants for the period 2005 through 2009. These are the most recent data currently available.

During the 2005-2009 period, sulfur dioxide was monitored by the State Department of Health at an air quality station located in downtown Honolulu. Concentrations monitored were consistently low compared to the state and federal standards. As indicated in Table 4, the 3-hour and 24-hour standards for sulfur dioxide are defined in terms of the annual second-highest concentration. Annual second-highest 3-hour concentrations ranged from 0.011 to 0.022 parts per million (ppm), while the annual second-highest 24-hour concentrations ranged from 0.002 to 0.007 ppm. These concentrations represent 5 percent or less of the allowable values. Annual average concentrations were only 0.001 ppm. There were no exceedances of the state/national 3-hour or 24-hour AAQS for sulfur dioxide during the 5-year period. Data pertaining to the new 1-hour standard have not yet been reported.

Particulate matter less than 10 microns in diameter (PM-10) is measured at the Pearl City monitoring station. Annual second-highest 24-hour PM-10 concentrations (which are most relevant to the standards) ranged from 45 to 99 $\mu g/m^3$ between 2005 and 2009 with several of these flagged due to fireworks on New Year's Eve. These concentrations represent up to 66 percent of the standards. Average annual concentrations ranged from 15 to 20 $\mu g/m^3$. All values reported were within the state and national AAQS.

Particulate matter less than 2.5 microns in diameter (PM-2.5) measured at the Pearl City monitoring station had annual 98th percentile 24-hour concentrations ranging from 7 to 13 $\mu g/m^3$ between 2005 and 2009. Average annual concentrations ranged from 4 to 5 $\mu g/m^3$. These values are less than about 40 percent of the allowable concentrations. All values reported were within the state and national AAQS.

Carbon monoxide measurements were also made at the Honolulu monitoring station. The annual second-highest 1-hour concentrations ranged from 1.6 to 2.7 ppm. The annual second-highest 8-hour concentrations ranged from 0.9 to 1.4 ppm. These values are well within the standards, and no exceedances of the state or national 1-hour or 8-hour AAQS were reported.

Nitrogen dioxide is monitored by the Department of Health at the Kapolei monitoring station (about 10 miles west of the project area). Annual average concentrations of this pollutant ranged from 0.004 to 0.005 ppm, safely inside the state and national AAQS.

The nearest available ozone measurements were obtained at Sand Island (about 6 miles south of the project area). The fourth-highest 8-hour concentrations (which are most relevant to the standard) for the period 2005 through 2009 ranged between 0.033 and 0.048 ppm, well inside the state and federal standards. The 8-hour standard for ozone did not exist prior to 2002. Prior to 2002, the now obsolete state 1-hour standard was typically exceeded several times each year.

Although not shown in the table, the nearest and most recent measurements of ambient lead concentrations that have been reported were made at the downtown Honolulu monitoring station between 1996 and 1997. Average quarterly concentrations were near or below the detection limit, and no exceedances of the state AAQS were recorded. Monitoring for this parameter was discontinued during 1997.

Based on the data and discussion presented above, it appears likely that the State of Hawaii AAQS for sulfur dioxide, nitrogen dioxide, particulate matter, ozone and lead are currently being met in the project area. While carbon monoxide measurements at the Honolulu monitoring station suggest that concentrations at that location are within the state and national standards, local "hot spots" may exist near traffic-congested intersections. The potential for this within the specific project area is examined later in this report.

6.0 SHORT-TERM IMPACTS OF PROJECT

Short-term direct and indirect impacts on air quality could potentially occur due to project construction. For a project of this nature, there are two potential types of air pollution emissions that could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation; and (2) exhaust emissions from on-site construction equipment. Indirectly, there also could be short-term impacts from slow-moving construction equipment traveling to and from the project site, from a

temporary increase in local traffic caused by commuting construction workers, and from the disruption of normal traffic flow caused by lane closures of adjacent roadways.

Fugitive dust emissions may arise from the grading and dirt-moving activities associated with site clearing and preparation work. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately. This is because of its elusive nature of emission and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [2] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50. Uncontrolled fugitive dust emissions at the project site would likely be somewhere near that level, depending on the amount of rainfall that occurs. In any case, State of Hawaii Air Pollution Control Regulations [3] prohibit visible emissions of fugitive dust from construction activities at the property line. Thus, an effective dust control plan for the project construction phase is essential.

Adequate fugitive dust control can usually be accomplished by the establishment of a frequent watering program to keep bare-dirt surfaces in construction areas from becoming significant sources of dust. In dust-prone or dust-sensitive areas, other control measures such as limiting the area that can be disturbed at any given time, applying chemical soil stabilizers, mulching and/or using wind screens may be necessary. Control regulations further

stipulate that open-bodied trucks be covered at all times when in motion if they are transporting materials that could be blown away. Haul trucks tracking dirt onto paved streets from unpaved areas is often a significant source of dust in construction areas. Some means to alleviate this problem, such as road cleaning or tire washing, may be appropriate. Paving of parking areas and/or establishment of landscaping as early in the construction schedule as possible can also lower the potential for fugitive dust emissions. Monitoring dust at the project property line could be considered to quantify and document the effectiveness of dust control measures.

On-site mobile and stationary construction equipment also will emit air pollutants from engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the annual standard for nitrogen dioxide is not likely to be violated by short-term construction equipment emissions which may occur for only a few months or less. Also, the new short-term (1-hour) standard for nitrogen dioxide is based on a three-year average; thus it is unlikely that relatively short-term construction emissions would exceed the standard. Carbon monoxide emissions from diesel engines are low and most likely will be relatively insignificant compared to vehicular emissions on nearby roadways.

Project construction activities will also likely obstruct the normal flow of traffic at times to such an extent that overall vehicular emissions in the project area may temporarily increase. The only means to alleviate this problem will be to attempt to keep roadways open during peak traffic hours and to move heavy

construction equipment and workers to and from construction areas during periods of low traffic volume. Thus, most potential short-term air quality impacts from project construction can be mitigated.

7.0 LONG-TERM IMPACTS OF PROJECT

7.1 Roadway Traffic

After construction is completed, use of the proposed facilities will result in increased motor vehicle traffic in the project area, potentially causing long-term impacts on ambient air quality. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides and other contaminates.

Federal air pollution control regulations require that new motor vehicles be equipped with emission control devices that reduce emissions significantly compared to vehicles manufactured 10 to 20 years ago. In 1990, President Bush signed into law the Clean Air Act Amendments. This legislation required further emission reductions, which have been phased in since 1994. More recently, additional restrictions were signed into law during the Clinton administration, and these began to take effect during the past decade. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles leave the state's roadways. It is estimated that carbon monoxide emissions, for example, will go down by an average of about 10 to 20 percent per vehicle during the next 10 years due to the replacement of older vehicles with newer models.

To evaluate the potential long-term indirect ambient air quality impact of increased roadway traffic associated with a project such as this, computerized emission and atmospheric dispersion models can be used to estimate ambient carbon monoxide concentrations along roadways leading to and from the project. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the pollutants generated by motor vehicles. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem that can be addressed locally to some extent, whereas nitrogen oxides air pollution most often is a regional issue that cannot be addressed by a single new development.

For this project, three scenarios were selected for the carbon monoxide modeling study: (1) year 2010 with present conditions, (2) year 2021 without the project, and (3) year 2021 with the project. For both of the future scenarios studied, it was assumed that rail transit would not be available to ensure that this study evaluated the worst-case scenario. To begin the modeling study of the three scenarios, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic queuing. For this study, several of the key intersections identified in the traffic study were also selected for air quality analysis. These included the following intersections:

- Moanalua Road at Pearlridge Elementary School
- Moanalua Road at Kaonohi Street
- Kamehameha Highway at Kaonohi Street

- Kamehameha Highway at Kanuku Street
- Kamehameha Highway at Hekaha Street
- Kamehameha Highway at Kaahumanu Street

The traffic impact report for the project [4] describes the projected future traffic conditions and laneage configurations of these intersections in detail. In performing the air quality impact analysis, it was assumed that all recommended traffic mitigation measures would be implemented.

The main objective of the modeling study was to estimate maximum 1-hour average carbon monoxide concentrations for each of the three scenarios studied. To evaluate the significance of the estimated concentrations, a comparison of the predicted values for each scenario can be made. Comparison of the estimated values to the national and state AAQS was also used to provide another measure of significance.

Maximum carbon monoxide concentrations typically coincide with peak traffic periods. The traffic impact assessment report evaluated morning and afternoon peak traffic periods. These same periods were evaluated in the air quality impact assessment.

The EPA computer model MOBILE6.2 [5] was used to calculate vehicular carbon monoxide emissions for each year studied. One of the key inputs to MOBILE6.2 is vehicle mix. Unless very detailed information is available, national average values are typically assumed, which is what was used for this study. Based on national average vehicle mix figures, the present vehicle mix in the project area was estimated to be 35.4% light-duty gasoline-powered

automobiles, 51.7% light-duty gasoline-powered trucks and vans, 3.6% heavy-duty gasoline-powered vehicles, 0.2% light-duty diesel-powered vehicles, 8.6% heavy-duty diesel-powered trucks and buses, and 0.5% motorcycles. For the future scenarios studied, the vehicle mix was estimated to change slightly with fewer light-duty gasoline-powered automobiles and more light-duty gasoline-powered trucks and vans. This has been the trend in the United States for the past several years.

Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively. These are conservative assumptions since morning/afternoon ambient temperatures will generally be warmer than this, and emission estimates given by MOBILE6.2 generally have an inverse relationship to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE6.2, these data were then input to an atmospheric dispersion model. EPA air quality modeling guidelines [6] currently recommend that the computer model CAL3QHC [7] be used to assess carbon monoxide concentrations at roadway intersections, or in areas where its use has previously been established, CALINE4 [8] may be used. Until a few years ago, CALINE4 was used extensively in Hawaii to assess air quality impacts at roadway intersections. In December 1997, the California Department of Transportation recommended that the intersection mode of CALINE4 no longer be used because research indicated that the model had become outdated. Studies have shown that CALINE4 may tend to over-predict maximum concentrations in some situations. Therefore, CAL3QHC was used for the subject analysis.

CAL3QHC was developed for the U.S. EPA to simulate vehicular movement, vehicle queuing and atmospheric dispersion of vehicular emissions near roadway intersections. It is designed to predict 1-hour average pollutant concentrations near roadway intersections based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Although CAL3QHC is intended primarily for use in assessing atmospheric dispersion near signalized roadway intersections, it can also be used to evaluate unsignalized intersections. This is accomplished by manually estimating queue lengths and then applying the same techniques used by the model for signalized intersections. Currently, one of the study intersections is unsignalized, Moanalua Road at Pearlridge Elementary School. For the future with-project scenario, in accordance with the traffic report, this intersection was assumed to become signalized.

Input peak-hour traffic data was obtained from the traffic study cited previously. This included vehicle approach volumes, saturation capacity estimates, intersection laneage and signal timings (where applicable). All emission factors that were input to CAL3QHC for free-flow traffic on roadways were obtained from MOBILE6.2 based on assumed free-flow vehicle speeds corresponding to the posted speed limits (25 to 35 mph depending on location).

Model roadways were set up to reflect roadway geometry, physical dimensions and operating characteristics. Concentrations predicted by air quality models generally are not considered valid

within the roadway-mixing zone. The roadway-mixing zone is usually taken to include 3 meters on either side of the traveled portion of the roadway and the turbulent area within 10 meters of a cross street. Model receptor sites were thus located at the edges of the mixing zones near all intersections that were studied for all three scenarios. This implies that pedestrian sidewalks either already exist or are assumed to exist in the future. All receptor heights were placed at 1.8 meters above ground to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for the morning cases, while atmospheric stability category 4 was assumed for the afternoon cases. These are the most conservative stability categories that are generally used for estimating worst-case pollutant dispersion within urban or suburban areas for these periods. A surface roughness length of 100 cm and a mixing height of 1000 meters were used in all cases. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration. Concentration estimates were calculated at wind directions of every 5 degrees.

Existing background concentrations of carbon monoxide in the project vicinity are believed to be at low levels. Thus, background contributions of carbon monoxide from sources or roadways not directly considered in the analysis were accounted for by adding a background concentration of 1.0 ppm to all predicted (modeled) concentrations for 2010. Although increased

traffic is expected to occur within the project area during the next several years with or without the project, background carbon monoxide concentrations may not change significantly since individual emissions from motor vehicles are forecast to decrease with time (offsetting emissions from traffic growth). Hence, a background value of 1.0 ppm was assumed to persist for the future scenarios studied.

Predicted Worst-Case 1-Hour Concentrations

Table 5 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated worst-case carbon monoxide concentrations are presented in the table for three scenarios: year 2010 with existing traffic, year 2021 without the project, and year 2021 with the project. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

As indicated in the table, the highest estimated 1-hour concentration within the project vicinity for the present (2010) case was 6.3 ppm. This was projected to occur during the morning peak traffic hour near the intersection of Moanalua Road and Kaonohi Street. Concentrations at other locations and times studied were 5.3 ppm or lower. All predicted worst-case 1-hour concentrations for the 2010 scenario were within both the national AAQS of 35 ppm and the state standard of 9 ppm.

In the year 2021 without the proposed project, the highest worst-case 1-hour concentration was again predicted to occur during the morning at the intersection of Moanalua Road and Kaonohi Street. A value of 5.4 ppm was predicted to occur at this location and time. Peak-hour worst-case values at the other locations and times studied for the 2021 without project scenario ranged between 2.5 and 4.8 ppm. Compared to the existing case, concentrations generally decreased somewhat at all locations studied. Worst-case concentrations for this scenario remained well within the state and national standards.

In the year 2021 with the proposed project, the predicted highest worst-case 1-hour concentration occurred again during the morning at the intersection of Moanalua Road and Kaonohi Street with a value of 5.5 ppm. Other concentrations for this scenario ranged between 3.1 and 5.3 ppm. Although the predicted concentrations increased slightly at all of the locations studied compared to the without project scenario, the values remained well within the state and federal standards.

Predicted Worst-Case 8-Hour Concentrations

Worst-case 8-hour carbon monoxide concentrations were estimated by multiplying the worst-case 1-hour values by a persistence factor of 0.5. This accounts for two factors: (1) traffic volumes averaged over eight hours are lower than peak 1-hour values, and (2) meteorological conditions are more variable (and hence more favorable for dispersion) over an 8-hour period than they are for a single hour. Based on monitoring data, 1-hour to 8-hour persistence factors for most locations generally vary from 0.4 to 0.8 with 0.6 being the most typical. One study [9] based on modeling

concluded that 1-hour to 8-hour persistence factors could typically be expected to range from 0.4 to 0.5. EPA guidelines [10] recommend using a value of 0.7 unless a locally derived persistence factor is available. Recent monitoring data for locations on Oahu reported by the Department of Health [11] suggest that this factor may range between about 0.2 and 0.6 depending on location and traffic variability. Considering the location of the project and the traffic pattern for the area, a 1-hour to 8-hour persistence factor of 0.5 will likely yield reasonable estimates of worst-case 8-hour concentrations.

The resulting estimated worst-case 8-hour concentrations are indicated in Table 6. For the 2010 scenario, the estimated worst-case 8-hour carbon monoxide concentrations for the six locations studied ranged from 2.0 ppm at the Moanalua Road/Pearlridge School intersection to 3.2 ppm at the Moanalua Road/Kaonohi Street intersection. The estimated worst-case concentrations for the existing case were within both the state standard of 4.4 ppm and the national limit of 9 ppm.

For the year 2021 without project scenario, worst-case concentrations ranged between 1.8 and 2.7 ppm, with the highest concentration occurring at Moanalua Road and Kaonohi Street. All predicted concentrations were within the state and national standards.

For the 2021 with project scenario, worst-case concentrations were predicted to either increase slightly or remain unchanged compared to the without project case. Predicted worst-case concentrations ranged from 2.1 to 2.8 ppm with the highest concentration

occurring again at the intersection of Moanalua Road and Kaonohi Street. All predicted 8-hour concentrations for this scenario were within both the national and the state AAQS.

Conservativeness of Estimates

The results of this study reflect several assumptions that were made concerning both traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is extremely unlikely and may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above. The 8-hour estimates are also conservative in that it is unlikely that anyone would occupy the assumed receptor sites (within 3 m of the roadways) for a period of 8 hours.

7.2 Electrical Demand

The proposed project also will cause indirect air pollution emissions from power generating facilities as a consequence of electrical power usage. The annual electrical demand of the project is estimated to reach approximately 28 million kilowatt-hours [12]. Electrical power for the project will most probably be provided mainly by oil-fired generating facilities located on Oahu, but some of the project power could also come from sources burning other fuels, such as H-Power and the AES coal-fired power plant at Campbell Industrial Park, or from renewable energy resources that are currently being developed. In order to meet

the electrical power needs of the proposed project, power generating facilities may be required to burn more fuel and hence more air pollution may be emitted at these facilities. Given in Table 7 are estimates of the indirect air pollution emissions that would result from the project electrical demand assuming all power is provided by burning more fuel oil at Oahu's power plants. These values can be compared to the island-wide emission estimates for 1993 given in Table 3. The estimated indirect emissions from project electrical demand amount to less than 0.1 percent of the present air pollution emissions occurring on Oahu.

7.3 Solid Waste Disposal

Solid waste generated by the proposed development when fully completed and occupied is not expected to exceed about 15 tons per day [13]. Most project refuse will likely be hauled away and burned at the H-Power facility at Campbell Industrial Park to generate electricity. Burning of the waste to generate electricity will result in emissions of particulate, carbon monoxide and other contaminants, but these will be offset to some extent by reducing the amount of fuel oil that would be required to generate electricity for the project. Table 8 gives emission estimates assuming all project solid waste is burned at H-Power. These values can be compared to the island-wide emission estimates for 1993 given in Table 3. The estimated potential indirect emissions from project solid waste disposal demand amount to less than 0.1 percent of the present air pollution emissions occurring on Oahu.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The major potential short-term air quality impact of the project will occur from the emission of fugitive dust during construction phases. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month, depending on rainfall. To control dust, active work areas and any temporary unpaved work roads should be watered at least twice daily on days without rainfall. Use of wind screens and/or limiting the area that is disturbed at any given time will also help to contain fugitive dust emissions. Wind erosion of inactive areas of the site that have been disturbed could be controlled by mulching or by the use of chemical soil stabilizers. Dirt-hauling trucks should be covered when traveling on roadways to prevent windage. A routine road cleaning and/or tire washing program will also help to reduce fugitive dust emissions that may occur as a result of trucks tracking dirt onto paved roadways in the project area. Paving of parking areas and establishment of landscaping early in the construction schedule will also help to control dust.

During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers and from trucks traveling to and from the project. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

After construction of the proposed project is completed and it is fully occupied, carbon monoxide concentrations in the project

area will likely increase slightly due to emissions from project-related motor vehicle traffic, but worst-case concentrations should remain within both the state and the national ambient air quality standards. Implementing any air quality mitigation measures for long-term traffic-related impacts is unnecessary and unwarranted.

Any long-term impacts on air quality due to indirect emissions from supplying the project with electricity and from the disposal of waste materials generated by the project are estimated to be negligible based on the magnitudes of the estimated emissions compared to the current island-wide emissions. To further moderate any impacts, any related air pollution could likely be reduced somewhat by the promotion of energy conservation and recycling programs within the proposed development.

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Figure 1 - Project Location

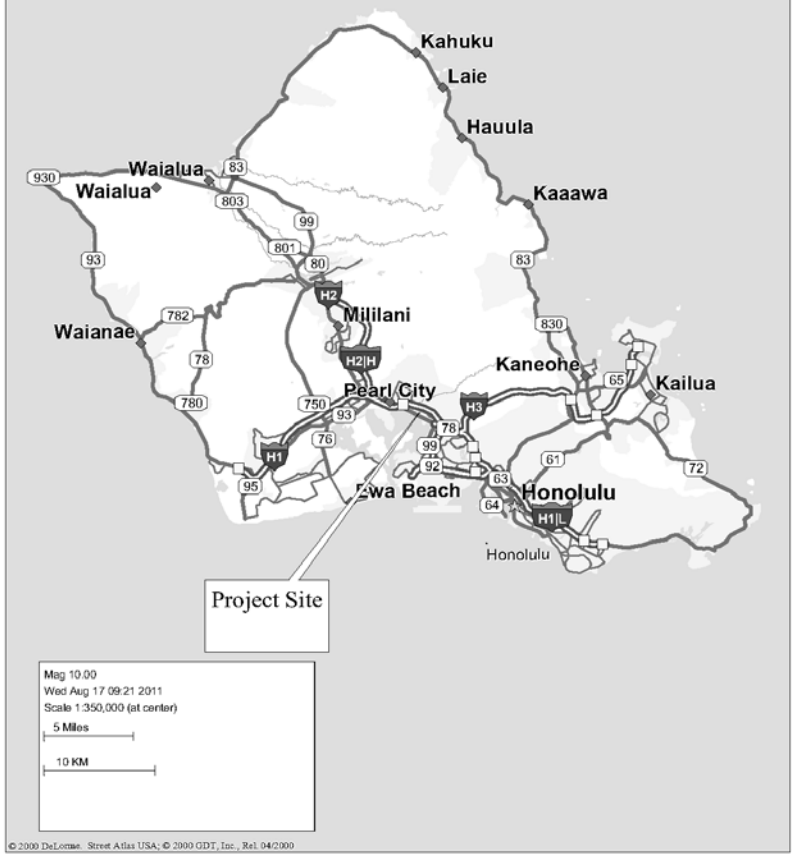

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Units	Averaging Time	Maximum Allowable Concentration		
			National Primary	National Secondary	State of Hawaii
Particulate Matter (<10 microns)	$\mu g/m^3$	Annual	-	-	50
		24 Hours	150[a]	150[a]	150[b]
Particulate Matter (<2.5 microns)	$\mu g/m^3$	Annual	15[c]	15[c]	-
		24 Hours	35[d]	35[d]	-
Sulfur Dioxide	ppm	Annual	-	-	0.03
		24 Hours	-	-	0.14[b]
		3 Hours	-	0.5[b]	0.5[b]
		1 Hour	0.075[e]	-	-
Nitrogen Dioxide	ppm	Annual	0.053	0.053	0.04
		1 Hour	0.100[f]	-	-
Carbon Monoxide	ppm	8 Hours	9[b]	-	4.4[b]
		1 Hour	35[b]	-	9[b]
Ozone	ppm	8 Hours	0.075[g]	0.075[g]	0.08[g]
Lead	$\mu g/m^3$	3 Months	0.15[h]	0.15[h]	-
		Quarter	1.5[i]	1.5[i]	1.5[i]
Hydrogen Sulfide	ppm	1 Hour	-	-	35[b]

[a] Not to be exceeded more than once per year on average over three years.
[b] Not to be exceeded more than once per year.
[c] Three-year average of the weighted annual arithmetic mean.
[d] 98th percentile value of the 24-hour concentrations averaged over three years.
[e] Three-year average of annual fourth-highest daily 1-hour maximum.
[f] 98th percentile value of the daily 1-hour maximum averaged over three years.
[g] Three-year average of annual fourth-highest daily 8-hour maximum.
[h] Rolling 3-month average.
[i] Quarterly average.

Table 2

ANNUAL WIND FREQUENCY FOR HONOLULU INTERNATIONAL AIRPORT (%)

Wind Direction	Wind Speed (knots)									Total
	0-3	4-6	7-10	11-16	17-21	22-27	28-33	34-40	>40	
N	0.5	2.5	1.3	0.5	0.0	0.0	0.0	0.0	0.0	4.8
NNE	0.3	1.2	1.6	1.5	0.2	0.0	0.0	0.0	0.0	4.7
NE	0.3	2.1	6.1	11.0	3.2	0.3	0.0	0.0	0.0	23.0
ENE	0.2	2.5	10.9	16.6	4.1	0.3	0.0	0.0	0.0	34.7
E	0.1	1.0	2.5	2.8	0.5	0.0	0.0	0.0	0.0	7.0
ESE	0.0	0.3	0.4	0.3	0.0	0.0	0.0	0.0	0.0	1.1
SE	0.0	0.3	0.8	1.0	0.1	0.0	0.0	0.0	0.0	2.2
SSE	0.1	0.4	1.2	0.7	0.1	0.0	0.0	0.0	0.0	2.4
S	0.1	0.5	1.4	0.6	0.1	0.0	0.0	0.0	0.0	2.7
SSW	0.0	0.3	0.8	0.3	0.0	0.0	0.0	0.0	0.0	1.5
SW	0.0	0.2	0.8	0.4	0.0	0.0	0.0	0.0	0.0	1.5
WSW	0.0	0.3	0.5	0.4	0.0	0.0	0.0	0.0	0.0	1.2
W	0.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.1
WNW	0.2	1.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	2.0
NW	0.4	2.3	0.8	0.1	0.0	0.0	0.0	0.0	0.0	3.8
NNW	0.5	2.3	0.8	0.2	0.0	0.0	0.0	0.0	0.0	3.8
Calm	2.5									2.5
Total	5.4	18.3	30.6	36.5	8.5	0.7	0.0	0.0	0.0	100.0

Source: Climatography of the United States No. 90 (1965-1974), Airport Climatological Summary, Honolulu International Airport, Honolulu, Hawaii, U.S. Department of Commerce, National Climatic Center, Asheville, NC, August 1978.

Table 3

AIR POLLUTION EMISSIONS INVENTORY FOR ISLAND OF OAHU, 1993

Air Pollutant	Point Sources (tons/year)	Area Sources (tons/year)	Total (tons/year)
Particulate	25,891	49,374	75,265
Sulfur Oxides	39,230	nil	39,230
Nitrogen Oxides	92,436	31,141	123,577
Carbon Monoxide	28,757	121,802	150,559
Hydrocarbons	4,160	421	4,581

Source: Final Report, "Review, Revise and Update of the Hawaii Emissions Inventory Systems for the State of Hawaii", prepared for Hawaii Department of Health by J.L. Shoemaker & Associates, Inc., 1996

Table 4

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR MONITORING STATIONS NEAREST LIVE-WORK-PLAY 'AIEA

Parameter / Location	2005	2006	2007	2008	2009
Sulfur Dioxide / Honolulu					
3-Hour Averaging Period:					
Highest Concentration (ppm)	0.029	0.016	0.021	0.011	0.023
2nd Highest Concentration (ppm)	0.022	0.014	0.018	0.011	0.021
No. of State AAQS Exceedances	0	0	0	0	0
24-Hour Averaging Period:					
Highest Concentration (ppm)	0.009	0.005	0.007	0.004	0.005
2nd Highest Concentration (ppm)	0.007	0.002	0.005	0.004	0.004
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration (ppm)	0.001	0.001	0.001	0.001	0.001
Particulate (PM-10) / Pearl City					
24-Hour Averaging Period:					
Highest Concentration ($\mu g/m^3$)	195(a)	87(a)	57(a)	73(a)	67(a)
2nd Highest Concentration ($\mu g/m^3$)	99(a)	64(a)	45(a)	55	45
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	16	15	15	18	20
Particulate (PM-2.5) / Pearl City					
24-Hour Averaging Period:					
Highest Concentration ($\mu g/m^3$)	88(a)	51(a)	9	26	23(a)
98th percentile Concentration ($\mu g/m^3$)	10	9	7	13	12
No. of State AAQS Exceedances	0	0	0	0	0
Annual Average Concentration ($\mu g/m^3$)	4	4	4	4	5
Carbon Monoxide / Honolulu					
1-Hour Averaging Period:					
Highest Concentration (ppm)	5.8	2.5	2.0	2.1	1.6
2nd Highest Concentration (ppm)	2.7	1.7	1.6	1.8	1.6
No. of State AAQS Exceedances	0	0	0	0	0
8-Hour Averaging Period:					
Highest Concentration (ppm)	1.4	1.1	1.1	1.0	0.9
2nd Highest Concentration (ppm)	1.4	1.1	1.0	1.0	0.9
No. of State AAQS Exceedances	0	0	0	0	0
Nitrogen Dioxide / Kapolei					
Annual Average Concentration (ppm)	0.005	0.005	0.005	0.004	0.004
Ozone / Sand Island					
8-Hour Averaging Period:					
Highest Concentration (ppm)	0.047	0.042	0.035	0.048	0.049
4th Highest Concentration (ppm)	0.046	0.042	0.033	0.043	0.048
No. of State AAQS Exceedances	0	0	0	0	0

(a) Data flagged due to fireworks.

Source: State of Hawaii Department of Health, "Annual Summaries, Hawaii Air Quality Data, 2005 - 2009"

Table 5

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR LIVE-WORK-PLAY ʻAIEA (parts per million)

Roadway Intersection	Year/Scenario					
	2010/Present		2021/Without Project		2021/With Project	
	AM	PM	AM	PM	AM	PM
Moanalua Road at Pearlridge School	4.1	2.9	3.7	2.5	5.3	3.1
Moanalua Road at Kaonohi Street	6.3	4.8	5.4	4.2	5.5	4.3
Kamehameha Highway at Kaonohi Street	5.1	5.3	4.3	4.7	4.8	4.8
Kamehameha Highway at Kanuku Street	4.5	4.5	4.0	4.0	4.2	4.1
Kamehameha Highway at Hekaha Street	5.1	4.9	4.8	4.0	4.9	4.1
Kamehameha Highway at Kaahumanu Street	5.2	4.7	4.5	3.9	4.7	4.0

Hawaii State AAQS: 9
National AAQS: 35

Note: 2021 with and without project scenarios assume no rail so as to represent a worst case.

Table 6

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS ALONG ROADWAYS NEAR LIVE-WORK-PLAY ʻAIEA (parts per million)

Roadway Intersection	Year/Scenario		
	2010/Present	2021/Without Project	2021/With Project
Moanalua Road at Pearlridge School	2.0	1.8	2.6
Moanalua Road at Kaonohi Street	3.2	2.7	2.8
Kamehameha Highway at Kaonohi Street	2.6	2.4	2.4
Kamehameha Highway at Kanuku Street	2.2	2.0	2.1
Kamehameha Highway at Hekaha Street	2.6	2.4	2.4
Kamehameha Highway at Kaahumanu Street	2.6	2.2	2.4

Hawaii State AAQS: 4.4
National AAQS: 9

Note: 2021 with and without project scenarios assume no rail so as to represent a worst case.

Table 7

ESTIMATED INDIRECT AIR POLLUTION EMISSIONS FROM LIVE-WORK-PLAY 'AIEA ELECTRICAL DEMAND[a]

Air Pollutant	Emission Rate (tons/year)
Particulate	1
Sulfur Dioxide	10
Carbon Monoxide	1
Volatile Organics	<1
Nitrogen Oxides	4

[a]Based on U.S. EPA emission factors for utility boilers [2]. Assumes electrical demand of 28 million kilowatt-hrs per year and low-sulfur oil used to generate power.

Table 8

ESTIMATED INDIRECT AIR POLLUTION EMISSIONS FROM LIVE-WORK-PLAY 'AIEA SOLID WASTE DISPOSAL DEMAND[a]

Air Pollutant	Emission Rate (tons/year)
Particulate	<1
Sulfur Dioxide	1
Carbon Monoxide	6
Nitrogen Oxides	14
Lead	<1

[a]Assumes solid waste disposal demand of 15 tons per day and that solid waste is burned in a refuse-derived fuel-fired power plant equipped with spray dryer and fabric filter. Emission rates based on U.S. EPA emission factors for refuse-derived fuel-fired combustors [2].

Appendix H

Preliminary Engineering Report

PRELIMINARY ENGINEERING REPORT
LIVE WORK PLAY AIEA
AIEA, OAHU, HAWAII

December 14, 2011
Revised July 31, 2012

Prepared for:

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PRELIMINARY ENGINEERING REPORT

LIVE WORK PLAY AIEA

Aiea, Oahu, Hawaii

Prepared for

Robertson Properties Group

Prepared by
Austin, Tsutsumi & Associates, Inc.
Civil Engineers • Surveyors
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December 14, 2011

Revised July 31, 2012

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AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

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PRELIMINARY ENGINEERING REPORT
FOR
LIVE WORK PLAY AIEA
PEARL CITY, OAHU, HAWAII

I. INTRODUCTION

The purpose of this report is to review the preliminary engineering design for the proposed Live Work Play Aiea community in Pearl City, Oahu, Hawaii. This report evaluates the existing site conditions and presents the proposed preliminary grading, drainage, roadway, electrical, water, and sewer improvements.

II. PROPOSED PROJECT

A. Location

The proposed Live Work Play Aiea community site is located in Pearl City Hawaii and has the following Tax Map Key: (1) 9-8-013: 013. The site is located at the southwest corner of the Moanalua Road/Kaonohi Street Intersection. Harbor Pointe condominiums and St. Timothy's Episcopal Church border the site to the west, Moanalua Road to the north, Kaonohi Street to the southeast, and Westridge Shopping Center to the south. The 14-acre property was previously developed as a drive-in movie theater and currently is used as a swap-meet venue three days a week. Refer to Exhibit 1 for Location and Vicinity Map.

B. Project Alternatives

For the purpose of comparison, this report provides information regarding the Live Work Play Aiea (Mixed Use) preferred alternative and two (2) alternative development plan scenarios.

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Live Work Play Aiea (Mixed Use, Preferred Alternative)

Live Work Play Aiea will be a mixed-use community consisting of up to 1,500 residential units, approximately 143,000 square feet of commercial/retail space, and approximately 80,000 square feet of office space. A “kamaaina” hotel, or possibly senior housing may be developed as an alternative use of a portion of the office space. The project proposes one (1) entrance to the community from Moanalua Road and three (3) entrances from Kaonohi Street. All existing structures on-site will be demolished, and the site will be re-graded. Refer to Exhibit 2 for Conceptual Site Plan.

Alternative Development Plan 1 (“Retail/Office-Use”)

Alternative Development Plan 1 (“Retail/Office-Use”) would include a retail and office development consisting of approximately 120,000 square feet of retail and 1,200,000 square feet of office space. The project proposes one (1) entrance to the development from Moanalua Road and two (2) entrances from Kaonohi Street. All existing structures on-site will be demolished, and the site will be re-graded.

Alternative Development Plan 2 (“Mall Expansion”)

Alternative Development Plan 2 (“Mall Expansion”) would include a shopping center development consisting of approximately 1,522,600 square feet of retail space. The project proposes one (1) entrance to the development from Moanalua Road and two (2) entrances from Kaonohi Street. All existing structures on-site will be demolished, and the site will be re-graded.

III. EXISTING CONDITIONS

A. Topography and Soil Conditions

There are three (3) single-story building structures and three (3) ticket booths on the property. Most of the site surfaces are paved. Roughly 10 percent of the site is grassed and these areas occur mostly on embankments.

The existing site was cut and filled many years ago to make a large, relatively flat area for movie viewing. Overall, the site generally slopes from north to the south (toward the ocean) with the high point occurring near the intersection of Moanalua Road and Kaonohi Street. The slopes on the main part of the site are generally between 2 and 5 percent, although steeper sections occur at the site entrances and on the embankments. Along the west side, a sloped embankment with a 2- to 10-foot drop occurs from north to south along the adjacent St. Timothy’s Episcopal Church and Harbor Pointe Condominium properties. Along the east side, there are retaining walls and an embankment with an overall drop of as much as 30 feet down to Kaonohi Street. On-site elevations range from approximately 34 feet mean sea level (MSL) at the lower Kaonohi Street entrance to approximately 97 feet MSL at the northeast corner of the property.

The Soil Survey of the Islands of Kauai, Oahu, Molokai, Maui and Lanai, State of Hawaii by the U.S. Department of Agriculture Soil Conservation Service identifies the native soil types of the area as Waipahu silty clay (WzC) and Lahaina silty clay (LaB and LaC). Refer to Exhibit 3 for Soil Survey Map.

Waipahu silty clays occur in the southeast half of the site. A typical soil profile consists of 12 inches of dark grayish-brown silty clay underlain by about 58 inches of dark-brown silty clay that is prismatic in structure. The lower part is very sticky and very plastic. Permeability is moderately slow and the Hydrologic Soil Group (HSG) is type "C". Where slopes are greater than 6 percent, the erosion hazard becomes moderate.

Lahaina silty clays occur in the northwest half of the site. A representative soil profile consists of about 15 inches of dark reddish-brown silty clay underlain by about 45 inches of dusky-red and dark reddish-brown subangular blocky silty clay and silty clay loam. The substratum is soft, weathered basic igneous rock. Permeability is moderate and the HSG is type "B". The erosion hazard is moderate on slopes greater than seven percent.

B. Infrastructure

1. Drainage

Runoff from about 80 percent of the site drains as surface flow over the paved surfaces and collects at a single grated drain inlet located in the southeastern portion of the site. The existing drain inlet connects via an 18-inch drainline to the City and County of Honolulu (C&C) Drainage System on Kaonohi Street. During heavy rain events, the single drain inlet and 18-inch drainline do not have enough capacity to convey the entire runoff from the site. Calculations show that during the 10-year storm approximately 43 cubic feet per second (cfs) of the overall 67 cfs at this inlet spills over the embankment to the northeast of the inlet and continues to C&C catch basins on Kaonohi Street.

The property manager of the swap-meet venue confirmed that the existing drain inlet does become overwhelmed during large storm events and consequently runoff overtops the concrete wall behind the drain inlet, flowing down to catch basins on Kaonohi Street. He also stated that overflow of site runoff had caused erosion and the collapse of a section of the concrete wall northeast of the drain inlet several years ago. The embankment below was subsequently lined with shotcrete to prevent further erosion of the embankment. This missing section of wall now acts as a drainage release, allowing excess runoff from the upper Drive-In site to flow down to Kaonohi Street below.

After discussing the overflow situation with the C&C Department of Planning and Permitting (DPP), they have tentatively agreed to allow the project to enlarge the existing 18-inch drainage connection to the C&C system, to allow more runoff to flow directly into their system rather than discharging it as surface flow to Kaonohi Street. Upon rezoning, a

preliminary drainage report will be submitted to DPP for review and approval.

At the eastern edge of the site (east of the grated drain inlet), including the two (2) Kaonohi Street Driveway entrances and the embankment there, runoff drains directly to Kaonohi Street as surface flow. Three (3) C&C catch basins on the west side of Kaonohi Street accept runoff from these areas. The storm drain line in Kaonohi Street is mostly 42 inches in diameter but changes to 48 inches just downstream of the site as it continues southwest toward Kamehameha Highway.

There is also a 30-inch diameter drain stub-out from the Kaonohi storm drain near the northeast corner of the site. However, it is not clear where this drain line stub routes and whom it serves. Additionally, the invert elevation at the stub connection is higher than most of the property site making it infeasible for much of the site area to drain in that direction.

While the project fronts Moanalua Road to the north, the site slopes away from Moanalua Road and no drainage flows in that direction. The two (2) C&C catch basins located along the Moanalua Road frontage only receive runoff from the off-site roadway areas.

Lastly, there is a relatively small portion of paved area in the southwest corner of the site that sheet flows south to the neighboring Westridge Shopping Center site.

Refer to Exhibit 4 for the Existing Conditions Drainage Area Map. Hydrology calculations can be found in Appendix A.

2. Water

There is an existing 12-inch cast iron water main along both the east side of Kaonohi Street and through the middle of Moanalua Road. There are also two (2) 36-inch concrete transmission water lines that run along the mauka and makai side of Moanalua Road. There are two (2) fire hydrants along Kaonohi Street (L-889 and L-886) and three (3) along Moanalua Road (L-2130, L-2132, and L-2133) that front the project site. Fire Hydrant L-889, along Kaonohi Street, has been simulated at 100 pounds per square inch (psi) of static pressure, and 71 psi of residual pressure at 2,000 gallons per minute (gpm) of flow. Fire Hydrants L-2130 and L-2133, along Moanalua Road, have both been simulated at 79 psi of static pressure, and 50 psi and 52 psi of residual pressure at 2,000 gpm of flow. The City and County of Honolulu, Board of Water Supply (BWS) confirms that the proposed mixed-use development will have a fire flow requirement of 2,000 gpm. See BWS Letter dated August 3, 2011 in Appendix B.

3. Sewer

There is a 12-inch sewer main that runs southwest along the east side of Kaonohi Street. The 12-inch sewer line increases to an 18-inch sewer line near the intersection of Kaonohi Street and Kamehameha Highway. The 18-inch sewer line connects to the Pearl City Wastewater Pump Station and then to the Waipahu Wastewater Pump Station which utilizes a double line force main. From the Waipahu Wastewater Pump Station, wastewater flows through the regional collection system to West Loch and ultimately discharges and is treated at the Honouliuli Wastewater Treatment Plant (HWWTP).

The HWWTP has a design capacity of 38 million gallons per day (mgd). As of December 2011, the plant processes approximately 26 mgd daily. Future expansion of the Honouliuli WWTP is targeted to provide a total capacity of 51 mgd.

The C&C Department of Environmental Services (ENV) is in the process of re-evaluating daily flow and system capacities of the regional wastewater collection system between Pearl City and HWWTP.

There is an existing 6-inch sewer connection stub out to the project site. The stub out is located near the southeast corner of the project site, at the property exit road.

4. Solid Waste

Existing solid waste generation for the property site is generated from the primary swap meet use. Existing solid waste is generally characterized as general commercial use waste along with some food waste due to a number of food vendors that participate at the existing swap meet operation.

5. Electrical

Hawaiian Electric Company's (HECO), Hawaiian Telecom's (HTCO), and Oceanic Time Warner Cable's (OTWC) existing facilities serving this area consist of aerial cables attached to a joint overhead pole line on the east side of Kaonohi Street. In addition, HECO and HTCO have underground ductlines, containing their respective cables, in the Moanalua Road right-of-way. In general, where OTWC does not have its own underground duct system, OTWC will enter into a leasing agreement with HTCO for space in HTCO's duct system. An overhead HECO pole line with 138 kV and 46 kV circuits is also located within the Moanalua Road right-of-way. The latter HECO facility serves the West Oahu area on a regional basis and would not likely be used to serve the project site.

C. Flood Zone

The entire site is within Flood Zone "D", defined as "Areas in which flood hazards are undetermined, but possible". The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panel number for this area is 15003C0243G. Refer to Exhibit 5 for the Flood Zone Map.

IV. PROPOSED IMPROVEMENTS

A. Grading and Drainage

Live Work Play Aiea Plan

The existing property site will be completely cleared and demolished. The site will be regraded for new building pads, parking lots, driveways, sidewalks, and landscaped areas. Retaining walls will be used where large grade changes occur, such as along Kaonohi Street. Overall grading patterns will continue to slope in a general north-south direction. All drainage improvements will be in conformance with the Department of Planning and Permitting Storm Drainage Standards which require that there be no increase in flows compared to existing conditions.

The proposed drainage system will consist of roof downspouts, drain inlets and catch basins that are connected by new underground storm drain lines. On-site runoff will generally drain toward the new curbed roadway and parking lot areas where it will be collected by the inlets and catch basins. All storm drain runoff will be routed to the C&C drainage system connection point at the southeast corner of the site. There is currently an 18-inch stub at this location; however, the size will most likely need to be increased to 30 inches to accommodate the expected flows. Previously the 18-inch stub was only able to accept a portion of the site flows while the rest overflowed to the Kaonohi Street. The proposed drainage design will capture as much of the lot runoff as possible so that surface flow to Kaonohi Street is minimized. There will be more piped flow at the connection point, but overall the flow to the C&C drainage system will be less as the proposed project is expected to have more permeable surface area (increased landscape area) than the existing condition.

As stated previously there is also an existing 30-inch stub located near the northeast corner of the site. However, this stub is not anticipated to be used due to the invert being higher than most of the site areas.

A small portion of the site (approximately 0.4 acre) that directly fronts Kaonohi Street will not be able to be picked up by the on-site storm drain system. This area will continue to drain as surface flow to Kaonohi Street similarly to existing conditions. The amount of surface flow going to Kaonohi Street is relatively small and will be reduced from existing conditions.

The southwestern corner of the site will continue to drain toward Westridge Shopping Center due to the lower elevation of the adjacent property. However, the amount of runoff flowing in this direction will also be reduced.

A portion of the site area will be taken and added to the Moanalua Road and Kaonohi Street right-of-ways (ROW) to make room for roadway widening. On Moanalua Road, the increased pavement width will result in slightly increased flows at the C&C catch basins there. On Kaonohi Street, there will be increased off-site flows; however, these increases will be off-set by the reduced on-site flows.

The overall runoff for the site will decrease under proposed conditions as shown:

Table A-1: Overall Stormwater Runoff

	Existing Condition	Proposed Condition
On-site 10-Year Storm Runoff	79.07 cfs	71.57 cfs
Overall 10-Year Storm Runoff	90.23 cfs	85.08 cfs

The reduction in flows is due to the 5 percent reduction in impervious surfaces on the proposed site. Detailed hydrology calculations can be found in Appendix A. Refer to Exhibit 6 for the Proposed Conditions Drainage Area Map.

Water quality treatment of on-site runoff will be provided per City water quality guidelines. The treatment best management practices will be designed during the building plan approval process.

Erosion control measures will be incorporated during the construction period to minimize soil loss and erosion hazards. A stabilized construction entrance will be installed at each exit from the construction site to reduce tracking of on-site soils off-site. Sediment control filters and sediment barriers will be installed over catch basin and drain inlet openings in on and off-site areas. Dust screens with silt fences will be positioned around the boundaries of the project site to detain sediment-laden runoff and prevent it from reaching off-site areas. Temporary sediment traps or basins will also be used as needed. Periodic spraying of loose soils with hydro mulch or paper mulch will be required for dust control.

Alternative Development Plan 1 ("Retail/Office-Use")

The Alternative Development Plan 1 "Retail/Office-Use" development option will contain slightly more impervious area than is proposed under the "Mixed-Use" design. If the Retail-Use option is selected, it is likely that a stormwater detention system would be needed to limit flow rates going to the C&C drainage system. An underground detention system would probably be used as opposed to an open basin due to the site constraints and the urban nature of the project.

Alternative Development Plan 2 ("Mall Expansion")

The Alternative Development Plan 2 "Mall Expansion" development option will contain slightly more impervious area than is proposed under the "Mixed-Use" design but less than the "Retail/Office-Use". If the Mall-Use option is selected, it

is likely that a stormwater detention system would be needed to limit flow rates going to the C&C drainage system. An underground detention system would probably be used for the project.

B. Water

Live Work Play Aiea Plan

Domestic water service and fire protection water will be provided by the Board of Water Supply's (BWS's) existing water system. The project will have separate waterlines that will provide domestic water – which includes irrigation water – and fire protection water. BWS will require the proposed irrigation system to be designed with a separate water service lateral for future connection to the Kalauao non-potable water system when non-potable water service becomes available.

The BWS's Water System Standards (WSS), Domestic Consumption Guidelines were used for the basis of determining the expected water demand for the project. Approximate water demands for the proposed Mixed Use Plan were estimated as follows:

- Residential: (Multi-Family High Rise) 300 gallons per day (gpd) per unit
- Hotel: 350 gpd per unit
- Retail: 120 gpd/1000 square feet
- Parks: 4,000 gpd/acre
- Public Open Space: 4,000 gpd/acre

The Total Average Daily Domestic Demand for the ultimate build-out of Live Work Play Aiea is estimated to be 540,000 gallons per day (gpd). See Appendix B for water demand calculations. The Total Maximum Day Demand is estimated to be 810,000 gpd, which is 1.5 times the project Average Day Demand. The Peak Hour Demand is estimated to be 1,125 gallons per minute (gpm), which is three times the Average Day Demand.

BWS has confirmed that the existing water system is presently adequate to accommodate the proposed Live Work Play Aiea plan. See BWS Letter dated August 3, 2011 in Appendix B.

BWS has also confirmed that the required fire flow rate is 2,000 gpm based on the Fire Flow Requirements stated in the WSS.

The domestic water system within the project site will meet the criteria set forth in the WSS. The criteria for sizing pipelines are as follows:

1. Maximum daily flow plus fire flow with a residual pressure of 20 pounds per square inch (psi) at the critical fire hydrant.

2. Peak hour flow with a minimum residual pressure of 40 psi.

3. Maximum velocity in distribution main (without fire flow) is 6 feet per second (fps).

Since the project will have separate domestic and fire waterlines, the determining pipeline sizing criteria for the domestic waterline will be Criteria 2 and 3. For the fire line, the determining criterion is Criterion 1, but without the maximum daily flow, i.e., the residual pressure at the critical hydrant will be based on the fire flow of 2,000 gpm.

The existing 12-inch cast iron water line in Kaonohi Street will be tapped near Fire Hydrant No. L-889. The domestic waterline and fire protection waterlines will be looped within the project area. See Exhibit B-1 for Preliminary Water System Improvement Plan.

BWS has noted that the static pressure at Fire Hydrant No. L-889 is 100 psi, which represents the theoretical pressure at the point of calculation with the reservoir full and no demands on the water system. BWS also noted that "in order to determine the flows that are available to the site, you will have to determine the actual field pressure by taking on-site pressure readings at various times of the day…" Upon re-zoning, field pressure readings will be taken. For the purpose of this PER, approximate pressure losses within the project's proposed water system have been calculated. Upon completion of actual field pressure readings, the available pressure within the project will be finalized.

Based on the topographic survey, the invert of the existing 12-inch waterline, at the fire hydrant connection, is at an approximate elevation of 28 feet. The highest pipe invert within the project is at approximately 80 feet. Therefore, the elevation difference between the connection point and the high point is approximately 53 feet, or 22.5 psi.

The domestic waterlines within the project are proposed to range from 4 inches to 12 inches, which will result in velocities less than the WSS maximum of 6 fps. (Upon final design, the pipeline sizes will be adjusted if needed based on the building fixture unit counts.) Based on the peak hour demand of 1,125 gpm, the headloss due to friction from the connection point to the high point is approximately 1.7 psi. Therefore, to meet the WSS criterion of a minimum pressure of 40 psi during peak hour demand, the residual pressure at the connection point should not be lower than about 64.2 psi. (64.2 psi at connection point – 22.5 psi elevation difference – 1.7 psi fiction loss = 40 psi.)

The fire lines will be 12 inches, which would result in a velocity of 5.7 fps at a fire flow of 2,000 gpm. For a fire flow of 2,000 gpm, the headloss due to friction is approximately 3.1 psi. Therefore, to meet the WSS criterion of a minimum pressure of 20 psi at the critical hydrant, the residual pressure at the connection point should not be lower than about 45.6 psi. (45.6 psi at connection point – 22.5 psi elevation difference – 3.1 psi fiction loss = 20 psi.)

Fire hydrants within the project site will be spaced a maximum of 250 feet apart, which meets the WSS for hydrant spacing.

Alternative Development Plan 1 ("Retail/Office-Use")

For the Retail/Office-Use development option, the estimated Total Average Daily Domestic Demand is 160,000 gpd, based on 1,320,000 square feet (sf) of retail and office space, at a demand of 120 gpd/sf. The corresponding peak hour demand is 333 gpm. Accordingly, the domestic waterline sizes would range from 4 inches to 6 inches. As with the Mixed-Use Plan, a 12-inch fire line would be required to provide the fire flow of 2,000 gpm.

Alternative Development Plan 2 ("Mall Expansion")

For the Mall Expansion development option, the estimated Total Average Daily Domestic Demand is 183,000 gpd, based on 1,522,600 square feet (sf) of retail space, at a demand of 120 gpd/sf. The corresponding peak hour demand is 381 gpm. Accordingly, the domestic waterline sizes would range from 4 inches to 6 inches. As with the Mixed-Use Plan, a 12-inch fire line would be required to provide the fire flow of 2,000 gpm.

Non-Potable Irrigation

For all development options, BWS will require the proposed project to be designed with a separate water service lateral for connection to the Kalauao non-potable water system when non-potable water service becomes available in the area. Irrigation flows will be computed upon refinement of the development plan and finalized during the building plan approval process.

C. Sewer

Live Work Play Aiea Plan

Estimated wastewater flows for the project were calculated according to the Department of Wastewater Management, City and County of Honolulu's "Design Standards of the Department of Wastewater Management, Volume 1, July 1993" (Design Standards). Where there was no applicable category or per capita flows included in the Design Standards, the County of Maui, Wastewater Reclamation Division's "Wastewater Flow Standards", 2004, was used to determine the wastewater contribution. The Design Average Wastewater Flow is estimated to be 417,000 gpd. (See Appendix C for wastewater calculations.) The Design Peak Flow is estimated to be 1.418 million gallons per day (mgd) or 985 gpm.

The on-site wastewater collection system will be installed within the project roads to collect wastewater from the proposed project buildings. The sewer lines will be sized to meet the requirements of the Uniform Plumbing Code. The wastewater from the project will discharge into the City's existing 12-inch sewer line that runs along the east side of Kaonohi Street.

In July 2012, ENV said that they will be installing new valves and separating sewage flows through pipes from the Pearl City WWPS and Waipahu WWPS to allow the City to continue processing applications for new sewer connections. The new valves and interim regional improvements are expected to be in place by mid 2014. According to ENV, the changes "will maximize existing capacity in a pipe from the Pearl City Pump Station by separating it from flows originating in Mililani and Waipahu, which will be directed through a pipe from the Waipahu Pump Station."

ENV stated: "This interim solution will allow timely connections for the larger construction projects proposed in the area, including The Plaza assisted living development project in Pearl City and the planned redevelopment of the old Kam Drive-In site, as well as smaller projects and individual home connections." According to ENV, sewer connection applications for projected flows of 2,000 gallons or more per day will be reviewed on a case-by-case basis and requests will be considered in relation to project size, timing, and timing of improvements to ensure appropriate flow capacity.

It is estimated that the Live Work Play Aiea community will be built out over a 13-year period with construction completed in phases. Phasing alternatives will be developed to allow Live Work Play Aiea to be aligned the City's regional wastewater collection system capacity capital improvements. For example, the first Live Work Play Aiea phase is not anticipated to start construction until 2014 at the earliest, and will include site preparation work, major roadway improvements, and limited new commercial and/or residential uses requiring sewer connections. Completion of any of the first phase commercial and/or residential uses is not anticipated until at least 2015 and it is acknowledged that occupancy and use of any commercial and/or residential uses require sewer connection approval prior to construction. Scheduling and completion of subsequent phases will need to take into account the status of the City's regional wastewater collection system capital improvements and it is acknowledged that the City reserves the right to determine the final timing and completion of their planned regional wastewater collection system capital improvements, as well as determining the process of allocating wastewater system capacity among competing projects.

The Applicant will continue to coordinate with DPP and ENV on the phasing of Live Work Play Aiea and identifying needed improvements to the regional wastewater collection system to accommodate the full build-out of Live Work Play Aiea.

Alternative Development Plan 1 ("Retail/Office-Use")

The Design Average Wastewater Flow for the Retail/Office-Use is estimated to be 223,000 gpd. (See Appendix C for wastewater calculations.) The Design Peak Flow is estimated to be 0.633 mgd or 440 gpm.

Alternate Development Plan 2 ("Mall Expansion")

The Design Average Wastewater Flow for the shopping center use is estimated to be 209,000 gpd. (See Appendix C for wastewater calculations.) The Design Peak Flow is estimated to be 0.586 mgd or 407 gpm.

D. Solid Waste

Live-Work-Play Aiea Plan

Estimated Total Solid Waste, H-Power from Solid Waste, Total Solid Waste to the Landfill and Total Recycled Material for the project were calculated based on research conducted for similar project uses from the Center for Sustainable Systems, CA.gov and Waste Characterization Study, Beck 2006 (see Appendix D for Preliminary Solid Waste Generation). The estimated Total Solid Waste calculations are based upon a factor that is applied to the square footage for retail, commercial, grocery, office and hotel (if applicable) uses or per capita for residential units. The Total Solid Waste for the project is estimated at 29,500 lbs/day.

Of the Total Solid Waste, the estimated H-Power from Solid Waste is calculated as percentages of the Total Solid Waste for the project. The values of the percentages used are based upon the origin of the solid waste (retail, commercial, grocery, etc). The H-power Generated from Solid Waste is estimated to be 25,300 lbs/day.

Of the Total Solid Waste, the estimated Total Solid Waste to the Landfill is the remainder of the solid waste that cannot be converted to H-Power or recycled. The Total Solid Waste to the Landfill is expected to be 4,200 lbs/day for the project.

Of the Total Solid Waste, the Total Recycled Material for the project is calculated based on typical percentages of Total Solid Waste for the project that can be recycled based upon the 2006 Beck Waste Characterization Study provided by C&C. The estimated Total Recycled Material for the project which includes cardboard, paper and HI-5 items is 9,800 lbs/day. The estimated Total HI-5 portion of the Recycled Material which includes only HI-5 designated plastic, aluminum and glass bottles is 300 lbs/day.

The projected solid waste is expected to be collected by private refuse services provided by the project.

Alternative Development Plan 1 ("Retail/Office-Use")

The Total Solid Waste for the Retail/Office alternative is estimated at 75,700 lbs/day. The H-power Generated from Solid Waste is estimated to be 58,400 lbs/day. The Total Solid Waste to the Landfill is expected to be 17,300 lbs/day for the project. The estimated Total Recycled Material which includes cardboard, paper and HI-5 items is 25,300 lbs/day.

Alternate Development Plan 2 ("Mall Expansion")

The Total Solid Waste for the Retail/Commercial alternative is estimated at 38,100 lbs/day. The H-power Generated from Solid Waste is estimated to be 29,300 lbs/day. The Total Solid Waste to the Landfill is expected to be 8,700 lbs/day for the project. The estimated Total Recycled Material which includes cardboard, paper and HI-5 items is 12,700 lbs/day.

E. Roadway

Live Work Play Aiea Plan

Development of Live Work Play Aiea will entail the creation of a new "Main Street" linking Moanalua Road to Kaonohi Street, as well as sidewalks, paths, and parking structures to accommodate pedestrian and vehicular circulation. The primary means of circulation within the project will be provided by the new "Main Street" with driveways off of this street leading to surface parking areas and parking structures for the commercial and residential uses. In addition to the Main Street connections with Moanalua Road and Kaonohi Street, two driveways off of Kaonohi Street will provide other access points to the project.

Roadway improvements include the installation of traffic signals at the Main Street connections with Moanalua Road and Kaonohi Street, restriping of all entrances to the project site as well as improvements to the Moanalua Road/Kaonohi Street intersection. Access to the newly signalized Moanalua Road and Kaonohi Street intersections will be provided through the project and includes internal connections with the existing Harbor Pointe and St. Timothy's Episcopal Church access roads.

In addition to the traffic signal at the Moanalua Road/Main Street intersection, other improvements at this intersection will include: 1) striping for new eastbound and new westbound left-turn lanes; 2) new striping for a left-turn lane and new shared left-turn/through/right-turn lane on the northbound approach; and 3) a new left-turn lane and a new shared through/right-turn lane in the southbound approach.

Moanalua Road east of the new Moanalua Road/Main Street intersection will be widened by one lane to allow for a total of two eastbound left-turn lanes, two through lanes, and one dedicated right turn lane at the Moanalua Road/Kaonohi Street intersection. Kaonohi Street will also be widened from the Moanalua Road/Kaonohi Street intersection to the new Kaonohi Street/Main Street intersection to add an additional lane for a total of two southbound through lanes. The new project access driveway across from the Pearlridge Center Driveway 1 along Kaonohi Street will be restriped to provide new northbound and southbound left-turn pocket lanes along Kaonohi Street. The minor approaches to this intersection will also be restriped to provide a left-tum lane and a shared through/right-turn lane.

At the Kaonohi Street/Main Street intersection, in addition to a new traffic signal, other improvements at this intersection will include restriping to: 1) create northbound and southbound left-turn lanes; and 2) provide a left-turn lane and a shared through/right-tum lane at the minor approaches.

For a detailed traffic analysis and proposed improvements, please refer to the project Traffic Impact Analysis Report dated December 12, 2011 by Austin, Tsutsumi & Associates, Inc.

Alternative Development Plan 1 ("Retail/Office-Use") and Alternative Development Plan 2 ("Mall Expansion")

For both development plan options, the off-site roadway improvements are expected to be the same as the Live Work Play Aiea Plan.

F. Electrical and Telecommunications

The proposed electric and communications systems will be developed in accordance with the specifications and standards of HECO, HTCO and OTWC. As State Public Utility Commission (PUC) regulated public utilities, HECO and HTCO are responsible for the development of off-site facilities that meet island-wide needs, such as power generating plants and power and signal transmission lines, and facilities that serve regional needs of the West Oahu area. Presently, the existing off-site facilities that would serve the property are HECO's Kaonohi Substation, located adjacent to Moanalua Road, HECO's Waimalu Substation, located adjacent to Komo Mai Drive, and HTCO's Aiea central office located near the intersection of Kamehameha Highway and Honomanu Street.

OTWC is a State Department of Commerce and Consumer Affairs cable television franchisee. Recently, HTCO was also granted a cable television franchise. Although not a PUC regulated utility, Oceanic's off-site facility construction policy is to provide such facilities where the anticipated revenue from the prospective service connections warrants the expenditure. Both HTCO and OTWC offer video, broadband, and telephone services. The design and construction of the proposed onsite electric and communications systems would meet the respective utility company's standards.

The projected electrical demand and telephone line requirements for each of the alternatives are summarized in Table F-1.

Table F-1: Electrical Demand and Telephone Line Requirements

Electrical and Communication Master Plan	Estimated Electric Demand (kiloVolt-Amperes kVA)	Estimated Electric Demand (kiloWatt Hours kWH/day)	Estimated Telephone Lines
Live Work Play Aiea Plan	6,263	89,590	2,473
Alternative Development Plan 1 (“Retail/Office-Use”)	7,212	100,860	1,320
Alternative Development Plan 2 (“Mall Expansion”)	8,825	123,442	1,523

1. Off-Site Electrical

   HECO has indicated that electric service to the property will be extended from HECO’s Moanalua Road duct system and that any off-site electrical facility development costs will be borne by HECO.

2. Off-Site Communications

   Telephone and cable television service will be extended to the property from the existing HTCO Moanalua Road duct system. Separate conduit laterals will be provided for HTCO and OTWC however, all conduits will be connected to HTCO’s duct system since OTWC does not presently have an underground duct system in Moanalua Road. Should there be insufficient space in HTCO’s existing duct system to accommodate the OTWC trunk cable, an alternative would be to construct a OTWC road crossing of Kaonohi Street to the existing overhead line. Due to the Joint Pole Committee rules, this OTWC road crossing would terminate in HTCO handhole/manhole and then rise up the joint utility pole.

3. On-Site Electrical

   The on-site electric and communications systems would consist of concrete encased, PVC conduits, typically installed within a common trench and located, where feasible, under the roadway sidewalk between the curb and the edge of the road shoulder. Manholes and handholes would be placed periodically to serve as pulling points for the utilities and as parcel/building service points. The anticipated duct complement for the main infrastructure would consist of three (3) 5-inch and two (2) 4-inch conduits for HECO, four (4) 4-inch conduits for HTCO and one (1) 4-inch conduit for OTWC. The number and size of conduits would vary based on the adjacent land usage with the typical minimum conduit complement for building service connections being two (2) 4-inch conduits for HECO, one (1) 4-inch conduit for HTCO and one (1) 4-inch conduit for OTWC.

   In addition to transformer pads for each of the buildings, HECO will require several switchgear pads throughout the property. The HECO switchgear acts as a protective device and sectionalizer that is used by HECO to minimize outages to the affected building as well as protect their main circuits. HTCO has indicated that due to the congestion in their existing Moanalua Road duct system, it is likely that a 30-foot x 25-foot “pair-gain” easement will be required. The “pair-gain” equipment allows HTCO to multiplex multiple service line connections onto a single trunk line. OTWC may also request a 6 feet x 6 feet easement for a cable node. Since the advent of HTCO’s cable television franchise, it is probable that both HTCO and OTWC will proposed to install fiber optic and/or hybrid infrastructure to feed the proposed development.

4. Area Lighting

   Illumination for at-grade roadways and parking spaces will be designed to meet Illuminating Engineering Society (IES) RP-8 criteria. Illumination for parking garages will be designed to meet IES RP-20 criteria. Luminaries selected will be specified with energy efficient ballasts and light sources.

V. CONCLUSION

Proposed improvements will be designed in accordance with the applicable rules and regulations of the City and County of Honolulu. The Department of Planning and Permitting Storm Drainage Standards require that there be no increase in flows compared to existing conditions. Since the overall property stormwater management plan for Live Work Play Aiea indicates a net decrease in stormwater runoff, this project exceeds C&C requirements. Erosion control and water quality measures will be provided to minimize pollution during and after construction. Water, Roadway, and Electrical designs are sufficient to serve the proposed project and will meet applicable State and C&C standards. Wastewater design will also meet applicable State and C&C standards. The C&C wastewater system may have capacity for initial phases of the proposed project. However, regional improvements and upgrades may be required for the off-site C&C wastewater collection system for the full build out of the project. Details of such improvements are not yet available and the Applicant will continue to actively pursue and coordinate with the C&C.

Based on the information presented in this report, Live Work Play Aiea will have no adverse effects to the existing utility and roadway surface facilities, with the possible exception of the regional C&C wastewater collection system, which, as of July 2012, ENV was evaluating in regard to flow, capacity, and interim and long-term regional improvements. Traffic impact and related circulation issues by Live Work Play Aiea are addressed in a separate traffic impact analysis report.

The Alternative Development Plans for “Retail/Office-Use” and “Mall Expansion” were provided for comparison purposes only as the mixed-use development is the preferred design. The alternative plans provide varied effects onto the existing utility and roadway surface facilities.

VI. REFERENCES

1. Board of Water Supply, City and County of Honolulu, Water System Standards, Domestic Consumption Guidelines, 2002
2. County of Maui, Wastewater Reclamation Division, Wastewater Flow Standards, 2004
3. Department of Planning and Permitting, City and County of Honolulu, Rules Relating to Storm Drainage Standards, 2000
4. Department of Wastewater Management, Design Standards of the Department of Wastewater Management, Volume 1, 1993
5. Federal Emergency Management Agency, Flood Insurance Rate Map, 2004
6. R.W. Beck, 2006 Waste Characterization Study, City and County of Honolulu, 2007
7. United States Department of Agriculture Soil Conservation Service, Soil Survey of the Islands of Kauai, Oahu, Molokai, Maui and Lanai, 1972

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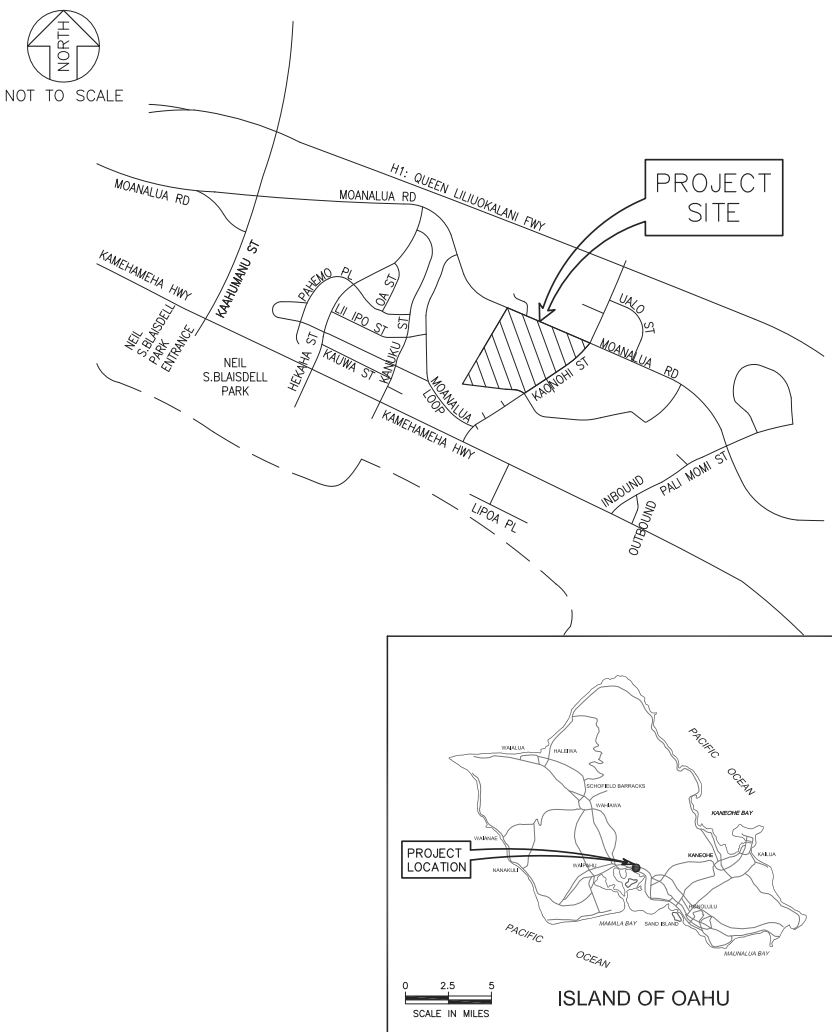
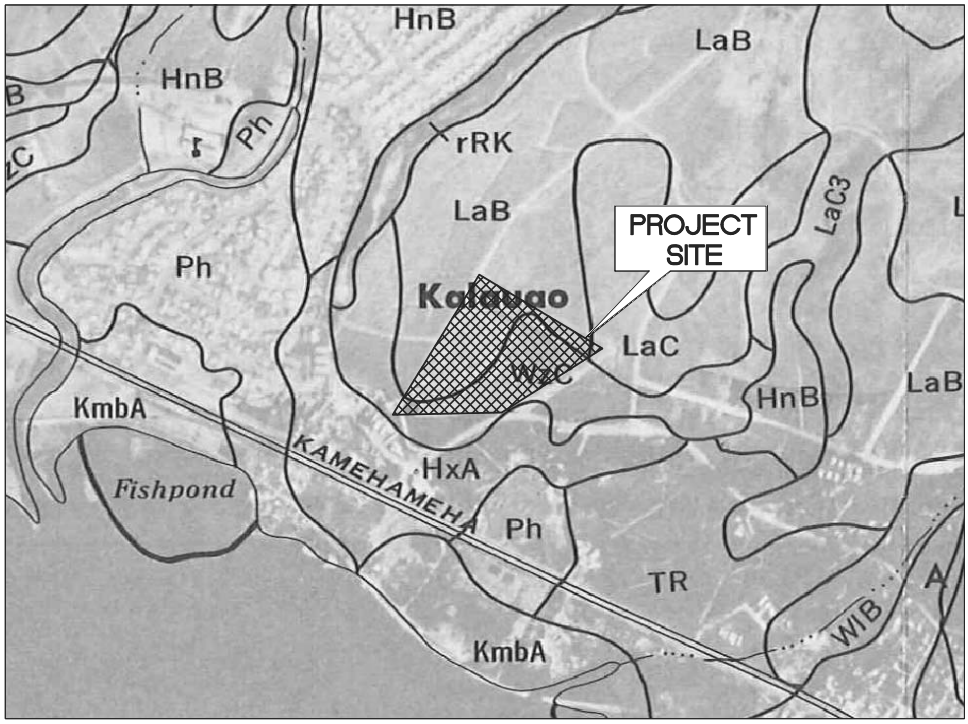
EXHIBITS



LIVE WORK PLAY AIEA	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII	EXHIBIT
	LOCATION AND VICINITY MAP	1



REFERENCE: SOIL SURVEY OF THE ISLANDS OF KAUAI, OAHU, MOLOKAI, MAUI AND LANAI, STATE OF HAWAII BY USDA-SCS DATED AUGUST 1972

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
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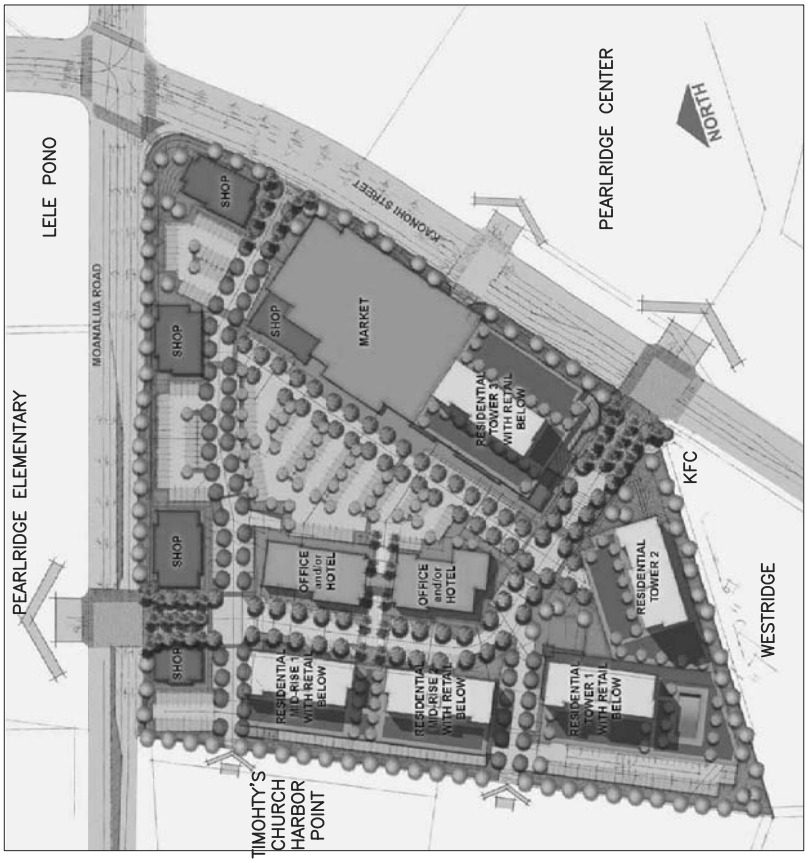
SOIL SURVEY MAP

EXHIBIT 3



PLAN, SUBJECT TO CHANGE, PROVIDED BY ROBERTSON PROPERTIES GROUP

LIVE WORK PLAY AIEA

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

PRELIMINARY SITE PLAN

EXHIBIT 2

The project site is located within Zone D. Zone D is defined as an area in which flood hazards are undetermined but possible.

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ENGINEERS,SURVEYORS • HONOLULU,HAWAII

EXHIBIT 5

FLOOD ZONE MAP

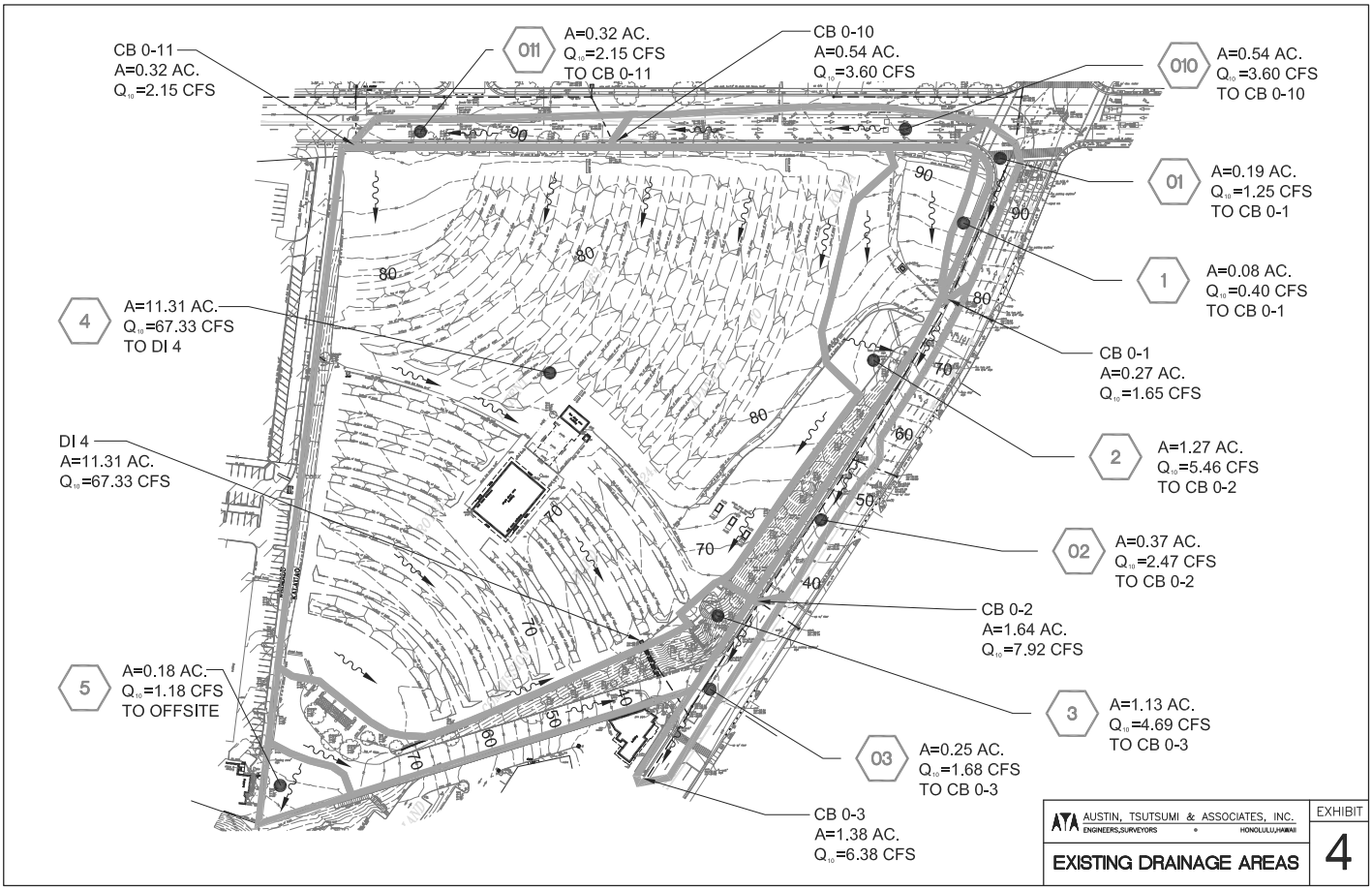

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EXHIBIT 4

EXISTING DRAINAGE AREAS

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APPENDICES

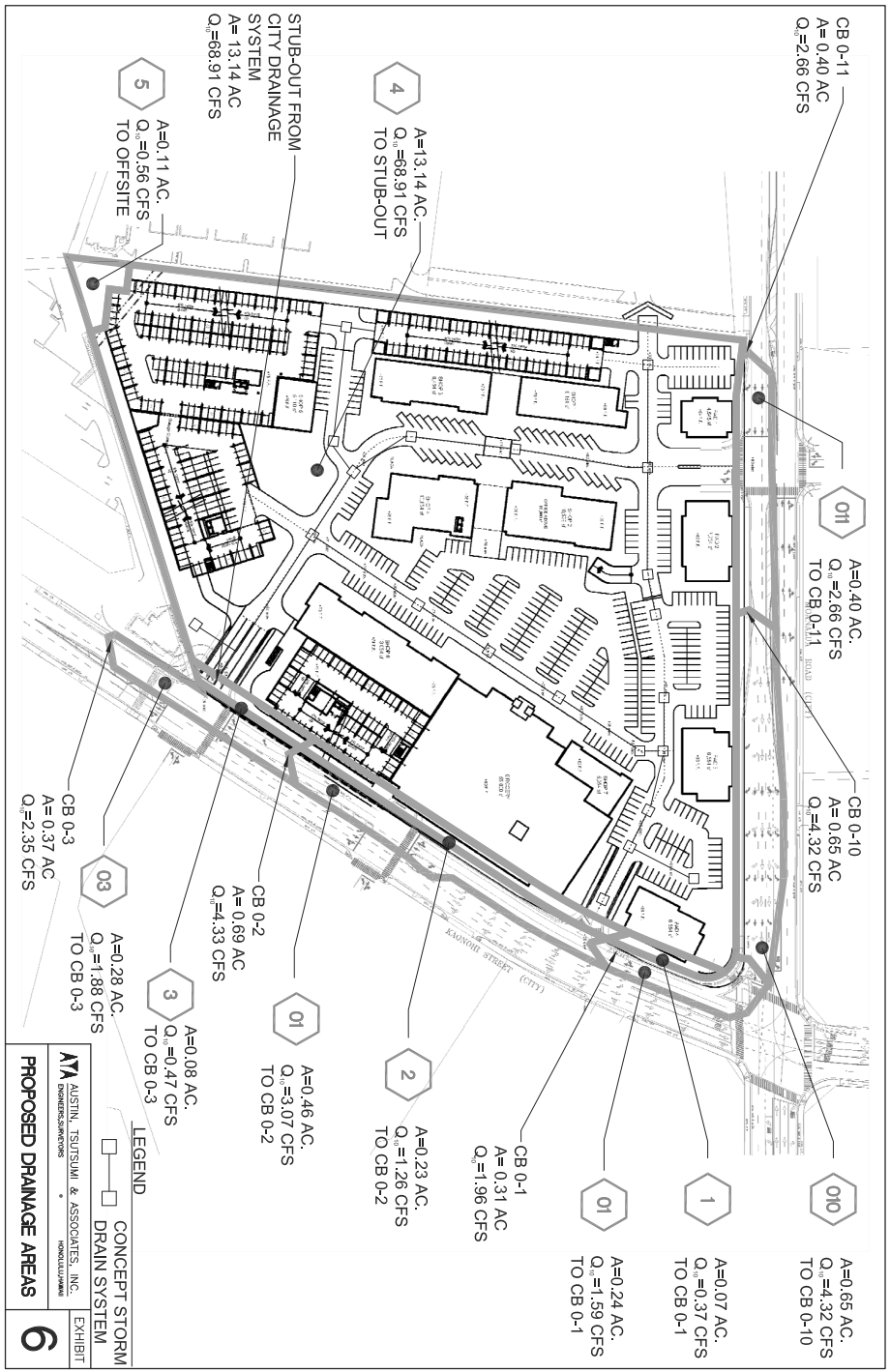

TABLE 1

RUNOFF CALCULATIONS - EXISTING CONDITIONS

Drainage Area	Area (ac)	Impervious Area (ac)	% Impervious	Weighted "C"	Tc (min.)	I_{10} 1-Hour (in/hr)	Correction Factor	I_{10} Adjusted (in/hr)	Q_{10} (cfs)	Drains To
ON-SITE AREAS										
1	0.083	0.055	66.3%	0.75	7.0	2.5	2.60	6.5	0.40	Off-site CB O-1
2	1.271	0.826	65.0%	0.74	10.0	2.5	2.30	5.8	5.46	Off-site CB O-2
3	1.129	0.581	51.5%	0.66	8.0	2.5	2.50	6.3	4.69	Off-site CB O-3
4	11.313	10.998	97.2%	0.93	7.5	2.5	2.55	6.4	67.33	On-site DI 4
5	0.184	0.176	95.7%	0.92	5.0	2.5	2.80	7.0	1.18	Westridge S.C.
ON-SITE TOTALS	**13.980**	**12.636**	**90.4%**						**79.07**	
OFF-SITE AREAS										
O-1	0.188	0.188	100.0%	0.95	5.00	2.5	2.80	7.0	1.25	Off-site CB O-1
O-2	0.371	0.371	100.0%	0.95	5.00	2.5	2.80	7.0	2.47	Off-site CB O-2
O-3	0.253	0.253	100.0%	0.95	5.00	2.5	2.80	7.0	1.68	Off-site CB O-3
O-10	0.542	0.542	100.0%	0.95	5.00	2.5	2.80	7.0	3.60	Off-site CB O-10
O-11	0.323	0.323	100.0%	0.95	5.00	2.5	2.80	7.0	2.15	Off-site CB O-11
OFF-SITE TOTALS	**1.677**	**1.677**	**100.0%**						**11.15**	

TOTALS AT RECEIVING CB/ DI

Receiving Structure	Total Area (ac)	Total Q_{10} (cfs)
Off-site CB O-1	**0.271**	**1.65**
Off-site CB O-2	**1.642**	**7.92**
Off-site CB O-3	**1.382**	**6.38 ****
Off-site CB O-10	**0.542**	**3.60**
Off-site CB O-11	**0.323**	**2.15**
On-site DI 4	**11.313**	**67.33**
Westridge Shop. Ctr.	**0.184**	**1.18**
TOTALS	**15.657**	**90.23**

** Actual flow at CB-O-3 is greater due to spill over at On-site DI 4

Notes:
1. 10-Year, 1-Hour Rainfall Intensity determined using Honolulu Stds. Plate 1, Revised April 8, 2011.
2. Correction Factor and Adjusted Intensity determined using Honolulu Stds. Plate 4.
3. Time of Concentration (Tc) determined using Plate 3 for overland flow and Manning's Equation for concentrated flow. Tc is limited to 5 minutes minimum.
4. Weighted Runoff Coefficients based on: Impervious C= 0.95, Grass/ Landscaped C=0.35

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APPENDIX B

PRELIMINARY WATER DEMAND CALCULATIONS AND PRELIMINARY FIRE FLOW REQUIREMENTS

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TABLE 2

RUNOFF CALCULATIONS - PROPOSED CONDITIONS

Drainage Area	Area (ac)	Impervious Area (ac)	% Impervious	Weighted "C"	Tc (min.)	I_{10} 1-Hour (in/hr)	Correction Factor	I_{10} Adjusted (in/hr)	Q_{10} (cfs)	Drains To
ON-SITE AREAS										
1	0.066	0.056	85.0%	0.86	6.5	2.5	2.65	6.6	0.37	Off-site CB O-1
2	0.229	0.195	85.0%	0.86	7.5	2.5	2.55	6.4	1.26	Off-site CB O-2
3	0.084	0.071	85.0%	0.86	7.0	2.5	2.60	6.5	0.47	Off-site CB O-3
4	13.135	11.164	85.0%	0.86	8.5	2.5	2.45	6.1	68.91	Stub-Out
5	0.108	0.092	85.0%	0.86	9.0	2.5	2.40	6.0	0.56	Westridge S.C.
ON-SITE TOTALS	**13.622**	**11.578**	**85.0%**						**71.57**	
OFF-SITE AREAS										
O-1	0.239	0.239	100.0%	0.95	5.00	2.5	2.80	7.0	1.59	Off-site CB O-1
O-2	0.461	0.461	100.0%	0.95	5.00	2.5	2.80	7.0	3.07	Off-site CB O-2
O-3	0.283	0.283	100.0%	0.95	5.00	2.5	2.80	7.0	1.88	Off-site CB O-3
O-10	0.649	0.649	100.0%	0.95	5.00	2.5	2.80	7.0	4.32	Off-site CB O-10
O-11	0.400	0.400	100.0%	0.95	5.00	2.5	2.80	7.0	2.66	Off-site CB O-11
OFF-SITE TOTALS	**2.032**	**2.032**	**100.0%**						**13.51**	

TOTALS AT RECEIVING CB/ DI

Receiving Structure	Total Area (ac)	Total Q_{10} (cfs)
Off-site CB O-1	**0.305**	**1.96**
Off-site CB O-2	**0.690**	**4.33**
Off-site CB O-3	**0.367**	**2.35**
Off-site CB O-10	**0.649**	**4.32**
Off-site CB O-11	**0.400**	**2.66**
Stub-Out	**13.135**	**68.91**
Westridge Shop. Ctr.	**0.108**	**0.56**
TOTALS	**15.654**	**85.08**

Notes:
1. 10-Year, 1-Hour Rainfall Intensity determined using Honolulu Stds. Plate 1, Revised April 8, 2011.
2. Correction Factor and Adjusted Intensity determined using Honolulu Stds. Plate 4.
3. Time of Concentration (Tc) determined using Plate 3 for overland flow and Manning's Equation for concentrated flow. Tc is limited to 5 minutes minimum.
4. Weighted Runoff Coefficients based on: Impervious C= 0.95, Grass/ Landscaped C=0.35

PRELIMINARY WATER DEMAND CALCULATIONS

LIVE WORK PLAY AIEA

Project Site Description

Total Project Area = 14.0 acres

Phase 1:
- Retail: 107,044 square feet (sf)
- Hotel: 150 units

Phase 1B:
- Retail: 17,608 sf
- Residential: 320 units

Phase 2:
- Retail: 13,054 sf
- Residential: 385 units

Phase 3:
- Retail: 5,679 sf
- Residential: 385 units

Phase 4:
- Residential: 410 units

Parks: 149,250 sf
Public Open Space: 119,097 sf

Average Daily Demand Standards

(Table 100-18 Domestic Consumption Guidelines, Water System Standards)

Retail:	120 gallons per day (gpd) / 1,000 sf
Residential:	300 gpd/ unit
Parks:	4,000 gpd/ acre
Public Open Space:	4,000 gpd/ acre

Notes:
1. The Commercial/Residential Mix category is used for the Retail demand.
2. Multi-Family High Rise category is used for the Residential demand.

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Water Demand Calculations

Average Daily Water Demand

Retail:	143,385 sf x 120 gpd / 1,000 sf =	**17,000 gpd**
Hotel:	150 units x 350 gpd/ unit =	**53,000 gpd**
Residential:	1,500 units x 300 gpd/ unit =	**450,000 gpd**
Parks:	3.42 acres x 4,000 gpd/ acre =	**14,000 gpd**
Open Space:	2.73 acres x 4,000 gpd/ acre =	**11,000 gpd**
TOTAL Average Daily Demand (Rounded):		**540,000 gpd**

Maximum Daily Water Demand

Maximum Daily Demand = Average Day Demand x 1.5 = 810,000 gpd

Peak Hour Water Demand

Peak Hour Demand = Average Day Demand x 3 = 1,125 gallons per minute

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ALTERNATIVE DEVELOPMENT PLAN 1 ("RETAIL/OFFICE")

Project Site Description

Total Project Area = 14.0 acres

Phase 1:
Retail: 40,000 sf
Office: 400,000 sf

Phase 2:
Retail: 40,000 sf
Office: 400,000 sf

Phase 3:
Retail: 40,000 sf
Office: 400,000 sf

Average Daily Demand Standards

(Table 100-18 Domestic Consumption Guidelines, Water System Standards)

Retail: 120 gallons per day (gpd) / 1,000 sf
Office: 120 gpd/ 1,000 sf

Note: The Commercial/Residential Mix category is used for the Retail and Office demands.

Water Demand Calculations

Average Daily Water Demand

Retail:	120,000 sf x 120 gpd / 1,000 sf =	**14,000 gpd**
Office:	1,200,000 sf x 120 gpd/ 1,000 sf=	**144,000 gpd**

TOTAL Average Daily Demand (Rounded): 160,000 gpd

Maximum Daily Water Demand

Maximum Daily Demand = Average Day Demand x 1.5 = 240,000 gpd

Peak Hour Water Demand

Peak Hour Demand = Average Day Demand x 3 = 333 gallons per minute

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ALTERNATIVE DEVELOPMENT PLAN 2 ("MALL EXPANSION")

Project Site Description

Total Project Area = 14.0 acres
Total Project Area = 1,522,600 sf

Average Daily Demand Standards

(Table 100-18 Domestic Consumption Guidelines, Water System Standards)

Retail: 120 gallons per day (gpd) / 1,000 sf

Note: The Commercial/Residential Mix category is used for the Retail demand.

Water Demand Calculations

Average Daily Water Demand

Retail: 1,522,600 sf x 120 gpd / 1,000 sf = 182,700 gpd

TOTAL Average Daily Demand (Rounded): 183,000 gpd

Maximum Daily Water Demand

Maximum Daily Demand = Average Day Demand x 1.5 = 275,000 gpd

Peak Hour Water Demand

Peak Hour Demand = Average Day Demand x 3 = 381 gallons per minute

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PRELIMINARY FIRE FLOW CALCULATIONS

Project Site Description

Total Project Area = 14.0 acres

Zoning Designation: B-2 (Community Business District)

Fire Flow Requirements

Small Shopping Centers — Fire Flow = **2,000 gallons per minute (gpm)**
Duration = **2 hours**
Fire Hydrant Spacing = **250 feet**

(Table 100-19 Fire Flow Requirements, Water System Standards)

Water Supply Requirements for Fire Suppression

Required Fire Suppression Storage = 2,000 gpm x 120 minutes = **240,000 gallons**

Project:	Live Work Play Aiea Project Fire Flow Calculations	Job No: 06-062.15 Computed by: DF	
TMK:	9-8-013: 013	Date: 11-09-11 [1 of 1]	

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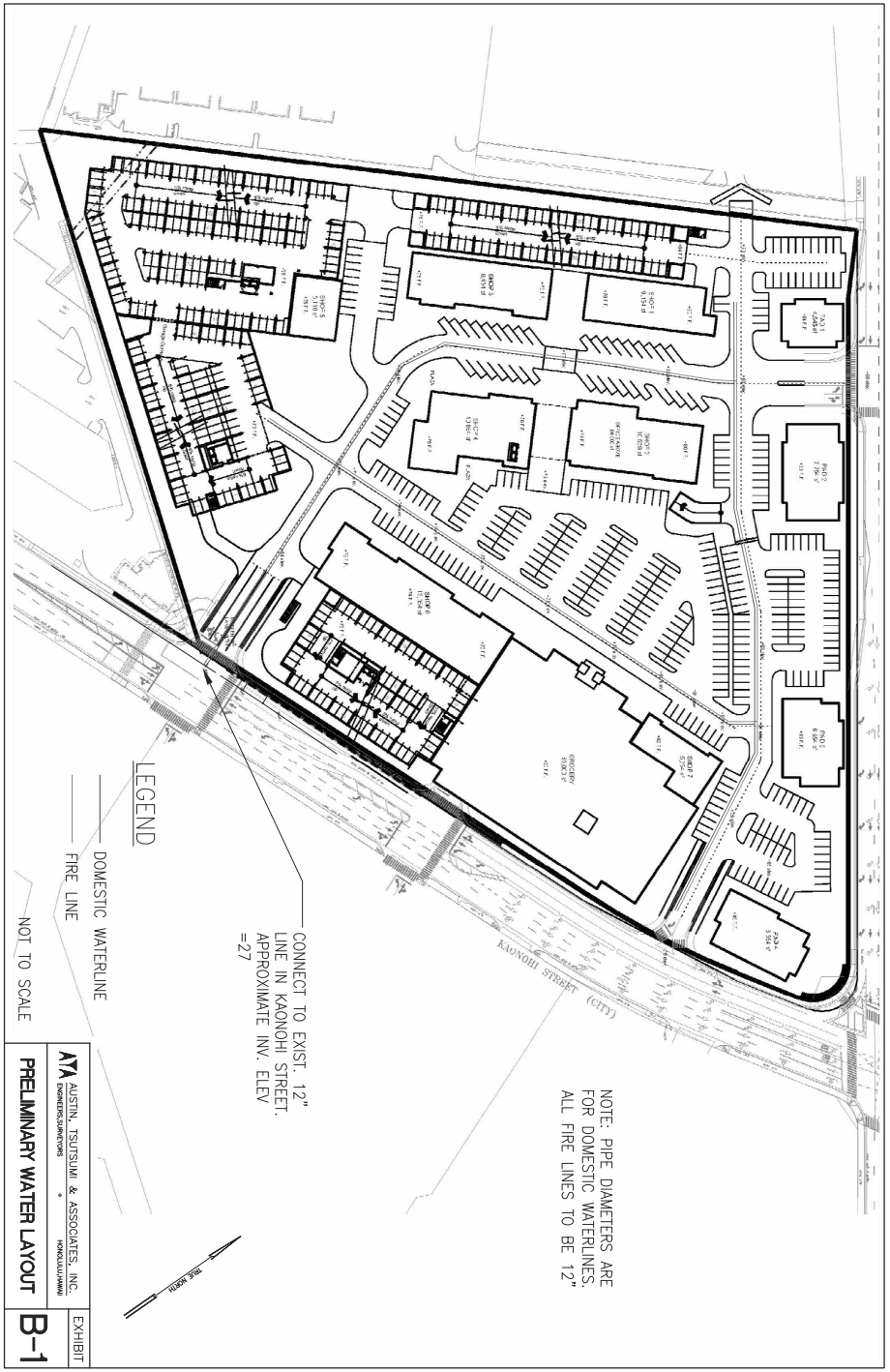

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

August 3, 2011

PETER B. CARLISLE, MAYOR

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ADAM C. WONG

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GLENN M. OKIMOTO, Ex-Officio

DEAN A. NAKANO
Acting Manager

RECEIVED
AUG 11 2011
AUSTIN, TSUTSUMI & ASSOCIATES, INC
Honolulu, Hawaii 96817-5031

Mr. Donohue M. Fujii, P.E.
Austin, Tsutsumi & Associates, Inc.
501 Sumner Street, Suite 521
Honolulu, Hawaii 96817-5031

Dear Mr. Fujii:

Subject: Your Letter Dated July 29, 2011 Requesting the Availability of Water and Flow and Pressure Data for the Proposed Kam Drive-In Commercial/Residential Development, TMK: 9-8-13: 13

Thank you for your letter on the proposed commercial/residential development in Pearl City.

The existing water system is presently adequate to accommodate the proposed commercial/residential development. However, please be advised that this information is based upon current data and, therefore, the Board of Water Supply reserves the right to change any position or information stated herein up until the final approval of your building permit. The final decision on the availability of water will be confirmed when the building permit is submitted for approval.

When water is made available, the applicant will be required to pay our Water System Facilities Charges for resource development, transmission and daily storage.

BWS Rules and Regulations require the use of non-potable water for the irrigation of large landscaped areas if a suitable water supply is available. Landscape irrigation for the proposed project should be designed with a separate water service lateral for connection to the Kalauao non-potable water system when non-potable water service becomes available in this area.

The on-site fire protection requirements should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

We have suspended fire flow tests on fire hydrants as a water conservation measure. However, you may use the following calculated flow data for the following fire hydrants:

Fire Hydrant Number	Location	Static Pressure (psi)	Residual Pressure (psi)	Flow (gpm)
L-2133	Moanalua Rd.	79	50	2000
L-2130	Moanalua Rd.	79	52	2000
L-887	Kaonohi St.	88	62	2000
L-889	Kaonohi St.	100	71	2000

The data are based on the existing water system, and the static pressure represents the theoretical pressure at the point of calculation with the reservoir full and no demands on the water system. The static pressure is not indicative of the actual pressure in the field. Therefore, in order to determine the flows that are available to the site, you will have to determine the actual field pressure by taking on-site pressure readings at various times of the day and correlating that field data with the above hydraulic design data.

Attached is a map showing the locations of the fire hydrants.

We confirm the fire flow requirement for the proposed commercial/residential development is 2000 gallons per minute.

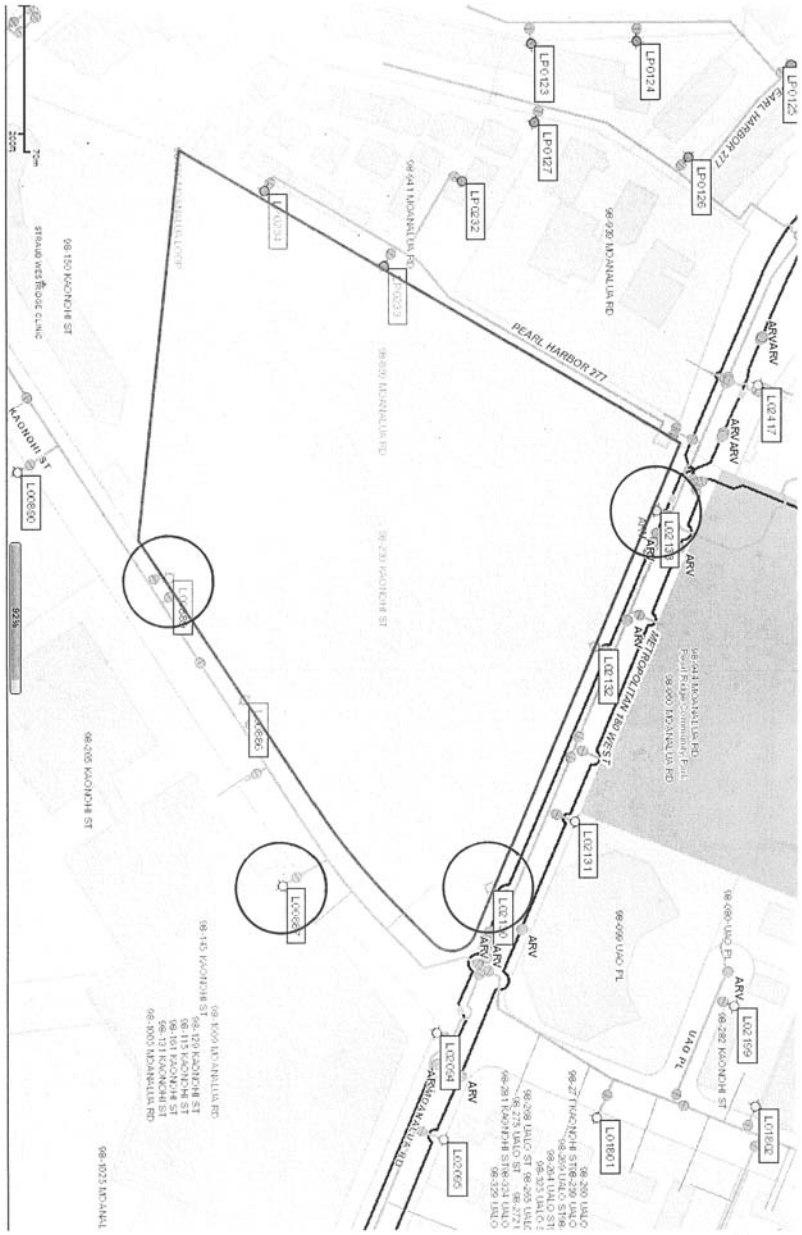
If you have any questions, please contact Robert Chun at 748-5443.

Very truly yours,

PAUL S. KIKUCHI
Chief Financial Officer
Customer Care Division

Attachment

cc: Scot Muraoka, Board of Water Supply



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CIVIL ENGINEERS • SURVEYORS

APPENDIX C

PRELIMINARY WASTEWATER CONTRIBUTION CALCULATIONS

PRELIMINARY WASTEWATER CONTRIBUTION CALCULATIONS

LIVE WORK PLAY AIEA

Project Site Description

Total Project Area = 14.0 acres

Phase 1:
Retail: 107,044 square feet (sf)
Hotel: 150 units

Phase 1B:
Retail: 17,608 sf
Residential: 320 units

Phase 2:
Retail: 13,054 sf
Residential: 385 units

Phase 3:
Retail: 5,679 sf
Residential: 385 units

Phase 4:
Residential: 410 units

Parks: 149,250 sf
Public Open Space: 119.097 sf

Design Flows:

Retail:
Average Daily Per Capita Flow = 15 gallons per day (gpd)
Capita Per Acre (cpa) = 300

Hotel:
Average Daily Per Unit Flow = 250 gpd

Residential:
Average Daily Per Capita Flow = 80 gpd

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Notes:

1. Average Daily Per Capita Flow for Retail developments based on the County of Maui, Wastewater Reclamation Division, "Wastewater Flow Standards", 2004.
2. Equivalent Population (Capita Per Acre) for Retail developments based on "Central Business" category from the City and County of Honolulu's "Design Standards of the Department of Wastewater Management, Volume 1, July 1993" (C&C Design Standards).
3. Average Daily Per Unit Flow for the Hotel based on the County of Maui, Wastewater Reclamation Division, "Wastewater Flow Standards", 2004.
4. Average Daily Per Unit Flow for Residential units based on the C&C Design Standards.
5. Density of Residential occupancy based on 2.8 persons per apartment per the C&C Design Standards.
6. Parks and Public Open Spaces assumed to contribute no wastewater flow.

Wastewater Contribution Calculations

Average Daily Flow:

Retail:	3.29 acres x 300 cpa x 15 gpd/capita (gpcd) =	**14,800 gpd**
Hotel:	150 units x 250 gpd/ unit =	**37,500 gpd**
Residential:	1,500 units x 2.8 capita/unit x 80 gpcd =	**336,000 gpd**
TOTAL Average Daily Flow:		**388,000 gpd**

Maximum Wastewater Flow:

Babbit Flow Factor = 3.53 (From Figure 22.2.4, C&C Design Standards)

Maximum Flow: 388,000 gpd x 3.53 Flow Factor = **1,370,000 gpd**

Dry Weather Infiltration/ Inflow:

Dry Weather Infiltration/ Inflow = 5 gpcd (Sewer laid above the normal groundwater table)

Capita:

Retail:	3.29 acres x 300 cpa =	987 capita
Hotel:	3.25 capita / unit x 150 units =	488 capita
Residential:	2.9 capita / unit x 1,500 units =	4,200 capita
TOTAL Capita:		5,675 capita

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Dry Weather Flow: 5,675 capita x 5 gpcd Dry Inflow = **28,375 gpd**

Design Average Flow:
388,000 gpd Avg. WW Flow + 28,375 gpd Dry Inflow = **417,000 gpd**

Design Maximum Flow:
1,370,000 gpd Max. WW Flow + 28,375 gpd Dry Inflow = **1,400,000 gpd**

Wet Weather Infiltration/ Inflow:

Wet Weather Infiltration/ Inflow = 1,250 gallons per acre per day (gad) (Sewer laid above the normal groundwater table

Wet Weather Infiltration/ Inflow:
14 acres x 1,250 gad Wet Inflow = **17,500 gpd**

Design Peak Flow:
1,400,000 gpd Design Max. Flow + 17,500 gpd Wet Inflow = **1,418,000 gpd**
= **985 gpm**

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ALTERNATIVE DEVELOPMENT PLAN 1 ("RETAIL/OFFICE-USE")

Project Site Description

Total Project Area = 14.0 acres

Phase 1:
Retail: 40,000 sf
Office: 400,000 sf

Phase 2:
Retail: 40,000 sf
Office: 400,000 sf

Phase 3:
Retail: 40,000 sf
Office: 400,000 sf

Design Flows:

Retail:
Average Daily Per Capita Flow = 15 gallons per day (gpd)
Capita Per Acre (cpa) = 300

Office:
Average Daily Per Capita Flow = 20 gallons per day (gpd)
Capita Per Acre (cpa) = 300

Notes:

1. Average Daily Per Capita Flow for Retail and Office developments based on the County of Maui, Wastewater Reclamation Division, "Wastewater Flow Standards", 2004.
2. Equivalent Population (Capita Per Acre) for Retail and Office developments based on "Central Business" category from the City and County of Honolulu's "Design Standards of the Department of Wastewater Management, Volume 1, July 1993" (C&C Design Standards).

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Wastewater Contribution Calculations

Average Daily Flow:

Retail:	2.75 acres x 300 cpa x 15 gpd/capita (gpcd) =	**12,400 gpd**
Office:	27.5 acres x 300 cpa x 20 gpd/capita (gpcd) =	**165,000 gpd**
TOTAL Average Daily Flow:		**178,000 gpd**

Maximum Wastewater Flow:

Babbit Flow Factor = 3.22 (From Figure 22.2.4, C&C Design Standards)

Maximum Flow: 178,000 gpd x 3.22 Flow Factor = **570,000 gpd**

Dry Weather Infiltration/ Inflow:

Dry Weather Infiltration/ Inflow = 5 gpcd (Sewer laid above the normal groundwater table)

Capita:

Retail:	2.75 acres x 300 cpa =	825 capita
Office:	27.5 capita / unit x 300 cpa =	8,250 capita
TOTAL Capita:		9,075 capita

Dry Weather Flow: 9,075 capita x 5 gpcd Dry Inflow = **45,000 gpd**

Design Average Flow:
178,000 gpd Avg. WW Flow + 45,000 gpd Dry Inflow = **223,000 gpd**

Design Maximum Flow:
570,000 gpd Max. WW Flow + 45,000 gpd Dry Inflow = **615,000 gpd**

Wet Weather Infiltration/ Inflow:

Wet Weather Infiltration/ Inflow = 1,250 gallons per acre per day (gad) (Sewer laid above the normal groundwater table

Wet Weather Infiltration/ Inflow:
14 acres x 1,250 gad Wet Inflow = **17,500 gpd**

Design Peak Flow:
615,000 gpd Design Max. Flow + 17,500 gpd Wet Inflow = **633,000 gpd**
= **440 gpm**

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ALTERNATIVE DEVELOPMENT PLAN 2 ("MALL EXPANSION")

Project Site Description

Total Project Area = 1,522,600 sf

Total Project Area = 34.95 acres

Design Flows:

Retail:

Average Daily Per Capita Flow =	15 gallons per day (gpd)
Capita Per Acre (cpa) =	300

Notes:

1. Average Daily Per Capita Flow for Retail developments based on the County of Maui, Wastewater Reclamation Division, "Wastewater Flow Standards", 2004.
2. Equivalent Population (Capita Per Acre) for Retail developments based on "Central Business" category from the City and County of Honolulu's "Design Standards of the Department of Wastewater Management, Volume 1, July 1993" (C&C Design Standards).

Wastewater Contribution Calculations

Average Daily Flow:

Retail: 34.95 acres x 300 cpa x 15 gpd/capita (gpcd) = **157,000 gpd**

Maximum Wastewater Flow:

Babbit Flow Factor = 3.12 (From Figure 22.2.4, C&C Design Standards)

Maximum Flow: 157,000 gpd x 3.12 Flow Factor = **490,000 gpd**

Dry Weather Infiltration/ Inflow:

Dry Weather Infiltration/ Inflow = 5 gpcd (Sewer laid above the normal groundwater table)

Retail Capita: 34.95 acres x 300 cpa = 10,486 capita

Dry Weather Flow: 10,486 capita x 5 gpcd Dry Inflow = **52,000 gpd**

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Design Average Flow:
157,000 gpd Avg. WW Flow + 52,000 gpd Dry Inflow = **209,000 gpd**

Design Maximum Flow:
490,000 gpd Max. WW Flow + 52,000 gpd Dry Inflow = **542,000 gpd**

Wet Weather Infiltration/ Inflow:

Wet Weather Infiltration/ Inflow = 1,250 gallons per acre per day (gad) (Sewer laid above the normal groundwater table

Wet Weather Infiltration/ Inflow:
34.95 acres x 1,250 gad Wet Inflow = **44,000 gpd**

Design Peak Flow:
542,000 gpd Design Max. Flow + 44,000 gpd Wet Inflow = **586,000 gpd**
= **407 gpm**

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DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET * HONOLULU, HAWAII 96813
Phone: (808) 768-8209 * Fax: (808) 768-4210

SEWER CONNECTION APPLICATION

APPLICATION NO.: **2010/SCA-0063** STATUS: **Approved**
DATE RECEIVED: **12/22/2009** IWDP APP. NO.:
PROJECT NAME: **2010/SCA-00 Kam Drive Inn Site, 1200 mf, 150,000 sf commercial**

$5,471,460.00
Estimated Wastewater System Facility Charge*

LOCATION:

Zone	Section	Plat	Parcel	
9	8	013	013	98-850 MOANALUA RD 608,968 Sq. Ft.

SPECIFIC LOCATION: **98-850 Moanalua Road**

APPLICANT: **SSFM INTERNATIONAL, INC., Trevin Chang**
501 Sumner Street, Suite 620
Honolulu, HI 96817

DEVELOPMENT TYPE: **Dwelling, Multi-family** SEWER CONNECTION WORK DESIRED: **Existing**
OTHER USES: **commercial (retail/office) 150,000 sf**
NON-RESIDENTIAL AREA: s.f. APPROXIMATE DATE OF CONNECTION: **12/01/2010**

PROPOSED UNITS	EXISTING UNITS	UNITS TO BE DEMOLISHED
No. of New Units: **1,200**	No. of Existing Units: **0**	No. of Units to be Demolished: **0**
Studios:	Studios:	Studios:
1-Bedroom: **240**	1-Bedroom:	1-Bedroom:
2-Bedroom: **780**	2-Bedroom:	2-Bedroom:
3-Bedroom: **180**	3-Bedroom:	3-Bedroom:
4-Bedroom:	4-Bedroom:	4-Bedroom:
5-Bedroom:	5-Bedroom:	5-Bedroom:
6-Bedroom:	6-Bedroom:	6-Bedroom:

REMARKS **May require IWDP.**

APPROVAL DATE: **02/01/2010**
EXPIRATION DATE: **02/01/2012**

Valid 2-years after approval date. Construction plans shall be completed and approved within this 2-year period. Construction shall commence within 1-year after approval of plans.
** Applicable WSFC shall be collected at the prevailing rate in accordance with ROH 1990, Chapter 14, Sections 14-10.3, 14-10.4, 14-10.5 and Appendix 14-D.*

REVIEWED BY: ***Tessa Ching***

Tessa Ching
Site Development Division, Wastewater Branch

ExternalID: **033669945-001** JobId: **33669945**

Initial Print Date: Monday February 1, 2010 10:37 am

Projected Solid Waste Generation
Live Work Play Aiea (Preferred Alternative)
Kam Drive In (06-062.15)
ATA - 11/08/2011

Project Data		
Residential	1,395,752	sq.ft
Residential	1,500	units
Grocery	55,000	sq.ft
Office or Hotel Use	80,000	sq.ft
Retail/Commercial	88,385	sq.ft

Population Assumption*		
Population	2.80	per/unit
Total	4,200	persons for 1,500 units
*Design Std. of Dept. of WW Mgmt		

KAM Drive-In Solid Waste Projections

Residential MSW Generation Approximations Using 4,200 Persons			
MSW Generation	4.600	lbs/person/day	Center for Sustainable Systems, 2007 national value.
Total	19,320	lbs/day	

Retail/Commercial MSW Generation Approximations Using 88,385 SF			
MSW Generation	0.0250	lbs/sq.ft/day	CA.gov (Guide to MSW, Santa Barbara County P.W. Shopping Center,1997)
Total	2,210	lbs/day	

Grocery Store MSW Generation Approximations Using 55,000 SF			
MSW Generation	0.059	lbs/sq.ft/day	CA.gov(Guidelines for preparation of EA,Food Store,Ventura C.S.W.M.D,1998)
Total	3,245	lbs/day	

Office Use MSW General Approximations Using 80,000 SF			
MSW Generation	0.059	lbs/sq.ft/day	CA.gov (Office Use, Guidelines for EA prep. Ventura County,1998)
Total	4,720	lbs/day	

Hotel Use MSW General Approximations Using 80,000 SF			
MSW Generation	0.059	lbs/sq.ft/day	CA.gov(Estimated Solid Waste Generation Rates for Service Establishments, Cal Recycle, 2011)
Total	4,720	lbs/day	

Projected Solid Waste

Residential	19,320	lbs/day
Retail/Commercial	2,210	lbs/day
Grocery Store	3,245	lbs/day
Office or Hotel Use	4,720	lbs/day
Total	29,495	lbs/day

APPENDIX D
PRELIMINARY SOLID WASTE GENERATION

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
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Projected Solid Waste Generation
Alternative Development Plan 1 ("Retail/Office-Use")
Kam Drive In (06-062.15)
ATA - 11/08/2011

Project Data		
Grocery	55,000	sq.ft
Office	1,200,000	sq.ft
Retail/Commercial	65,000	sq.ft

KAM Drive-In Solid Waste Projections

Retail/Commercial MSW Generation Approximations Using 65,000 SF			
MSW Generation	0.0250	lbs/sq.ft/day	CA.gov (Guide to MSW, Santa Barbara County P.W. Shopping Center,1997)
Total	1,625	lbs/day	

Grocery Store MSW Generation Approximations Using 55,000 SF			
MSW Generation	0.059	lbs/sq.ft/day	CA.gov(Guidelines for preparation of EA,Food Store,Ventura C.S.W.M.D,1998)
Total	3,245	lbs/day	

Office Use MSW General Approximations Using 1,200,000 SF			
MSW Generation	0.059	lbs/sq.ft/day	CA.gov (Office Use, Guidelines for EA prep. Ventura County,1998)
Total	70,800	lbs/day	

Projected Solid Waste

Retail/Commercial	1,625	lbs/day
Grocery Store	3,245	lbs/day
Office	70,800	lbs/day
Total	75,670	lbs/day

H-POWER (From Solid Waste)[1]

Commercial/Grocery/Office or Hotel	77.1%	of solid waste	Characterization Study[1], it is assumed that H-Power generation from solid waste
Total	58,342	lbs/day	would be similar to other Commerical/Office/Hotel usages.

H-POWER (From Solid Waste)[1]

Residential	90.2%	of solid waste	(3-8, Beck, 2006)
Total	17,427	lbs/day	(3-12, Beck, 2006)
Commercial/Grocery/Office or Hotel	77.1%	of solid waste	Characterization Study[1], it is assumed that H-Power generation from solid waste would be
Total	7,845	lbs/day	similar to other Commerical/Office/Hotel usages.

Solid Waste to Landfill[1]

Residential	9.8%	of solid waste
Total	1,893	lbs/day
Commercial/Grocery/Office or Hotel	22.9%	of solid waste
Total	2,330	lbs/day

Recycled Solid Waste Breakdown[1]

Residential		
Paper	6163	lbs/day
Plastic (HI-5)	39	lbs/day
Aluminum (HI-5)	39	lbs/day
Glass (HI-5)	116	lbs/day
Total	6,357	lbs/day
Commercial (Includes Office or Hotel/Retail/Grocery uses)		
Paper	3287	lbs/day
Plastic (HI-5)	41	lbs/day
Aluminum (HI-5)	31	lbs/day
Glass (HI-5)	41	lbs/day
Total	3,400	lbs/day

[1]Taken from Waste Characterization Study. Beck, 2006
Residential - Table 3-5, Commercial - Table 3-7

Projected Waste Generated Summary

Total Solid Waste	29,500	lbs/day
Total H-Power	25,300	lbs/day
Total Landfill Solid Waste	4,200	lbs/day

Total Recycled Material (Including Paper)**	9,757	lbs/day

Filename: X:\2006\06-062\EIS\Solid Waste Generation\Kam DI - Projected Solid Waste Generation

Projected Solid Waste Generation
Alternative Development Plan 2 ("Mall Expansion")
Kam Drive In (06-062.15)
ATA - 12/12/2011

Project Data		
Retail/Commercial	1,522,600	sq.ft

KAM Drive-In Solid Waste Projections

Retail/Commercial MSW Generation Approximations Using 1,522,600 SF			
MSW Generation	0.0250	lbs/sq.ft/day	CA.gov (Guide to MSW, Santa Barbara County P.W. Shopping Center,1997)
Total	38,065	lbs/day	

Projected Solid Waste

Retail/Commercial	38,065	lbs/day

H-POWER (From Solid Waste)[1]

Retail/Commercial	77.1%	of solid waste
Total	29,348	lbs/day

Solid Waste to Landfill[1]

Retail/Commercial	22.9%	of solid waste
Total	8,717	lbs/day

Recycled Solid Waste Breakdown[1]

Retail/Commercial		
Paper	12,295	lbs/day
Plastic (HI-5)	152	lbs/day
Aluminum (HI-5)	114	lbs/day
Glass (HI-5)	152	lbs/day
Total	12,714	lbs/day

[1]Taken from Waste Characterization Study. Beck, 2006, Table 3-7

Solid Waste to Landfill[1]

Commercial/Grocery/Office	22.9%	of solid waste
Total	17,328	lbs/day

Recycled Solid Waste Breakdown[1]

Commercial (Includes Office/Retail/Grocery uses)		
Paper	24,441	lbs/day
Plastic (HI-5)	303	lbs/day
Aluminum (HI-5)	227	lbs/day
Glass (HI-5)	303	lbs/day
Total	25,274	lbs/day

[1]Taken from Waste Characterization Study. Beck, 2006, Table 3-7

Projected Waste Generated Summary

Total Solid Waste	75,700	lbs/day
Total H-Power	58,400	lbs/day
Total Landfill Solid Waste	17,300	lbs/day

Total Recycled Material (Including Paper)**	25,300	lbs/day

**Total taken as a percentage of the projected solid waste

Filename: X:\2006\06-062\EIS\Solid Waste Generation\Kam DI - Projected Solid Waste Generation

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC.
CIVIL ENGINEERS • SURVEYORS

APPENDIX E

PRELIMINARY ELECTRICAL AND TELEPHONE LOAD SUMMARY

Projected Waste Generated Summary

Total Solid Waste	38,100	lbs/day
Total H-Power	29,300	lbs/day
Total Landfill Solid Waste	8,700	lbs/day

Total Recycled Material (Including Paper)**	12,700	lbs/day

**Total taken as a percentage of the projected solid waste

Filename: X:\2006\06-062\EIS\Solid Waste Generation\Kam DI - Projected Solid Waste Generation

Kam Drive-In Site - Preliminary Energy Consumption and Telephone Line Budget

for Austin, Tsutsumi and Associates (Based on 12 April 2011 Project Summary) Date: Rev 8 November 2011

Use	Unit/ Space	SF	VA per Space	VA per SF	Total KVA	Oper. Hours	Total KWH per day	Total MWH per month	Lines per Unit	Lines per 1000 SF	Anticipated Operational Hours	HECO EUI per Use	Yearly MWH based on HECO EUI	MWH Delta
Phase - 4														
Residential Condominium	410	395,404		2.85	1,127	14	15,777	473.30	615		0800 - 2200	14.4	5693.82	14.23
Parking - Surface	6		50		0	5	2	0.05			1800 - 2400			
Parking - Structure	630		250		158	17	2,678	80.33			24 hour operation			
Phase - 4 Totals	1046				1,285		18,456	553.67		0				
Residential/Mixed Use Totals	4653				6263		89590	2688	2250	223				
Alternate 1 - Office/Retail Option														
Retail		120,000		5	600	14	8,400	252.00		120	0800 - 2200	25.5	3060.00	36.00
Office		1,200,000		4.5	5,400	14	75,600	2,268.00		1,200	0800 - 2200	22.8	27360.00	144.00
Parking - Surface	240		50		12	5	60	1.80			1800 - 2400			
Parking - Structure	4800		250		1,200	14	16,800	504.00			0800 - 2200			
Office/Retail Totals	5040				7,212		100,860	3,025.80		1,320				
Alternate 2 - Retail Option														
Retail		1,522,600		5	7,613	14	106,582	3,197.46		1,523	0800 - 2200	25.5	38826.30	456.78
Parking - Surface	240		50		12	5	60	1.80			1800 - 2400		21.60	
Parking - Structure	4800		250		1,200	14	16,800	504.00			0800 - 2200		6048.00	
Retail Totals	5040				8,825		123,442	3,703.26		1,523			44895.90	

HECO Electricity Utilization Index (EUI) - Energy Consumption based on Space Usage Type

- Grocery Space - 70.5 kWH/sq. ft. - year
- Retail Space - 25.5 kWH/sq. ft.- year
- Office Space - 22.82 kWH/sq. ft.-year
- Lodging/Hotel Space - 22.7 kWH/sq. ft.-year
- Condominium Space - 14.4 kWH/sq. ft.-year
- Restaurant Space - 52.88 kWH/sq. ft.-year

Kam Drive-In Site - Preliminary Energy Consumption and Telephone Line Budget

for Austin, Tsutsumi and Associates (Based on 12 April 2011 Project Summary) Date: Rev 8 November 2011

Use	Unit/ Space	SF	VA per Space	VA per SF	Total KVA	Oper. Hours	Total KWH per day	Total MWH per month	Lines per Unit	Lines per 1000 SF	Anticipated Operational Hours	HECO EUI per Use	Yearly MWH based on HECO EUI	MWH Delta
Phase - 1														
Grocery Anchor		55,000		14	770	14	10,780	323.40		55	0800 - 2200	70.5	3877.50	-3.30
Retail		52,044		5	260	14	3,643	109.29		52	0800 - 2200	25.5	1327.12	15.61
Office/Hotel		80,000		4.5	360	14	5,040	151.20		80	0800 - 2200	22.8	1824.00	9.60
Parking - Surface	321		50		16	5	80	2.41			1800 - 2400			
Parking - Structure	427		250		107	17	1,815	54.44			24 hour operation			
Phase - 1 Totals	748				1,513		21,358	640.74		187				
Phase - 1B														
Retail		17,608		5	88	14	1,233	36.98		18	0800 - 2200	25.5	449.00	5.28
Residential Condominium	320	308,608		2.85	880	14	12,313	369.40	480		0800 - 2200	14.4	4443.96	11.11
Parking - Surface	24		50		1	5	6	0.18			1800 - 2400			
Parking - Structure	542		250		136	17	2,304	69.11			24 hour operation			
Phase - 1B Totals	886				1,104		15,856	475.67		18				
Phase - 2														
Retail		13,054		5	65	14	914	27.41		13	0800 - 2200	25.5	332.88	3.92
Residential Condominium	385	345,870		2.85	986	14	13,800	414.01	578		0800 - 2200	14.4	4980.53	12.45
Parking - Surface	19		50		1	5	5	0.14			1800 - 2400			
Parking - Structure	597		250		149	17	2,537	76.12			24 hour operation			
Phase - 2 Totals	1001				1,201		17,256	517.68		13				
Phase - 3														
Retail		5,679		5	28	14	398	11.93		6	0800 - 2200	25.5	144.81	1.70
Residential Condominium	385	345,870		2.85	986	14	13,800	414.01	578		0800 - 2200	14.4	4980.53	12.45
Parking - Surface	7		50		0	5	2	0.05			1800 - 2400			
Parking - Structure	580		250		145	17	2,465	73.95			24 hour operation			
Phase - 3 Totals	972				1,159		16,664	499.93		6				

Appendix I

Market Study, Economic Impact Analysis, and Public Costs/Benefits Assessment

Market Study, Economic Impact Analysis, and Public Receipts/Costs Assessment of the

PROPOSED

LIVE, WORK, PLAY AIEA

COMMUNITY

Aiea, Oahu, Hawaii

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REAL ESTATE
CONSULTANTS
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November 18, 2011

Mr. John Manavian
Robertson Properties Group
120 N. Robertson Boulevard
Los Angeles, California 90048-3115

Market Study, Economic Impact Analysis and Public Fiscal Receipts/Costs Assessment of the Proposed Live, Work, Play Aiea Community Aiea, Oahu, Hawaii

Dear Mr. Manavian:

At your request, we have completed a series of market and econometric analyses associated with Live, Work, Play Aiea, a proposed mixed-use community to be located on the 13.98 acres of the Kam Swap Meet and the former Kamehameha Drive-In site fronting Moanalua Road and Kaonohi Street, across from the Pearl Ridge Shopping Center in Aiea, approximately nine miles northwest of central Honolulu, Oahu.

The multi-phase community will contain up to 1,500 residential units in five residential buildings, 143,000 square feet of neighborhood commercial space, and 80,000 square feet of office/medical (and/or lodging component) within a master planned community providing a comprehensive lifestyle opportunity within a modern urban environment. The subject property is an "in-fill" location, and will benefit from close proximity and synergistic interaction with established urban uses and the proposed Honolulu Rapid Transit rail system.

Our assignment was to: (1) determine the level of demand for Live, Work, Play Aiea relative to available supply; (2) assess the appropriateness of the site and master plan from a market perspective; and (3) quantify the economic impacts of the project within the public and private spheres presently and in the future. Our study was primarily comprised of three elements:

1. **Market Study**. To ascertain whether there currently exists or will exist sufficient demand in the Aiea residential, commercial and office/medical real estate sectors to successfully absorb the finished subject inventory in a timely manner given its characteristics and those of competing in-place and proposed regional developments.

2. **Economic Impact Analysis**. To estimate the general and specific effects on the local economy which will result from Live, Work, Play Aiea, including construction and business employment, wages and income, contractor/supplier profits, end-user expenditures, and other regional monetary and employment effects. This study also identifies and determines specific effects associated with regional real property issues including population, school-age children, and affordable housing.

3. **Public Fiscal Costs/Benefit Assessment**. To quantify the tax receipts, marginal public costs, and net marginal benefits which will be received by the State of Hawaii and the City & County of Honolulu resulting from Live, Work, Play Aiea's actualization and operation.

The subject property, identified on State of Hawaii Tax maps as First Division Tax Map Key 9-8-13, Parcel 13: (1) varies from level to sloping from mauka to makai; (2) has superior access and frontage characteristics; (3) offers excellent view panoramas; and (4) is surrounded by existing high density urban development.

The site is (1) generally rectangular; (2) within the "Urban District" on State Land Use maps; (3) zoned "B-2 Business" by the County; and (4) is one of the larger vacant business-classified parcels in greater Honolulu.

The pertinent results from our studies are presented in the following report, which opens with an Executive Summary focusing on brief narrative describing our conclusions. The remainder of the report is comprised of a series of six addenda exhibits containing the tabular presentation of our data, analysis and modeling for each aspect of the assignment.

As part of our investigation program, we have: visited the subject property and its environs; researched the Honolulu and the Aiea submarkets including residential, commercial, and office/business real property market sectors; interviewed knowledgeable parties active in the regional economy; reviewed government statistics, policies and publications; accessed on-line databases; and compiled materials from published and private sources.

We have analyzed the master plan under several scenarios, concentrating on the primary alternative summarized. In addition, we have assessed the impact on our conclusions if portions (or all) of the 80,000 square foot office/medical component are put to alternative uses, such as convalescent care, senior housing and/or lodging or specialized residential uses.

All conclusions presented herein are subject to the limiting conditions, assumptions and certifications of The Hallstrom Group, Inc., in addition to any others specifically set forth in the text. All work has been completed in conformance with the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute, and the Uniform Standards of Professional Appraisal Practice (USPAP).

Based on our investigation and analysis, we have concluded as of September 1, 2011 (the effective date of study):

- The makai area of Aiea is a well-established, middle-class, mixed-use community located at the westerly gateway to greater urbanized Honolulu. There is an evident demand for additional residential and commercial development in the virtually built-out neighborhood that has not been met due to the lack of available development sites.

- The Live, Work, Play Aiea master plan reflects progressive mixed-use planning and design, the underlying site has the attributes necessary to support the proposed project, and we conclude the subject will be strongly competitive in the regional residential, commercial and office/medical sectors.

- We forecast the proposed 143,400 square feet of commercial space inventory of the subject will be fully absorbed within seven years from initial offerings; the 1,500 residential units will sell-out within ten years from the completion of the first condominium homes; and, the 80,000 square feet of office/medical space will require up to 12 years to absorb depending upon the final use of the component.

- Construction of the community will provide some $766.9 million in investment into the Oahu economy, creating thousands of worker-years during development and stabilized employment after completion. It will provide an a opportunity for hundreds of families to enjoy a comprehensive "urban village" lifestyle with residences, shopping, restaurants, employment, health and other services, and amenities within an easily walkable community.

- The City and County of Honolulu will realize real property Gross Excise taxes and other secondary receipts of $83.5 million during the 13-year construction and absorption period, and $8.1 million annually on a stabilized basis thereafter.

- The State of Hawaii will receive General Excise, income tax and secondary revenues of $244.1 million during the build and sales projection time frame, and $21.0 million per year thereafter.

- During construction both the County and State will experience substantial net cash flow benefits.

- When viewed from a marginal revenue/cost perspective comparing the fiscal impacts from building the project ("with") versus not building it ("without"),the County will experience a net marginal benefit of $28,350 annually on a stabilized basis after full absorption. The State of Hawaii will have a net marginal benefit of $26,956 per year. The total net benefit to local governments is $55,306 annually.

We appreciate the opportunity to be of service to the Robertson Property Group in regards to this prominent mixed-use community.

Respectfully submitted,

THE HALLSTROM GROUP, INC.

Tom W. Holliday

Tom W. Holliday

/jmo/as

THE HALLSTROM GROUP INC.
REAL ESTATE CONSULTANTS & APPRAISERS

Market Study,
Economic Impact Analysis, and
Public Fiscal Receipts/Costs Assessment

PROPOSED
LIVE, WORK, PLAY AIEA
COMMUNITY

Located at

Aiea, Oahu, Hawaii

Prepared for

Mr. John Manavian
The Robertson Property Group

As of

November 2011

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ADDENDA

Exhibit I - Primary Study Area Residential Market
Exhibit II - Primary Study Area Commercial Market
Exhibit III - Primary Study Area Office Market
Exhibit IV - Oahu Tourism and Hotel Market
Exhibit V - Economic Impace Analysis
Exhibit VI - Public Fiscal Tax Receipts Assessment
Qualifications of The Hallstrom Group, Inc.
Qualifications of the Analysts

INTRODUCTION

"Live, Work, Play Aiea" (LWPA) will comprise approximately 14 acres located in the in the lower elevations of Aiea, makai of the H-1 Freeway, between Kamehameha Highway and Moanalua Road. The near-rectangular site is within a near fully-developed, well-established, mixed-use urban neighborhood, and represents one of the prime in-fill opportunities in the Greater Honolulu real estate market.

Capitalizing on a level to sloping site having superior access/frontage and view potential characteristics, favorable climate, and consistent with nearby similar existing uses, the subject development is intended to be a leading edge master planned urban village community.

The current design calls for: up to 1,500 condominium homes, at least thirty percent (per the city and county rules) of which will meet City and County affordable housing pricing guidelines; up to 143,400 square feet of commercial space, primarily neighborhood retail in a "main street" setting; and, up to 80,000 square feet of office space which will support a variety of businesses, medical, service-oriented and other uses. The community will contain surface and structured parking, landscaped paths, thematic design, and provide a new "Main Street" connector road for the area.

LWPA will be the first major mixed-use community with transit ready-design elements interacting with the proposed Honolulu Rapid Transit rail line, located near a primary station of the system that is a focal point for achieving Transit Oriented Development planning objectives.

LWPA will transform a well-located, near-vacant property providing nominal economic benefit to the community, which historic use is now considered obsolete, into a regional asset providing needed affordable/workforce housing, producing thousands of "worker years" of employment and wages,

attracting significant new capital investment, and stimulating spending. This activity will in turn create employment and business opportunities for Oahu residents and further expand the tax base for the state and county.

The Hallstrom Appraisal Group, Inc.'s assignment was to analyze the proposed LWPA master-planned community from a real estate market perspective and to identify and quantify probable market and economic impacts associated with its development in light of competitive, regional, prevailing and forecast trends to answer four basic study questions:

1. Is there sufficient demand to absorb the various "marketable" components of the subject community during a reasonable exposure period given competing developments and projected statewide/regional market trends?

2. Will the community be an appropriate use of the underlying site relative to market needs?

3. What will be the general/specific and direct/indirect economic impacts on Oahu resulting from the undertaking of the subject community via employment, wages, business operations, population, and other economic activity related to the real property asset?

4. What will be the effect on the state and county "public purse" from the LWPA project?

These issues were addressed through a comprehensive research and inquiry process utilizing data from market investigation, governmental agencies, various Hawaii-based media, industry spokespersons/sources, on-line databases, and published public and private documents.

The pertinent results of our study are highlighted in the following Executive Summary which contains a concise narrative and tabular synopsis of our conclusions. Additional supporting materials, data tables, descriptions of our methodology and the models depicting the subject community's

lifespan from commencement to completion, are presented in the Addenda.

This Executive Summary presentation is divided into six sections:

1. **Primary Study Conclusions**

2. **Real Estate Outlook**

3. **Overview of the Community's Master Plan Market Concept**

4. **Market Study of the Community's Master Plan Components**

5. **Appropriateness of the Subject Site and Absorption Estimates**

6. **Economic Impacts of the Proposed Community**

7. **Public Fiscal Receipts/Costs Assessment**

The primary source information regarding the subject community used in our study were: maps, master plans, unit counts, density estimates and background materials provided by MVE Pacific and PBR Hawaii; cost estimates and associated materials supplied by Form Partners LLC; resident population and housing projections, community plan materials and other data from the City & County of Honolulu Department of Planning and Permitting; the United States 2010 Census; sales and listing data from the Honolulu Board of Realtors and Hawaii Information Service; and, data from our files.

Definition of Market Area Location Terms

The LWPA site and environs have been viewed by our firm on many occasions and specifically for this assignment. The effective date of study was September 1, 2011.

Within our analysis, we repeatedly use terms to describe various market areas and regions of Oahu pertinent to our study. Many are officially defined, as in the Central Oahu and

Ewa District; others are more generally/loosely identified market areas. Among these are:

- "*Greater Honolulu*", the urbanized corridor stretching from Aiea/Pearl City to Hawaii Kai.
- "*Central Honolulu*", roughly from the Airport/Mapunapuna to Kahala, encompassing Downtown and Waikiki.
- "*Primary Study Area*", the communities of Aiea and Pearl City, identified as "Neighborhoods" 20 and 21, respectively, on City & County of Honolulu Department of Planning and Permitting maps. These also generally correspond with the "Aiea" and "Waiau/Pacific Palisades" Development Plan Sub-Area designations, and are slightly different than the US Census place/tract designations.
- "*Subject Neighborhood*", the area makai of the H-1 Freeway between Waimalu Stream and the H-1/H201 Freeway interchange. Commonly called the "Pearlridge" area or neighborhood.

Due to the need to extract data and variables from the variety of sources listed above, not all of the information is geographically coterminous as the defined area may change slightly from one source to the next. We do not believe there was any instance where these minor differences were significant enough to skew the data.

PRIMARY STUDY CONCLUSIONS

Based on our analysis of the subject property, its environs, and envisioned development we have reached the following conclusions as of September 1, 2011 regarding the probable market standing and economic impacts of the proposed Live, Work, Play Aiea community:

- Although Hawaii is slowly recovering from a recent cyclical down real estate market, expectations are activity will generally recover towards long-term average levels over the next several years, and that another upcycle will ensue. And, regardless of the recent economic instability there continues to be an unmet need for affordably-priced housing on Oahu generally, and in greater Honolulu, specifically (including the study area).
- The Aiea makai residential market, typified by older mid to high-rise condominiums and some older single family subdivisions, is relatively stable, with mostly long-term households who enjoy living in the area. Few units are listed for sale, market exposure times are short, and prices did not fall as dramatically during the recent downturn as was seen elsewhere on the island. There have been no major inventory additions for upwards of two decades.
- The demand for new residential units in the Primary Study Area will range from a minimum of 1,024, based on the Planning Department's assumption of virtually no available developable land, to a market-based maximum of 7,531 units, assuming sufficient land were available, over the next 25 years through 2035. Mid-point demand will be for 4,278 additional homes.
- The number of existing unsold and planned units in the Primary Study Area excluding the subject project, totals less than 200 homes, apart from redevelopment of existing house lots.
- Comparison of our demand and supply projections indicates there will be a minimum shortfall in the Primary Study Area residential sector of from circa 600-plus (as artificially restricted by supply) to 7,100 new residential units (assuming natural market growth); with a mid-point under-supply of 3,800 units. Our analysis clearly demonstrates there will be sufficient unmet demand in the study area to absorb the 1,500 homes of subject inventory.

- In addition to serving the needs of community residents, the study area is a primary regional commercial center for Oahu, with nearly two million square feet of commercial floor space, or 10 percent of the island total, including the second largest shopping center. Vacancy rates are among the lowest on the island, rents are high for a non-Central Honolulu/Waikiki location, most businesses are long-term tenants, and there is little turnover (with available spaces being readily absorbed).

- As with residential uses, the demand for commercial space in the study area is limited by the scarcity of available land for additional inventory more so than by a lack of potential patronage. We estimate that were there sufficient development sites, the community could support up to an additional 525,000 to 800,000 square feet of gross leasable floor space by 2035; an increase of up to 40 percent over the existing inventory, and keeping with its status as a regional shopping and dining destination. Apart from regional-serving potentials there is also existing unmet and projected future demand for new "Neighborhood Commercial" development in the subject's effective trade area.

- While there are available (and under-built) commercial sites elsewhere in the region, there are scarce development opportunities in the high-demand Subject Neighborhood which could address market demand levels.

- The primary focus of the LWPA commercial component is to address the specific day-to-day needs of the project's residents, and enhance the supply of "neighborhood commercial" in the immediate trade area; not to provide regional/destination stores in direct competition with Pearlridge. This study projects the demand created by the LWPA residents (primary patrons), other trade area residents, on-site workers, and passer-bys/intercept (secondary patrons) will be sufficient to absorb the commercial component of 143,000 square feet prior to full build-out of the community.

- The study area office space sector has approximately 250,000 square feet of inventory, or less than two percent of the total amount built on Oahu; the majority of which is for service and medical businesses serving community residents or supporting other businesses in the area. The vacancy rate of 8.74 percent is low relative to the entire island and rents are in the middle to upper-end of the range. Expanding medical uses have been the source of most of the demand in the Primary Study Area, with traditional office/business use demand growing at a smaller rate. Interviews with area brokers and building managers indicate medical-oriented users are expected to continue seeking additional space in the Subject Neighborhood.

- We estimate the demand for additional office floor space in the study area over the next 25 years will total about 180,000 square feet, an increase of over 70 percent above current levels; which assumes sufficient development land is available, a continuation of the existing focus on medical-related business types, and a continuation of historic demand trends. Estimates could reach be if a new, atypical, and/or major operation locates to the area.

- As with residential and commercial lands, available office-potential development sites are scarce, and we are not aware of any major proposed project in the near to mid-term.

- The subject property is a superior location for the proposed development in regards to access, views, slope, shape, complimentary existing adjacent uses, climate and ability to provide a quality lifestyle and business opportunities for a wide-range of owners and end-users. It will have the attributes necessary to be highly competitive in all its product sectors, and will capture a reasonable market share during its offering period.

- If the Honolulu Rapid Transit project proceeds as planned, LWPA will work synergistically with the system by using the available capacity being created.

The proposed line will not meaningfully impact the near to mid-term standing of the subject development or substantially impact the absorption velocity during the initial phases. LWPA will achieve similar overall absorption whether or not the rail is built. Current plans call for completion of the line to Central Honolulu in 2019. By the time the train is fully operational in 2020-21, LWPA will be in its final phase of construction with the large majority of product already absorbed, so the only real uptick will be experienced in the final years of sales; a positive movement which was reflected in our absorption estimates for the last years of sales/leasing, and throughout our economic modeling.

- We estimate the 1,500 LWPA residential homes, many of which will meet affordable pricing guidelines, will be fully absorbed (sold-out) within a 10-year sales period. The 143,385 square feet of neighborhood commercial space will require just over seven years to reach full-occupancy, and the lease-up of the 80,000 square foot office/medical space component will take up to 12 years. Alternative uses of the office space in response to emerging market demand, such as for senior-oriented services and/or hotel uses, could speed the absorption of this component.

Our annualized mid-point absorption estimates are summarized on Table A.

- LWPA will generate circa $766.9 million in capital investment into the Oahu economy. The construction and on-going operations/maintenance of the residences, commercial and businesses, and community facilities will provide an estimated 12,776 "worker-years" of employment and $621.2 million in total wages over a 13-year absorption period. After "stabilization" the urban village community will support some 951 permanent jobs with an annual payroll of about $46.9 million and host an estimated $157.9 million in economic activity per year.

TABLE A

SUMMARY OF SUBJECT ABSORPTION PROJECTIONS BY PRODUCT TYPE
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
Using Rounded Mid-Point Demand Estimates

Year		Residential		Commercial Floor Space		Office Floor Space	
		Inventory	Demand	Inventory	Demand	Inventory	Demand
		(Units)		(in Sq. Ft.)		(in Sq. Ft.)	
2014	Phase I Opens			107,044	75,000	80,000	8,500
2015	Phase IB Opens	320	150	17,608	20,000		7,500
2016			100		15,000		5,000
2017	Phase 2 Opens	385	125	13,054	10,000		5,000
2018			150		10,000		6,000
2019	Phase 3 Opens	385	150	5,679	10,000		6,000
2020	HRT System Opens		175		3,385		7,000
2021	Phase 4 Opens	410	200				7,000
2022			200				7,000
2023			200				7,000
2024			50				7,000
2025							7,000
Totals		**1,500**	**1,500**	**143,385**	**143,385**	**80,000**	**80,000**
Average Annual Rate of Absorption During Sales Period			**150 Units**		**20,484 Gross Sq. Ft.**		**6,667 Gross Sq. Ft.**

Source: The Hallstrom Group, Inc.

- At build-out the de facto population of the community will be some 4,080 persons of which 4,035 will be full-time residents (with a DOE-estimated 570 school-age children attending public schools) and 45 will be comprised of non-resident owners and their guests periodically using their condominium. The total resident household income will be $116.5 million annually on a stabilized basis (in constant 2011 dollars), and discretionary expenditures into Oahu businesses by the LWPA community residents will be some $72.7 million per year.

- The on-going business activity within the commercial and office components will be substantial, both directly on-site and in stimulation of existing off-site companies. During the absorption period, a total of $1.51 billion in taxable sales/revenues are projected, averaging $115.9 million per year. Following stabilization, $170.5 million annually in business activity will be occurring in the community.

- The project will have nominal impacts on the socio-economic aspects of the surrounding community that relate to real property issues. Property values in the subject neighborhood are largely driven by external, cyclical economic factors and its existing cumulative mass, not any single new project. Further, the estimated prices of the envisioned LWPA community residences will not be substantially above the range for the existing Honolulu market inventory. It is not expected there will be any in-migration to Oahu as a direct result of the operating components of the community.

- The City and County of Honolulu will realize real property Gross Excise taxes and other secondary receipts of $83.5 million during the 13-year construction and absorption period, and $8.1 million annually on a stabilized basis thereafter. The State of Hawaii will receive General Excise, income tax and secondary revenues of $244.1 million during the build and sales

projection time frame, and $21.0 million per year thereafter.

- When viewed from a marginal revenue/cost perspective comparing the fiscal impacts from building the project ("with") versus not building it ("without"), the County will experience a net marginal benefit of $28,350 annually on a stabilized basis after full absorption. The State of Hawaii will have a net marginal benefit of $26,956 per year. The total net benefit to local governments is $55,306 annually.

The major economic impacts and public costs/benefits conclusions are summarized on Table B. The column on the left summarizes the cumulative impacts during the initial 13-year construction and sales period, and the right hand column the annual impacts thereafter. All figures are expressed in constant 2011 dollars.

REAL ESTATE OUTLOOK

The Hawaii economy began recovery from the depths of a significant recession at the end of 2009. During the following year growth returned to the vital visitor industries of Oahu and Maui (less so for Kauai and the Big Island), and other economic sectors showed signs of stabilization. Business activity, employment, real estate and tax receipts, among other indicators, appeared to have passed through the nadir of the down-cycle and into a nascent recovery mode.

The positive signs continued into early 2011, but were meaningfully disrupted in the spring by events external to the islands, including the Japan earthquake and tsunami, political instability in the Middle East, rising oil prices, European credit issues, and a sluggish mainland US recovery. While tourism, hotel and retail indicators have continued to show subsequent growth, though more subdued, the overall Hawaii economy has been generally static in recent months with limited expansion and concerns that a new recessionary period is in the offing.

TABLE B

SUMMARY COMPARISON OF MAJOR ECONOMIC IMPACTS AND PUBLIC FISCAL RECEIPTS AND MARGINAL COSTS
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
All Amounts Expressed in Constant, Uninflated 2011 Dollars

Economic Impact Analysis Item	Cumulative During 13-Year Build-Out/Absorption Period	Stabilized Annually Thereafter
Direct Capital Investment	$766,895,940	
Local Contractor's Profits	$76,689,594	
Local Supplier's Profits	$30,675,838	
Worker Years of Jobs	12,776	951
Employee Wages	$621,204,378	$46,884,062
De Facto Population		4,080
Estimated Number of School-Age Children		639
Estimated Number of Children in Public Schools (DOE figure)		570
Full-Time Resident Household Income	$706,742,582	$116,496,030
Owners/Guest Expenditures (On & Off Site)	$441,449,220	$72,724,035
Total Operating Gross Receipts (Business Activity)	$1,398,029,500	$157,869,500
Outside Patronage Expenditures	$1,506,338,750	$170,538,750
Total Oahu "Base" Economic Impact	$2,395,252,748	$179,293,410

Public Fiscal Revenues Analysis	Cumulative During 13-Year Build-Out/Absorption Period	Stabilized Annually Thereafter
Gross Tax Receipts		
City & County of Honolulu	$83,462,312	$8,066,334
State of Hawaii	$244,137,263	$21,003,611

Public Fiscal Costs Analysis	Net Revenues		Net Costs		Benefit/(Loss)
Correlated Marginal Revenues/Costs Analysis (1)					
City & County of Honolulu	$115,110	-	$86,760	=	$28,350
State of Hawaii	$354,961	-	$328,005	=	$26,956
Total	**$470,071**	-	**$414,765**	=	**$55,306**

(1) The net difference in governmental revenues and costs "with" the subject project being built versus "without" it being built.

Source: The Hallstrom Group, Inc.

The slowing of growth in the key State industries has also resulted in many traditionally trailing sectors becoming mired and not recovering and expanding as had been anticipated, particularly on the neighbor islands.

While activity levels have shown significant increases, prices in most sectors of the Hawaii real estate market have not demonstrated substantial revival during the initial economic recovery over the past 18 months.

However, on Oahu demand for moderate to lower priced residential units continues to be very high (and evidencing some appreciation), investor interest in hotels and other commercial properties has meaningfully increased, and there are escalating numbers of Asian buyers (notably Japanese, Chinese and Korean) attracted by the post-recessionary prices and a favorable exchange rate.

Notwithstanding the impacts on Oahu residential sector from continuing external factors, the market has foundational conditions which should enable a move towards an upcycle if the national economy stays out of recessionary mode. Mortgages are again readily available at generationally-low interest rates (although the approval process is more extensive), there is no major "overhang" of existing inventory which must be absorbed as in many American cities, and there has been continuing natural household growth over the past four years which creates pent up demand that will again express itself via real estate as the island economy regains its vigor.

According to the University of Hawaii Economic research Organization (UHERO), despite concerns over a softening recovery, full-year 2011 will report advances in regards to virtually every major economic indicator, including employment, personal income, gross domestic product, and tourism statistics, with further gains anticipated in 2012.

This economic cycle has been numerously repeated since Statehood in seven to 10-plus year time-frames.

Expectations are statewide real estate activity will again show modest gains for the remainder of 2011 and into 2012, albeit at lower prices and absorption levels than mid-decade highs, followed by movement into the next growth cycle by 2013-14. Based on historic trending, by the mid to latter part of this decade, hyper-appreciation and shortages of supply may well again be community concerns.

The real estate market in the Subject Neighborhood, comprised of the Aiea neighborhoods located makai of the H-1 Freeway corridor, fared relatively well during the recent recession in comparison with other locales on Oahu and throughout the state.

While average prices for residential inventory plummeted by as much as 25 to 40-plus percent from 2006-07 peaks in many island locales, average single family home prices in the Subject Neighborhood were off 26 percent, and condominium unit average prices fell by just 11 percent. Commercial floor space vacancies remained exceptionally low at less than two percent, Pearlridge stayed effectively fully occupied with only minor downward spending levels, and few tenants in the area sought/received meaningful rent rebates which were common elsewhere. Land values declined by only a respectable 10 to 15 percent.

Brokers report continuing strong interest in the community for product, with limited numbers of listings and short marketing times.

Regardless of the near-term issues, a solid foundation supports a continuing demand for a variety of urban uses in the primary study area over near to long-term.

During the build-out period of LWPA there could be one or more economic/market cycles with periods of rapid absorption and others slow; although it would not be expected for the regional sectors to stagnate as would be seen elsewhere due to the well-established and high demand character of the area.

And, despite the recession and slowness of the recovery, there persists a chronic shortage of competitive quality, affordably-priced housing in Greater Honolulu. This residential sector, which is critical to the sustainability of a community, is a specific target category for much the subject product.

OVERVIEW OF THE MASTER PLAN MARKET CONCEPT

The Live, Work, Play Aiea (LWPA) master plan envisions an urban village embodying leading-edge planning, design, and development techniques, providing a comprehensive lifestyle opportunity for a diverse population of residents, while being complementary with surrounding uses and enhancing the real property inventory of the surrounding Aiea community.

LIVE, WORK, PLAY AIEA PHASING AND MARKETABLE COMPONENTS			
Phase	Residential Units	Commercial Space	Office Space
		(Square Feet)	(Square Feet)
1		107,044	80,000
1B	320	17,608	
2	385	13,054	
3	385	5,679	
4	410		
Totals	1,500	143,385	80,000

From a market perspective, the master plan builds upon a favorable confluence of factors, primary of which are:

- *A scarcity of newer inventory in a high-demand area.* The Primary Study Area is a well-established neighborhood at the westerly gateway to the Greater Honolulu core. The Subject Neighborhood is a self-contained urban environment, with a wide mix of neighborhood and regional use types, a favorable climate, access to major transportation routes, and a central location with relative proximity to Downtown and Waikiki employment centers, the airport, and outlying rural districts.

  The demand for residential units in the area is strong, as evidenced by the scarcity of inventory on the resale market, how quickly it is absorbed, and the lessened decline in prices during the recent market downturn. Most of the owners are long-time members of the community and there is an expressed need for additional housing to support generations of families who wish to continue living in Primary Study Area. And, many of the households which move to Ewa/Kapolei and Central Oahu in order to find reasonably-priced newer units would welcome purchase alternatives closer to town.

  Similarly, the Subject Neighborhood experiences among the highest commercial occupancy levels on Oahu, with available space at a premium and scarce vacancies typically quickly filled. Many of the stores, restaurants and service providers have been at their location for decades. As a major regional shopping destination with

strong freeway/highway access characteristics, within a well-populated neighborhood trade area, it is a highly competitive location for new and expanding businesses.

However, Primary Study Area has been effectively built-out for many years, with only limited amounts of product additions in the residential, commercial, and office sectors.

LWPA will address this lack of competitive new supply during the coming decade, and provide a vital opportunity for "refreshing" the aging Primary Study Area real estate inventory with new product specifically designed to meet the demands of both younger and older generations.

- *A superior site.* The subject property is one of the larger, prime developable, "vacant" holdings in Greater Honolulu. At nearly 14 acres, with an efficient shape, relatively gentle topography, excellent view planes, ready access to major roadways, and complementary adjacent urban development, the site offers a superior opportunity to meet planning objectives calling for sustainable, mixed-use, lifestyle projects.

  Additionally, it will be among the first communities to relate with the proposed Honolulu high-capacity rapid transit project (or Honolulu Area Rapid Transit, HART) and embody the Transit Oriented Development (TOD) planning concepts intended to maximize the system's potentials.

  Within a market context, the subject property is viewed as a "in-fill" parcel, appropriate for near-term moderate to intense development, which would readily integrate into the exiting community, forgoing additional urban sprawl in Central Oahu and Ewa, and not requiring the use of agricultural or otherwise pristine lands to meet resident, business and consumer needs.

- *In concert with market trends.* Although Honolulu has a significant amount of high-rise condominium and apartment inventory for a city of its size, the residential development trend on the island since the mid-1980s was away from Greater Honolulu residential mid and high-rise condominiums buildings and focused towards low-intensity, mostly single family-type, product in Ewa/Kapolei, Central Oahu and East Honolulu.

  However, over the past decade, Oahu residents have returned to embracing a new generation of mid and high-rise living opportunities, as evidenced by the absorption of some 4,000 such new units in Downtown, Kakaako, Waikiki, and elsewhere in the central core, covering a broad pricing and buyer spectrum. Evolving unit designs, project amenities, security benefits, and integration of (or easy access to) supporting businesses, are perceived as providing a highly desirable lifestyle by buyers ranging from young families/professionals to aging "empty nesters".

  The opportunity to "get out of the car" and walk or use public transportation is another factor in the resurgence of this residential sector.

  Leading market design trends are also moving away from strip malls and enclosed "boxy" developments towards a more pedestrian-friendly and visually appealing "main street" and "urban village" ambience, with inviting streets , neighborhood stores, gathering areas, and a walkable scale.

  The inclusion of office space completes the comprehensive lifestyle concept by insuring proximate space for businesses which service the residents and nearby community, and the retail components of the project.

  The LWPA master plan builds on these evolutions, and will be Hawaii's most significant and fully realized mixed-use development to date.

- *Adaptability to an evolving market environment.* A competitive, large-scale, mixed-use project taking years to build-out, requires the ability to adapt to a changing market environment.

  Beyond the "standard" types of uses envisioned for the subject project, the developer perceives a potential for other uses that could be successfully incorporated. Senior housing/assisted living/long-term convalescent care, and associated geriatric medical services (that serve the entire community), are anticipated to be in major demand in coming years and could be successfully integrated into LWPA. As could research & development concerns, a kamaaina lodging facility, or a business requiring major space resources near Honolulu.

Based on our analysis of the subject property and project from a market perspective, we conclude the proposed LWPA master plan will:

- Embrace leading edge mixed use "urban village" design concepts.
- Maximize the reasonable development potentials of a prime parcel.
- Complement and enhance existing urban development in its neighborhood.
- Address existing and forecast needs for additional residential and commercial inventory in the study area, which otherwise will not likely be met.
- Integrate well with established and evolving planning goals and the proposed Honolulu Rapid Transit system.
- Provide a desirable/competitive comprehensive lifestyle experience.
- Is representative of the highest and best use of the property.

MARKET STUDY OF THE MASTER PLAN COMPONENTS

The Study Area Residential Market

The population of the Primary Study Area, incorporating Aiea and Waiau/Pacific Palisades, was estimated at 77,484 as of 2010 by the City and County of Honolulu Department of Planning and Permitting (DPP), housed in 25,794 units, with an average resident household size of 3.11 persons. We note, the US Census results for approximately the same area appear to indicate the DPP 2010 forecasts were understated by several percent.

Approximately 96.5 percent of the units are occupied by resident households, with the remainder split between second home/non-resident owners and a nominal number of units which are vacant or in disrepair. This resident usage level is among the highest for any area of Greater Honolulu, the vacancy rate among the lowest.

Current/Near-Term Market

As indicated by the graph below, the current average price for a single family home in the Subject Neighborhood is $515,813, or about 73.2 percent of the island–wide figure. The average price for a condominium unit is at $255,327, or 71.7 percent of the Oahu average. The relatively advanced age of the Subject Neighborhood and that the region was developed as a "middle class/work force" suburban community for central Honolulu workers and their families, contribute to the lower than average price structures.

The trends are generally reflective of the movement seen throughout Oahu since prices reached their peak in 2006-7, with single family housing prices in the Subject Neighborhood off just over 20 percent and condominiums off just over 10 percent. These indicators depict a larger drop than seen in overall Oahu averages, which was primarily due to an appreciation rate that was higher from 2004-07 that spiked prices to uncharacteristically high levels.

The overall strength of the Subject Neighborhood sector, despite the recent down cycle, is demonstrated by its:

- Low vacancy rates relative to other island neighborhoods, at about half the overall Oahu level.
- The scarcity of units listed for re-sale. Currently some 0.9 percent of the total Subject Neighborhood inventory is on the market, among the lowest for any community on Oahu, which overall has circa 1.3 percent of the residential product on the island available for purchase at the present time.
- Strong market acceptance of product. The average "days on market" and "percent of asking price" achieved by residential transactions in the Subject Neighborhood are similar to slightly more favorable than seen in island-wide statistics. Brokers report that many transactions in the area are via "pocket listings", more so than in other areas of Oahu, wherein the property is effectively "placed' by the agency between known clients without ever becoming a true open market listing.

Our discussions with area brokers confirmed the Subject Neighborhood has an above-average consistent, steady demand and comparative competitiveness, with strong interest in additional units among existing area residents; many of which currently live in multi-generational households.

Additionally, with increasingly worsening congestion along the H-1 corridor becoming more of a quality of life issue, they felt that meaningful numbers of buyers who are currently

purchasing in the more outlying developments in Ewa/Kapolei and Central Oahu would be attracted to the study area if competitive product were made available.

Mid to Long-Term Outlook

Based upon DPP's conclusion the region is effectively "built-out" with virtually no major opportunities for new development, the DPP-generated models forecast the population in the study area will drop by some 1,400 persons to 76,028 by the year 2035. However, due to anticipated decreases in average household sizes over the same period, their output projects the smaller population will still require some 1,024 more housing units than are currently in place.

We consider the DPP projections to be a minimalist perspective in light of the characteristics of the existing inventory, community demographics, and there being some sites with reasonable re-development potential; the subject being the prime example.

Our analysis, using baseline market demand figures, assumes the Primary Study Area population, if sufficient inventory were available, would continue to attract about 8.4 percent of the total residents of Oahu, as is its current ratio to the overall island population.

This moderate perspective, which is not artificially limited by consideration of the scarcity of developable land, indicates the population would grow to 87,210 residents by 2035 if sufficient re/development were pursued, creating a demand for up to 7,531 new units over the next quarter-century. We have adopted these forecasts as representative of the "maximum" potential demand for purposes of analysis. However, it is likely even more demand would appear if enough housing inventory were made available.

The indicated mid-point demand would be for 4,278 new additional housing units in the study area during the projection time-frame.

The persons comprising the projected unit demand would primarily include natural community growth (in Aiea and

elsewhere on the island), and de-coupling of existing multi-generation households who want to stay in or relocate to the study area.

A wide spectrum of household types, reflective of the general Oahu market, would be expected to utilize new units in the study area, including: first-time buyers; seniors/empty nesters; Central Oahu/Ewa owners relocating closer to town; families moving away from central Honolulu (but wanting to stay close to work); purchasers looking to upgrade into, or desirous of the lifestyle opportunities of, a modern condominium home; and, buyers seeking affordable to lower-market priced new units which are often unavailable in the Greater Honolulu area.

In order to best fit the forecast demand for units in the region, approximately 25 percent of the new units over the next 25 years will need to be priced at under $300,000 (in 2011 dollars), 40 percent from $300,000 to $750,000, and the remaining 35 percent above $750,000.

At present, an affordable priced home for a moderate income family in Honolulu (four persons at 80 to 120 percent of median income) is in the range $300,000 to $450,000 in accordance with the prevailing interest rate and other estimated factors. For a two-person household, the affordable range for a family at 80 to 120 percent of the median level is from $240,000 to $360,000.

The projected demand will best serve the market if divided between multifamily units, which should comprise some 85 percent of the total additional product, and with single family homes the remaining 15 percent.

There is no unsold new product overhang in the study area which must be absorbed. All projected demand must be met via new development.

There are no major residential projects entitled, proposed, or announced in the general study area according to the current DPP annual report apart from Hale Mohalu II, a 163 unit project in Pearl City offering affordable senior units. The $40 million

development had a ground-breaking ceremony in April 2011 with completion anticipated in 2013.

Some sites in the region have consolidation and redevelopment potential; however, it will take significant time and effort for the market to identify, assemble, entitle, and build any projects. It is likely a successful LWPA would contribute to further redevelopment interest in the Subject Neighborhood, although the prospective scale is highly limited due to the scarcity of available, competitive properties.

There are also some isolated minor in-fill, re-subdivision and single family condominiumization opportunities in the study area; however, it is likely the potential number of such additional units is no more than 250.

In comparing the demand and supply projections, it is evident that the former will far exceed the latter in the study area over the next 25 years. There is forecast demand for between 1,024 units (a DPP estimate based on having virtually no additional supply possible) and 7,531 units (market-based figure), with a mid-point of 4,278 units.

The potential additional supply at this time is at best circa 400 units, excluding the subject project, leaving a short-fall of at least 600-plus to 7,100 units.

It is readily apparent, that the availability of additional supply, not lack of demand, will limit expansion of the residential inventory in the study area, and that any competitive unit offered should be absorbed.

Given the well-established demand for housing in the Primary Study Area, the scarcity of competitive development, and the envisioned quality and estimated pricing of LWPA, we conclude it will achieve a favorable market standing upon commencement of pre-sale and opening of the initial phase.

Addenda Exhibit I contains our residential market study data and modeling tables, along with brief narrative discussion of the methodology and factors.

The Study Area Commercial Market

The Primary Study Area is a regional and destination shopping location for all Oahu customers, in addition to serving as the neighborhood trade area to a large resident population. There are approximately 2.8 million gross square feet of space in the region, or about 14 percent of the island-wide total.

Many of the improvements and tenant businesses have been in-place for decades; however, the Pearl Highlands Center has been a focus of new big box development in recent years. Generally, vacancy rates are lower than island averages and rents higher than in other locations outside Central Honolulu.

The subject/Pearlridge neighborhood has some 1.8 million gross square feet of commercial floor space in major centers/developments, in addition to several hundred thousand square feet in free-standing and minor improvements.

On a per capita basis, the area has more square feet of commercial space per resident than other Oahu communities, and is well-above the overall island average. This is primarily due to Pearlridge Center and abutting projects, which together comprise the second largest shopping destination on the island and attract patrons from throughout Oahu.

The commercial real estate market in the neighborhood is among the most well-established and stable in the State. Vacancies are low, turnover rare, and interest consistent.

Current/Near-Term Market

At present, the vacancy rate among the major centers in the subject neighborhood is only 1.38 percent (24,600 square feet), or just over half the Oahu average of 2.52 percent. A total of 7,870 square feet were absorbed in the first quarter of 2011, twelve percent of the island total demand.

As of the effective study date Pearlridge Center is effectively full at 99.5 percent occupancy, according to management. No major tenants were expected to vacate in 2011-12, none are experiencing major operating difficulties, there were no major cases of tenants seeking or receiving rent rebates, and there are businesses interested in space were it to be available.

We note, that subsequent to our study date, the Borders book store at Pearlridge was unexpectedly closed; however, expectations are the space will quickly be re-let to one or several tenants.

According to brokers/agents, businesses are attracted to the neighborhood primarily by:

- The cumulative attraction created around/by Pearlridge Center and the number of customers this attracts.
- Its location in "the saddle" between Central Honolulu and Ewa/Central Oahu, placing much of urbanized Oahu's population from Kapolei to Wahiawa to Kahala within a 15 to 20 minute (12 to 15 mile) drive.
- Easy access to the H-1 Freeway and Kamehameha Highway.
- Ready availability of parking throughout the area.
- The unique and diverse mix of local and mainland/franchise businesses, large department and small "mom and pop" stores, and the variety of medical, financial, and other services available, which effectively combine to make the area a "one stop" location for virtually every retail, dining, entertainment, and service need.

The commercial floor space sectors of both the Primary Study Area and Subject Neighborhood weathered the recent recession better than most locations on Oahu or elsewhere in the islands, and interest in these prime locations will increase as the economy continues its recovery.

Mid to Long-Term Outlook

Based on historic capture rates, projected island-wide population and economic growth, and evolving demographic and development trends, we project there will be a demand for between upwards of 350,000 to 625,000 gross square feet of additional commercial floor space in the Primary Study Area

over the next 25 years, if sufficient entitled, developable land were available.

This is the equivalent of 31 to 60 gross site acres.

While some of the new demand will be a result of the continuing concentration of regional and destination businesses in the area, residential development at LWPA, and in-fill are expected to bring thousands of new residents (and their consumer needs) into the area.

Within the Subject Neighborhood, where much of the demand would be focused if possible, there are almost no vacant sites available for development other than the LWPA parcel. However, there are an estimated 78 gross acres of entitled or proposed commercial development sites within the Primary Study area outside of the Subject Neighborhood; which will be available to meet forecast additional demand in the region.

Within the Subject Neighborhood, there is significant external demand unrelated to the resident population of the community, and thus problematic to quantify using standard modeling techniques.

Commercial floor space absorption on the re-leasing market in the area has ranged from 18,000 to 45,000 square feet per year over the past decade. And, all agents and center managers agree that the totals would be higher if more competitive space were made available.

Over the past 40 years, since the opening of Pearlridge Center in 1972, a total of more than 1.5 million square feet of new inventory has been absorbed in the Primary Study Area, averaging 37,500 square feet per year. However, the absorption rate has been hampered in the past decade as reduced amounts of product have been added to the area inventory.

Using our market-based resident population projections, the additional persons moving into the neighborhood will create demand for 334,000 square feet of commercial space in addition

to demand generated by consumer populations elsewhere flowing into the areas.

In both the new space and re-leasing markets, demand has been limited by the scarcity of available supply, slow turnover of existing space and limited development, not the evident demand.

Were sufficient space made available, we forecast the Primary Study Area could absorb between 14,000 and 25,000 gross square feet of commercial floor space annually on a going-forward basis over the coming quarter of a century or a total of from 350,000 to 625,000 additional square feet by 2035. This represents an increase of 35 to 50 percent in the amount of inventory in the area.

However, there are insufficient vacant commercial-entitled or commercial-probable development and/or redevelopment sites in the Subject Neighborhood to support such sector expansion near Pearlridge Center, which is the focus of the market, apart from LWPA.

Given the consistent, strong and continuing demand for commercial space in the Subject Neighborhood, and the scarcity of competitive inventory supply opportunities, there is substantial market support for the commercial space component of LWPA.

Subject Commercial Component Perspective

Although the market dynamics of the Subject Neighborhood are highly favorable and supportive of a wide-variety of general commercial use-types at the site, it is not the intent of the developer to compete with, or provide an alternative to the existing projects in the area, nor to become a regional or destination location attracting external patronage from elsewhere on Oahu.

The focus of the LWPA commercial component will be to meet the on-site, and proximate community "neighborhood commercial" floor space demands, including patronage from:

- Residents and guests of the 1,500 subject multifamily condominium homes (the primary consumer group).
- Employees of tenant businesses occupying the subject commercial and office space.
- Other day workers completing tasks in the project.
- Residents of proximate subdivisions and condominium projects (notably those within a few blocks walking distance and who live upslope on Kaonohi Street).
- Passer-bys and intercept consumers moving through the neighborhood.
- Patrons seeking-out a specific product, store or restaurant.

These demographic groups represent a substantial demand quotient specific to LWPA, and are quantified in the absorption section of this Executive Summary.

Addenda Exhibit II contains our commercial market study data and modeling tables, along with brief narrative discussion of the methodology and factors.

The Study Area Office Market

The Subject Neighborhood contains some 309,000 gross leasable square feet of office space, comprising the large majority of the available space in the Primary Study Area and Central Oahu, constituting some 0.44 percent of the total island's office market. It is a secondary use in the community relative to the size of the residential and commercial sectors and the amount of floor space on a per capita resident basis is at 3.99 square feet per person, less than one-third the overall Oahu average of 12.70 square feet per person.

There is currently some 33,000 square feet of vacant office space in the area, equating to a vacancy rate of 10.73 percent of the total available inventory, which, though somewhat high and reflective of the stagnant Oahu office market, is well-below the island-wide average vacancy rate of 14.66 percent.

The large majority of the existing space has been developed since 1975, equating to an average annual absorption rate for new inventory of about 11,000 to 13,000 square feet per year. There have been no major additions to the community's office inventory in more than a decade.

Space lease rents are in the middle to middle-upper end of the market range for the island, as are operating expenses.

Overall, the neighborhood experienced a negative absorption of 6,336 square feet of office space in the first half of 2011, a rate of tenancy loss slightly slower than that for Oahu as a whole. The area has experienced increasing vacancy rates since mid-2006, at which time it stood at 2.8 percent.

Medical-oriented concerns are the primary tenant segment, including practitioner offices, laboratories, diagnostic/treatment clinics, insurers, consultants, and supporting businesses, both independent (serving the local resident community and the population patronizing Pearlridge Center) and in association with Pali Momi Medical Center. It is estimated these uses comprise upwards of 45 to 55 percent of the current tenancy base.

The remaining space is occupied by general office users; mostly small businesses and professional firms, financial concerns, companies associated with and or supporting the commercial activity in the area, resident/neighborhood-oriented users, and satellite offices for companies with multiple locations on the island.

The medical segment is well-established in the area, has minor turnover, and has demonstrated consistently expanding demand (albeit slowly and cyclically) and a relative resistance to economic downturns. The general office segment has shown far more volatility and less stability.

The vacancy loss in recent years has not primarily been among medical-oriented businesses, which have demonstrated relative stability, but among the general office tenants; mostly as a result of contraction associated with the 2008-09 recession and

lingering economic instability. However, some loss has been attributed to the expansion of the Kapolei office sector which has provided an expanding alternative for businesses seeking a Central Oahu and Ewa location.

The Subject Neighborhood is continuing its movement towards being among the primary health care centers on Oahu. The Pali Momi Medical Center, which has seen a six-fold increase in patients over the past two-decades, and expanded several times (and is now seeking a site to develop a free-standing 8,000 square foot Women's Center), has proven to be a major draw for medical uses in close proximity to Pearlridge Center.

Beyond Pali Momi's 81,000 square foot medical office building, tens of thousands of square feet in the 100,000 square foot Pearlridge Office Center and elsewhere in the community. In addition to the critical mass created by the hospital and associated facilities, regional destinations and shopping centers such as Pearlridge are traditionally considered a highly desirable location for medical providers.

Dedicated medical office spaces in the area are at or near full occupancy.

Leasing agents report that medical-oriented businesses currently represent at least two-thirds to "more than 80 percent" of those expressing interest in locating in the region. This is indicative of the long-term expansion and relative stability of the health industry in comparison with the less-stable general business sector.

Medical providers and supporting companies are also interested in a Subject Neighborhood location as it sits at the gateway to Greater Honolulu and is easier to access (and closer to) the expanding populations of Ewa/Kapolei and Central Oahu without forcing clients to drive into the city center; while still retaining reasonable proximity for those patients/users who live in town.

Based on our research, we estimate the demand for new dedicated/specialized medical space in the study area could

reach upwards of 8,000 to 10,000 feet per year were sufficient floor area made available.

As with the residential and commercial sectors, potential office development sites in the Subject Neighborhood are extremely scarce, and the softness of the general office market would likely make financing new building construction not specifically-oriented towards medical users problematic.

Demand by the general office sector is projected to remain subdued to mid-decade, with likely some further declines in occupied space, before stabilizing and moving into a modest expansion cycle absorbing an estimated 2,000 to 4,000 feet per year.

Apart from the proposed office component of LWPA, the only significant potential addition to the Subject Neighborhood office inventory of which we are aware is the announced 8,000 square foot Pali Momi Women's Center. However, it has not been determined if the facility will be in a new free-standing building, utilize vacant office space in an existing project, or (perhaps) seek to convert existing commercial space, if available.

The existing vacant office floor space, which is of varying size bays and competitiveness, represents approximately 2.5 to nearly four years of currently available supply.

LWPA will provide a superior location for general office development, in a new complex having sufficient parking, easy access, and proximity to 1,500 new households and dozens of commercial and other business. And, it will be desirable for many medical users.

Given the amount of office space proposed for the subject project (80,000 square feet), the softness in the general office sector, and the existing overhang of available space, the LWPA office component could require a longer absorption period than for the residential and commercial components.

There is the potential the planned LWPA office space (or a portion thereof) could be adapted/revised prior to build-out in order to maximize absorption velocity. Therefore as part of the master plan the developer is considering alternative uses.

Among the uses being considered as alternatives by the developer, and for which there is apparent market support, are:

Senior-Oriented Services -- There is an expanding need for specialized care and a variety of medical and non-medical services for the aging and long-lived Oahu resident population, and particularly so given the median age of persons living in the Primary Study Area is above the median for the entire island.

According to the 2010 census, approximately 19 percent of the total population in the Primary Study Area is above age 65, and 38 percent is above age 50. And, an increase in this demographic group is probable given the proximity/accessibility of comprehensive shopping opportunities, a hospital, public transportation systems and medical and other supporting services.

Creating geriatric-oriented medical, service and specialized residential spaces would target rapidly expanding population segments.

More importantly it would synergistically interact with any senior housing units within LWPA, increasing the attraction of the housing units by providing ready access to need services while providing a steady stream of customers for the office space businesses.

Within the same context, a convalescent care/hospice facility could also present a viable alternative for a portion of the subject office component.

Lodging Use (Hotel) -- Although the property is not in a resort-quality location nor will LWPA have a visitor-oriented theme, there is reasonable market support for

considering of inclusion of a limited-service, kamaaina type, hotel within LWPA.

Among the primary segments contributing to potential guest demand are:

Servicing the Community. There are several hundred thousand residents within five miles of the subject site, generating the need for nearby lodging for their guests. On the mainland, a community of this size would have in-town lodging.

Pearl Harbor Visitors. At present, there are no competitive lodging facilities in close proximity to Pearl Harbor, the leading visitor attraction in Hawaii. A subject hotel would particularly appeal to the large number of tourists who come to Oahu for a day or two while in transit to a neighbor island or before or after a cruise, along with those with business at the naval base or specifically interested in the emerging WWII Pacific destination attraction being created around Ford Island.

Medical-Oriented Guests. Pali Momi Medical Center and the surrounding medical-services community attracts many overnight patients and their family/friends. At present there are no proximate places for these persons to stay.

Shoppers. Pearlridge and the other centers in the vicinity (such as Waikele Outlet and Pearl Highlands) are an attraction for neighbor island residents and shopping-oriented tourists; notably Australians.

In light of the size of the potential guest demographic (relative to standard Hawaii resort hotels), an appropriate-sized lodging facility would contain some 130 to 180 rooms housed in approximately 40,000-plus square feet of floor space, which would provide an optimum number of rooms to allow efficient operation without over-building relative to reasonable demand.

Increased demand could be generated via an extended stay component to the facility, which would attract military personnel and their families being reassigned.

Addenda Exhibit III contains our office/business market study data and modeling tables, along with brief narrative discussion of the methodology and factors. Exhibit IV contains data regarding Oahu tourism, hotels and lodging demand.

APPROPRIATENESS OF THE SUBJECT SITE AND ABSORPTION ESTIMATES

Appropriateness of the Subject Site

The subject property provides a superior location for the proposed community in regards to its physical, market, and neighborhood characteristics. The attributes of the site and master plan were addressed in the foregoing "Overview of the Master Plan Concept" section. Based on our analysis of the subject property and project from a market perspective, we conclude LWPA will:

- Embrace leading edge mixed-use "urban village" design concepts.
- Maximize the reasonable development potentials of a prime parcel.
- Complement and enhance existing urban development in its neighborhood.
- Address existing and forecast needs for additional residential and commercial inventory in the Primary Study Area and Subject Neighborhood, which otherwise will not likely be met.
- Integrate well with established and evolving planning goals and the proposed Honolulu Rapid Transit system.
- Provide a desirable/competitive comprehensive lifestyle experience.

- Is representative of the highest and best use of the property.

LWPA will have the attributes necessary to be highly competitive in all its product sectors, and will capture a reasonable market share during its offering period.

Subject Product Absorption Estimates

We have estimated the probable market acceptance levels and resulting absorption of the saleable master plan components of LWPA using three methodologies.

- Gross Demand/Supply Comparison -- This technique assumes that if there is insufficient existing and planned supply to meet projected market gross demand levels during the projection period.

- The Residual Method -- In this technique, the competitive inventory planned for the Primary Study Area over the projection period are placed on a time-line depicting their combined anticipated rates of absorption or assuming a reasonable market share. To the extent this supply of units falls short of the forecast demand for product in the Primary Study Area or exceeds the total, a respective undersupply or oversupply situation is present.

Residential Unit Absorption Estimates

- The Market Shares Method -- This approach accounts for the probable competitiveness of the subject inventory regardless of the total level of product being otherwise offered on the market. In essence, it is an estimate of how much of the total forecast demand in the either the Primary Study Area or Subject Neighborhood (as applicable) the subject could expect to capture on an annual basis in light of its location, estimated pricing, competitive, and amenity characteristics.

Gross demand for additional housing units in the Primary Study Area will far exceed anticipated supply.

Even if all of the under-construction and other potential units identified in the region achieve the maximum absorption velocity anticipated or enter the market as quickly as possible,

there will still remain substantial unmet residual demand sufficient to absorb the subject units in a timely manner within a decade-long exposure period (pre-sale to sell-out).

Given the quality, amenities, pricing, and comprehensive lifestyle envisioned for LWPA it will achieve a high standing and prove highly competitive in the market; able to garner a substantial share of demand even were there significant numbers of competing units proposed. In light of the scarcity of other product, the market capture rate for the subject residential inventory will be high, and indicates sell-out will require some 8 to 12 years.

We conclude the 1,500 proposed multifamily units of the LWPA master plan will achieve full absorption within approximately ten-years of initial closings; which are anticipated to commence in late 2014.

Only in the last phases of the project does our conclusion ascribe measurable impact to the proposed Honolulu Rapid Transit undertaking. Construction of the much-delayed system has not commenced, and the section of line connecting the study area to Downtown destinations will not be completed until at soonest the end of 2019, which we consider a highly optimistic forecast in light of the actual construction time required for similar projects in mainland locations.

By 2020, the fourth phase of LWPA is anticipated to be under-construction, with some 55 percent of the inventory already absorbed with little or no positive effect from the under-construction system. However, the completion of the line would likely help shorten the sales period for the last 45 percent of product by increasing the velocity of absorption for the remaining residential and office space product during the last several years of offering.

While having a complete, operating rail system in close proximity will undoubtedly enhance the value and desirability of the subject units over the long-term, its influence on the speed of original sales will be muted. The successful absorption of the final phases of LWPA inventory are not dependant upon

the rail being completed. Were it not built, the sell-out period would only be lengthened by less than one year.

Our absorption conclusions are supported by the experiences of other mid to high-rise condominium projects in Greater Honolulu over the past decade, and that this sector has shown recovery faster than most in the residential market.

As shown on the following chart, recent major condominium offerings have achieved absorption rates 127.7 units annually during the original sales period.

ANNUALIZED ORIGINAL SALES ABSORPTION RATES FOR RECENT HONOLULU CONDOMINIUM PROJECTS

Project	Completion Date	Total Units	Annualized Absorption (Sales/Year)
Lanikea	2005	100	50.4
Hokua	2006	248	123.6
Koolani	2006	370	184.8
Moana Pacific	2007	700	318.0
909 Kapiolani	2007	225	86.4
Capitol Place	2008	394	189.6
Keola Lai	2008	352	158.4
Watermark	2008	196	93.6
Pinnacle	2008	37	14.4
Allure	2010	291	57.6
		Average	127.7

The major master-planned developments in Ewa/Kapolei and Central Oahu have also demonstrated the ability to sustain the absorption levels projected for the subject.

ANNUALIZED ORIGINAL SALES ABSORPTION RATES IN CENTRAL OAHU AND EWA MASTER-PLANNED COMMUNITIES FROM 2002 THROUGH 2010

Project	Absorption Period	Total Units Sold	Annualized Absorption (Sales/Year)
Ewa Gentry	2002-2010	1,883	188.3
Makakilo	2002-2010	808	80.8
Oceanpointe	2003-2010	1,934	214.9
Mililani	2002-2008	2,243	280.4
Royal Kunia	2002-2004	507	169.0
		Average	186.7

Commercial Space Absorption Estimates

Gross demand analysis as applied to the subject development is problematic. While the demand for additional commercial space in the specific Primary Study Area, and may exceed potential supply additions, there are a variety of other considerations. These include the in-construction and proposed extensive commercial developments in the Primary Study Area outside the Subject Neighborhood (notably the Pearl Highlands Center), and that many area commercial projects are destination and regional centers which have attract island-wide patronage reaching well-beyond the Primary Study area population base.

For similar reasons, the Residual and Market Share Method is not specifically insightful either due to the difficulty in defining the effective trade area relative to the Subject Neighborhood.

When these approaches are applied on a regional basis incorporating Primary Study Area and the surrounding trade area, it would appear that projected demand and proposed supply indicators are in general balance without the subject product. However, there is such a diversity of available sites across a large area, with substantial questions over whether many of the projects will be actualized (notably the Waiawa community), that the resulting indicators provide minimal insight.

Despite the limitations of these techniques when applied to the subject, all available indicators point to a strong commercial sector in the Subject Neighborhood, specifically, and within the Primary Study area, generally, with a substantial continuing interest for competitive space among developers and businesses, and increasing patronage at regional stores.

It is not the expressed intent of the developer to compete in the regional commercial trade area on an open market basis, but rather to include the retail, restaurant, and service component of the master plan primarily to meet the needs of LWPA residents and their guests, and employees/workers in the development. Additionally, it is anticipated it will capture some of the commercial "up-stream" demand created by the thousands of residents living on Kaonohi Street mauka of the property for

whom the subject would be among the closest shopping alternatives, general passer-by/intercept demand from travelers along Moanalua Road and Kamehameha Highway, and other patrons attracted by a specific store or restaurant.

The table below summarizes how the demand from these patron populations would "absorb" the subject commercial floor space.

SUMMARY OF NEIGHBORHOOD COMMERCIAL SPACE DEMAND CREATED BY SUBJECT RESIDENTS AND OTHERS AT BUILD-OUT
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

1. Stabilized Subject Population		
Full-Time Residents		4,080
2. Per Capita Demand for Commercial Space (in Gross Square Feet per Person)		
Total for All Commercial Needs		23.8
"Neighborhood" Space Demand as Percent of Total		55%
Total Per Capita "Neighborhood" Commercial Space Demand in Square Feet		13.1
Allowance for "Service Commercial/Medical" Space (50% of Neighborhood demand)		6.5
Allowance for "Support/Other Commercial" Space (25% of Neighborhood demand)		3.3
Total Per Capita Floor Space Demand for Local-Oriented Commercial Space		22.9
3. Indicated Subject Commercial Floor Space Demand		
From Subject Project Population		93,266
Patronage From Other Sources	% of Community Demand	
Employees and Day Workers in Community	10%	9,327
Nearby Population in Non-Subject Projects (1)	25%	23,317
Passer-By's/Intercept and Others	25%	23,317
Total Estimated Gross Floor Space Demand at Stabilization		**149,226**

(1) The subject commercial space will be the most proximate neighborhood shopping opportunity for residents living mauka on Kaonohi Street, an intercept/immediate trade area with a resident population of several thousand persons.

Source: The Hallstrom Group, Inc.

We note, commercial space typically leases-up in anticipation of expanding market demand brought on by increasing trade area populations and business growth, not in arrears after the growth has already occurred. The tenants want to be in-place in order to capitalize on the market expansion as it takes place and earn loyalty among new patrons.

Further, as envisioned for the subject, large blocks of space in any new center are absorbed at the beginning of the lease-up

process, as anchor tenants (and secondary businesses wishing to locate near them) contract for floor space.

Our absorption estimates for the LWPA commercial space also consider the pace of construction of this component in concert with the phasing of the overall development.

Office Space Absorption Estimates

We conclude the 143,385 square foot commercial component of LWPA will require seven years to achieve full absorption.

Gross demand for additional office space in the Primary Study Area will exceed anticipated supply additions during the projection period extending to 2035. However, there are currently some 33,000 square feet of available vacant space (more than 10 percent of the total inventory), or enough to satisfy upwards of two years of projected demand.

We are not aware of any under-construction or proposed major office space additions in the Primary Study Area or Subject Neighborhood; however, there are several minor redevelopment projects being discussed (under 10,000 square feet) and there are plans to convert a vacant retail space into medical office use.

Even if all of these minor additions achieve the maximum absorption velocity anticipated or enter the market as quickly as possible, there will still remain substantial unmet residual demand sufficient to absorb the subject floor space beginning in circa 2014-16, at which time the subject product will have little competition in the market. This various absorption methodologies indicate the subject office/business component would require some 8 to nearly 20 years of exposure period to fully lease-up.

Given the attributes of the proposed LWPA office space, particularly its location within a growing medical-services community; inclusion within a new, modern, vibrant mixed-use urban village; and, the lack of competitive alternatives in the Subject Neighborhood, it will achieve a reasonable standing and prove competitive in the market; capable of capturing a substantial share of study area and regional demand. The

Market Shares Method indicates lease-up will require between 8 and 16 years.

As previously noted, there is the potential that evolving market demands and community needs could result in the adaptation of the office component into uses for which there is a demonstrated existing, or identifiable future, demand.

If all or portions of the 80,000 square foot office space component are oriented towards or converted to other uses contemplated in this study, the anticipated absorption velocity could be increased. We project:

- Dedicated, high-quality medical space having specialized plumbing, electrical and access features, should achieve lease-up at up to twice the rate of standard tenancy space.
- Senior-oriented care and health services would achieve similar absorption rates as medical space, but could be much faster if a significant portion was put towards a convalescent care/hospice facility.
- A limited-service "kamaaina" hotel, envisioned as having some 150 guest rooms within approximately 40,000 square feet, would result in immediate absorption of the space and would be expected to require three to five years to complete ramp-up and reach stabilized operating levels.
- There is the potential for some of this space to ultimately be used for senior housing, specialized, and other residential-type uses. This would also speed the absorption of the component.

If these, or similarly supported, uses are incorporated into (or become all of) the master planned office space within LWPA, our estimated time for absorption of this component would decrease from circa 10 to 16 years under "standard" use to between four to 12 years under the alternative options.

We conclude the 80,000 square feet of proposed space within the LWPA master plan, when viewed as primarily for office/medical uses, will achieve full lease-up in approximately 12 years. Less time if one or more of the alternatives being considered is incorporated into the product offering.

ECONOMIC IMPACTS FROM DEVELOPMENT

In order to forecast the primary economic impacts resulting from the development of LWPA, we have constructed a model depicting the "lifespan" of the project from groundbreaking (assumed in 2013), through the completion of the final Phase IV in 2021, post-construction absorption to 2025, and stabilized "operation" thereafter.

Sources for the primary factors include:

- Construction timing/phasing and costs were estimated by the development team.
- Job counts were taken from similar projects and operations, and/or based on industry standards.
- Wages are based on data from the State Department of Labor & Industrial Relations.
- Household size, income and spending, population, and school-aged children estimates were based on government materials including US Department of Housing and Urban Development and 2010 census data.
- Business activity variables are based on our analysis of similar use-types on Oahu.

Selected summary tables from the modeling process are contained in Addenda Exhibit V. The primary sources and variables contributing to the model are footnoted on each table.

LWPA will infuse more than $766.9 million in capital investment into the Oahu economy.

The construction and on-going operations/maintenance of the LWPA's multifamily homes, commercial and office spaces, and community facilities will provide an estimated 12,776 "worker-years" of full-time employment and $621.2 million in total wages over a 13-year build-out and absorption period.

After completion the community will support some 951 permanent full-time-equivalent jobs, on and off-site, with an annual payroll of about $46.9 million.

The 143,000 square foot commercial and 80,000 square foot office/medical components, together with project maintenance requirements, will create an estimated $1.5 billion in total business activity revenue during the absorption period, and $170.5 million annually thereafter.

We note that not all of this spending will be "new" to Oahu. A small portion, particularly the commercial demand created through intercept of upslope residents, represents a relocation of their patronage from other commercial locations.

If a hotel use is incorporated into a portion of the office space (circa 150 rooms housed in 40,000 square feet), the business activity and employment/wage totals decline marginally. The stabilized job count for the entire community drops to 825 positions, wages to $40 million, and total business activity to $130 million per year.

At build-out the de facto population of LWPA will be some 4,080 persons of which 4,035 (or 99 percent) will be full-time residents, with 639 being school-age children. The State Department of Education has estimated that 570 of these children will be public school students. There will also be an average of 45 persons daily populating the community comprised of non-resident owners and their guests periodically using their "second" unit/home.

Should the hotel-use alternative be implemented, the de facto population will increase by an estimated 215 persons, and discretionary spending by on-site persons will increase by more than $10 million per year.

The total resident household income will be $116.5 million annually on a stabilized basis, and discretionary expenditures into Oahu businesses by the LWPA population will be some $72.7 million per year. Outside patronage of the subject businesses will total nearly $99.5 million annually.

During its almost 13 years of build-out and absorption, LWPA will have a base economic impact on Oahu of some $2.4 billion with a stabilized annual benefit of $179.3 million thereafter.

LWPA will have nominal impacts on the socio-economic aspects of the subject neighborhood that relate to real property issues. Property values in the study area are largely driven by external, cyclical economic factors and cumulative mass, not any single new project.

The envisioned LWPA homes are to be moderately priced and will include at least thirty percent (per the city and county rules) meeting City and County affordable housing pricing guidelines. LWPA will fit in well with the nearby uses and be complimentary with the proposed nearby rail system. There will be minimal in-migration to Oahu as a direct result of LWPA or its operating components.

PUBLIC FISCAL RECEIPTS/COSTS ASSESSMENT

Public Fiscal Receipts (Tax Revenues)

The City & County of Honolulu and State of Hawaii will receive millions of dollars in tax receipts from the construction and "operation" of LWPA, from numerous revenue sources.

For the City & County, the primary tax source will be from Real Property Taxes paid by the owners of the various LWPA components, which was estimated by applying prevailing tax rates against the projected market value of the finished

inventory (construction costs, plus allocated land value, and developers profit), and the County's share of the General Excise Tax.

From these sources, it is estimated the County will receive some $62.8 million in tax receipts during the 13-year absorption period for the project, and annual collections of $6.1 million on a stabilized basis thereafter.

Secondary taxes associated with other daily activities in the subject community will contribute additional funds.

Real Property and General Excise taxes typically generate about 75 percent of total County revenues, secondary taxes the remainder.

Application of this ratio to the LWPA property tax and GET sums results in a cumulative total estimated tax collection from the subject of $83.5 million during the initial construction and sales period, and $8.1 million annually on a stabilized basis.

The State of Hawaii will receive an estimated $200.1 million in primary receipts from State Income (from worker wages, resident's households and operating businesses) and General Excise Taxes (on contractor costs, spending by workers and residents, and outside patronage at operating businesses) during the 13-year construction and absorption period, and a stabilized amount of $17.1 million annually. They will also receive additional tax revenues from secondary sources.

Income and General Excise taxes typically generate about 81 percent of total State revenues, secondary taxes the remainder.

Application of this ratio to the LWPA income tax and GET sums results in a cumulative total estimated tax collection from the subject of $246.1 million during the initial construction and sales period, and $21.0 million annually on a stabilized basis.

Public Fiscal Costs

Having quantified the cumulative revenue benefits, the second step in public fiscal assessment is to quantify the probable costs

of local government services which will be required directly due to, or in general support of, the project.

The appropriate method for determining the additional cost impact on the public purse resulting from the subject development is through application of the "With and Without" technique, wherein we estimate the public costs assuming there is no LWPA ("without") and compare it to the estimated costs assuming the project is completed ("with").

The difference between the "Without" and "With" indicators for the development is the "marginal" (or increased) expenses to the State and County arising from the proposed subject community.

We have applied the "With and Without" method on a stabilized basis (after build-out and absorption) using the "per capita costs" approach.

The per capita cost approach assumes every individual in a community is equally responsible for all costs of governance regardless of the actual services they, their household, or business may avail themselves of. It is founded on a commonweal concept.

The State 2011-12 operating budget will spend some $11.36 billion servicing a de facto population of 1,558,301 individuals, or an average per capita expense of $7,289 per person.

Similarly, the City & County of Honolulu 2011-12 operating budget will spend some $1.82 billion servicing a de facto population of 943,000 individuals, or an average per capita expense of $1,928 per person.

Without LWPA

LWPA will have an estimated population of 4,035 full-time residents.

The vast majority of these persons are current Oahu residents, likely Hawaii-born, and part of the on-going "natural growth" of the island community. A small minority will be recent in-migrants from the neighbor islands or elsewhere.

If these individuals did not live within the subject development, they would be living somewhere else on Oahu.

On a per capita basis the 4,035 persons will account for an allocated total of $29,411,115 annually in State costs and $7,779,480 in County expenditures per year.

These substantial per capita public costs would be incurred regardless if they lived in LWPA or elsewhere on the island and would "follow' them wherever they ultimately choose to live. They would utilize the same government services and resources whether residing in Kapolei, Kailua, Kakaako, etc.

The costs are not "new", as they represent on-going natural growth; are not a function of the subject development; and, are inevitable whether LWPA is constructed or not.

Thus, from a "Without the LWPA Project" perspective, the cost to the State and County governments would be $29.4 million and $7.8 million, respectively.

Beyond allocated per capita expenses which are a direct dollar estimate, there are indirect planning and community goals that would be negatively impacted "without" LWPA.

Long-term public planning efforts envision a range of outcomes which will have apparent and significantly favorable, but somewhat unquantifiable, economic impacts.

The common planning goals of increasing infrastructure system efficiencies, creating sustainable communities, minimizing environmental footprints, and slowing urbanization of Oahu's agricultural lands, are accepted as foundational for the continued economic health of both the public and private sectors.

"Without" LWPA, it is highly likely these households will contribute to urban sprawl in Ewa and Central Oahu, as these outlying "growth" locations would provide the most logical alternatives families to LWPA given the price of units and rents in Honolulu.

This could result in a further loss of agricultural lands, the need to extend infrastructure systems, build new school and civic spaces, increase commuter traffic, and widen the area which must be covered by emergency services.

With LWPA

If LWPA is developed, it will have a total estimated de facto population of 4,080 persons, including the 4,035 full-time, current residents discussed foregoing and some 45 non-residents (on average) who would use their unit as a second-home or for other purposes.

The non-residents are assumed to have a similar overall impact on State and County government demands as would a full-time resident, and are allocated the same per capita cost.

On a per capita basis the total subject population (4,080 persons) will account for an allocated total of $29,739,120 annually in State costs and $7,866,240 in County expenditures.

As one of the last in-fill sites within a well-established neighborhood, the LWPA master plan represents a unique opportunity in the Primary Study Area to maximize indirect planning and community benefits while mitigating the governmental capital and operational costs arising from new or under-serviced urban development.

Among these attributes are:

- The population of LWPA will utilize existing street/highway, utility and other systems, school facilities, and emergency services and not likely require their wholesale extension or major expansion, lessening the need for costly new regional infrastructure which would be required elsewhere to support the population of 4,080 persons projected to live at LWPA.

- If the HRT rail line is built as proposed, LWPA will work synergistically with the system by utilizing the available capacity being created and providing significant ridership at one of the primary stations/hubs, while lessening any new demands on the existing traffic grid.

Economic benefits will flow to HRT via a stable commuter/user base of hundreds of trips daily by LWPA residents and workers helping to fund the operation, and LWPA households will reap the benefits of reduced family transportation costs and potential time savings. However, the system, as the earliest will not be completed until the final phases of the subject development so it will not have a major impact on product absorption whether it is constructed in a timely manner or not.

- LWPA will contain numerous environmental design elements. This will lessen the environmental impact of the LWPA project and population relative to both older development in the region and the on-going suburban sprawl in Central Oahu and Ewa/Kapolei. These master planning characteristics will limit the need for mitigation over the long-term and enhance the sustainability of the Subject Neighborhood. As is becoming increasingly evident to planners and the market, an environmentally-stable project is a positive economic asset to the larger community.

- The mixed-use design of the project will result in an integrated urban village creating opportunities for a comprehensive lifestyle within walking distances (or at least within a small trade area), minimizing the number of "vehicle miles" generated by the LWPA population and their flow/impact on roadway traffic. This lowers the burden of constructing new infrastructure and enhances the spending power of households via transportation savings.

Comparison of With and Without Cost Indicators

The chart below summarizes the "With and Without" method of assessing the public fiscal impact associated with the proposed LWPA project on a dollar basis.

COMPARISON OF ANNUAL WITH AND WITHOUT GOVERNMENT COST INDICATORS

	With LWPA		Without LWPA		Net Cost to Government
City & County of Honolulu	$ 7,866,240	-	$ 7,779,480	=	$ 86,760
State of Hawaii	$29,739,120	-	$29,411,115	=	$328,005
Total	**$37,605,360**		**$37,190,595**		**$414,765**

It is not possible to precisely quantify the indirect planning and community goal benefits which will result from LWPA ("with") relative to having to house the population elsewhere on the island ("without"); but, they are substantial and would likely cumulatively outweigh the estimated additional costs associated with the subject project.

Correlation of Additional Public Revenues and Costs

The additional ("marginal") public costs which will be incurred by the State and County governments as a result of the construction of LWPA relative to its not being built will total some $414,765 per year.

These additional costs are exclusively associated with the 45 non-resident persons estimated (on average) to be within the subject community every day.

To determine the net impact of public costs versus revenues, it is necessary to estimate the marginal tax receipts flowing from these same 45 persons and compare them to the aforestated expenses.

As with costs, it is assumed that without the LWPA development the 4,035 full-time residents would create similar tax revenues while living elsewhere on Oahu.

Non-resident units will comprise 3.00 percent of the entire LWPA inventory, assuming they are of average price (assessment) within the project their annual real property tax payments will total $149,437, and with adjustment for revenues

from other proportional taxes, the county will receive additional marginal tax receipts from the subject development as follows:

ADDITIONAL ANNUAL MARGINAL COUNTY TAX RECEIPTS	
Total Real Property Taxes Paid by LWPA Residential Units	$2,884,963
Percentage Owned by Non-Residents	3.0%
Non-Resident RPT Payments	$86,549
Plus Adjustments for Other City & County Taxes/Fees	33.0%
Total Marginal County Tax Receipts	**$115,110**

This assumes the 4,035 residents in full-time households would purchase a similarly assessed unit elsewhere on Oahu as they would if LWPA were not built.

Non-resident spending comprises 1.69 percent of the total annual expenditures projected to be made at LWPA on a stabilized basis ($2.87 million out of an aggregate $170.54 million).

It is reasonable to assume that their share of State tax revenues generated on the property, which are (for the most part) spending-based, is of similar proportion. The marginal annual tax receipts to the State would be as follows:

ADDITIONAL ANNUAL MARGINAL STATE TAX RECEIPTS	
Total Annual State Tax Receipts from LWPA	$21,003,611
Percentage Generated by Non-Resident Spending	1.69%
Total Marginal State Tax Receipts	**$354,961**

This indicator may be nominally over-stated as most non-residents would not be paying State Income taxes.

The estimated additional marginal government service costs and tax receipts resulting from LWPA are summarized below:

CALCULATION OF NET ANNUAL MARGINAL FISCAL IMPACTS					
	Revenues		**Costs**		**Benefit/(Loss)**
City & County of Honolulu	$115,110	-	$ 86,760	=	$28,350
State of Hawaii	$354,961	-	$328,005	=	$26,956
TOTAL	**$407,071**		**$414,765**		**$55,306**

Development of the subject community will result in minor marginal "profits" for both the County and the State of between $25,000 and $30,000 per year on a stabilized basis following build-out.

We do not anticipate that either the State or County would suffer "losses" in any year during the construction and sales period, either.

The LWPA design embodies many of the planning concepts considered to be favorable for creating a sustainable, economically-healthy community beyond a positive marginal public fiscal assessment.

Addenda Exhibit VI contains our composite model depicting our estimated flow of tax receipts during the life of the project, from ground-breaking through build-out, absorption and stabilized use

LIMITING CONDITIONS AND ASSUMPTIONS

The research, analysis, conclusions, and certification for valuation or market studies performed by The Hallstrom Group, Inc. are subject to and influenced by the following:

- The report expresses the opinion of the signers as of the date stated in the letter of transmittal, and in no way has been contingent upon the reporting of specified values or findings. It is based upon the then present condition of the national and local economy and the then purchasing power of the dollar.

- Legal descriptions used within the report are taken from official documents recorded with the State of Hawaii, Bureau of Conveyances, or have been furnished by the client, and are assumed to be correct. No survey is made for purposes of the report.

- Any sketches, maps, plot plans, and photographs included in the report are intended only to show spatial relationships and/or assist the reader in visualizing the property. They are not measured surveys or maps and we are not responsible for their accuracy or interpretive quality.

- It is assumed that the subject property is free and clear of any and all encumbrances other than those referred to herein, and no responsibility is assumed for matters of a legal nature. The report is not to be construed as rendering any opinion of title, which is assumed to be good and marketable. No title information or data regarding easements which might adversely affect the use, access, or development of the property, other than that referenced in the report, was found or provided. The property is analyzed as though under responsible ownership and competent management.

- Any architectural plans and/or specifications examined assume completion of the improvements in general

conformance with those documents in a timely and workmanlike manner.

- Preparation for, attendance, or testimony at any court or administrative hearing in connection with this report shall not be required unless prior arrangements have been made therefor.

- If the report contains an allocation of value between land and improvements, such allocation applies only under the existing program of utilization. The separate valuations for land and building must not be used in conjunction with any other purpose and are invalid if so used.

- If the report contains a valuation relating to a geographical portion or tract of real estate, the value reported for such geographical portion relates to such portion only and should not be construed as applying with equal validity to other portions of the larger parcel or tract; and the value reported for such geographical portion plus the value of all other geographical portions may or may not equal the value of the entire parcel or tract considered as an entity.

- If the report contains a valuation relating to an estate in land that is less than the whole fee simple estate, the value reported for such estate relates to a fractional interest only in the real estate involved, and the value of this fractional interest plus the value of all other fractional interest may or may not equal to the value of the entire fee simple estate considered as a whole.

- It is assumed that there are no hidden or inapparent conditions of the property, subsoil, or structures which would render it more or less valuable; we assume no responsibility for such conditions or for engineering which might be required to discover such factors.

- Nothing in the report should be deemed a certification or guaranty as to the structural and/or mechanical (electrical, heating, air-conditioning, and plumbing) soundness of the building(s) and associated mechanical systems, unless otherwise noted.

- Information, estimates, and opinions provided by third parties and contained in this report were obtained from sources considered reliable and believed to be true and correct. However, no responsibility is assumed for possible misinformation.

- Possession of the report, or a copy thereof, does not carry with it the right of publication, and the report may not be used by any person or organization except the client without the previous written consent of the appraiser, and then only in its entirety. If the client releases or disseminates the reports to others without the consent of the appraiser, the client hereby agrees to hold the appraiser harmless, and to indemnify the analysts from any liability, damages, or losses which the analysts might suffer, for any reason whatsoever, by reason of dissemination of the report by the client. Further, if legal action is brought against the analyst by a party other than the client concerning the report or the opinions stated therein, the client agrees, in addition to indemnifying the analysts for any damages or losses, to defend said analysts in said action at client's expense. However, nothing herein shall prohibit the client or analysts from disclosing said report or opinions contained therein as may be required by applicable law.

- Disclosure of the contents of this report is governed by the By-Laws and Regulations of the Appraisal Institute. Neither all nor any part of the contents of this report (especially any conclusions as to value, the identity of the appraisers or the firm which they are connected, or any reference to the Appraisal Institute or to the MAI designation) shall be disseminated to the public through advertising media, public relations media, news media,

sales media, or any public means of communication without the prior consent and approval of the appraisers.

- Unless otherwise stated in this report, the existence of hazardous material, which may or may not be present on the property, was not observed by the appraiser. The appraiser has no knowledge of the existence of such materials on or in the property. The appraiser, however, is not qualified to detect such substances. The presence of substances such as asbestos, urea-formaldehyde foam insulation, or other potentially hazardous materials may affect the value of the property. The value estimate is predicated on the assumption that there is no such material on or in the property that would cause a loss in value. No responsibility is assumed for any such conditions, or for any expertise or engineering knowledge required to discover them. The client is urged to retain an expert in this field, if desired.

- The Americans with Disabilities Act (ADA) became effective January 26, 1992. We have not made a specific compliance survey and analysis of this property to determine whether or not it is in conformity with the various detailed requirements of the ADA. It is possible that a compliance survey together with a detailed analysis of the requirements of the ADA could reveal that the property is not in compliance with one or more of the requirements of the act. If so, this fact could have a negative effect upon the value of the property. We did not consider possible noncompliance with the requirements of ADA in estimating the value of the property.

- The function of this report is for the sole purpose(s) stated herein. It may not be used in connection with any proposed or future construction for a real estate syndicate(s), real estate investment trust(s) or limited partnership to solicit investors or limited partners, and may not be relied upon for such purposes.

- The appraiser's conclusion of value is based upon the assumption that there are no hidden or unapparent conditions of the property that might prevent buildability. The appraiser recommends that due diligence be conducted through the local building department or the municipality to investigate buildability and whether the property is suitable for its intended use. The appraiser makes no such representations, guarantees or warranties.

CERTIFICATION

The undersigned does hereby certify that, to the best of his knowledge and belief, the statements of fact contained in this report are true and correct. It is further certified that the reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are his personal, impartial, and unbiased professional analyses, opinions, conclusions and recommendations. He further certifies that he has no present or prospective interest in the property that is the subject of this report, and has no personal interest with respect to the parties involved. He has no bias with respect to the property that is the subject of this report or the parties involved with this assignment. His engagement in this assignment was not contingent upon developing or reporting predetermined results. His compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this report. The Hallstrom Group, Inc. has not previously appraised the subject property within the three years prior to this assignment. The analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute, and the Uniform Standards of Professional

Appraisal Practice. The use of this report is subject to the requirements of the Appraisal Institute relating to review by duly authorized representatives. The undersigned certifies that he has made a personal visit to the property that is the subject of this report. No other persons provided significant real property consulting assistance other than the undersigned.

Tom W. Holliday

Tom W. Holliday

/jmo/as

5144_R01

A D D E N D A

PRIMARY STUDY AREA RESIDENTIAL MARKET

In this exhibit are twelve tables presenting the data and models which were used to project the demand for additional residential units in the Primary Study Area and the Subject Neighborhood, and to estimate the absorption velocity for the 1,500-unit residential component of the Live, Work, Play Aiea master plan.

Principal sources for the materials and modeling variables included:

- City & County of Honolulu Department of Planning and Permitting
- United States Census Bureau
- US Department of Housing and Urban Development
- Honolulu Board of Realtors Multiple Listing Service
- Hawaii Information Service Public Record Data
- Bank of Hawaii
- State of Hawaii Department of Business, Economic Development and Tourism

Table I-1 Historic and Projected Resident Population for the Primary Study Area 2000 to 2035

Table I-2 Quantification of Housing Unit Demand in the Primary Study Area 2011 to 2035

Table I-3 Estimate of Housing Price Affordability of Primary Study Area Residents, Four-Person Household

Table I-4 Estimate of Housing Price Affordability of Primary Study Area Residents, Two-Person Household

Table I-5 Striated Projections of Housing Unit Demand By Selling Price in the Primary Study Area 2011 to 2035

Table I-6 Division of Projected Demand by Unit Type for Housing Units in the Primary Study Area 2011 to 2035

Table I-7 Summary of Subject Neighborhood Single Family Market Activity

Table I-8 Summary of Subject Neighborhood Multifamily Market Activity

Table I-9 Summary of Subject Neighborhood Combined Single Family and Multifamily Market Activity

TABLE I-1

HISTORIC AND PROJECTED RESIDENT POPULATION
FOR PRIMARY STUDY AREA 2000 TO 2035
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

Year	Historic			Projected Figures				
	2000	2005	2010	2015	2020	2025	2030	2035
Minimum: DPP Socio-Economic Projections (1)								
Aiea	31,436	31,142	31,180	31,205	30,999	30,831	30,682	30,525
% Annual Average Change		-0.19%	0.02%	0.02%	-0.13%	-0.11%	-0.10%	-0.10%
Waiau/Pacific Palisades	47,744	47,189	46,304	46,418	46,133	45,909	45,703	45,503
% Annual Average Change		-0.23%	-0.38%	0.05%	-0.12%	-0.10%	-0.09%	-0.09%
Total Primary Study Area Population	**79,180**	**78,331**	**77,484**	**77,623**	**77,132**	**76,740**	**76,385**	**76,028**
% Annual Average Change		-0.21%	-0.22%	0.04%	-0.13%	-0.10%	-0.09%	-0.09%
% of Oahu Total	9.0%	8.7%	8.5%	8.2%	8.0%	7.7%	7.5%	7.3%
Maximum: Baseline Market Projections								
Aiea	31,436	31,142	31,180	32,000	32,800	33,600	34,400	35,200
% Annual Average Change		-0.19%	0.02%	0.53%	0.50%	0.49%	0.48%	0.47%
Waiau/Pacific Palisades	47,744	47,189	46,304	47,500	48,600	49,700	50,800	51,900
% Annual Average Change		-0.23%	-0.38%	0.52%	0.46%	0.45%	0.44%	0.43%
Total Primary Study Area Population	**79,180**	**78,331**	**77,484**	**79,500**	**81,400**	**83,300**	**85,200**	**87,100**
% Annual Average Change		-0.21%	-0.22%	0.52%	0.48%	0.47%	0.46%	0.45%
% of Oahu Total	9.0%	8.7%	8.5%	8.4%	8.4%	8.4%	8.4%	8.4%

Note: For comparative purposes we have utilized the C&C of Honolulu DPP projections, and their 2010 population estimate for the study area, which is defined on Development Plan maps as the "Aiea" and the "Waiau/Pacific Palisades" sub-areas. These areas differ slightly from the US "Census Defined Places" of "Aiea", "Waimalu" and "Pearl City", which had a resident population as of the 2010 census of 70,766. Attempting to extrapolate the total coterminous area of the DPP plan from the available Census figures appears to indicate the DPP 2010 estimates were low relative to the Census by several percentage points. However, it is the growth trends which are most pertinent in our projection process; what will be the expansion over the forecast period, not the exactness of the beginning base figure.

(1) From DPP "Socio-Economic Projections 2000 - 2035 by Development Plan Sub-Area", September 2009.

Source: C&C of Honolulu DPP, and The Hallstrom Group, Inc.

EXHIBIT I
Page 2

Table I-10- Unsold, Under-Construction and Planned Residential Development in the Primary Study Area, Central Oahu and Ewa

Table I-11 Projection of Potential Subject Unit Absorption Using the Residual Method Based on Total Demand for Residential Units in the Primary Study Area

Table I-12- Summary of Projected Subject Unit Demand Levels in the Primary Study Area Using the Market Shares Method

TABLE I-3

ESTIMATE OF HOUSING PRICE AFFORDABILITY FOR PRIMARY STUDY AREA RESIDENTS
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
BASED ON A FOUR-PERSON HOUSEHOLD

1. Based on General HUD/State/County Criteria

Grouping	Low Income	Low-Moderate Income	Moderate	Moderate - Gap Group Income	Lower-Market Incomes
Household Income as a Percent of County Median	**80% or less**	**80% to 100%**	**100% to 120%**	**120% to 140%**	**140% to 180%**
Gross Household Monthly Income	$5,440	$6,800	$8,160	$9,520	$12,240
Maximum Mortgage/Housing Payment	$1,523	$1,904	$2,285	$2,666	$3,427
Maximum Mortgage Amount (2)	$283,707	$354,680	$425,653	$496,627	$638,387
Downpayment at 5% of Sales Price	$14,932	$18,667	$22,403	$26,138	$33,599
Total Affordable Purchase Price	**$298,639**	**$373,347**	**$448,056**	**$522,765**	**$671,986**

2. Based on Conventional Financing Criteria

Grouping	Low Income	Low-Moderate Income	Moderate	Moderate - Gap Group Income	Lower-Market Incomes
Gross Household Monthly Income	$5,440	$6,800	$8,160	$9,520	$12,240
Maximum Allowable Housing Expense (3)	$1,523	$1,904	$2,285	$2,666	$3,427
Maximum Mortgage Amount (4)	$309,591	$387,039	$464,488	$541,936	$666,551
Downpayment at 20% of Sales Price	$77,398	$96,760	$116,122	$135,484	$166,638
Total Affordable Purchase Price	**$386,989**	**$483,799**	**$580,610**	**$677,420**	**$833,189**

Note: Median household income for City and County of Honolulu estimated at $81,600 in 2010 for four person household.

(1) Based on standard governmental affordability criteria at 28%.
(2) Assuming 5.0% annual interest and 30 year mortgage. Interest rate assumed to be circa 1/2 point higher than prevailing market rates.
(3) Conventional financing with maximum monthly mortgage payment at 28% of gross income. No reserves or mortgage insurance required.
(4) Based on Bank of Hawaii published rates as of report publication date for standard (non-Jumbo) 30-year home mortgage loan of 4.25% and jumbo rate of 4.625%

Source: HUD, State of Hawaii and The Hallstrom Group, Inc.

TABLE I-2

QUANTIFICATION OF HOUSING UNIT DEMAND FOR THE PRIMARY STUDY AREA 2011 to 2035
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
Covering the Aiea and Waiau/Pacific Palisades Planning Areas

	Year-End 2010	2015	2020	2025	2030	2035	Additional Units Required by 2035 (1)
Scenario One: Minimum Projections Using DPP Socio-Economic Projections							
Resident Population	77,484	77,623	77,132	76,740	76,385	76,028	
Average Household Size	3.11	2.91	2.87	2.83	2.80	2.76	
Total Resident Units Required	24,904	25,128	25,313	25,509	25,702	25,892	
Vacancy/Non-Resident Purchaser Allowance (3.45% of resident unit demand)	859	867	873	880	887	893	
TOTAL MARKET UNIT DEMAND	**25,794**	**26,026**	**26,218**	**26,421**	**26,622**	**26,818**	**1,024**
Scenario Two: Maximum Projections Using Baseline Market Figures and 2010 Census Household Size							
Resident Population	78,331	77,484	79,500	81,400	83,300	85,200	
Average Household Size	3.04	2.90	2.86	2.81	2.76	2.71	
Total Resident Units Required	25,767	26,719	27,797	28,968	30,181	31,439	
Vacancy Allowance (3% of resident unit demand)	773	802	834	869	905	943	
Non-Resident Purchaser Allowance (Max 3% of resident unit demand)	258	401	556	869	905	943	
TOTAL MARKET UNIT DEMAND	**26,797**	**27,921**	**29,187**	**30,706**	**31,992**	**33,325**	**7,531**

CONCLUDED HOUSING UNIT DEMAND RANGE

	2010	2011-2015	2016-2020	2021-2025	2026-2030	2031-2035	Totals
MINIMUM DEMAND							
Periodic	0	232	192	203	201	196	1,024
Cumulative	0	232	424	627	828	1,024	
Average Annual Demand (2)		46	38	41	40	39	
MAXIMUM DEMAND							
Periodic	1,003	1,124	1,266	1,519	1,286	1,333	7,531
Cumulative	1,003	1,324	2,791	4,511	5,997	7,531	
Average Annual Demand (2)		265	293	344	297	307	
MID-POINT DEMAND							
Periodic	502	678	729	861	743	765	4,278
Cumulative	502	778	1,607	2,569	3,413	4,278	
Average Annual Demand (2)		156	166	192	169	173	

(1) There were an estimated 25,794 housing units in the primary study area as of year-end 2010
(2) Existing (or latent) demand/oversupply is assumed absorbed equally over projection period.

Source: Various and The Hallstrom Group, Inc.

TABLE I-5

STRIATED PROJECTIONS OF HOUSING UNIT DEMAND
BY SELLING PRICE IN THE PRIMARY STUDY AREA 2011 TO 2035
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

Period	Periodic Demand (1) 2011 to 2015	2016 to 2020	2021 to 2025	2026 to 2030	2031 to 2035	Total Demand 2011-2035
1. Minimum Demand						
Less Than $300,000 (2)	**63**	**50**	**51**	**48**	**45**	**257**
Percent of Total Demand	27.00%	26.00%	25.00%	24.00%	23.00%	25.06%
$300,000 to $500,000 (3)	**51**	**40**	**41**	**38**	**37**	**207**
Percent of Total Demand	22.00%	21.00%	20.00%	19.00%	19.00%	20.25%
$500,000 to $750,000 (4)	**46**	**38**	**41**	**40**	**39**	**205**
Percent of Total Demand	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
$750,000 to $1,250,000	**39**	**35**	**39**	**40**	**39**	**192**
Percent of Total Demand	17.00%	18.00%	19.00%	20.00%	20.00%	18.75%
Over $1,250,000	**32**	**29**	**32**	**34**	**35**	**163**
Percent of Total Demand	14.00%	15.00%	16.00%	17.00%	18.00%	15.94%
Total Market Demand	**232**	**192**	**203**	**201**	**196**	**1,024**
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
2. Maximum Demand						
Less Than $300,000 (2)	**358**	**381**	**430**	**357**	**353**	**1,878**
Percent of Total Demand	27.00%	26.00%	25.00%	24.00%	23.00%	24.94%
$300,000 to $500,000 (3)	**291**	**308**	**344**	**282**	**291**	**1,517**
Percent of Total Demand	22.00%	21.00%	20.00%	19.00%	19.00%	20.15%
$500,000 to $750,000 (4)	**265**	**293**	**344**	**297**	**307**	**1,506**
Percent of Total Demand	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
$750,000 to $1,250,000	**225**	**264**	**327**	**297**	**307**	**1,420**
Percent of Total Demand	17.00%	18.00%	19.00%	20.00%	20.00%	18.85%
Over $1,250,000	**185**	**220**	**275**	**253**	**276**	**1,209**
Percent of Total Demand	14.00%	15.00%	16.00%	17.00%	18.00%	16.06%
Total Market Demand	**1,324**	**1,467**	**1,720**	**1,487**	**1,534**	**7,531**
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Note: Estimates based on combination of resident household income analysis, median prices being paid for inventory, and evident trends in the primary (Aiea) and general (Central Oahu/Ewa) residential markets.
Non-resident buyers comprise a portion of the upper-price tiers.

The median price of a single family home on Oahu in June 2011 was $562,500, and $301,000 for a condominium unit.

(1) Existing (or latent) demand/oversupply is assumed expressed in the market evenly over projection period.
(2) Generally comprising the "below 80% of median household income" group.
(3) Includes households in the 80% to 120% of median income groups.
(4) Includes households in the 120% to 180% of median income groups.

Source: Various and The Hallstrom Group, Inc.

TABLE I-4

ESTIMATE OF HOUSING PRICE AFFORDABILITY FOR PRIMARY STUDY AREA RESIDENTS
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
BASED ON A TWO-PERSON HOUSEHOLD

1. Based on General HUD/State/County Criteria

Grouping	**Low Income**	**Low-Moderate Income**	**Moderate**	**Moderate - Gap Group Income**	**Lower-Market Incomes**
Household Income as a Percent of County Median	**80% or less**	**80% to 100%**	**100% to 120%**	**120% to 140%**	**140% to 180%**
Gross Household Monthly Income	$4,352	$5,440	$6,528	$7,616	$9,792
Maximum Mortgage/Housing Payment	$1,219	$1,523	$1,828	$2,132	$2,742
Maximum Mortgage Amount (2)	$227,077	$283,707	$340,523	$397,152	$510,784
Downpayment at 5% of Sales Price	$11,951	$14,932	$17,922	$20,903	$26,883
Total Affordable Purchase Price	**$239,028**	**$298,639**	**$358,445**	**$418,055**	**$537,667**

2. Based on Conventional Financing Criteria

Grouping	**Low Income**	**Low-Moderate Income**	**Moderate**	**Moderate - Gap Group Income**	**Lower-Market Incomes**
Gross Household Monthly Income	$4,352	$5,440	$6,528	$7,616	$9,792
Maximum Allowable Housing Expense (3)	$1,219	$1,523	$1,828	$2,132	$2,742
Maximum Mortgage Amount (4)	$247,795	$309,591	$371,590	$433,386	$557,385
Downpayment at 20% of Sales Price	$61,949	$77,398	$92,898	$108,347	$139,346
Total Affordable Purchase Price	**$309,744**	**$386,989**	**$464,488**	**$541,733**	**$696,731**

Note: Median household income for City and County of Honolulu estimated at $65,280 in 2010 for two person household.

(1) Based on standard governmental affordability criteria at 28%.
(2) Assuming 5.0% annual interest and 30 year mortgage. Interest rate assumed to be circa 1/2 point higher than prevailing market rates.
(3) Conventional financing with maximum monthly mortgage payment at 28% of gross income. No reserves or mortgage insurance required.
(4) Based on Bank of Hawaii published rates as of report publication date for standard (non-Jumbo) 30-year home mortgage loan of 4.25% and jumbo rate of 4.625%

Source: HUD, State of Hawaii and The Hallstrom Group, Inc.

TABLE I-6

DIVISION OF PROJECTED DEMAND BY UNIT TYPE
FOR HOUSING UNITS IN THE PRIMARY STUDY AREA 2011 TO 2035
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

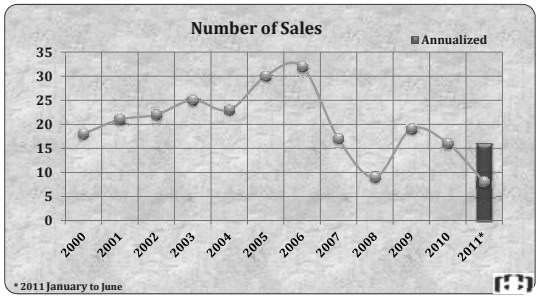
	Periodic Demand (1)					Total
	2011 to 2015	2016 to 2020	2021 to 2025	2026 to 2030	2026 to 2030	Demand 2011-2035
1. Using Minimum Demand Projections						
Single Family Homes	46	35	32	28	24	165
Percent of Total	20%	18%	16%	14%	12%	16%
Multifamily Units	186	157	171	173	172	859
Percent of Total	80%	82%	84%	86%	88%	84%
Total	**232**	**192**	**203**	**201**	**196**	**1,024**
	100%	100%	100%	100%	100%	100%
2. Using Maximum Demand Projections						
Single Family Homes	265	264	275	208	184	1,196
Percent of Total	20%	18%	16%	14%	12%	16%
Multifamily Units	1,059	1,203	1,445	1,279	1,350	6,335
Percent of Total	80%	82%	84%	86%	88%	84%
Total	**1,324**	**1,467**	**1,720**	**1,487**	**1,534**	**7,531**
	100%	100%	100%	100%	100%	100%
Mid-Point						
Single Family Homes	156	149	154	118	104	**577**
Multifamily Units	622	680	808	726	761	**2,836**
Total	**778**	**829**	**961**	**844**	**865**	**4,278**

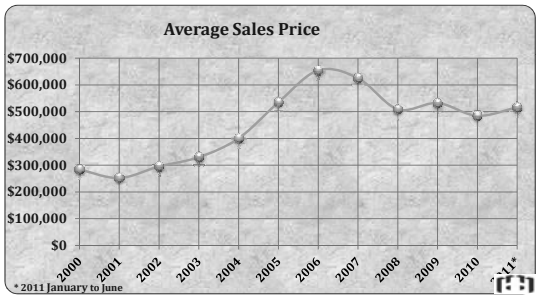
Source: The Hallstrom Group, Inc.

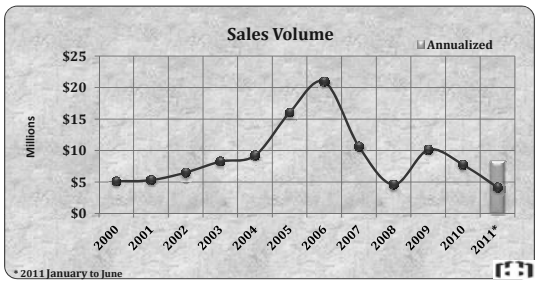
Table I-7

SUMMARY OF SUBJECT NEIGHBORHOOD SINGLE FAMILY MARKET ACTIVITY
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

SINGLE FAMILY	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
Number of Sales	18	21	22	25	23	30	32	17	9	19	16	8
Average Sales Price	$283,528	$252,145	$295,318	$330,040	$400,213	$534,593	$654,186	$625,088	$509,000	$532,026	$484,579	$515,813
Sales Volume	$5,103,500	$5,295,050	$6,497,000	$8,251,000	$9,204,900	$16,037,800	$20,933,950	$10,626,500	$4,581,000	$10,108,500	$7,753,265	$4,126,500





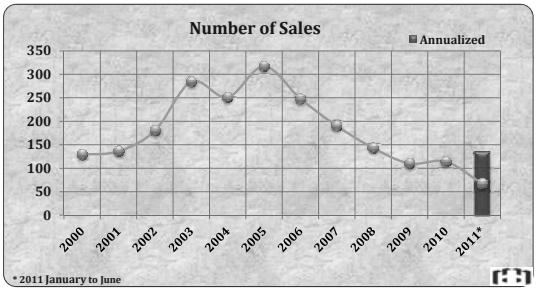


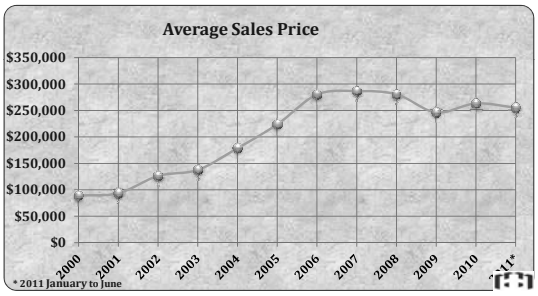
Source: Honolulu MLS, and The Hallstrom Group, Inc.

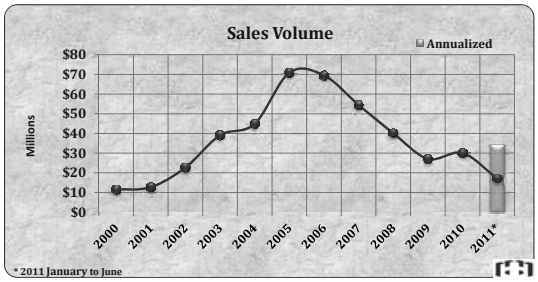
Table I-8

SUMMARY OF SUBJECT NEIGHBORHOOD MULTIFAMILY MARKET ACTIVITY
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

CONDO / TOWNHOUSES	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*
Number of Sales	129	136	180	284	251	317	248	190	143	110	114	67
Average Sales Price	$88,995	$93,429	$126,147	$137,593	$178,784	$223,685	$280,144	$286,696	$280,538	$246,376	$263,313	$255,327
Sales Volume	$11,480,325	$12,706,404	$22,706,395	$39,076,495	$44,874,800	$70,908,132	$69,475,650	$54,472,288	$40,116,915	$27,101,400	$30,017,700	$17,106,900



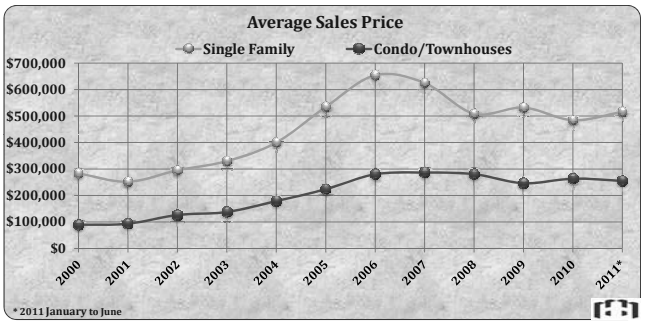


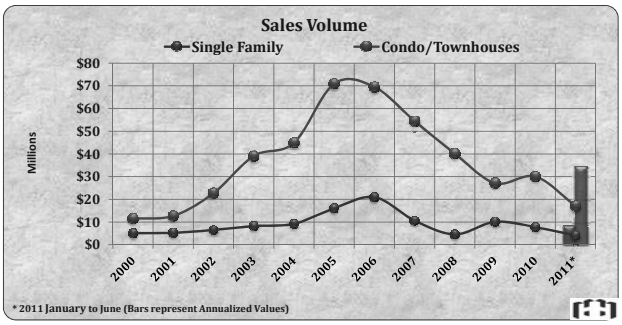


Source: Honolulu MLS, and The Hallstrom Group, Inc.

Table I-9

SUMMARY OF SUBJECT NEIGHBORHOOD COMBINED SINGLE FAMILY AND MULTIFAMILY MARKET ACTIVITY
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii





Source: Honolulu MLS, and The Hallstrom Group, Inc.

Table I-10

UNSOLD, UNDER-CONSTRUCTION AND PLANNED RESIDENTIAL DEVELOPMENT IN THE PRIMARY STUDY AREA, CENTRAL OAHU AND EWA
Maket Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

			Total # of Units				Unsold / To Be Built (as of July 2011)				Year	
Name	**Location**	**Acres**	**Single Fam**	**Multi Fam**	**Affordable**	**Total**	**Single Fam**	**Multi Fam**	**Affordable**	**Total**	**Built Out**	**Status**
Hale Mohalu II	Pearl City				163	163			163	163	2012	Under Construction
Ewa Makai by Gentry	EWA				82	1,673				947	Uncertain	Under Construction
Franciscan Vistas/Iolina/Meleana Kula	EWA			290	290	291			290	291	2014	Under Construction
Kahiwelo, Ph. 1 & 2 (Makakilo east)	Makakilo			472	0	472		18	0	18	2017	Under Construction
Kanehili (East Kapolei I, State DHHL)	Kapolei	92			403	403			193	193	2012	Under Construction
Ko Olina Resort	EWA				392	4,450				3,286	Uncertain	Under Construction
Mehana at City of Kapolei	Kapolei				345	1,150			345	1,050	2020	Under Construction
Ocean Pointe/Hoakalei Residences	Makakilo				821	4,850			821	1,862	2016	Under Construction
Parkside at Kalani (in Wahiawa)	Central Oahu				0	30				18	Uncertain	Under Construction
Villages of Kapolei	Kapolei	888			3,465	4,229				496	2015	Under Construction
Area H Apartments	EWA				192	192			192	192	Uncertain	Planned
Castle & Cooke Waiawa	Central Oahu	108				1,500				1,500	Uncertain	Planned
East Kapolei II (DHHL & HHFDC)	Kapolei	223			1,622	1,622				1,622	2016	Planned
Ewa by Gentry	EWA				2,771	6,816				658	Uncertain	Planned
Ho'opili	Kapolei	925			3,510	11,750			3,510	3,510	2030	Planned
Kapolei Mixed Use	Kapolei	N.A.			300	1,000			300	1,000	2016	Planned
Kapolei West (Ko Olina, Phase II)	Kapolei	234			720	2,500			720	2,500	2025	Planned
Koa Ridge Makai	Central Oahu				0	3,500				3,500	2012	Planned
Leihano at Kapolei (K. Senior Village)	Kapolei	43			0	714				714	Uncertain	Planned
Makaiwa Hills	EWA	908			1,115	4,280			1,115	4,280	2025	Planned
Palailai Residential (Kapolei Mauka)	Kapolei	350				350				350	2020	Planned
Royal Kunia, Phase II	Central Oahu	327			603	2,007			603	2,007	Uncertain	Planned
Single Family Units in Areas A & H	EWA		107		0	107	107			107	Uncertain	Planned
Waiawa Ridge Development, Phase I	Central Oahu	546				5,000				5,000	Uncertain	Planned
TOTALS		**4,644**	**107**	**762**	**16,631**	**58,886**	**107**	**18**	**8,089**	**35,101**		

*Information based on City and County of Honolulu Annual Report Fiscal Year 2009-10. (Most recent available)

TABLE I-11

PROJECTION OF POTENTIAL SUBJECT UNIT ABSORPTION USING THE RESIDUAL METHOD BASED ON
TOTAL DEMAND FOR RESIDENTIAL UNITS IN THE PRIMARY STUDY AREA
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu Hawaii

	TOTAL	Sales Period					
Segment	**UNITS**	**2011-2015**	**2016-2020**	**2021-2025**	**2026-2030**	**2031-2035**	**Total**
Scenario One: Minimum Demand							
Potential Supply							
Hale Mohalu II	163	163					163
In-Fill and Minor Projects	250	50	50	50	50	50	250
Total Potential Supply	**413**	**213**	**50**	**50**	**50**	**50**	**413**
Regional Residential Unit Demand	**1,024**	**232**	**192**	**203**	**201**	**196**	**1,024**
Shortage or (Excess) Supply	**611**	**19**	**142**	**153**	**151**	**146**	**611**
Potential Residual Subject Demand							
at 100% Capture Rate	611	19	142	153	151	146	611
at 90% Capture Rate	550	17	128	138	136	131	550
Scenario Two: Maximum Demand							
Potential Supply							
Hale Mohalu II	163	163					163
In-Fill and Minor Projects	250	50	50	50	50	50	250
Total Potential Supply	**413**	**213**	**50**	**50**	**50**	**50**	**413**
Regional Residential Unit Demand	**7,531**	**1,324**	**1,467**	**1,720**	**1,487**	**1,534**	**7,531**
Shortage or (Excess) Supply	**7,118**	**1,111**	**1,417**	**1,670**	**1,437**	**1,484**	**7,118**
Potential Residual Subject Demand							
at 100% Capture Rate	7,118	1,111	1,417	1,670	1,437	1,484	7,118
at 90% Capture Rate	6,407	1,000	1,275	1,503	1,293	1,336	6,407
Mid-Point							
Potential Supply							
Hale Mohalu II	163	163					163
In-Fill and Minor Projects	250	50	50	50	50	50	250
Total Potential Supply	**413**	**213**	**50**	**50**	**50**	**50**	**413**
Regional Total Unit Demand (mid-point)	**4,278**	**778**	**829**	**961**	**844**	**865**	**4,278**
Shortage or (Excess) Supply	**3,865**	**565**	**779**	**911**	**794**	**815**	**3,865**
Potential Residual Subject Demand							
at 100% Capture Rate	3,865	565	779	911	794	815	3,865
at 90% Capture Rate	3,478	509	701	820	714	734	3,478

Source: City & County of Honolulu, & The Hallstrom Group, Inc.

TABLE I-12

SUMMARY OF PROJECTED SUBJECT UNIT DEMAND LEVELS
IN THE PRIMARY STUDY AREA USING THE MARKET SHARES METHOD
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
Assuming Sales/Pre-Sales of 1,500 Subject Units to Begin in 2014

Scenario One: Using Minimum Demand Assumptions

Sales Year Date	Sales Year Period	Total Regional MF Demand	Effective Subject Share	Indicated Total Subject Absorption
2014	1	37	70.00%	26
2015	2	37	72.50%	27
2016	3	31	75.00%	24
2017	4	31	87.50%	27
2018	5	31	90.00%	28
2019	6	31	90.00%	28
2020	7	31	90.00%	28
2021	8	34	90.00%	31
2022	9	34	90.00%	31
2023	10	34	90.00%	31
2024	11	34	90.00%	31
2025	12	34	90.00%	31
2026	13	35	90.00%	31
2027	14	35	90.00%	31
2028	15	35	90.00%	31
2029	16	35	90.00%	31
2030	17	35	90.00%	31
2031	18	34	90.00%	31
2032	19	34	90.00%	31
2033	20	34	90.00%	31
2034	21	34	90.00%	31
2035	22	34	90.00%	31
Totals		**747**	**87.40%**	**653**

Scenario Two: Using Maximum Demand Assumptions

Sales Year Date	Sales Year Period	Total Regional SF Demand	Effective Subject Share	Indicated Total Subject Absorption
2014	1	91	70.00%	64
2015	2	91	72.50%	66
2016	3	268	75.00%	201
2017	4	268	87.50%	234
2018	5	268	90.00%	241
2019	6	268	90.00%	241
2020	7	268	90.00%	241
2021	8	291	73.00%	212
Totals		**1,812**	**82.80%**	**1,500**

Source: The Hallstrom Group, Inc.

EXHIBIT II

PRIMARY STUDY AREA COMMERCIAL MARKET

In this exhibit are seven tables presenting the data and models which were used to project the demand for additional commercial (retail/restaurant/service) in the Primary Study Area and the Subject Neighborhood, and to estimate the absorption velocity for the 143,385 square foot unit commercial space component of the Live, Work, Play Aiea master plan.

Principal sources for the materials and modeling variables included:

- CB Richard Ellis
- Honolulu Board of Realtors Multiple Listing Service
- Hawaii Information Service Public Record Data
- Various Property Owners, Management Agents and Brokers for Major Commercial Projects in the Primary Study Area
- LoopNet
- State of Hawaii Department of Business, Economic Development and Tourism

Table II-1 Summary of Existing Retail/Restaurant Commercial Space Development in Hawaii by Island

Table II-2 Comparison of Existing Retail/Restaurant Space Development Per Capita on Oahu by Trade Area

Table II-3 Summary of Existing Major Center Space Development on Oahu and in the Primary Study Area

Table II-4 Quantification of Retail/Restaurant Floor Space Demand in the Primary Study Area from 2010 to 2035

Table II-5 Estimated Total Additional Retail/Restaurant Floor Space and Acreage Demand for the Primary Study Area 2011 to 2035

Table II-6 Existing Vacant and Proposed Commercial Land in the Primary Study Area

Table II-7 Summary of Neighborhood Commercial Space Demand Created by Subject Residents and Others at Build-Out

TABLE II-1

SUMMARY OF EXISTING RETAIL/RESTAURANT COMMERCIAL SPACE DEVELOPMENT IN HAWAII BY ISLAND
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
As of First Quarter 2011, Major Islands Only

County	C& C of Honolulu	Maui	Kauai	Hawaii	State Totals
Resident Population (2010)	909,071	146,308	64,786	180,820	1,300,985
1. Summary of Inventory					
Number of Major Retail Centers	123	51	16	36	226
Gross Leaseable Area in Centers (1) (Square Feet)	16,555,631	3,875,941	1,218,989	3,110,518	24,761,079
Other Gross Leaseable Area (2) (Square Feet)	3,535,000	575,000	208,300	795,000	5,113,300
Total Estimated Commercial GLA (Square Feet)	**20,090,631**	**4,450,941**	**1,427,289**	**3,905,518**	**29,874,379**
2. Per Capita Spatial Allowance (Square Feet per Person)					
Per Resident Population Member	22.10	30.42	22.03	21.60	22.96

(1) Complexes with circa 50,000 square feet and up.
(2) Includes smaller projects and hotels. Does not include space within mixed-use, multi-tenant buildings located in Light Industrial parks.

Source: CB Richard Ellis, State DBEDT and The Hallstrom Group, Inc.

TABLE II-2

COMPARISON OF EXISTING RETAIL/RESTAURANT SPACE DEVELOPMENT PER CAPITA ON OAHU BY TRADE AREA
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
As of First Quarter 2011

Trade Area	Honolulu	Ewa	Central Oahu	Windward
Total Estimated Commercial GLA (Square Feet)	**13,259,816**	**2,009,063**	**3,415,407**	**1,406,344**
Estimated Resident Population (2010)	467,993	138,994	158,965	127,564
Per Capita Spatial Allowance for Each Resident (Square Feet per Person)	**28.33**	**14.45**	**21.49**	**11.02**
Per Capita Allowance Island Wide	22.10	22.10	22.10	22.10
Ratio of Region Per Capita Development to Island Average	**128.20%**	**65.40%**	**97.22%**	**49.88%**

Source: CB Richard Ellis, State DBEDT and The Hallstrom Group, Inc.

TABLE II-4

QUANTIFICATION OF RETAIL/RESTAURANT FLOOR SPACE DEMAND
IN THE PRIMARY STUDY AREA FROM 2010 TO 2035 (1)
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

Year	Regional Population (2) Annual Growth Rate	Regional Population (2) Forecast Total	X	Per Capita Demand in Square Feet	=	Total Resident Demand in Square Feet	X	Regional Capture Rate (3)	=	Net Regional Demand in Square Feet
2010		77,484		22.95		1,778,258		100.0%		1,778,258
2015	0.51%	79,500		23.25		1,848,375		100.0%		1,848,375
2020	0.47%	81,400		23.50		1,912,900		100.0%		1,912,900
2025	0.46%	83,300		23.75		1,978,375		100.0%		1,978,375
2030	0.45%	85,200		24.00		2,044,800		100.0%		2,044,800
2035	0.44%	87,100		24.25		2,112,175		100.0%		2,112,175

Note: Total amount of floor space in the Primary Study Area is an estimated 1,778,226 square feet.

(1) Per capita demand includes space for retail/restaurant (and service/neighborhood) commercial uses only.
(2) Using "Baseline Market Projections" from Table I-1.
(3) The Primary Study Area is a major regional shopping destination attracting patrons from throughout Oahu. It has resulted in there being an average of 22.95 per square feet of floor space per area resident with an effective capture rate of 100 percent. The assumption is that this proportionate trend will continue, with nominal gains in the per capita floor space level over time.

Source: The Hallstrom Group, Inc.

TABLE II-3

SUMMARY OF EXISTING MAJOR CENTER SPACE DEVELOPMENT
ON OAHU AND IN THE PRIMARY STUDY AREA
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
As of First Quarter 2011

	Oahu	Aiea/Waiau
Total Estimated "Major Center" GLA (Square Feet)	9,578,073	1,778,226
Estimated Resident Population (2010)	911,841	77,484
Major Center Per Capita Spatial Allowance for Each Resident (Square Feet per Person)	10.50	22.95
General Market Operating Overview		
Vacant Area in Square Feet	241,726	24,600
Vacancy Rate	2.52%	1.38%
Range of Avg. Monthly Base per Square Foot Rents		
Low	$3.31	$2.28
High	$4.77	$3.75
Percentage Rent (if Applicable)		
Low	2.00%	3.00%
High	15.00%	12.50%
Average Monthly per Square Foot Operating Expenses		
Low	$0.75	$1.05
High	$2.10	$1.68
Space Absorbed in First Quarter 2011	63,251	7,820

Source: CB Richard Ellis, Colliers Hawaii ,State DBEDT and The Hallstrom Group, Inc.

TABLE II-5

ESTIMATED TOTAL ADDITIONAL RETAIL/RESTAURANT FLOOR SPACE AND ACREAGE DEMAND
FOR THE PRIMARY STUDY AREA 2011 TO 2035
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

Summary of Demand

Year	Forecast Floor Space Demand (in Sq. Ft.)	Divided by FAR Allowance (1)	Resulting Land Area Demand (in Acres)
2011	1,778,258	0.25	163
2015	1,848,375	0.25	170
2020	1,912,900	0.25	176
2025	1,978,375	0.25	182
2030	2,044,800	0.25	188
2035	2,112,175	0.25	194

FINISHED FLOOR SPACE ANALYSIS (in Square Feet)

Periodic Additions Required (Sq. Ft.):	Demand
2011 to 2015	70,117
2015 to 2020	64,525
2021 to 2025	65,475
2026 to 2030	66,425
2031 to 2035	67,375
Cumulative Additional Space Required:	**333,917**
Increase as a Percent of Existing Floor Space	**18.78%**

DEVELOPABLE LAND AREA ANALYSIS (in Acres)

Periodic Additions Required (Acres):	Demand
2011 to 2015	6.4
2015 to 2020	5.9
2021 to 2025	6.0
2026 to 2030	6.1
2031 to 2035	6.2
Cumulative Additional Acreage Required	**30.7**
Increase as a Percent of Existing Acreage:	**18.78%**

(1) Assuming average finished "Floor Area Ratio" of .25 for finished commercial development sites.

Source: The Hallstrom Group, Inc.

TABLE II-6

EXISTING VACANT AND PROPOSED COMMERCIAL LAND IN PRIMARY STUDY AREA
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

Project Name/Identification	Total Vacant/Proposed Net Site Acres	Estimated Potential Floor Area in Sq. Ft.
Aiea-Waiawa (Excludes the Subject Property)	54	526,902
Pearl City	24	234,179
TOTAL PROPOSED COMMERCIAL FLOOR SPACE AND ACREAGE IN PRIMARY STUDY AREA	**78**	**761,080**

Note: Includes proposed commercial lands in master planned communities

Source: CB Richard Ellis and The Hallstrom Group, Inc.

EXHIBIT III

PRIMARY STUDY AREA OFFICE MARKET

In this exhibit are five tables presenting the data and models which were used to project the demand for additional office (standard and medical) in the Primary Study Area and the Subject Neighborhood, and to estimate the absorption velocity for the 80,000 square foot unit office space component of the Live, Work, Play Aiea master plan.

Principal sources for the materials and modeling variables included:

- CB Richard Ellis
- Honolulu Board of Realtors Multiple Listing Service
- Hawaii Information Service Public Record Data
- Various Property Owners, Management Agents and Brokers for Major Commercial Projects in the Primary Study Area
- LoopNet
- State of Hawaii Department of Business, Economic Development and Tourism

Table III-1 Comparison of Existing Office Space Development Per Capita on Oahu by Trade Area

Table III-2 Summary of Existing Office Space Development on Oahu and in the Primary Study Area

Table III-3 Quantification of Office Floor Space Demand in the Primary Study Area from 2010 to 2035

Table III-4 Estimated Total Additional Office Floor Space and Acreage Demand for the Primary Study Area 2011 to 2035

Table III-5 Summary of Projected Subject Office Floor Space Demand Levels in the Primary Study Area Using the Market Shares Method

TABLE II-7

SUMMARY OF NEIGHBORHOOD COMMERCIAL SPACE DEMAND
CREATED BY SUBJECT RESIDENTS AND OTHERS AT BUILD-OUT
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

1. Stabilized Subject Population		
Full-Time Residents		4,080
2. Per Capita Demand for Commercial Space (in Gross Square Feet per Person)		
Total for All Commercial Needs		23.8
"Neighborhood" Space Demand as Percent of Total		55%
Total Per Capita "Neighborhood" Commercial Space Demand in Square Feet		13.1
Allowance for "Service Commercial/Medical" Space (50% of Neighborhood demand)		6.5
Allowance for "Support/Other Commercial" Space (25% of Neighborhood demand)		3.3
Total Per Capita Floor Space Demand for Local-Oriented Commercial Space		22.9
3. Indicated Subject Commercial Floor Space Demand		
From Subject Project Population		93,266
Patronage From Other Sources	**% of Community Demand**	
Employees and Day Workers in Community	10%	9,327
Nearby Population in Non-Subject Projects (1)	25%	23,317
Passer-Bys/Intercept and Others	25%	23,317
Total Estimated Gross Floor Space Demand at Stabilization		**149,226**

(1) The subject commercial space will be the most proximate neighborhood shopping opportunity for residents living mauka on Kaonohi Street, an intercept/immediate trade area with a resident population of several thousand persons.

Source: The Hallstrom Group, Inc.

TABLE III-2

SUMMARY OF EXISTING OFFICE SPACE DEVELOPMENT ON OAHU AND IN THE PRIMARY STUDY AREA
Market Study of the Proposed Aiea Rezoning Master Plan
Aiea, Oahu, Hawaii
As of First Quarter 2011

	Oahu	Aiea/Waiau
Total Estimated Office GLA (Square Feet)	11,583,718	308,870
Estimated Resident Population (2010)	911,841	77,484
OfficePer Capita Spatial Allowance for Each Resident (Square Feet per Person)	12.70	3.99
General Market Operating Overview		
Vacant Area in Square Feet	1,698,636	33,132
	14.66%	10.73%
Range of Avg. Monthly Base per Square Foot Rents		
Low	$2.16	$2.81
High	$3.88	$3.01
Average Monthly per Square Foot Operating Expenses		
Low	$0.94	$1.01
High	$1.56	$1.34
Space Absorbed in First Quarter 2011	(154)	(213)

Source: CB Richard Ellis, Colliers Hawaii ,State DBEDT and The Hallstrom Group, Inc.

TABLE III-1

COMPARISON OF EXISTING OFFICE SPACE DEVELOPMENT PER CAPITA ON OAHU BY TRADE AREA
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
As of First Quarter 2011

Trade Area	Island Total	Honolulu	Ewa	Central Oahu	Windward
Total Estimated Commercial GLA (Square Feet)	**11,583,718**	**10,696,742**	**369,238**	**308,780**	**208,958**
Estimated Resident Population (2010)	911,841	467,993	138,994	158,965	127,564
Per Capita Spatial Allowance for Each Resident (Square Feet per Person)	**12.70**	**22.86**	**2.66**	**1.94**	**1.64**
Per Capita Allowance Island Wide		12.70	12.70	12.70	12.70
Ratio of Region Per Capita Development to Island Average		**179.92%**	**20.91%**	**15.29%**	**12.89%**

Source: CB Richard Ellis, State DBEDT and The Hallstrom Group, Inc.

TABLE III-3

QUANTIFICATION OF OFFICE FLOOR SPACE DEMAND
IN THE PRIMARY STUDY AREA FROM 2010 TO 2035
Market Study of the Proposed Live, Work, Play Aiea
Aiea, Oahu, Hawaii

Using "Baseline Market Estimates" (1)

Year	Patronage Population: Annual Growth Rate	Patronage Population: Forecast Total	X	Per Capita Demand in Square Feet	=	Total Resident Demand in Square Feet	X	Regional Capture Rate (2)	=	Net Regional Demand in Square Feet
2010		77,484		3.98		308,386		100.0%		308,386
2015	0.51%	79,500		4.50		357,750		100.0%		357,750
2020	0.47%	81,400		5.00		407,000		100.0%		407,000
2025	0.46%	83,300		5.50		458,150		100.0%		458,150
2030	0.45%	85,200		6.00		511,200		100.0%		511,200
2035	0.44%	87,100		6.50		566,150		100.0%		566,150

Note: Total amount of floor space currently occupied in the Primary Study Area is 308,870 square feet.

(1) From Table I-1.
(2) The Primary Study Area is a medical and office destination attracting patrons from throughout the region, which has resulted in there being an average of 3.98 square feet of floor space per area resident with an effective capture rate of 100 percent. The assumption is that this proportionate trend will continue, with gains in the per capita floor space over time.

Source: The Hallstrom Group, Inc.

TABLE III-4

ESTIMATED TOTAL ADDITIONAL OFFICE FLOOR SPACE AND ACREAGE DEMAND
FOR THE PRIMARY STUDY AREA 2010 TO 2030
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

Using Baseline Market Projections Year	Forecast Floor Space Demand (in Sq. Ft.)	Divided by FAR Allowance (1)	Resulting Land Area Demand (in Acres)
2010	308,386	0.50	14
2015	357,750	0.50	16
2020	407,000	0.50	19
2025	458,150	0.50	21
2030	511,200	0.50	23
2035	566,150	0.50	26

FINISHED FLOOR SPACE ANALYSIS (in Square Feet)

Periodic Additions Required (Sq. Ft.):	Scenario 2
2011 to 2015	48,880
2016 to 2020	49,250
2021 to 2025	51,150
2026 to 2030	53,050
2031 to 2035	54,950
Cumulative Additional Space Required:	**257,280**
Increase as a Percent of Existing Floor Space	**83.43%**

DEVELOPABLE LAND AREA ANALYSIS (in Acres)

Periodic Additions Required (Acres):	Scenario 2
2011 to 2015	2.3
2016 to 2020	2.3
2021 to 2025	2.3
2026 to 2030	2.4
2031 to 2035	2.5
Cumulative Additional Acreage Required	**11.8**
Increase as a Percent of Existing Acreage:	**83.58%**

(1) Assuming average finished "Floor Area Ratio" of .50 for finished office development sites.

Source: The Hallstrom Group, Inc.

TABLE III-5

SUMMARY OF PROJECTED SUBJECT OFFICE FLOOR SPACE DEMAND LEVELS
IN THE PRIMARY STUDY AREA USING THE MARKET SHARES METHOD
Market Study of the Proposed Live, Work, Play Aiea
Aiea, Oahu, Hawaii
Assuming Leasing/Pre-Leasing of 80,000 Subject Square Feet to Begin in 2014

Using Baseline Market Indicators

Sales Year		Total Regional Office Demand	Effective Subject Share	Indicated Total Subject Absorption
Date	Period			
2014	1	9,776	50.00%	4,888
2015	2	9,776	55.00%	5,377
2016	3	9,850	60.00%	5,910
2017	4	9,850	67.00%	6,600
2018	5	9,850	67.00%	6,600
2019	6	9,850	67.00%	6,600
2020	7	9,850	67.00%	6,600
2021	8	10,230	67.00%	6,854
2022	9	10,230	67.00%	6,854
2023	10	10,230	67.00%	6,854
2024	11	10,230	67.00%	6,854
2025	12	10,230	67.00%	6,854
2026	13	10,610	29.75%	3,156
Totals		**130,562**	**61.27%**	**80,000**

Source: The Hallstrom Group, Inc.

EXHIBIT IV

OAHU TOURISM AND HOTEL MARKET

In this exhibit are four tables presenting the data and models which were used to assess the demand for a limited to moderate-service circa 140-room hotel component in the Live, Work, Play Aiea master plan should it be considered as an alternative to office use.

Principal sources for the materials and modeling variables included:

- Hawaii Visitors & Convention Bureau
- Hospitality Advisors LLC
- PKF Hawaii
- First Hawaiian Bank
- City & County of Honolulu Department of Planning and Permitting
- State of Hawaii Department of Business, Economic Development and Tourism

Table IV-1 Island of Oahu/Waikiki Tourism Industry Trends (1965-2011)

Table IV-2 Waikiki Resort District Hotel Industry Trends (Off-Beach Facilities with Restaurants/Mid-Price Properties Only, 1974-2011)

Table IV-3 Historic and Projected Total Lodging Room Night Demand Oahu and Waikiki 1965 Through 2030

Table IV-4 Planned Additions to Oahu Lodging Unit Supply

TABLE IV-1

ISLAND OF OAHU/WAIKIKI TOURISM INDUSTRY TRENDS
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

YEAR	TOTAL VISITORS	Annual Pct. Change	PERCENT OF STATE TOTAL	AVERAGE LENGTH OF STAY (days)	Annual Pct. Change	TOTAL VISITOR DAYS	Annual Pct. Change	VISITOR EXPENDITURES: ESTIMATED TOTAL (1) (000's)	Annual Pct. Change	DAILY PER CAPITA	Annual Pct. Change	TOTAL LODGING UNITS	Annual Pct. Change
1965	662,278	---	96.50%	8.00	---	5,298,221	---	$185,000	---	$34.92	---	9,850	---
1970	1,680,426	30.75%	93.90%	7.25	-1.88%	12,183,088	25.99%	$515,000	35.68%	$42.27	4.21%	21,217	23.08%
1975	2,622,580	11.21%	92.70%	7.03	-0.61%	18,436,740	10.27%	$975,000	17.86%	$52.88	5.02%	25,699	4.22%
1976	2,956,099	12.72%	91.80%	6.95	-1.14%	20,544,885	11.43%	$1,125,000	15.38%	$54.76	3.54%	27,099	5.45%
1977	3,069,698	3.84%	89.40%	6.72	-3.31%	20,628,373	0.41%	$1,175,000	4.44%	$56.96	4.02%	28,083	3.63%
1978	3,218,861	4.86%	87.70%	6.68	-0.60%	21,501,991	4.24%	$1,300,000	10.64%	$60.46	6.14%	29,294	4.31%
1979	3,417,938	6.18%	86.30%	6.57	-1.65%	22,455,854	4.44%	$1,475,000	13.46%	$65.68	8.64%	32,088	9.54%
1980	3,324,656	-2.73%	84.50%	6.48	-1.37%	21,543,770	-4.06%	$1,650,000	11.86%	$76.59	16.60%	34,173	6.50%
1981	3,289,345	-1.062%	83.60%	6.33	-2.31%	20,821,553	-3.35%	$1,800,000	9.09%	$86.45	12.87%	33,480	-2.03%
1982	3,606,479	9.64%	85.00%	6.31	-0.32%	22,756,880	9.29%	$2,050,000	13.89%	$90.08	4.20%	34,610	3.38%
1983	3,669,019	1.73%	84.00%	6.15	-2.54%	22,564,468	-0.85%	$1,975,000	-3.66%	$87.53	-2.84%	35,761	3.33%
1984	3,942,731	7.46%	81.20%	6.25	1.63%	24,642,069	9.21%	$2,300,000	16.46%	$93.34	6.64%	36,848	3.04%
1985	3,912,172	-0.78%	80.10%	6.12	-2.08%	23,942,493	-2.84%	$2,350,000	2.17%	$98.15	5.16%	38,600	4.75%
1986	4,479,977	14.51%	79.90%	6.07	-0.82%	27,193,461	13.58%	$2,950,000	25.53%	$108.48	10.52%	39,010	1.06%
1987	4,381,111	-2.21%	75.80%	5.96	-1.81%	26,111,422	-3.98%	$3,211,705	8.87%	$123.00	13.38%	38,185	-2.11%
1988	4,594,530	4.87%	74.80%	5.92	-0.67%	27,199,619	4.17%	$3,949,929	22.99%	$145.22	18.07%	37,841	-0.90%
1989	4,895,021	6.54%	73.70%	5.85	-1.18%	28,635,875	5.28%	$4,524,468	14.55%	$158.00	8.80%	36,467	-3.63%
1990	5,005,307	2.25%	71.80%	5.81	-0.68%	29,080,835	1.55%	$5,026,332	11.09%	$172.84	9.39%	36,899	1.18%
1991	4,653,624	-7.03%	67.70%	5.60	-3.61%	26,060,292	-10.39%	$5,106,254	1.59%	$195.94	13.36%	36,623	-0.75%
1992	4,527,147	-2.72%	69.50%	5.75	2.68%	26,031,093	-0.11%	$4,840,221	-5.21%	$185.94	-5.10%	36,851	0.62%
1993	4,213,470	-6.93%	68.80%	5.77	0.35%	24,311,723	-6.61%	$4,442,967	-8.21%	$182.75	-1.72%	36,604	-0.67%
1994	4,695,167	11.43%	73.02%	5.85	1.39%	27,466,727	12.98%	$5,090,134	14.57%	$185.32	1.41%	36,194	-1.12%
1995	4,915,840	4.70%	74.20%	5.90	0.85%	29,003,456	5.59%	$5,890,602	15.73%	$203.10	9.59%	36,174	-0.06%
1996	5,092,680	3.60%	74.63%	5.88	-0.34%	29,944,958	3.25%	$6,313,595	7.18%	$210.84	3.81%	36,146	-0.08%
1997	5,017,069	-1.48%	72.96%	5.95	1.11%	29,828,984	-0.39%	$6,323,745	0.16%	$212.00	0.55%	35,971	-0.48%
1998	4,741,130	-5.50%	70.31%	5.41	-9.01%	25,649,513	-14.01%	$4,770,809	-24.56%	$186.00	-12.26%	36,206	0.65%
1999	4,558,168	-3.86%	67.62%	5.67	4.81%	25,844,813	0.76%	$4,600,377	-3.57%	$178.00	-4.30%	35,861	-0.95%
2000	4,776,960	4.80%	68.48%	6.61	16.58%	31,575,706	22.17%	$5,904,657	28.35%	$187.00	5.06%	36,303	0.81%
2001 (1)	4,268,937	-10.63%	67.61%	6.88	4.15%	29,388,797	-6.93%	$5,375,000	-8.97%	$182.89	-2.20%	36,500	0.54%
2002	4,239,887	-0.68%	66.36%	6.96	1.10%	29,494,656	0.36%	$5,125,000	-4.65%	$173.76	-4.99%	36,457	-0.12%
2003	4,066,258	-4.10%	64.08%	7.27	4.45%	29,579,916	0.29%	$5,200,000	1.46%	$175.79	1.17%	36,600	0.39%
2004	4,476,229	10.08%	64.80%	6.80	-6.46%	30,438,357	2.90%	$5,350,000	2.88%	$175.77	-0.02%	35,987	-1.67%
2005	4,751,855	6.16%	64.07%	6.89	1.32%	32,740,281	7.56%	$5,679,200	6.15%	$173.46	-1.31%	34,340	-4.58%
2006	4,606,438	-3.06%	62.13%	6.80	-1.31%	31,323,778	-4.33%	$5,536,800	-2.51%	$176.76	1.90%	34,008	-0.97%
2007	4,596,330	-0.22%	61.30%	6.78	-0.36%	31,142,644	-0.58%	$5,729,200	3.47%	$184.00	4.10%	33,588	-1.24%
2008	4,193,685	-8.76%	62.47%	7.13	5.23%	29,900,974	-3.99%	$5,644,300	-1.48%	$188.77	2.59%	34,081	1.47%
2009	4,032,198	-3.85%	62.82%	7.35	3.09%	29,636,655	-0.88%	$5,031,600	-10.86%	$169.78	-10.06%	34,025	-0.16%
2010	4,334,359	7.49%	62.07%	7.38	0.44%	31,998,319	7.97%	$5,724,500	13.77%	$178.90	5.37%	34,040	0.04%
2011 (2)	4,450,000	2.67%	60.12%	7.45	0.91%	33,152,500	3.61%	$6,300,000	10.05%	$190.03	6.22%	34,900	2.53%

(1) The State DBEDT changed its method of estimating expenditures from a tax receipts/economic activity formula to a survey of departing visitors in 2001-02. Analysis has confirmed this results in a significant understatement of actual expenditures and fails to account for in-state (Kamaaina) travel. In example, the formula-based 2001 figure is more than 10% lower than the DBEDT survey-based estimates. While we have adopted the State figures since 2001, which results in an apparent but unfounded large-scale change from 200, we believe DBEDT survey method is meaningfully inadequate.
(2) Preliminary year-end estimates based on data through May.

Source: DBEDT, The Hawaii Visitors & Convention Bureau, First Hawaiian Bank, and The Hallstrom Group, Inc.

TABLE IV-2

WAIKIKI RESORT DISTRICT HOTEL INDUSTRY TRENDS
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
Off-Beach Facilities with Restaurants/Mid-Price Properties Only

YEAR	ROOM RENTAL RATE	Annual Pct. Change	AVERAGE OCCUPANCY RATE	Annual Pct. Change	FOOD REVENUE/ ROOM (1)	Annual Pct. Change	BEVERAGE REVENUE/ ROOM (1)	Annual Pct. Change	TOTAL FOOD AND BEVERAGE: REVENUE/ ROOM (1)	RATIO TO ROOM RATES	Annual Pct. Change
1974	$18.63	---	78.19%	---	$8.42	---	$3.66	---	$12.08	64.84%	---
1975	$21.70	16.48%	73.12%	-6.48%	$8.58	1.90%	$3.96	8.20%	$12.54	57.79%	-10.88%
1976	$22.94	5.71%	82.24%	12.47%	$9.38	9.32%	$4.30	8.59%	$13.68	59.63%	3.19%
1977	$25.68	11.94%	80.07%	-2.64%	$10.49	11.83%	$3.91	-9.07%	$14.40	56.07%	-5.97%
1978	$29.96	16.67%	74.59%	-6.84%	$11.94	13.82%	$3.82	-2.30%	$15.76	52.60%	-6.19%
1979	$34.19	14.12%	63.58%	-14.76%	$13.18	10.39%	$4.13	8.12%	$17.31	50.63%	-3.75%
1980	$34.78	1.73%	73.19%	15.11%	$13.26	0.61%	$4.62	11.86%	$17.88	51.41%	1.54%
1981	$33.90	-2.53%	73.82%	0.86%	$15.24	14.93%	$4.77	3.25%	$20.01	59.03%	14.82%
1982	$35.69	5.28%	81.25%	10.07%	$15.73	3.22%	$4.70	-1.47%	$20.43	57.24%	-3.02%
1983	$36.32	1.77%	79.13%	-2.61%	$15.15	-3.69%	$4.45	-5.32%	$19.60	53.96%	-5.73%
1984	$39.56	8.92%	85.73%	8.34%	$16.50	8.91%	$4.48	0.67%	$20.98	53.03%	-1.73%
1985	$44.31	12.01%	83.72%	-2.34%	$17.38	5.33%	$4.60	2.68%	$21.98	49.61%	-6.46%
1986	$50.23	13.36%	85.94%	2.65%	$15.30	-11.97%	$3.33	-27.61%	$18.63	37.09%	-25.23%
1987	$53.36	6.23%	87.08%	1.33%	$16.27	6.34%	$3.39	1.80%	$19.66	36.84%	-0.66%
1988	$63.19	18.42%	86.10%	-1.13%	$12.24	-24.77%	$3.06	-9.73%	$15.30	24.21%	-34.28%
1989	$69.29	9.65%	88.90%	3.25%	$13.22	8.01%	$2.27	-25.82%	$15.49	22.36%	-7.67%
1990	$76.43	10.30%	88.59%	-0.35%	$11.31	-14.45%	$2.48	9.25%	$13.79	18.04%	-19.29%
1991	$77.46	1.35%	82.17%	-7.25%	$11.59	2.48%	$2.30	-7.26%	$13.89	17.93%	-0.61%
1992	$79.38	2.48%	80.77%	-1.70%	$12.41	7.08%	$2.26	-1.74%	$14.67	18.48%	3.06%
1993	$75.46	-4.94%	75.52%	-6.50%	$12.36	-0.40%	$2.25	-0.44%	$14.61	19.36%	4.76%
1994	$72.16	-4.37%	82.32%	9.00%	$11.49	-7.04%	$1.97	-12.44%	$13.46	18.65%	-3.66%
1995	$77.32	7.15%	85.52%	3.89%	$12.29	6.96%	$2.05	4.06%	$14.34	18.55%	-0.57%
1996	$84.36	9.11%	83.09%	-2.84%	$13.37	8.79%	$2.11	2.93%	$15.48	18.35%	-1.06%
1997	$90.24	6.97%	81.78%	-1.58%	$13.93	4.19%	$2.34	10.90%	$16.27	18.03%	-1.75%
1998	$89.98	-0.29%	76.19%	-6.84%	$14.77	6.03%	$2.49	6.41%	$17.26	19.18%	6.39%
1999	$87.57	-2.68%	73.88%	-3.03%	$14.51	-1.76%	$2.73	9.64%	$17.24	19.69%	2.63%
2000	$89.42	2.11%	76.71%	3.83%	$13.97	-3.72%	$2.70	-1.10%	$16.67	18.64%	-5.31%
2001	$90.41	1.11%	72.59%	-5.37%	$13.94	-0.21%	$2.65	-1.85%	$16.59	18.35%	-1.57%
2002	$78.14	-13.57%	72.02%	-0.79%	$11.15	-20.01%	$2.53	-4.53%	$13.68	17.51%	-4.59%
2003	$79.81	2.14%	71.32%	-0.97%	$12.95	16.14%	$3.38	33.60%	$16.33	20.46%	16.87%
2004	$81.96	2.69%	77.87%	9.18%	$10.31	-20.39%	$3.39	0.30%	$13.70	16.72%	-18.31%
2005	$87.08	6.25%	76.34%	-1.96%	$14.05	36.28%	$4.22	24.48%	$18.27	20.98%	25.52%
2006	$97.10	11.51%	67.37%	-11.75%	$12.15	-13.52%	$4.68	10.90%	$16.83	17.33%	-17.39%
2007	$112.67	16.04%	73.70%	9.40%			Data No Longer Available				
2008	$117.32	4.13%	73.00%	-0.95%							
2009	$101.68	-13.33%	68.50%	-6.16%							
2010	$101.41	-0.27%	72.70%	6.13%							
2011 (2)	$105.35	3.89%	74.30%	2.20%							

Note: Source of data changed from PKF Hawaii to Hospitality Advisors in 2007. Survey properties and groupings were subject to change.

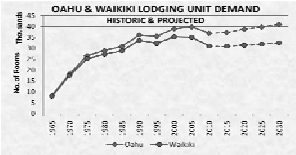
(1) Per occupied room per night through 1985, per registered hotel guest thereafter.
(2) Through May.

Source: PKF Hawaii, Hospitality Advisors, The Hawaii Visitors & Convention Bureau, and The Hallstrom Group, Inc.

TABLE IV-3

HISTORIC AND PROJECTED TOTAL LODGING ROOM NIGHT DEMAND
OAHU AND WAIKIKI 1965 THROUGH 2030
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
Using Mid-Point Demand Forecasts

	HISTORIC									FORECAST				
Year	**1965**	**1970**	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**	**2025**	**2030**
Total Oahu														
Total Visitor Nights (1)	4,635,943	10,502,662	15,814,160	18,219,114	20,030,321	24,080,528	24,087,616	26,798,746	27,988,426	26,560,000	27,000,000	28,000,000	29,000,000	30,000,000
Average Party Size	1.92	1.97	2.04	2.15	2.22	2.28	2.32	2.35	2.40	2.46	2.48	2.47	2.49	2.50
Total Annual Lodging Nights Demand	2,414,554	5,331,301	7,752,039	8,474,007	9,022,667	10,561,635	10,382,593	11,403,722	11,661,844	10,796,748	10,887,097	11,336,032	11,646,586	12,000,000
Average Annual Percent Change		24.2%	9.1%	1.9%	1.3%	3.4%	-0.3%	2.0%	0.5%	-1.5%	0.2%	0.8%	0.5%	0.6%
Average Occupancy Rate Allowance (2)	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%	80.0%
Total Rooms Required to Meet Demand (3)	8,269	18,258	26,548	29,021	30,900	36,170	35,557	39,054	39,938	36,975	37,285	38,822	39,886	41,096
Additional Inventory Required (Forecast Only)										**2,775**	**3,085**	**4,622**	**5,686**	**6,896**
Waikiki Only														
Total Annual Lodging Nights Demand	2,342,117	5,144,705	7,364,437	7,965,566	8,436,194	9,822,321	9,448,160	10,320,368	10,262,423	9,069,268	9,036,290	9,182,186	9,317,269	9,480,000
Average Annual Percent Change		23.9%	8.6%	1.6%	1.2%	3.3%	-0.8%	1.8%	-0.1%	-2.3%	-0.1%	0.3%	0.3%	0.3%
Percent of Island wide Total Nights	97.0%	96.5%	95.0%	94.0%	93.5%	93.0%	91.0%	90.5%	88.0%	84.0%	83.0%	81.0%	80.0%	79.0%
Total Rooms Required to Meet Demand (4)	8,021	17,619	25,221	27,279	28,891	33,638	32,357	35,344	35,145	31,059	30,946	31,446	31,908	32,466
Additional Inventory Required (Forecast Only)										**2,059**	**1,946**	**2,446**	**2,908**	**3,466**



(1) Visitors typically spend one less night than the total number of days in their visit; i.e. seven days/six nights. The "visitor nights" figure accounts for this adjustment from total "visitor days" data previously presented.
(2) 80% figure used as stabilized allowance. This is annualized average in Waikiki since 1965, and reflective of what a "healthy" Hawaii hotel expects to generate.
(3) Total annual lodging demand, divided by occupancy rate, with sum than divided by 365 nights per year.
(4) Calculated using 80% occupancy rate allowance according to formula in footnote 3.

Source: DBEDT and The Hallstrom Group, Inc.

TABLE IV-4

PLANNED ADDITIONS TO OAHU LODGING UNIT SUPPLY
Market Study of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

Project Name	Lodging Type	No. of Units	Estimated Completion	Comments
Ko Olina Resort				
Marriott Ko Olina	Timeshare	96	2012	Final phase of 750 unit project.
Disney Ko Olina	Timeshare/Hotel	819	2011	Scheduled for August 2011 opening.
Other Projects	Timeshare	2,886	2018	In design, infrastructure completed.
Other Projects	Hotel	2,163	2018	No announcement on next project.
Ohana Islander Waikiki	Timeshare	136	2015	Conversion of 235-room hotel.
Turtle Bay/Kuilima Resort	Timeshare/Hotel	2,500	Uncertain	Project on-hold due.
Hoakalei at Ocean Pointe	Hotel	950	2015	Ground-breaking no yet announced.
Laie Marriott Courtyard	Hotel	220	2014	Expected to break ground in 2011.
Haleiwa Hotel	Boutique Hotel	80	Uncertain	Controversial, Not Yet Approved.
Total Proposed Lodging Units		**9,850**		

Source: DPP and The Hallstrom Group, Inc.

EXHIBIT V

ECONOMIC IMPACT ANALYSIS

In this exhibit are six tables presenting the data and models which were used to forecast the primary economic impacts associated with/resulting from the proposed Live, Work, Play Aiea master plan.

Principal sources for the materials and modeling variables included:

- State of Hawaii Department of Labor and Industrial Relations
- Form Partners LLC
- Budgets of Selected Built and Proposed Major Mixed-Use Projects
- University of Hawaii Economic Research Organization
- United States Census Bureau
- Bank of Hawaii
- First Hawaiian bank
- City & County of Honolulu Department of Planning and Permitting
- State of Hawaii Department of Business, Economic Development and Tourism

Table V-1 Proposed Phased Development Schedule and Estimated Construction Costs

Table V-2 Estimated Full-Time Equivalent Employment Positions Created by Development

Table V-3 Estimated Yearly Employee Wages Created by Development

Table V-4 Estimated Subject De Facto Population, Resident household Income and Discretionary Expenditures

Table V-5 Projected Subject On-Site Operating Economic Activity

Table V-6 Summary of Economic Impacts Associated with Subject Development

TABLE V-1

PROPOSED PHASED DEVELOPMENT SCHEDULE AND ESTIMATED CONSTRUCTION COSTS
Economic Impact Analysis of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
All Construction Costs Provided by Form Partners LLC and Development Team

	Phase I and 1B			Phase II		Phase III		Phase IV		Totals
	2013	2014	2015	2016	2017	2018	2019	2020	2021	
Infrastructure Emplacement	$3,000,000	$5,000,000		$3,000,000		$2,000,000	$500,000	$1,000,000	$500,000	$15,000,000
Commercial Construction	$16,056,439	$32,113,361	$7,923,600	$5,874,300		$2,555,550				$64,523,250
Office Construction	$11,998,800	$24,001,200								$36,000,000
Residential Product										
Tower 1						$100,648,170	$67,098,780			$167,746,950
Tower 2							$33,549,390	$100,648,170	$33,549,390	$167,746,950
Tower 3				$100,648,170	$67,098,780					$167,746,950
Midrise 1		$24,686,171	$49,379,749							$74,065,920
Midrise 2		$24,686,171	$49,379,749							$74,065,920
TOTAL ANNUAL CONSTRUCTION COSTS	$31,055,239	$110,486,903	$106,683,098	$109,522,470 $0	$67,098,780	$105,203,720	$101,148,170	$101,648,170	$34,049,390	$766,895,940
Contractor Profits	$3,105,524	$11,048,690	$10,668,310	$10,952,247	$6,709,878	$10,520,372	$10,114,817	$10,164,817	$3,404,939	$76,689,594
Supplier Profits	$1,242,210	$4,419,476	$4,267,324	$4,380,899	$2,683,951	$4,208,149	$4,045,927	$4,065,927	$1,361,976	$30,675,838

Source: Form Partners, LLC, and The Hallstrom Group, Inc.

TABLE V-2

ESTIMATED YEARLY FULL-TIME EQUIVALENT EMPLOYMENT POSITIONS CREATED BY DEVELOPMENT
Economic Impact Analysis of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

	Phase I			Phase II		Phase III		Phase IV		Post-Construction Absorption				Totals
Construction Employment (1)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Infrastructure Emplacement	8	13		8		5	1	3	1					38
Commercial Construction	80	161	40	29		13								323
Office Construction	60	120												180
Residential Construction														
Tower 1						503	335							839
Tower 2							168	503	168					839
Tower 3				503	335									839
Midrise 1		123	247											370
Midrise 2		123	247											370
Total Annual Construction Jobs	148	540	533	540	335	521	504	506	169					3,797
On-Going Business Employment														
Commercial (2)		188	238	275	300	325	350	358	358	358	358	358	358	3,826
Office (3)		34	64	84	104	128	152	180	208	236	264	292	320	2,066
Maintenance & Common Element (4)			15	20	26	33	41	48	56	63	71	78	82	532
Total Annual Business Jobs	0	222	316	379	430	486	543	587	622	658	693	729	760	6,424
Off-Site Employment (5)	37	190	212	230	191	252	262	273	198	164	173	182	190	2,555
TOTAL ANNUAL JOBCOUNT	185	952	1,062	1,148	957	1,259	1,309	1,366	989	822	867	911	951	12,776

(1) Infrastructure construction employment estimated at 1 worker-year for every $400,000 in costs. Vertical construction (all types) employment estimated at 1 worker-year for every $200,000 in costs.
(2) Employment estimated at 1 full-time-equivalent worker for every 400 square feet of gross floor area.
(3) Employment estimated at 1 full-time-equivalent worker for every 250 square feet of gross floor area.
(4) Includes common element administration and maintenance staff of 7 jobs, and ratio of one full-time-equivalent maintenenance/repair worker for every 20 units.
(5) Estimated at one cumulative off-site employment position for every four on site positions.

Source: Hallstrom Group, Inc.

TABLE V-3

ESTIMATED YEARLY EMPLOYEE WAGES CREATED BY DEVELOPMENT
Economic Impact Analysis of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

	Phase I			Phase II		Phase III		Phase IV		Post-Construction Absorption				Totals
Construction Wages (1)	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Infrastructure Emplacement	$459,375	$765,625		$459,375		$306,250	$76,563	$153,125	$76,563					$2,296,875
Commercial Construction	$4,917,284	$9,834,717	$2,426,603	$1,799,004		$782,637								$19,760,245
Hotel Construction	$3,674,633	$7,350,368												$11,025,000
Residential Construction														
Tower 1						$30,823,502	$20,549,001							$51,372,503
Tower 2							$10,274,501	$30,823,502	$10,274,501					$51,372,503
Tower 3				$30,823,502	$20,549,001									$51,372,503
Midrise 1		$7,560,140	$15,122,548											$22,682,688
Midrise 2		$7,560,140	$15,122,548											$22,682,688
Total Annual Construction Wages	$9,051,292	$33,070,989	$32,671,699	$33,081,881	$20,549,001	$31,912,389	$30,900,065	$30,976,627	$10,351,063					$232,565,007
On-Going Business Wages														
Commercial (2)		$8,061,328	$10,211,016	$11,823,281	$12,898,125	$13,972,969	$15,047,813	$15,411,647	$15,411,647	$15,411,647	$15,411,647	$15,411,647	$15,411,647	$125,447,162
Office (3)		$2,040,000	$3,840,000	$5,040,000	$6,240,000	$7,680,000	$9,120,000	$10,800,000	$12,480,000	$14,160,000	$15,840,000	$17,520,000	$19,200,000	$123,960,000
Maintenance & Common Element (4)			$653,950	$879,450	$1,161,325	$1,499,575	$1,837,825	$2,176,075	$2,514,325	$2,852,575	$3,190,825	$3,529,075	$3,698,200	$23,993,200
Total Annual Business Wages		$10,101,328	$14,704,966	$17,742,731	$20,299,450	$23,152,544	$26,005,638	$28,387,722	$30,405,972	$32,424,222	$34,442,472	$36,460,722	$38,309,847	$273,400,362
Off-Site Employment Wages (4)	$1,666,177	$8,585,174	$9,577,160	$10,357,354	$8,628,125	$11,356,953	$11,807,641	$12,317,412	$8,920,887	$7,415,708	$7,815,971	$8,216,233	$8,574,215	$115,239,009
TOTAL ANNUAL WAGES	$10,717,469	$51,757,491	$56,953,824	$61,181,967	$49,476,576	$66,421,886	$68,713,343	$71,681,761	$49,677,922	$39,839,931	$42,258,443	$44,676,956	$46,884,062	$621,204,378

(1) Average annual wage for full-time-equivalent construction worker (all trades) at $61,250 on Oahu.
(2) Average annual wage for full-time-equivalent retail trade worker at $32,790 on Oahu.
(3) Average annual blended wage for full-time-equivalent office workers at $60,000 on Oahu. Acknowledges major medical tenancy.
(5) Average annual wage for full-time-equivalent general worker at $45,100 on Oahu.

Source: State of Hawaii Department of Labor and Industrial Relations, and Hallstrom Group, Inc.

TABLE V-4

ESTIMATED SUBJECT DE FACTO POPULATION, RESIDENT HOUSEHOLD INCOME AND DISCRETIONARY EXPENDITURES
Economic Impact Analysis of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

	Phase I			Phase II		Phase III		Phase IV		Post-Construction Absorption			
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential Product (1 & 2)													
Tower 1													
Number of Sales Yearly							75	75	60	75	75	25	
Cumulative Sales							75	150	210	285	360	385	385
Resident Units							73	146	204	276	349	373	373
Non-Resident Units							2	5	6	9	11	12	12
Resident Population							202	404	565	767	968	1,036	1,036
Non-Resident Population							2	4	5	7	8	9	9
Tower 2													
Number of Sales Yearly									35	75	75	125	75
Cumulative Sales									35	110	185	310	385
Resident Units									34	107	179	301	373
Non-Resident Units									1	3	6	9	12
Resident Population									94	296	498	834	1,036
Non-Resident Population									1	3	6	10	12
Tower 3													
Number of Sales Yearly					55	150	75	75	55				
Cumulative Sales					55	205	280	355	410	410	410	410	410
Resident Units					53	199	272	344	398	398	398	398	398
Non-Resident Units					2	6	8	11	12	12	12	12	12
Resident Population					148	551	753	955	1,103	1,103	1,103	1,103	1,103
Non-Resident Population					2	6	9	11	13	13	13	13	13
Midrise 1													
Number of Sales Yearly			75	50	35								
Cumulative Sales			75	125	160	160	160	160	160	160	160	160	160
Resident Units			73	121	155	155	155	155	155	155	155	155	155
Non-Resident Units			2	4	5	5	5	5	5	5	5	5	5
Resident Population			202	336	430	430	430	430	430	430	430	430	430
Non-Resident Population			2	4	5	5	5	5	5	5	5	5	5
Midrise 2													
Number of Sales Yearly			75	50	35								
Cumulative Sales			75	125	160	160	160	160	160	160	160	160	160
Resident Units			73	121	155	155	155	155	155	155	155	155	155
Non-Resident Units			2	4	5	5	5	5	5	5	5	5	5
Resident Population			202	336	430	430	430	430	430	430	430	430	430
Non-Resident Population			2	4	5	5	5	5	5	5	5	5	5
Total Resident Population		0	404	673	1,009	1,412	1,816	2,219	2,623	3,026	3,430	3,834	4,035
Total Non-Resident Population		0	5	8	12	17	21	25	29	33	37	42	44
TOTAL DE FACTO POPULATION		0	408	680	1,021	1,429	1,837	2,244	2,652	3,060	3,467	3,875	4,080
RESIDENT HOUSEHOLD INCOME (3)		$0	$11,649,603	$19,416,005	$29,124,008	$40,773,611	$52,423,214	$64,072,817	$75,722,420	$87,372,023	$99,021,626	$110,671,229	$116,496,030
TOTAL DISCRETIONARY EXPENDITURES (4)		$0	$7,292,756	$12,154,594	$18,231,890	$25,524,646	$32,777,755	$40,030,863	$47,291,900	$54,545,008	$61,798,117	$69,077,657	$72,724,035

(1) Resident households estimated to have average size of 2.83 persons (based on 2010 census for Oahu), with average occupancy of 98%.
(2) Non- resident parties estimated to have average size of 3.11 persons (resident size plus 10%), with average occupancy of 25%.
(3) The median household income for Oahu was at $81,700 for 2010.
(4) Based on average daily expenditures of $175 per day for non-resident population members and 60% of resident household income.

Source: The Hallstrom Group, Inc.

TABLE V-5

PROJECTED SUBJECT ON-SITE OPERATING ECONOMIC ACTIVITY
Economic Impact Analysis of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

	Operations Commence 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Totals During Absorption
Commercial Businesses (1)	$14,062,500	$71,250,000	$82,500,000	$90,000,000	$97,500,000	$105,000,000	$107,538,750	$107,538,750	$107,538,750	$107,538,750	$107,538,750	$107,538,750	$1,105,545,000
In-Project Patronage %	0%	5%	7%	10%	14%	18%	22%	26%	30%	35%	40%	50%	21%
Outside Project Patronage Expenditures	$14,062,500	$67,687,500	$76,725,000	$81,000,000	$83,850,000	$86,100,000	$83,880,225	$79,578,675	$75,277,125	$69,900,188	$64,523,250	$53,769,375	$868,774,113
Office (2)	$1,593,750	$12,000,000	$15,750,000	$19,500,000	$24,000,000	$28,500,000	$33,750,000	$39,000,000	$44,250,000	$49,500,000	$54,750,000	$60,000,000	$382,593,750
In-Project Patronage %	0%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	6%
Outside Project Patronage Expenditures	$1,593,750	$11,760,000	$15,277,500	$18,720,000	$22,800,000	$26,790,000	$31,387,500	$35,880,000	$40,267,500	$44,550,000	$48,727,500	$52,800,000	$358,043,984
Maintenance/Renovations (3)		$300,000	$500,000	$750,000	$1,050,000	$1,350,000	$1,650,000	$1,950,000	$2,250,000	$2,550,000	$2,850,000	$3,000,000	$18,200,000
In-Project Patronage %		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Outside Project Patronage Expenditures		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Economic Activity													
In-Project Patronage Spending	$0	$4,102,500	$6,747,500	$10,530,000	$15,900,000	$21,960,000	$27,671,025	$33,030,075	$38,494,125	$45,138,563	$51,888,000	$63,969,375	$319,431,163
% of Total Activity	0.0%	4.9%	6.8%	9.6%	13.0%	16.3%	19.4%	22.2%	25.0%	28.3%	31.4%	37.5%	21.2%
Outside Project Patronage Spending	$15,656,250	$79,447,500	$92,002,500	$99,720,000	$106,650,000	$112,890,000	$115,267,725	$115,458,675	$115,544,625	$114,450,188	$113,250,750	$106,569,375	$1,186,907,588
% of Total Activity	100.0%	95.1%	93.2%	90.4%	87.0%	83.7%	80.6%	77.8%	75.0%	71.7%	68.6%	62.5%	78.8%
TOTAL PROJECT GROSS REVENUES	$15,656,250	$83,550,000	$98,750,000	$110,250,000	$122,550,000	$134,850,000	$142,938,750	$148,488,750	$154,038,750	$159,588,750	$165,138,750	$170,538,750	$1,506,338,750

(1) Estimated based on average annual sales of $750 per square foot.
(2) Estimated based on average annual revenues of $2,000 per square foot.
(7) Estimated at $1,200 per unit/home per year.

Source: Hallstrom Group, Inc.

EXHIBIT VI

PUBLIC FISCAL RECEIPTS/COSTS ASSESSMENT

This exhibit is comprised of a single table presenting the summary model used to quantify the public fiscal costs/benefits associated with the Live, Work, Play Aiea master plan.

Principal sources for the materials and modeling variables included;

- City & County of Honolulu Real Property Assessment Division
- City & County of Honolulu Department of Budget & Fiscal Services
- State of Hawaii Department of Budget & Finance
- State of Hawaii Department of Business, Economic Development and Tourism

Table VI-1 *Public Fiscal Receipts Summary Table*

TABLE V-6

SUMMARY OF ECONOMIC IMPACTS ASSOCIATED WITH SUBJECT DEVELIOPMENT
Economic Impact Analysis of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii

	Construction Begins 2013	Operations Commence 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Totals During Absorption
Construction Activity														
Construction Wages	$9,051,292	$33,070,989	$32,671,699	$33,081,881	$20,549,001	$31,912,389	$30,900,065	$30,976,627	$10,351,063					$232,565,007
Contractor Profits	$3,105,524	$11,048,690	$10,668,310	$10,952,247	$6,709,878	$10,520,372	$10,114,817	$10,164,817	$3,404,939					$76,689,594
Supplier Profits	$1,242,210	$4,419,476	$4,267,324	$4,380,899	$2,683,951	$4,208,149	$4,045,927	$4,065,927	$1,361,976					$30,675,838
Other Construction Costs	$17,656,214	$61,947,748	$59,075,766	$61,107,443	$37,155,949	$58,562,810	$56,087,362	$56,440,799	$18,931,412					$426,965,502
Total Construction Impact	$31,055,239	$110,486,903	$106,683,098	$109,522,470	$67,098,780	$105,203,720	$101,148,170	$101,648,170	$34,049,390					$766,895,940
Project De Facto Population Spending														
On-Site Spending			$4,102,500	$6,747,500	$10,530,000	$15,900,000	$21,960,000	$27,671,025	$33,030,075	$38,494,125	$45,138,563	$51,888,000	$63,969,375	$319,431,163
Off-Site Spending			$3,190,256	$5,407,094	$7,701,890	$9,624,646	$10,817,755	$12,359,838	$14,261,825	$16,050,883	$16,659,554	$17,189,657	$8,754,660	$122,018,058
Total Project Population Impact			$7,292,756	$12,154,594	$18,231,890	$25,524,646	$32,777,755	$40,030,863	$47,291,900	$54,545,008	$61,798,117	$69,077,657	$72,724,035	$441,449,220
Outside Patronage Spending		$15,656,250	$79,447,500	$92,002,500	$99,720,000	$106,650,000	$112,890,000	$115,267,725	$115,458,675	$115,544,625	$114,450,188	$113,250,750	$106,569,375	$1,186,907,588
TOTAL BASE ECONOMIC IMPACT	$31,055,239	$126,143,153	$193,423,354	$213,679,564	$185,050,670	$237,378,366	$246,815,925	$256,946,758	$196,799,965	$170,089,633	$176,248,304	$182,328,407	$179,293,410	$2,395,252,748

Source: Hallstrom Group, Inc.

THE HALLSTROM GROUP INC.
REAL ESTATE CONSULTANTS & APPRAISERS

PROFESSIONAL BACKGROUND AND SERVICES

The Hallstrom Group, Inc. is a Honolulu based independent professional organization that provides a wide scope of real estate consulting services throughout the State of Hawaii with particular emphasis on valuation studies. The purpose of the firm is to assist clients in formulating realistic real estate decisions. It provides solutions to complex issues by delivering thoroughly researched, objective analyses in a timely manner. Focusing on specific client problems and needs, and employing a broad range of tools including after-tax cash flow simulations and feasibility analyses, the firm minimizes the financial risks inherent in the real estate decision making process.

The principals and associates of the firm have been professionally trained, are experienced in Hawaiian real estate, and are actively associated with the Appraisal Institute and the Counselors of Real Estate, nationally recognized real estate appraisal and counseling organizations.

The real estate appraisals prepared by The Hallstrom Group accomplish a variety of needs and function to provide professional value opinions for such purposes as mortgage loans, investment decisions, lease negotiations and arbitrations, condemnations, assessment appeals, and the formation of policy decisions. Valuation assignments cover a spectrum of property types including existing and proposed resort and residential developments, industrial properties, high-rise office buildings and condominiums, shopping centers, subdivisions, apartments, residential leased fee conversions, special purpose properties, and vacant acreage, as well as property assemblages and portfolio reviews.

Market studies are research-intensive, analytical tools oriented to provide insight into investment opportunities and development challenges, and range in focus from highest and best use determinations for a specific site or improved property, to an evaluation of multiple (present and future) demand and supply characteristics for long-term, mixed-use projects. Market studies are commissioned for a variety of purposes where timely market information, insightful trends analyses, and perceptive conceptual conclusions or recommendations are critical. Uses include the formation of development strategies, bases for capital commitment decisions, evidence of appropriateness for state and county land use classification petitions, fiscal and social impact evaluations, and the identification of alternative economic use/conversion opportunities.

ARBITRATION
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TABLE VI-1

PUBLIC FISCAL TAX RECEIPTS SUMMARY TABLE
Economic Impact Analysis of the Proposed Live, Work, Play Aiea Master Plan
Aiea, Oahu, Hawaii
All Amounts Expressed in Constant 2011 Dollars

Development Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Totals
PRIMARY PUBLIC BENEFITS (Revenues)														
1. REAL PROPERTY TAXES	$822,049	$2,066,399	$2,509,054	$2,644,170	$3,384,643	$3,452,201	$4,192,675	$4,192,675	$4,981,231	$4,981,231	$4,981,231	$4,981,231	$4,981,231	$48,170,024
2. STATE INCOME TAXES														
Taxable Personal Income	$10,717,469	$63,407,094	$76,369,829	$90,305,974	$90,250,187	$118,845,100	$132,786,159	$147,404,180	$137,049,944	$138,861,556	$125,400,341	$127,211,953	$141,280,069	$1,399,889,856
Taxable Corporate Profits	$521,728	$4,357,418	$14,772,845	$18,253,303	$19,143,013	$21,964,563	$23,841,719	$25,147,119	$24,520,906	$41,824,669	$25,534,200	$26,422,200	$27,286,200	$273,589,884
Personal Taxes Paid	$546,591	$3,233,762	$3,894,861	$4,605,605	$4,602,760	$6,061,100	$6,772,094	$7,517,613	$6,989,547	$7,081,939	$6,395,417	$6,487,810	$7,205,283	$71,394,383
Corporate Taxes Paid	$22,956	$191,726	$650,005	$803,145	$842,293	$966,441	$1,049,036	$1,106,473	$1,078,920	$1,840,285	$1,123,505	$1,162,577	$1,200,593	$12,037,955
TOTAL STATE INCOME TAXES	$569,547	$3,425,488	$4,544,866	$5,408,750	$5,445,052	$7,027,541	$7,821,130	$8,624,086	$8,068,467	$8,922,225	$7,518,922	$7,650,386	$8,405,876	$83,432,338
3. STATE GROSS EXCISE TAX														
Taxable Transactions														
Construction Contracts	$31,055,239	$110,486,903	$106,683,098	$109,522,470	$67,098,780	$105,203,720	$101,148,170	$101,648,170	$34,049,390	$0	$0	$0	$0	$766,895,940
Worker Disposable Income Purchases	$6,430,481	$31,054,495	$34,172,294	$36,709,180	$29,685,946	$39,853,132	$41,228,006	$43,009,056	$29,806,753	$23,903,958	$25,355,066	$26,806,173	$28,130,437	$396,144,978
Unit Owner/Guest Expenditures (on/off site)	$0	$0	$7,292,756	$12,154,594	$18,231,890	$25,524,646	$32,777,755	$40,030,863	$47,291,900	$54,545,008	$61,798,117	$69,077,657	$72,724,035	$441,449,220
Non-Resident Patronage Expenditures	$0	$15,656,250	$79,447,500	$92,002,500	$99,720,000	$106,650,000	$112,890,000	$115,267,725	$115,458,675	$115,544,625	$114,450,188	$113,250,750	$106,569,375	$1,186,907,588
Total Taxable Transactions	$37,485,720	$157,197,648	$227,595,649	$250,388,744	$214,736,616	$277,231,498	$288,043,930	$299,955,814	$226,606,718	$193,993,592	$201,603,370	$209,134,580	$207,423,847	$2,791,397,726
TOTAL STATE EXCISE TAX	$1,762,766	$7,392,219	$10,702,685	$11,774,531	$10,097,989	$13,036,811	$13,545,266	$14,105,422	$10,656,181	$9,122,549	$9,480,398	$9,834,554	$9,754,106	$131,265,478
TOTAL GROSS PUBLIC REVENUES														
To C&C Honolulu (Item #1 and portion of #3)	$1,017,892	$2,887,674	$3,698,122	$3,952,320	$4,506,530	$4,900,591	$5,697,554	$5,759,787	$6,165,133	$5,994,747	$6,034,504	$6,073,850	$6,064,913	$62,753,618
Adjustment for Other Proportional Taxes	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	33%	
Adjusted C&C Honolulu Revenues	$1,353,797	$3,840,607	$4,918,503	$5,256,586	$5,993,685	$6,517,786	$7,577,747	$7,660,517	$8,199,627	$7,973,013	$8,025,890	$8,078,221	$8,066,334	$83,462,312
To State (Items #2 & remainder #3)	$2,136,434	$9,996,284	$14,058,269	$15,874,895	$14,420,953	$18,615,702	$19,861,246	$21,162,114	$17,540,533	$17,031,076	$15,945,859	$16,392,124	$17,076,106	$200,111,596
Adjustment for Other Proportional Taxes	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	23%	
Adjusted State Revenues	$2,627,814	$12,295,430	$17,291,671	$19,526,121	$17,737,772	$22,897,313	$24,429,332	$26,029,400	$21,574,856	$20,948,223	$19,613,406	$20,162,313	$21,003,611	$246,137,263
AGGREGATE TAX REVENUES	$3,981,611	$16,136,036	$22,210,174	$24,782,706	$23,731,457	$29,415,099	$32,007,079	$33,689,918	$29,774,483	$28,921,236	$27,639,296	$28,240,534	$29,069,945	$329,599,575

Source: The Hallstrom Group, Inc.

PROFESSIONAL QUALIFICATIONS OF THOMAS W. HOLLIDAY

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Supervisor/Senior Analyst	The Hallstrom Group, Inc. Honolulu, Hawaii Since 1980
Former Staff Appraiser	Davis-Baker Appraisal Co. Avalon, Santa Catalina Island, California

Education

- B.A. (Communications/Journalism) 1978 California State, University at Fullerton
- SREA Course 201- Principles of Income Property Appraising
- Expert witness testimony before State of Hawaii Land Use Commission and various state and county boards and agencies since 1983.
- Numerous professional seminars and clinics
- Contributing author to Hawaii Real Estate Investor, Honolulu Star Bulletin

On January 1, 1991, the American Institute of Real Estate Appraisers (AIREA) and the Society of Real Estate Appraisers (SREA) consolidated, forming the Appraisal Institute (AI).

Recent Neighbor Island Assignments

- Market Study, Economic Impact Analyses and Public Costs/ Benefits (Fiscal Impact) Assessments

Big Island
-- Kamakana Villages (Mixed-Use Residential Development)
-- W.H. Shipman Ltd, Master Plan (Various Urban Uses)
-- Nani Kahuku Aina (Mixed-Use Resort Community
-- Kona Kai Ola (Mixed-Use Resort Community)
-- Waikoloa Highlands (Residential)
-- Waikoloa Heights (Mixed-Use Residential Development)

Kauai
-- Village at Poipu (Resort/Residential)
-- Ocean Bay Plantation (Resort/Residential)
-- Waipono/Puhi (Mixed-Use Planned Development)
-- Eleele Commercial Expansion (Commercial)

Maui
-- Upcountry Town Center (Mixed-Use Project)
-- Maui Lani (Mixed-Use Community)
-- Honuaula (Mixed-Use Community)
-- Maui Business Park, Phase II (Industrial/Commercial)
-- Kapalua Mauka (Master Planned Community)
-- Hailiimaile (Mixed-Use Master Planned Community)
-- Pulelehua (Master Planned Community)
-- Westin Kaanapali Ocean Villas Expansion (Resort/ Timeshare)

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