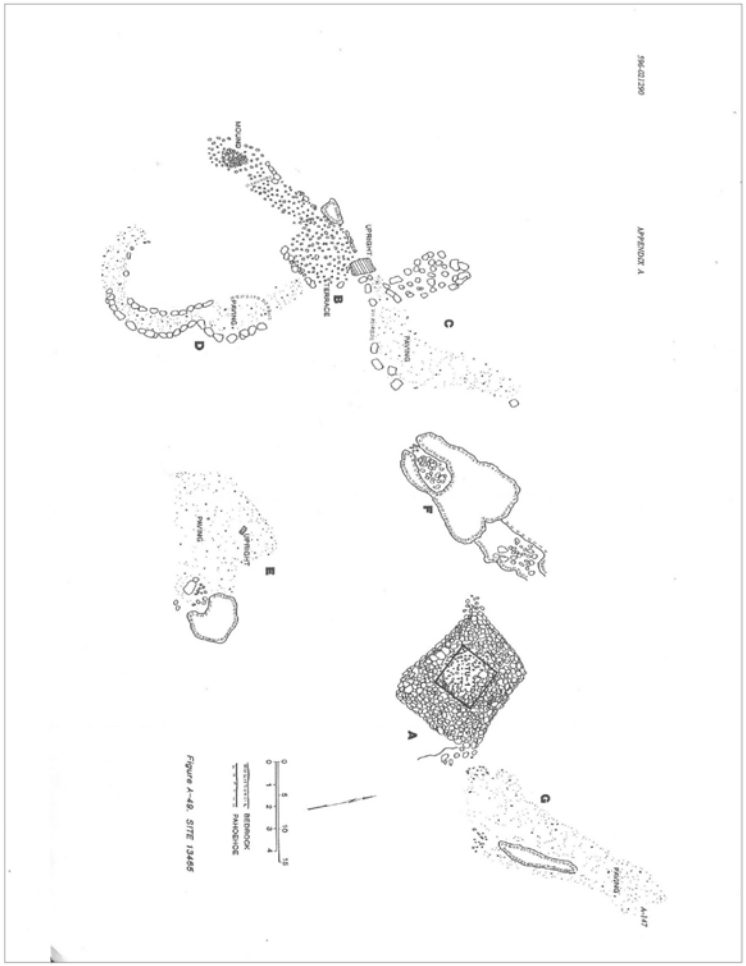


Figure 25. Site 13465 Plan Map from Donham (1990:A-147)

discovered in 1989. The original site form and a sketch map are reproduced in *Appendix A*. PHRI recommended the site for further data collection. Haun & Associates staff were unable to relocate the site despite repeated attempts.

Site 13477

Site 13477 is described as consisting of two adjacent enclosures (Feature A), a C-shape wall (Feature B), and a mound (Feature C; Donham 1990: A-153. The site was assigned agriculture and possible habitation functions by PHRI. No map or photograph is provided in the report. PHRI recommended the site for further data collection. Haun & Associates staff were unable to relocate the site.

Other Sites

Several features were identified in the immediate vicinity of sites recommended for preservation during the process of relocating the preservation sites. These features are described below and are depicted on *Figure 27* below.

Site T-2 is a large enclosure, approximately 115 m square. The walls are bi-faced with a narrow core-fill and are in generally good condition. The walls average 80 cm in thickness and 120 cm in height. There is a gap in the south wall that likely was caused by construction associated with Palani Road, based on the presence of a large berm of bulldozed stone. The enclosure surrounds Sites 13398, 13408, 13409 and 13410. **Site T-5** is an L-shaped wall that extends inland from the east wall of the T-2 enclosure. It is possible that the T-5 wall and the east side of the enclosure are part of Site 13411. That site is described a consisting of "three walls and a mound. The longest wall is at least 100.00 m long, and is oriented NW-SE" (Donham 1990: A-111). A metal site tag from the original PHRI survey was found adjacent to the west side of the T-2 enclosure. The tag was labeled Site 13408 suggesting that the west side of the T-2 enclosure was considered part of Site 13408, which included 5 walls of unstated construction, length or orientation. The height, construction, and shape of the T-2 enclosure indicate that it is probably an early historic structure that served to exclude free-ranging cattle from an interior that was used for residential, agricultural and potentially mortuary and ritual purposes.

Three walls (**T-3, T-5, and T-399**), a habitation terrace (Site **T-427**), and three enclosures (**T-2, T-6, and T-397**) also were identified, but not recorded.

CONCLUSION

In consultation with SHPD, it was agreed that the transect strategy, combined with relocation of sites recommended for data recovery and/or preservation, would be an appropriate tasks to evaluate the prior survey data and to mitigate agricultural features. The transects were to be archaeologically surveyed and documented to: (a) evaluate the 1989 survey data, including site location accuracy, adequacy of original site documentation, and evaluation of original functional interpretations and recommended treatments; and (b) provide data recovery-level documentation of agricultural sites.

The PHRI inventory survey report (Donham 1990) provides a detailed discussion of feature types and settlement patterning that is supported by the survey update results. The project area is characterized by numerous agricultural features and pahoehoe excavations. Temporary habitation sites are associated with these features. Burials are also present, but relatively few in number and widely dispersed. The PHRI survey work included test excavations and analysis of seven radiocarbon samples, a relatively large number for similar projects conducted 20 years ago. The PHRI report explicitly noted field conditions, primarily dense vegetation, which hindered site boundary definition in the vicinity of the current project area.

Transect Survey

The current transect survey documented thirteen previously unidentified sites with 15 features. In addition, 98 agricultural features (Site 26090) and eight resource procurement features (Site 26910) were documented. These agricultural and resource procurement sites span the entire project area, but are significantly denser in distribution in the inland portions of Transect 1, and especially Transect 3. These two extensive site complexes include numerous newly and previously identified agricultural features and excavations.

The transect survey identified 50 lava tubes and blisters. Only fourteen contained evidence of cultural activity such as structural modifications, artifacts, or food remains. Two lava tubes contained previously unidentified burials. Thirty-six lava tubes lacked any evidence of cultural use. These "non-cultural" tubes were fully explored but not mapped. It is possible that some were used for collecting water, but no evidence of water collection was detected.

Over 900 linear meters of subterranean lava tubes and blisters were mapped and described. This field documentation work frequently required working in confined chambers, some with ceilings as low as 25-30 cm (10-12 inches). The intensive effort to investigate very small chambers is a relatively new practice that gained importance in the past decade because of the need to insure appropriate protection of Hawaiian burial sites. Twenty years ago lava tubes generally were not explored beyond passages that were not readily accessible by crawling or walking.

In addition to agricultural features and pahoehoe excavations, the newly identified sites consist of twelve temporary habitation sites and one burial site. Another burial was identified at one of the temporary habitation sites. Most of the newly identified sites (8) are situated in the inland portion of Transect 1. Three were found in Transect 3 and two in Transect 2.

PHRI reported seven sites with a total of 91 features that were situated within the surveyed transects. Five of the previously reported sites consist exclusively of agricultural features (82 total). Only one of the PHRI sites in the transects was relocated (13463) and it was actually located north of Transect 1. Review of PHRI site records for potential correlation with newly identified sites extended well beyond the transect limits, as much as 100 m beyond the transect boundaries, but met with no success.

Site Relocation

The site relocation effort focused on 25 previously identified sites that each include one or more non-agricultural feature (see *Table 8*). Seven sites could not be relocated. Fourteen sites were relocated with a high degree of confidence and four were likely identified, but confirmation is precluded by the limited data available from the original survey. Four sites were likely relocated and assigned new site numbers by PLI (Cleghorn and Reeve

2009) and CSH (Tulchin and Hammatt 2009) during inventory surveys of the proposed Ane Keohokalole Highway that forms the seaward boundary of the project area.

Seven sites could not be relocated. One of these sites is Site 13474. The PHRI report indicates that this site is a lava tube over 50 m in length that was used for habitation, but the original field form for the site indicates the presence of 5-6 poorly preserved burials (see *Appendix A*). Corbin and Wong-Smith (2007) reported that the site was relocated and GPS coordinates were available; however, in 2009 Haun & Associates personnel were not able to relocate the site, despite four attempts using location data derived from client provided GPS coordinates, the original topographic map and aerial photograph used by PHRI in 1989.

Table 9 and *Figure 26* show the actual versus reported locations of sites that were relocated. The data demonstrate that the reported site locations have an average error of 74.25 m. There is a wide range in the distance data (0 to 225 m). The directional data indicate that the location errors are not consistent in the direction of the error. This means that the error is not predictable, but can be used to develop a justification for the site relocation search area size. The search area should extend out from the reported location a distance of at least 100 m.

Table 9. Reported Versus Actual Site Locations

Site	Distance (m)	Direction	Comment
13395	18	NNE	
13398	184	ESE	
13400	225	ENE	
13403	83	SW	On Project Area Boundary
13404	65	SSW	Outside Project Area
13408	39	WNW	
13409	57	NW	
13410	47	WNW	
13413	25	NNE	
13441	0	N/A	inside actual site extent
13450	97	SE	
13452	68	SSE	
13462	66	NW	
13463	56	N	
13465	29	SSW	
13471	129	NE	

Two sites that could not be relocated (13449 and 13459) are very close to the inland boundary of the project area. It is possible that these two sites are actually situated inland of the project area. If the two sites are located outside the current project area, then only five sites within the current project area could not be relocated. The PHRI report assigned Site 13459 a habitation function in the body of the report, but added an additional possible burial function in a tabular listing of sites in Appendix C (Donham 1990:C-25). The site description notes the presence of two unidentified mammal bones.

Two other sites that could not be relocated (13402 and 13394) have insufficient information to be relocated. Site 13402 is collapsed section of wall of unknown dimensions with no site map or photograph.

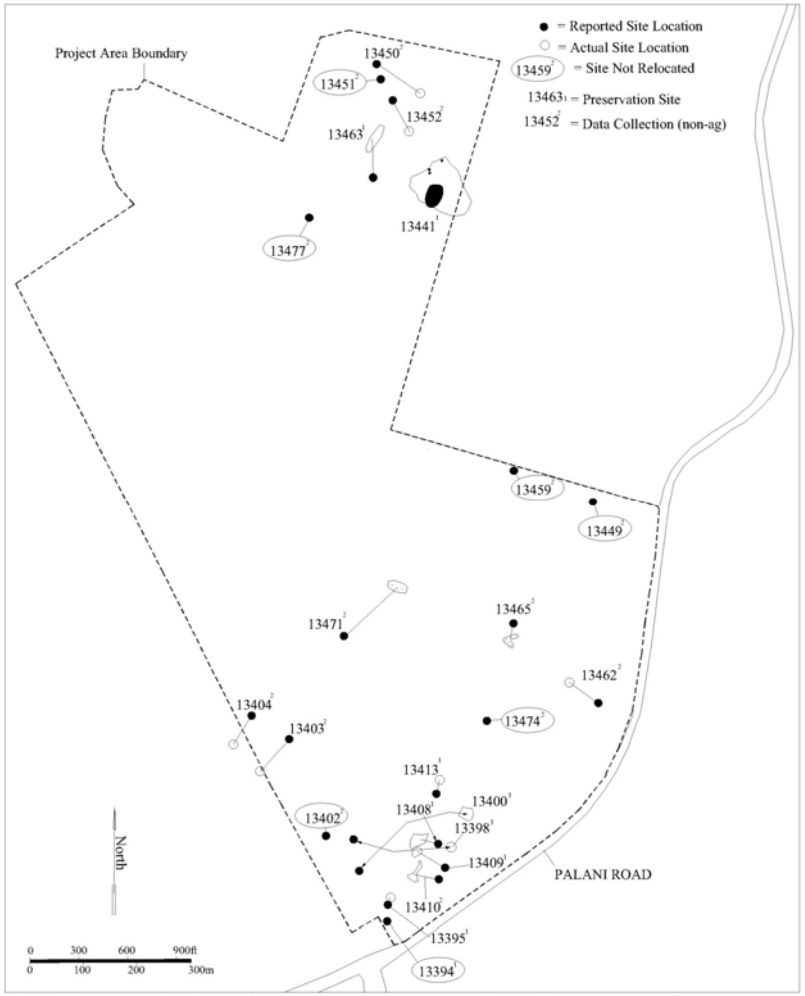


Figure 26. Reported and Actual Locations of PHRI Preservation and Data Recovery Sites

Site 13394 is an alignment of stones of unknown dimensions and no map or photograph. The sites are located in areas with numerous agricultural features, many of which may resemble a collapsed wall or alignment.

Survey Update Recommendations

It is recommended that as part of the data recovery mitigation for the project systematic, pedestrian survey coverage be conducted that broadly encompasses the areas where five sites (13477, 13451, 13459, 13449, and 13474) could not be relocated. These areas are situated in the inland half of the project area where the vegetation tends to be dense.

All previously identified sites that include non-agricultural and non-resource exploitation features should be documented with scaled plan maps, photographs, and written descriptions. Any newly identified sites encountered should be similarly documented. Test excavations should be conducted at previously identified and newly identified sites, where necessary to determine site or feature function.

It is further recommended that as part of the monitoring phase of the project, any previously undisturbed areas not included within the surveyed transects and areas systematically surveyed to relocate sites, be systematically inspected. Any newly discovered sites should be properly documented and SHPD consulted regarding site significance and proposed treatment.

Significance Assessment

Pursuant to DLNR (2003) Chapter 275-6 (d), the initial significance assessments provided herein are not final until concurrence from the DLNR has been obtained. The sites identified during the survey are assessed for significance based on the criteria outlined in the Rules Governing Procedures for Historic Preservation Review (DLNR 2003: Chapter 275). According to these rules, a site must possess integrity of location, design, setting, materials, workmanship, feeling, and association and shall meet one or more of the following criteria:

1. Criterion “a”. Be associated with events that have made an important contribution to the broad patterns of our history;

2. Criterion “b”. Be associated with the lives of persons important in our past;

3. Criterion “c”. Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

4. Criterion “d”. Have yielded, or is likely to yield, information important for research on prehistory or history; and

5. Criterion “e”. Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts--these associations being important to the group’s history and cultural identity.

Based on the above criteria, the 15 sites identified during the transectt survey are assessed as significant under Criterion “d” (*Table 10*). The sites have yielded information important for understanding prehistoric to historic land use in the project area. Two sites (Sites 26902 and 26906) are additionally assessed as significant under Criterion “e” for their cultural value based on the presence of human remains.

Recommended Treatments

The two sites containing human remains (Sites 26902 and 26906) are recommended for preservation (see *Table 10*). The 13 remaining sites retain the potential to yield information important for understanding prehistoric and early historic land use. These sites are recommended for data recovery mitigation. The plans for data recovery would be detailed in a Data Recovery Plan prepared for DLNR-SHPD review and approval. The specific plans for preservation and maintenance of the burial features would be detailed in a Burial Treatment Plan prepared for DLNR-SHPD and the Hawaii Island Burial Council (HIBC) review and approval. *Figure 27* illustrates previously and newly identified and sites recommended for preservation. The plans for non-burial preservation sites would be detailed in a Site Preservation Plan prepared for DLNR-SHPD review and approval. In addition, it is recommended that a monitoring plan be prepared for DLNR-SHPD review and approval.

Table 10. Site Significance and Recommended Treatment

SIHP Number	Type	Function	Significance Criteria*	Recommended Treatment**
26896	Lava Tube	Temporary Habitation	D	DR
26897	Complex (2)	Temporary Habitation	D	DR
26898	Lava Tube	Temporary Habitation	D	DR
26899	Lava Tube	Temporary Habitation	D	DR
26900	Complex (2)	Temporary Habitation	D	DR
26901	Lava Tube	Temporary Habitation	D	DR
26902	Lava Tube	Temporary Habitation/Burial	D, E	PR
26903	Lava Tube	Temporary Habitation	D	DR
26904	Lava Tube	Temporary Habitation	D	DR
26905	Lava Tube	Temporary Habitation	D	DR
26906	Lava Tube	Burial	D, E	PR
26907	Lava Tube	Temporary Habitation	D	DR
26908	Lava Tube	Temporary Habitation	D	DR
26909	Complex (98)	Agriculture	D	DR
26910	Complex (8)	Resource Procurement	D	DR

Significance Criteria - D = Information Content, E = Cultural Value

****Recommended Treatments - DR=Data Recovery, PR=Preservation***

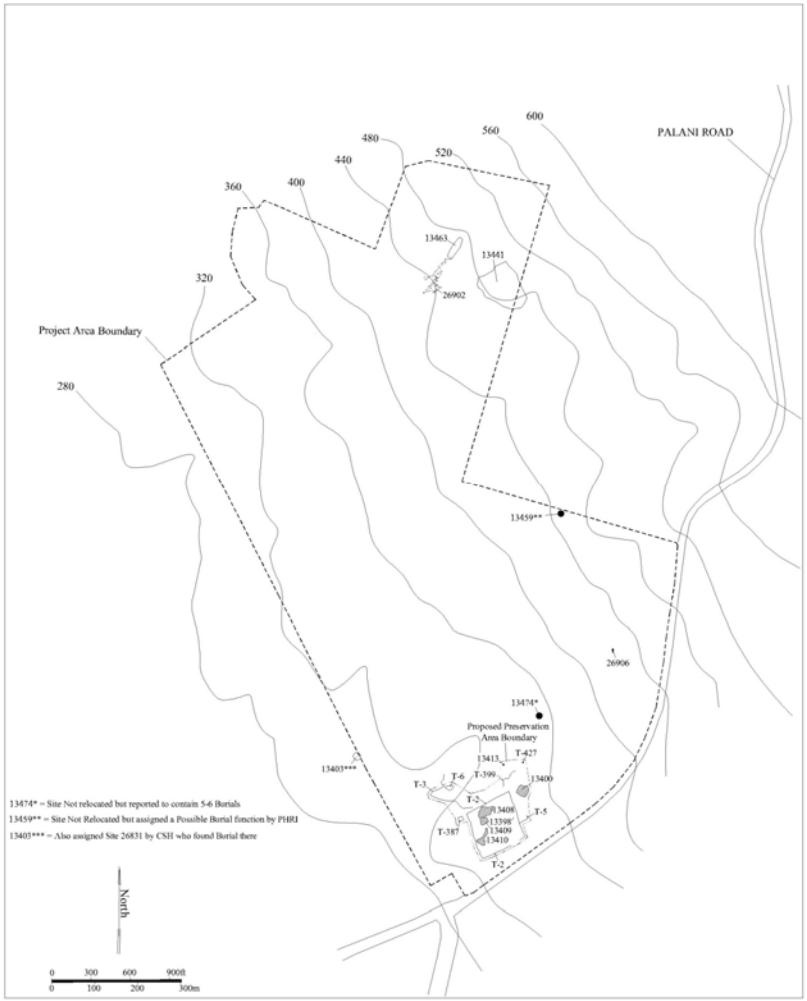


Figure 27. Location of Preservation Sites

REFERENCES

Burgett, B., L. McGerty and R. Spear
1999 An Archaeological Inventory Survey of a 22.5-acre Parcel (Parcel K) in the Ahupua`a of Waikoloa, South Kohala District, Island of Hawaii (TMK: 6-8-22:01, 05). Scientific Consultant Services, Inc. report prepared for Mauna Lani Resort.

Carter, L.
1986 An Archaeological Reconnaissance of the Makai Parcel of Kaupulehu Ahupua'a, North Kona, Hawaii Island. Prepared for Barnwell Industries, Inc., Honolulu.

Corbin, A.B., and H. Wong-Smith
2007 Archaeological Survey and Cultural Impact Assessment in Support of an EIS for the Kona Non-Ceded Lands, Land of Keahuolu, North Kona District, Island of Hawai'i, TMK:30-7-4-21:020, Por.014, Por.021. Prepared for Belt Collins Hawaii, Ltd. and State of Hawaii.

Cleghorn, P.L., and R.B. Reeve
2009 Summary of Archaeological Investigations at the Southern End of the Proposed Ane Keohokalole Highway, Keahuolu, North Kona, Hawaii. Prepared for Belt Collins Hawaii, Ltd. and Queen Lili'uokalani Trust.

DNLR (Department of Land and Natural Resources
2003 Hawai'i Administrative Rules, Title 13, Department of Land and Natural Resources, Subtitle 13, State Historic Preservation Division Rules.

Donham, T.K.
1987 Archaeological Reconnaissance Survey, Resort Expansion Area and Selected Undeveloped Resort Parcels, Waikoloa Beach Resort, Land of Waikoloa, South Kohala, Island of Hawaii. Prepared by Paul H. Rosendahl, Ph.D., Inc. for Transcontinental Development Company.

1990 Archaeological Inventory Survey, Queen Lili'uokalani Trust Property, Land of Keahuolu, North Kona District, Island of Hawaii. PHRI Report 596 prepared for Belt, Collins & Associates, Honolulu.

Donham, T., and P. Jensen
1988 Archeological Data Recovery and Intensive Survey, Resort Expansions Area and Selected Undeveloped Resort Parcel, Waikoloa Beach Resort, Land of Waikoloa, South Kohala, Island of Hawaii. PHRI report 371 prepared for Belt, Collins & Associates.

Dye, T.
2002 Archaeological Data Recovery in the Barren Zone, Manini'owali and Kuki'o 2nd Ahupua'a, Kona, Hawai'i. Prepared by T.S. Dye & Colleagues, Archaeologists, Inc. for W/B Manini'owali.

Hammatt, H., D. Shideler and D. Borthwick
1987 Archaeological Survey and Test Excavations of a 15-acre Parcel, Kealakehe, Kona, Hawaii. Prepared for Mauna Lani Resort, Inc.

Haun, A. and D. Henry
2004 Archaeological Inventory Survey, TMK: 3-6-8-22:18 and 3-6-8-22: por 40. Lands of Waikoloa and Anaeho'omalu, South Kohala District, Island of Hawaii. Haun & Associates Report 364 prepared for Mr. Curt DeWeese, Honolulu.

Jensen, P.
1989a Archaeological Inventory Survey, Waikoloa Beach Resort Parcels 20, 21, 22 and 23 and Strip between Parcel 23 and Kiholo-Puako Trail, Land of Waikoloa, South Kohala District, Island of Hawaii. PHRI report 512-061689 prepared for Transcontinental Development Company.

1989b Archaeological Inventory Survey, Undeveloped Portions of Lot 8 of File Plan 1562, Waikoloa Beach Resort, Land of Anaeho'omalu, South Kohala District, Island of Hawaii. PHRI report 594-041989 prepared for Royal Waikoloan Resort.

1989c Archaeological Inventory Survey, Undeveloped Portions of Lots 1-7of File Plan 1562, and the Strip adjacent to the Kiholo-Puako Trail, Waikoloa Beach Resort, Lands of Anaeho'omalu and Waikoloa, South Kohala District, Island of Hawaii. PHRI report 454-006189 prepared for Transcontinental Development Company.

1989d Archaeological Inventory Survey, Mauna Lani Cove Project Area, Mauna Lani Resort, Lands of Kalahuipuaa and Waikoloa, South Kohala District, Island of Hawaii. PHRI report 588-060589 prepared for Belt, Collins & Associates.

1989e Archaeological Inventory Survey, Mauna Lani Resort New Golf Course, Lands of Kalahuipuaa and Waikoloa, South Kohala District, Island of Hawaii. PHRI report 496-120988 prepared for Mauna Lani Resort, Inc.

2001 Data Recovery at Site 21877, Development "Site L", Land of Waikoloa, South Kohala District, Island of Hawaii. PHRI report 2110-021501 prepared for Maryl Group, Inc.

Jensen, P., T. Donham, and P. Rosendahl
1992 Archaeological Mitigation Program, Queen Lili'uokalani Trust Property, Phase I: Mitigation Plan for Data Recovery, Interim Site Protection and Monitoring, Land of Keahuolu, North Kona District, Island of Hawaii. PHRI Report 1152-012192 prepared for Belt, Collins & Associates, Honolulu.

Juvik, S.P. and J.O. Juvik (editors)
1998 *Atlas of Hawaii*, Third Edition. Honolulu: University of Hawaii Press.

Landrum, J., F. Reinman, A. Schilz, C. O`Hare, and A. Torres
2002 Archaeological Inventory Survey, Mauna Lani Resort, South Kohala, Hawaii Island, 688-acre Undesignated Portion and 20-acre Portion of Parcel "Y" (TMK: 6-8-22:32). AMEC Earth and Environmental, Inc. report prepared for Mauna Lani Service, Inc.

Nakamura, M., K. Sherry and L. Tamimi
1998 Foraging for Food? Prehistoric Pit Features at Pohakuloa, Hawaii. *Rapa Nui Journal.*

O'Hare, C., and S.T. Goodfellow
1994 Phased Archaeological Mitigation Program, Kealakehe Planned Community, Phase II: Archaeological Data Recovery. Land of Kealakehe, North Kona District, Island of Hawaii.

Reinecke, J.E.
1930 Survey of Sites on West Hawai'i. Ms. In Bishop Museum (1930).

Sato, H.H., W. Ikeda, R. Paeth, R. Smythe, and M. Takehiro, Jr.
1973 *Soil Survey of the Island of Hawaii, State of Hawaii.* U.S. Department of Agriculture, Soil Conservation Service and University of Hawaii Agricultural Experiment Station. Washington, D.C.: Government Printing Office.

Tulchin J. and H. Hammatt
2009 Archaeological Inventory Survey of an Approximately 2.3-km Long Portion of the Proposed Ane Keohokalole Highway Project, Kealakehe and Keahuolu Ahupua'a, North Kona District, Island of Hawai'i. Prepared for Belt Collins Hawaii Ltd..

Welch, D.
1989 Archaeological Mapping and Data Recovery at Mauna Lani Golf Course and Beach Park Area, South Kohala, Hawaii. IARII report prepared for Mauna Lani Resort, Inc.

Walker, A.
1993 Amendment No. 2, Archaeological Mitigation Program, Queen Lili'uokalani Trust Property, Phase I: Mitigation Plan for Data Recovery, Interim Site Protection and Monitoring, Land of Keahuolu, North Kona District, Island of Hawaii. PHRI Letter Report 1152-110593 to Dr. Don Hibbard, Historic Preservation Division, DLNR.

Wolfe, E.W., and J. Morris
2001 Geologic Map of the Island of Hawaii. U.S. Department of the Interior, U.S. Geological Survey. Miscellaneous Investigations Series.

APPENDIX A – SITE RECORD FOR 13474 (T-257)

PHRI

SITE SURVEY RECORD Site No. 50-___-___-_____

I. IDENTIFICATION

Prior Site No. T-257 Survey Area QLTL

II. LOCATION TMK: ___-___-___-___:_____

Island Hawaii District N. Kona Land Keahuole

Coordinates _____

III. FORMAL DESCRIPTION Site Type lava tube

Component Features PHH tube with a smaller cave area SW of blister & larger cave to NE.

Dimensions blister opening = @2.2 m N-S x @1.2 m E-W.

Construction stacked rock W. of blister (in cave) @3.2 m x @3.1 m

Portable Remains goat, pers. dog bones. Human remains. 1 waterworn stone, approx. 20 cm in diameter @ 30m into cave

Deposit scattered dirt deposits from cracks in ceiling all through cave, 2-5cm deep

Condition good

Integrity unaltered

Misc. Comments Cave height at blister opening (SW side) = @ 75 cm. Cave height = @ 40 cm - 200 cm. Cave width = @ 2-5m. Overall length = 55+m. Veers to S at 4m

IV. ENVIRONMENTAL SETTING Zone inland

Terrain PHH flows, fairly level slope

Vegetation X-mas berry, keawe, fountain grass

Approx. Elevation _____ Soil volcanic loam

Misc. Comments turns W. at @ 43.5 m. burials located @ 51-55m into cave.

V. FUNCTIONAL INTERPRETATION Site Type burial

Apparent Age prehistoric

Basis for Interpretation burials

SITE SURVEY RECORD (Cont. -2-) Site No. 50-___-___-_____

VI. SIGNIFICANCE EVALUATION

Nature R=M I/C=M

Degree A/F D/C

Misc. Comments _____

VII. RECOMMENDATIONS

Nature of Any Further Work Intensive data collection

Estimated Scope detailed map, preservation of remains, removal of remains, study

Estimated Effort 4 MD

Misc. Comments _____

VIII. ADDITIONAL COMMENTS

MNI taken from mandible frags

Remains of at least 5, and probably 6 adult individuals located near the back of the longer cave. All are highly fragile, very wet, and highly fragmented. Some type of preservative would have to be placed on them before removal.

No pubis frags appear to be intact for aging, but ages could be taken from mandibular teeth.

The mandibles examined all appear to have a congenital lack of M3's, which may indicate a relationship between the individuals.

Appear to be members of both sexes, but lab work confirmation necessary.

IX. RECORD DATA Project No. 89-596

Recorder CF, AB, TR Date 9/26/89

Photo References Roll 23 = 33-36

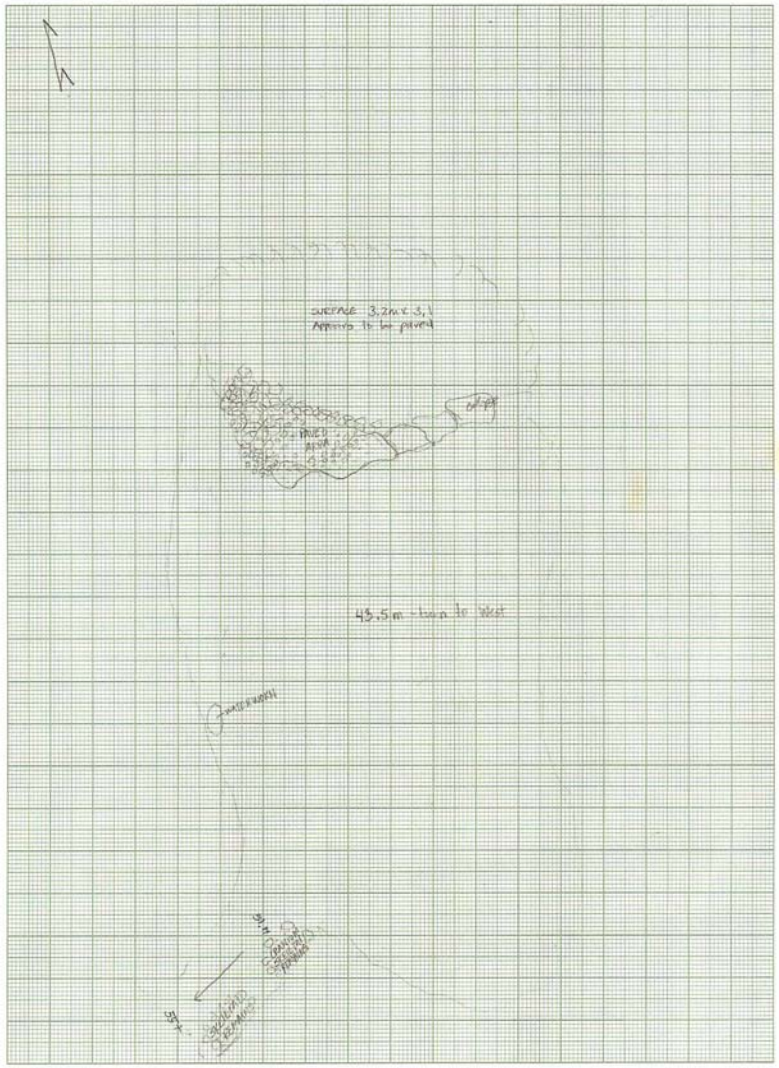
X. MAP NOTES aerial photo, site map

PHRI 11/5/82

T-259
9/12/89
GTL

89-596

SKETCH MAP - NOT TO SCALE



46 1510

10 X 10 TO THE CENTIMETER 18 X 25 CM.
KEUFFEL & ESSER CO. MADE IN U.S.A.

APPENDIX C PRELIMINARY ENGINEERING REPORT

PRELIMINARY ENGINEERING REPORT

FOR

KAMAKANA VILLAGES AT KEAHUOLU

KAILUA·KONA, HAWAII
TMK: (3) 7·4·021: 20

PREPARED BY:

LYON ASSOCIATES
45 N. King Street, Suite #501
Honolulu, Hawaii 96817

12/29/2009

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 PROJECT DESCRIPTION

The proposed Kamakana Villages at Keahuolu master planned mixed use affordable housing project (the “Project”) is planned to contain about 2,330 dwelling units (single-family and multi-family residences) on approximately 272 acres of land located at Tax Map Key: (3) 7-4-021: 20 in North Kona, Hawaii.

The land use elements for Kamakana Villages includes residential units, retail, commercial, public and/or private school facilities, archaeological and open space preserve areas, active and passive parks, a trail and bikeway system and associated infrastructure. Infrastructure facilities required to support the development include roads, drainage facilities, drinking water system, wastewater collection system, electrical system, telephone system and cable television system.

The Hawaii Housing Finance and Development Corporation ("HHFDC") commissioned an Environmental Impact Statement ("EIS") to study the impacts anticipated from the development of Kamakana Villages. Notice of the Final EIS was published in The Environmental Notice on October 8, 2008 (Final Environmental Impact Statement - Keahuolu Affordable Housing Project; Belt Collins, September 2008). The EIS analyzed three development concepts of various densities (1,020, 1,840 and 2,330 dwelling units), each with approximately 197,000 sq.ft. of commercial/retail space. This PER further analyzes one of those three development concepts, as shown below in Table 1-1.

Table 1-1: Preliminary Development Plan

Year	Land Use				
	Residential Units			Commercial/Retail (SF)	School (ACRES)
	Multifamily	Single Family/ Double Family	*Affordable Housing*		
2012-2014	340	76	*250*	41,833 SF	
2015-2018	437	94	*329*	24,500 SF	4.26 ACRES
2019-2021	202	176	*127*	32,667 SF	8.15 ACRES
2022-2024	278	96	*200*		
2025-2026	259	80	*166*		
2027-2028	153	139	*96*	98,000 SF	
Total	1,669	661	*1168*	197,000 SF	12.41 ACRES
	2330 Total Units				

2.0 EXISTING CONDITIONS

2.1 ROADWAYS AND TRAFFIC

Palani Road borders the Project along the southern boundary. The proposed Ane Keohokalole Highway, which will be under construction in late 2009/early 2010, will border the Project along the *makai* boundary and the newly constructed Keanalehu Drive borders a short portion of the Project along the *mauka* boundary. Keanalehu Drive and Manawalea Street meet at the northern-*mauka* tip of the Project and were completed in late 2008.

2.2 DRAINAGE FACILITIES

There are currently no existing drainage facilities and no defined natural drainage ways onsite. Since there are no natural storm water channels within the Project area it is likely that there is high permeability of the existing soils. Proposed drainage facilities will be constructed in the Ane Keohokalole Highway at intersections which feed the project.

2.3 EXISTING DWS INFRASTRUCTURE IN THE VICINITY OF THE PROJECT SITE

Although there are no existing water commitments for the Project, planned improvements to existing DWS systems will support development of the Project.

The majority of the Project site is within the 595-foot Kealakehe High School reservoir's service zone which extends from the 495-foot elevation to the 225-foot elevation. A portion of the site, along the extension of Keanalehu Drive (about 9 acres) lies above the 495-foot elevation and would require service from DWS' 935-foot reservoir system to provide adequate water pressure. See Figure 2-1: Offsite Water Master Plan.

There is existing water system infrastructure around the Project area which connects to well sites above Mamalahoa Highway. An existing 16-inch water line in Manawale'a Street from the 595-foot elevation Kealakehe High School reservoir stubs out to the Project site and services the 495 to 225-foot elevation water service pressure zone. There is also a 12-inch water line in Manawale'a Street providing water service above the 495-foot elevation. There is an existing 16-inch water line in Palani Road along the project site and a new water line will be installed with the new Ane Keohokalole Highway construction later this year. The line will be a 16-inch main from Palani Road to Makala Boulevard that will be cost shared between Kamakana Villages and Queen Liliuokalani Trust. From Makala Boulevard to Manawalea Street, the water line will be 12-inch line and paid for by the Kamakana Villages Project.

A 1.0 million gallon (MG) reservoir exists at the 595-foot elevation Kealakehe High School reservoir site. The site is designed for a second reservoir to be constructed in the future.

2.4 WASTEWATER COLLECTION, TREATMENT, AND DISPOSAL

Hawaii County's Kealakehe Sewage Treatment Plant (STP) is located *makai* of Queen Ka'ahumanu Highway. Regional sewer in the area connects to an existing 30-inch sewer line that crosses Queen Ka'ahumanu Highway near the police station. The original EIS indicated that the County had reserved 431,360 gallons per day (GPD) capacity at the Kealakehe STP for Kamakana Villages.

3.0 PROPOSED CIVIL INFRASTRUCTURE

Infrastructure for Kamakana Villages would be built in phases as the project site is developed. Construction is anticipated to begin in 2011 and provide the required infrastructure for the initial stages of development in 2012. From 2012 until 2025 the infrastructure system would be expanded to accommodate the entire project. Construction of the proposed development is anticipated to be completed by 2028. Originally it was anticipated that site construction would begin in 2010 and continue through 2020, however the schedule has been adjusted and now reflects a more accurate timeline. Overall construction cost by Phase has been broken down below in Table 3-1: Construction Cost by Phase. This table includes all on-site and off-site construction costs involved at each phase of development.

Table 3-1: Construction Cost by Phase

Project Development	Onsite Cost	Offsite Cost	Total Phase Cost
Phase 1	$29,129,377.00	$11,941,075.00	$41,070,452.00
Phase 2	$27,162,240.00	$3,049,900.00	$30,212,140.00
Phase 3	$22,159,703.00	$1,000,000.00	$23,159,703.00
Phase 4	$13,677,271.00	$8,472,450.00	$22,149,721.00
Phase 5	$17,194,959.00	$0.00	$17,194,959.00
Phase 6	$20,591,828.00	$0.00	$20,591,828.00
Total Construction Cost			$ 154,378,803.00

3.1 ROADWAYS AND TRAFFIC

The County of Hawaii's proposed Ane Keohokalole Highway is the key roadway to facilitate full build out of the Keahuolu project. Without Ane Keohokalole Highway, vehicular access to the site would be limited to access on Keanalehu Drive, and connections to Palani Road during later development phases of the project.

The Ane Keohokalole Highway design has been completed and construction is set to begin late 2009/early 2010. The right-of-way is set to be 120-feet wide and will have a posted speed limit of 30 miles per hour. The initial phase of construction includes sections that have one and two lanes in each direction but the entire Highway is planned to be upgraded to two lanes in each direction. There is a portion with two lanes in each direction and a portion with only one lane in each direction but future construction on the highway will upgrade then entire highway to a 4-lane highway. The initial phase also includes improvements to Palani Road from the Ane Keohokalole Highway down to Queen Ka'ahumanu Highway. The County plans to designate the highway as a bus transit corridor. The final plans indicate regional bus transit stops at the Ane Keohokalole Highway/Makala Boulevard intersection and at the Ane Keohokalole Highway/Manawalea Street intersection with both bus stops fronting the Kamakana Villages. Bus stops are also proposed on Ane Keohokalole Highway for local circulators serving the *mauka* and *makai* neighborhoods.

Construction costs for the Ane Keohokalole Highway will be covered by Federal Stimulus funds and contributions from landowners with frontage along the Highway. However, no Federal funds have to date been made available for the installation of major utility transmission lines within the Highway. Therefore, the proposed waterline to be installed in the Ane Keohokalole Highway will be cost-shared between the Keahuolu Project Developers and the Queen Liliuokalani Trust.

One standard intersection and two right-in/right-out intersections are proposed along Palani Road. To minimize impacts on traffic along Palani Road, the intersections would likely include deceleration and acceleration lanes and the right-in/right-out intersections would include a raised median to prevent vehicles from attempting to make left turn movements. The final determinations on the traffic mitigation measures along Palani Road will be made based upon the recommendations in the TIAR currently underway for Kamakana Villages and discussions with the Department of Public Works.

Kamakana Villages' internal roadways would be pedestrian friendly, designed to accommodate cars, bicycles and pedestrians. The internal roadways will be designated in consultation with the County Department of Public Works for dedication to the County. The preliminary layout of the internal roads has been designed to comply with the Village Design Guidelines of the Kona Community Development Plan. An order-of-magnitude cost for the internal grading and roadways, including water, sewer, drainage, electric, telephone and cable television utilities, based on this preliminary plan is $129,915,378. A more detailed breakdown of the onsite phasing construction costs can be seen in Appendix A.

Existing traffic conditions have been assessed in a previous report.

3.2 SITE GRADING AND EROSION CONTROL

Ideally, major grading will be minimized at Kamakana Villages. The existing topography would be altered only to the extent necessary for construction of the proposed improvements. It is anticipated that grading would occur on a localized scale and that cut and fill quantities would generally balance as construction progresses by phase. Grading permits, approved by the State Department of Land and Natural Resources Historic Preservation Division, the County Planning Department and the County Department of Public Works would be required for all grading activities.

During all phases of construction, erosion control practices would comply with State, County and Federal regulations. National Pollutant Discharge Elimination System (NPDES) general permit coverage authorizing discharges of storm water associated with construction activities would be required for the project from the State Department of Health, Environmental Management Division, Clean Water Branch. Best management practices to control erosion during construction would be a component of the NPDES permit.

3.3 DRAINAGE FACILITIES

Storm water runoff from the site would be collected through swales, ditches, gutters, inlets and/or catch basins, and transported through pipes to dry wells, seepage wells or infiltration areas for disposal. Infiltration areas, seepage wells and dry wells would be located in open spaces and parking lots, where practical. Dry wells would also be located within the roadway right-of-way as needed. An underground injection control (UIC) permit is required by the State Department of Health to construct and operate the dry wells. It is recommended to include best management practices in the design of the drainage system, such as vegetated swales, bioretention areas, and storm drain filtration devices to capture sediments and prevent pollutants from entering the groundwater.

3.4 WATER SYSTEM

3.4.1 PROJECTED SUPPLY REQUIREMENTS

The proposed water system would be developed in accordance with the 2002 State of Hawaii Water System Standards, Rules and Regulations. For details of the project's water supply requirements, see Appendix B. The design and construction of the proposed offsite and onsite water systems within the road right-of-way would meet County Standards for dedication to the Department of Water Supply (DWS).

The projected average and maximum day demand of the proposed development are summarized in Table 3-2 below.

Table 3-2: Water Requirements

Water Master Plan	Cumulative By Phase Average Daily Demand (gallons per day)	Cumulative By Phase Max. Daily Demand (gallons per day)
Phase 1	182,760	274,140
Phases 1 & 2	451,320	676,980
Phases 1-3	644,170	966,255
Phases 1-4	793,770	1,190,653
Phases 1-5	961,690	1,442,535
Phases 1-6 (Full Development)	1,116,040	1,674,060

3.4.2 SOURCES OF SUPPLY

3.4.2.1 INITIAL WELL DEVELOPMENT

The Keopu-HFDC well, identified as State No. 3957-05, will be the project's initial source of supply. The location of this well is shown on Figure 2-1. It is above Mamalahoa Highway at elevation 1600 feet on TMK 7-5-13:22, a parcel of land owned by the State. It was completed and pump tested in 2003. As documented in Appendix C, final pump testing in April 2003 was run for four days at an average

of 1648 GPM. Drawdown stabilized at 9.8 feet and the pumped water salinity was very low (chlorides of less than 10 mg/l). The well taps high level groundwater with a static level about 56 feet above sea level.

To put Well 3957-05 into the production, the following improvements must be completed: (1) installation of a 1050 GPM pump and motor, providing a nominal capacity of 1.5 MGD; (2) control building and other site improvements as required by DWS; (3) a 12-inch transmission main to a new upgradient storage tank; (4) the upgradient storage tank with a 1703-foot spillway and tentatively sized at 0.5 MG; and (5) a 16-inch main from the tank down to Mamalahoa Highway and north along Mamalahoa Highway to DWS' existing 16-inch main at its point of connection to the QLT 1703-foot tank. Ongoing field studies are being undertaken to confirm or revise the storage tank size so that the number of well pump cycles are limited to one or two a day.

The 1.5 MGD supply capacity will be allocated 2/3 to the project and 1/3 to DWS. As shown on Table 3.2, the 1.0 MGD supply allocation from Well 3957-05 for the project will be sufficient to supply its maximum day demand through Phase 3.

3.4.2.2 DEVELOPMENT OF THE SECOND WELL

As shown on Figure 2-1, the project's second well will be developed on or upgradient of DWS' Moeauoa Tank site (TMK 7-5-01:55). The 0.05 MG tank is now out of service as its lower, 1616-foot spillway elevation does not match the 1703-foot elevation of more recently constructed storage reservoirs. In 1991, the USGS completed the Komo Monitor Well at this site. It was drilled from 1600-foot ground level to about 22 feet below sea level and then completed with four-inch casing for monitoring purposes. This well taps high level groundwater which stands about 40 feet above sea level. Details of its construction and water levels can be found in Appendix D. The results of this well establish that a production well located on or upgradient of this parcel will tap high level groundwater and, if properly developed, will be very likely to be able to provide a supply of 1.5 MGD or more.

Development of this well, which is necessary to supply the project's Phases 4 through 6, which have a combined projected maximum day demand of 0.7078 MGD (Table 3-2), will require the following improvements: (1) drilling, casing, and pump testing the well; (2) installing a pump and motor, tentatively selected to have 1.5 MGD capacity to be confirmed during pump testing; (3) control building and other site improvements as required by DWS; (4) a 12-inch transmission main to a new upgradient storage tank; (5) the upgradient storage tank with a 1703-foot spillway and tentatively sized at 0.5 MG pending results of field studies; and (6) a 16-inch main from the tank down to Mamalahoa Highway.

The new well would have 20-inch casing to accommodate a four-pole submersible motor. The casing and annulus would be configured so that the solid portion of the

casing would function as a shroud for the motor to ensure its proper cooling. The well would be drilled to at least 200 feet below sea level to maximize its hydraulic capacity. Based on the project's maximum day supply projection and the 2/3 and 1/3 supply allocation of the well capacity for the project and DWS, a capacity of 1.06 MGD (740 GPM) would suffice to complete the project's Phases 4 to 6. However, the objective would be to achieve a full 1.5 MGD capacity to match other high elevation well capacities to the north and south.

3.4.3 RESERVOIR STORAGE

Based on the maximum day criterion, two new 1.0 MG reservoirs will be required for the project to accommodate water storage. The first 1.0 MG reservoir will be installed at the existing Kealakehe High School reservoir site. Based on discussions between HHFDC and DHHL, the second reservoir will be located at a new 595-foot elevation site on the DHHL Keahuolu property on TMK 7-4-21: portion of 21. The site would be off the future extension of Keanalehu Drive. A temporary access road with two 12-inch water lines extending about 1,270 linear feet would be required off of Manawalea up to the reservoir site. The access road would be over TMK 7-4-21: portions of 20 and 21.

Construction of the second reservoir site would require a grading permit, an NPDES general permit, and building permits for the reservoir structure. If dry wells are constructed at the reservoir site, an Underground Injection Control permit may also be required depending on well depth.

3.4.4 WATER LINES

The *Villages of La'i'Opua Water Master Plan* identified transmission deficiencies in the offsite water system. Approximately 3,200 linear feet of 8-inch water line in Kealaka'a Street, from Palani Road to Manawalea Street, are being upsized to a 12-inch water line. Approximately 800 linear feet of new 12-inch water line may be required in the existing Manawale'a Street to connect to the extension in Kealaka'a Road. As previously discussed, 4,400 total linear feet of 12-inch and 16-inch water line will be installed within Ane Keohokalole Highway, between Palani Road and Manawale'a Street. Upon finalization of the development concept, the Department of Water Supply requested that the developer update the *Villages of La'i'Opua Water Master Plan* to determine whether there are any other system deficiencies and required improvements. The proposed Offsite Water Master Plan can be seen in Figure 2-1.

3.4.5 OFFSITE WATER SYSTEM COSTS

Order-of-magnitude costs for the off-site water system improvements would be as follows.

Off-site Wells and Appurtenances (Well Site No. 3957-05 will be required from Phase 1 through Phase 3 and the second well for Phase 4 onward).

Well Site No. 3957-05	$3,985,650
Second Well	$5,182,970
Reservoirs: TWO (2) total will be required	
1) DHHL Keahuolu property: 1.00 MG Reservoir	$2,620,000
2) Kealakehe High School Reservoir Site:1.00 MG Reservoir	$2,620,000
Phase A	
Off-site transmission	$2,128,875
Phase B	
Off-site transmission	$ 161,500
Phase C	
Off-site transmission	$ 668,880

3.4.6 ONSITE DISTRIBUTION SYSTEM

The onsite water system would consist of main water lines within the roadway network. The system would be connected to the existing water system at Keanalehu Drive and Manawale'a Street and at Palani Road and Ane Keohokalole Highway, forming a looped water system. The Kamakana Villages water system network would have a minimum pipe size of 6-inches in diameter and a maximum pipe size of 12-inches in diameter, based on the proposed roadway layout and development layout and densities. The water lines would be sized to meet the maximum daily demand plus fire flow with a residual pressure of 20 pounds per square inch (psi) at the critical fire hydrant or the peak hour demand with a residual pressure of 40psi.

3.5 WASTEWATER SYSTEM

The proposed sewer system would be developed in accordance with the Hawaii County Department of Environmental Management criteria. For details of the sewer system criteria, see Appendix C. The design and construction of the proposed offsite sewer system and onsite sewer system would meet County Standards for dedication to the County Department of Environmental Management.

The projected sewer flows are summarized in Table 3-3: Sewer Requirements. Sewer system calculations are provided in Appendix E.

Table 3-3: Sewer Requirements

Sewer Master Plan	Cumulative By Phase Design Average Flow (gallons per day)	Design Peak Flow (gallons per day)
Phase 1	110,420	548,856
Phases 1 & 2	265,980	1,141,556
Phases 1-3	392,946	1,658,142
Phases 1-4	491,750	1,975,284
Phases 1-5	582,040	2,270,165
Phases 1-6 (Full Development)	673,778	2,555,477

The original EIS indicated that the County had reserved 431,360 gallons per day (GPD) capacity at the Kealakehe Sewage Treatment Plant (STP) for Kamakana Villages. Increased capacity at the Kealakehe STP would be required to accommodate the full development of the site. The Department of Environmental Management would have to expand the STP and are currently undertaking a master plan to review options to upgrade the STP. Two improvement projects to the STP are planned which include 1) sludge removal ($8,600,000 has been appropriated for the sludge removal, of which $600,000 has been allotted for design work); and 2) aeration upgrade ($8,250,000 has been appropriated for the aeration upgrade, of which $750,000 has been allotted for design work). The two improvement projects will allow the STP to continue to operate at the present capacity and allow for future capacity upgrades.

R-3 Water (undisinfected secondary recycled water) from the Kealakehe STP is discharged in the lava fields *mauka* of Queen Kaahumanu Highway in the DHHL/Villages of La'i'opua. R-3 Water is not suitable for irrigation use for the project. The County would have to further treat the effluent to R-1 Water (significant reduction in viral and bacterial pathogens) before the effluent would be suitable for irrigation use at Kamakana Villages. The County has plans to upgrade the STP to produce R-1 Water in FY 10-11. In addition, a pump system, storage and transmission lines for the recycled effluent system would be required.

3.5.1 OFFSITE

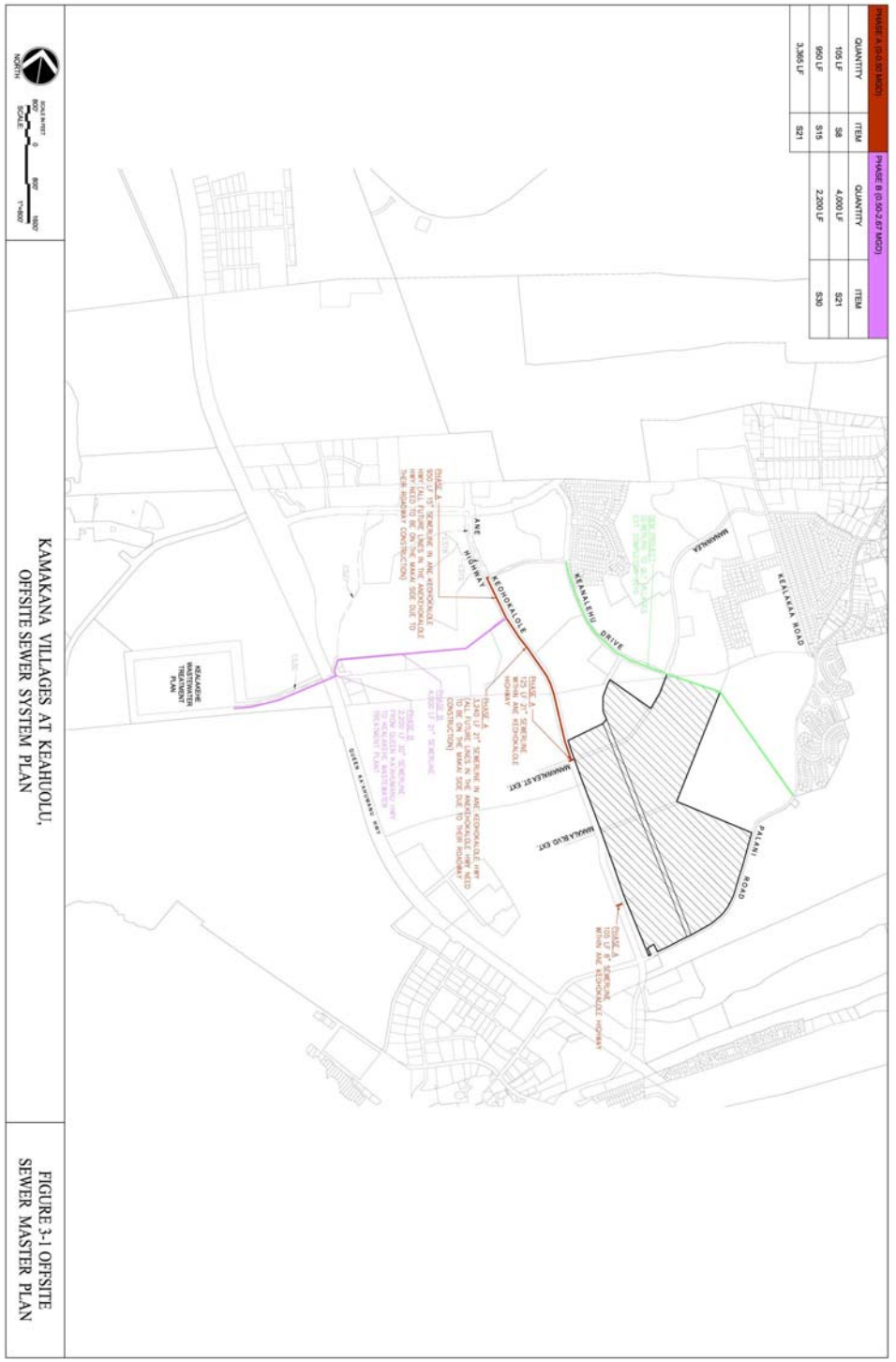
Sewer lines from the project site to the STP would be routed along Ane Keohokalole toward Kealakehe Parkway. In the first Phase of the Project, the proposed sewer line will connect to the existing main at the intersection of Puohulihuli Street and Ane Keohokalole. Based on discussions with the Department of Environmental Management, there is sufficient capacity in this line running down to the sewage treatment plant to serve the early stages of the project.

The second phase of the offsite Sewer Master Plan suggests installation of a line through the La'i'Opua lands. Based on the design flows, this is necessary because the existing line does not have the sufficient capacity to serve the entire project. This proposed line includes a new 30-inch line that crosses Queen Ka'ahumanu Highway en route to the treatment plant. The proposed Offsite Sewer Master Plan can be seen in Figure 3-1.

The following order-of-magnitude costs for offsite sewer system construction assume that the low area within the project site would be developed with sewage-pumping facilities.

Phase A	$ 930,550
Phase B	$1,888,400
Total	$2,818,950

These cost estimates are based on the best available information from DHHL for future development.



3.5.2 ONSITE

The onsite sewer system would consist of sewer lines within the roadway network. The system would connect to the offsite sewer lines. The sewer system would have a minimum pipe size of 6-inches in diameter and a maximum pipe size of 15-inches. Because of the natural slope of the Project site, a lift station and force main will be required to pump sewage to where it can gravity flow and exit the site. There is one proposed outflow connection to the offsite sewer system at Ane Keohokalole Highway and Manawalea Street.

4.0 ELECTRIC AND COMMUNICATIONS SYSTEMS

The proposed electric and communications systems would be developed in accordance with the specifications and standards of Hawaii Electric Light Company (HELCo.), Hawaiian Telcom Inc. (HTCo.) and Oceanic Time Warner Cable (Oceanic). As State Public Utility Commission (PUC) regulated public utilities, HELCo. 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 Kailua-Kona area. Presently, the existing off-site facilities that would serve this development are HELCo.'s Palani Substation located at the intersection of Henry Street and Palani Road and HTCo.'s Kailua-Kona central office located near the intersection of Queen Kaahumanu Highway and Palani Road. Oceanic is a State Department of Commerce and Consumer Affairs cable television franchisee that is the sole land-line provider of cable television service to Hawaii Island. 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 Oceanic offer broadband and telephone services. The design and construction of the proposed onsite electric and communications systems would meet the respective utility company's standards and the County requirements for roadway dedication.

The projected electrical demand and telephone line requirements are summarized in Table 4-1.

Table 4-1: Electrical Demand and Telephone Line Requirements

Electric and Comm. Master Plan	Electric Demand (kiloVolt-Amperes kVA)	Telephone Lines
Phase 1	2,446	734
Phases 1 & 2	5,264	1,579
Phases 1 through 3	7,371	2,211
Phases 1 through 4	9,241	2,772
Phases 1 through 5	10,936	3,280
Phases 1-6 (Full Development)	13,048	3,914

4.1 OFFSITE ELECTRIC

Electric ductlines to the Project site will be constructed as part of the Ane Keohokalole Highway Federal Aid project although funding for the ductlines will be provided, in part, by this Project. The ductlines will extend from HELCo.'s Palani Substation located on the South side of Palani Road across the County Department of Water Supply's 310 Reservoir and will consist of concrete encased, PVC conduits and manholes. Presently, HELCo. has installed one 10 MVA transformer in Palani Substation and has sufficient land area to install three additional 10 MVA transformers. It should be noted HELCo.'s main regional substation, located along Kaiwi Street has reached its capacity and that under the agreement with Queen Liliuokalani Trust for dedication of the Palani Substation site, HELCo. has dedicated a certain amount substation capacity to the Makalapua

Development. Based on its PUC tariff, HELCo. will require large developments such as Kamakana Village to advance the cost for construction of additional facilities within the Palani Substation site to support the residential and commercial development. For a 5-year period after the facilities are energized and begin paying for their electricity usage, HELCo. will, on a yearly basis, issue a refund, based on the electricity revenues, of a portion or all these advanced costs to the Kamakana Villages Developer.

As discussed in the HHFDC La'i'Opua Utility Assessment, since HELCo. considers Palani Substation to be a regional facility, the substation capacity is not dedicated to any particular development. Hence, as coincident development around the Kailua-Kona area continues, HELCo. would continue to place transformers within the Palani Substation to meet the demand of this development. Depending upon the length of time for the full build-out of the Kamakana Village to be completed, if the Palani Substation has reached its capacity, the need for another substation site may arise.

4.2 OFFSITE COMMUNICATIONS

HTCo. and Oceanic ductlines to the project site will be constructed as part of the Ane Keohokalole Highway Federal Aid project although funding for the ductlines will be provided by this project. The ductlines will extend from the existing overhead and underground facilities presently located on Palani Road and Henry Street. HTCo.'s ductline will consist of concrete encased, PVC conduits and manholes. Oceanic's ductline will consist of a concrete encased PVC conduit and handholes. Based on its PUC tariff, HTCo. would not normally require an off-site facility development charge unless the telephone provisioning requested was deemed to be in excess of HTCo.'s standard installation for this type of Development. Similarly, Oceanic would not normally request an off-site facility development payment.

The following order-of-magnitude costs are for offsite electric and communication duct systems construction.

Ane Keohokalole Duct System	$ 1,726,000
Anticipated HELCo. Charges	$ 550,000
Anticipated Palani Substation Development Charge	$ 2,000,000
Total	$ 4,276,000

4.3 ONSITE

The onsite 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 road right-of-way line. Manholes and handholes would be place periodically to serve as pulling points for the utilities and as parcel service points. These ductlines would connect to the Ane Keohokalole Highway ductline at the various intersections. The anticipated duct complement for the major roadways would consist of 4-5" and 2-4" conduits for HELCo., 4-4" conduits for HTCo. and 1-4" conduit for Oceanic. The number and size of conduits would vary based on the adjacent land usage

with the typical minimum conduit complement being 2-2" conduits for HELCo., 1-4" conduit for HTCo. and 1-4" conduit for Oceanic on local residential roadways.

4.4 STREET LIGHTING

Pending the acceptance by the County for use of the proposed roadway luminaire selected by the Development, the County standard street lighting system would consist of low pressure sodium, cut-off luminaires, aluminum poles, bracket arms and breakaway aluminum transformer base mounted on a cast-in-place reinforced concrete foundation. The typical street light spacing for County dedicable roadways would be at 130 feet to 160 feet on center. To retain dedicability, proposed changes to this spacing should be submitted to the County for review and approval. The street lighting system would be energized through unmetered electrical connections to HELCo. secondary power sources situated along the Development roadways.

Kamakana On-Site Phasing Estimate

			Phase 1		Phase 2		Phase 3		Phase 4		Phase 5		Phase 6		
Project Name	**Quantity**	**Unit Cost (2009)**	**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**	**Quantity**	**Cost**	
Project Start Date (Onsite Start)	date (year)														
Acres (Buildable area inclusive of LOCAL ROW)	acre		50.29		45.40		51.08		28.58		38.83		42.39		
Sitework															
SUB-TOTAL				**$11,128,707.00**		**$10,529,040.00**		**$7,439,673.00**		**$3,876,041.00**		**$4,143,064.00**		**$9,560,818.00**	$46,677,343.00
Roadways															
SUBTOTAL				**$5,697,145.00**		**$4,313,200.00**		**$3,870,665.00**		**$3,066,180.00**		**$3,656,340.00**		**$2,980,660.00**	$23,584,190.00
Water Infrastructure															
SUB-TOTAL				**$1,541,985.00**		**$1,502,700.00**		**$1,408,065.00**		**$914,895.00**		**$1,328,140.00**		**$953,150.00**	$7,648,935.00
Sewer Main															
SUB-TOTAL				**$2,570,670.00**		**$2,275,800.00**		**$2,569,670.00**		**$1,604,315.00**		**$2,337,035.00**		**$1,552,400.00**	$12,909,890.00
Drainage(Drywell)															
SUB-TOTAL				**$1,050,000.00**		**$1,675,000.00**		**$1,400,000.00**		**$900,000.00**		**$1,475,000.00**		**$1,125,000.00**	$7,625,000.00
Electrical Transmission (Power, Phone, Data, TV)															
SUB-TOTAL				**$5,921,300.00**		**$4,959,800.00**		**$3,759,200.00**		**$2,597,200.00**		**$3,143,200.00**		**$2,522,700.00**	
Other															
SUB-TOTAL				**$1,219,570.00**		**$1,906,700.00**		**$1,712,430.00**		**$718,640.00**		**$1,112,180.00**		**$1,897,100.00**	$8,566,620.00
TOTAL				**$29,129,377.00**		**$27,162,240.00**		**$22,159,703.00**		**$13,677,271.00**		**$17,194,959.00**		**$20,591,828.00**	$129,915,378.00
GRAND TOTAL - PHASES 1 thru 6		**$129,915,378.00**													

KAMAKANA VILLAGES

APPENDIX A: ONSITE CONSTRUCTION COST ESTIMATE BY PHASE

APPENDIX B: WATER

Appendix-Water System

Criteria

The water system criteria for the Kamakana Villages follows the Hawaii County Department of Water Supply's Standards dated 2002. The applicable criteria are shown below:

1. Water Consumption

Land Use	Average Daily Demand
Single Family or Duplex	400 gpd per unit
Multi-Family	400 gpd per unit
Commercial	3,000 gpd per acre
Schools	4,000 gpd per acre
Parks	4,000 gpd per acre

Notes:
DWS indicated that the Project should minimize the use of water for landscaping.

2. Demand Factors:

a. Maximum daily demand =1.5 x average daily demand
b. Peak hour demand =5.0 x average daily demand

3. Well Supply Requirements:

a. Provide maximum day supply in a 24-hour pumping day
b. Limit capacity of pumps in high elevation wells to 1080 gpm (per Steve Lum/Milton Pavao conversation.)
c. Well supply allocated 2/3 to the Project and 1/3 to DWS

4. Fire Flow Requirements:

a. 500 gallons per minute (gpm) for two hours for single family homes with a lot size of 10,000 square feet or larger.
b. 1,000 gpm for one hour for single family homes with a lot size of 10,000 square feet or less.
c. 1,500 gpm for one hour for multi-family
d. 2,000 gpm for two hours for schools.

5. Pipeline sizing:

a. Maximum daily demand plus fire flow with a residual pressure of 20 pounds per square inch (psi) at critical fire hydrant.
b. Peak hour demand with a residual pressure of 40psi.
c. In determining the carrying capacity of the mains, the "C" values to be applied are:

Pipe Diameter	"C"
8", 12"	110
16", 20"	120
24" and larger	130

Water Daily Demands Post-Phase 1

Single Family & Double Family Residential =	400 gallons/unit	per DWS Table 100-18
Multi-family Residential =	400 gallons/unit	per DWS Table 100-18
Commercial =	3,000 gallons/acre	per DWS Table 100-18
Schools =	4,000 gallons/acre	per DWS Table 100-18
Parks =	4,000 gallons/acre	per DWS Table 100-18

Phase 1	Units	Daily Demand (gallons/unit)	Average Demand (Gallons)	Maximum Daily Demand (Gallons)
Single Family	76	400	30,400	45,600
Multi-Family	340	400	136,000	204,000
Commercial	0.96	3,000	2,880	4,320
Schools	0	4,000	0	0
Parks	3.37	4,000	13,480	20,220
Total			182,760	274,140

Reservoir Sizing:

1) Meet maximum daily consumption (1.5 x Average Day). Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

1.5x 182,760 = 274,140 gallons

2) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

Fire Flow (Worst Case is Small Commercial) = 2000 gpm for 2 hours 240,000 gallons

Max Day Rate for 2 hours 22,845 gallons

Storage = 350,460 gallons

Condition 2 governs.

Will need to construct 1.0 MG of storage volume. (1.0 MG > 0.35 MG)

Wells:

Required Well Pump Capacity = (3/2) x (274,140) = 411,210 GPD = 286 gpm

Install One 1080 gpm well pump.

KAMAKANA VILLAGES

Water Daily Demands Post-Phase 2

Single Family & Double Family Residential =	400 gallons/unit	per DWS Table 100-18
Multi-family Residential =	400 gallons/unit	per DWS Table 100-18
Commercial =	3,000 gallons/acre	per DWS Table 100-18
Schools =	4,000 gallons/acre	per DWS Table 100-18
Parks =	4,000 gallons/acre	per DWS Table 100-18

Phases 1 & 2	Units	Daily Demand (gallons/unit)	Average Demand (Gallons)	Maximum Daily Demand (Gallons)
Single Family	170	400	68,000	102,000
Multi-Family	777	400	310,800	466,200
Commercial	1.52	3,000	4,560	6,840
Schools	4.26	4,000	17,040	25,560
Parks	12.73	4,000	48,520	72,780
Total			451,320	676,980

Reservoir Sizing:

1) Meet maximum daily consumption (1.5 x Average Day). Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

1.5x 451,320 = 676,980 gallons

2) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

Fire Flow (Worst Case is Schools) = 2000 gpm for 2 hours 240,000 gallons

Max Day Rate for 2 hours 56,415 gallons

Storage = 395,220 gallons

Condition 1 governs.

No new reservoirs necessary. (1.0 MG > 0.68 MG)

Wells:

Required Well Pump Capacity = (3/2) x (676,980) = 1,015,470 GPD = 705 gpm

Provided by One 1080 gpm well pump.

Water Daily Demands Post-Phase 3

Single Family & Double Family Residential =	400 gallons/unit	per DWS Table 100-18
Multi-family Residential =	400 gallons/unit	per DWS Table 100-18
Commercial =	3,000 gallons/acre	per DWS Table 100-18
Schools =	4,000 gallons/acre	per DWS Table 100-18
Parks =	4,000 gallons/acre	per DWS Table 100-18

Phases 1-3	Units	Daily Demand (gallons/unit)	Average Demand (Gallons)	Maximum Daily Demand (Gallons)
Single Family	346	400	138,400	207,600
Multi-Family	979	400	391,600	587,400
Commercial	2.27	3,000	6,810	10,215
Schools	12.41	4,000	49,640	74,460
Parks	14.43	4,000	57,720	86,580
Total			644,170	966,255

Reservoir Sizing:

1) Meet maximum daily consumption (1.5 x Average Day). Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.
   1.5x 644,170 = 966,255 gallons
2) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.
   Fire Flow (Worst Case is Schools) = 2000 gpm for 2 hours
   240,000 gallons
   Max Day Rate for 2 hours 80,521 gallons
   Storage = 427,361 gallons

Condition 1 governs.

No new reservoirs necessary. (1.0 MG > 0.97 MG)

Wells:

Required Well Pump Capacity = (3/2) x (966,255) = 1,449,382 GPD = 1007 gpm

Provided by One 1080 gpm well pump.

KAMAKANA VILLAGES

Water Daily Demands Post-Phase 4

Single Family & Double Family Residential =	400 gallons/unit	per DWS Table 100-18
Multi-family Residential =	400 gallons/unit	per DWS Table 100-18
Commercial =	3,000 gallons/acre	per DWS Table 100-18
Schools =	4,000 gallons/acre	per DWS Table 100-18
Parks =	4,000 gallons/acre	per DWS Table 100-18

Phases 1-4	Units	Daily Demand (gallons/unit)	Average Demand (Gallons)	Maximum Daily Demand (Gallons)
Single Family	442	400	176,800	265,200
Multi-Family	1257	400	502,800	754,200
Commercial	2.27	3,000	6,810	10,215
Schools	12.41	4,000	49,640	74,460
Parks	14.43	4,000	57,720	86,580
Total			793,770	1,190,655

Reservoir Sizing:

1) Meet maximum daily consumption (1.5 x Average Day). Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.
   1.5x 793,770 = 1,190,655 gallons
2) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.
   Fire Flow (Worst Case is Schools) = 2000 gpm for 2 hours
   240,000 gallons
   Max Day Rate for 2 hours 99,221 gallons
   Storage = 452,295 gallons

Condition 1 governs.

Will need to construct an additional 1.0 MG of storage volume. (2.0 MG > 1.19 MG)

Wells:

Required Well Pump Capacity = (3/2) x (1,190,655) = 1,785,982 GPD = 1240 gpm

Install 2nd 1080 gpm well pump.

Water Daily Demands Post-Phase 5

Single Family		
& Double Family Residential =	400 gallons/unit	per DWS Table 100-18
Multi-family Residential =	400 gallons/unit	per DWS Table 100-18
Commercial =	3,000 gallons/acre	per DWS Table 100-18
Schools =	4,000 gallons/acre	per DWS Table 100-18
Parks =	4,000 gallons/acre	per DWS Table 100-18

Phases 1-5	Units	Daily Demand (gallons/unit)	Average Demand (Gallons)	Maximum Daily Demand (Gallons)
Single Family	522	400	208,800	313,200
Multi-Family	1516	400	606,400	909,600
Commercial	2.27	3,000	6,810	10,215
Schools	12.41	4,000	49,640	74,460
Parks	22.51	4,000	90,040	135,060
Total			961,690	1,442,535

Reservoir Sizing:

1) Meet maximum daily consumption (1.5 x Average Day). Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

1.5x 961,690 = 1,442,535 gallons

2) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

Fire Flow (Worst Case is Schools) = 2000 gpm for 2 hours
240,000 gallons
Max Day Rate for 2 hours 120,211 gallons
Storage = 480,281 gallons

Condition 1 governs.

No new reservoirs necessary. (2.0 MG > 1.44 MG)

Wells:

Required Well Pump Capacity = (3/2) x (1,442,535) = 2,163,802 GPD = 1503 gpm

Provided by two 1080 gpm well pumps.

KAMAKANA VILLAGES

Water Daily Demands Post-Phase 6 (Full Development)

Single Family		
& Double Family Residential =	400 gallons/unit	per DWS Table 100-18
Multi-family Residential =	400 gallons/unit	per DWS Table 100-18
Commercial =	3,000 gallons/acre	per DWS Table 100-18
Schools =	4,000 gallons/acre	per DWS Table 100-18
Parks =	4,000 gallons/acre	per DWS Table 100-18

Phases 1-6 (Full Development)	Units	Daily Demand (gallons/unit)	Average Demand (Gallons)	Maximum Daily Demand (Gallons)
Single Family	661	400	264,400	396,600
Multi-Family	1669	400	667,600	1,001,400
Commercial	4.52	3,000	13,560	20,340
Schools	12.41	4,000	49,640	74,460
Parks	30.21	4,000	120,840	181,260
Total			1,116,040	1,674,060

Reservoir Sizing:

1) Meet maximum daily consumption (1.5 x Average Day). Reservoir full at the beginning of the 24-hour period with no source input to the reservoir.

1.5x 1,116,040 = 1,674,060 gallons

2) Meet maximum day rate plus fire flow for duration of fire. Reservoir 3/4 full at start of fire, with credit for incoming flow from pumps, one maximum size pump out of service.

Fire Flow (Worst Case is Schools) = 2000 gpm for 2 hours
240,000 gallons
Max Day Rate for 2 hours 139,505 gallons
Storage = 506,007 gallons

Condition 1 governs.

No new reservoirs necessary. (2.0 MG > 1.67 MG)

Wells:

Required Well Pump Capacity = (3/2) x (1,674,060) = 2,511,090 GPD = 1744 gpm

Provided by two 1080 gpm well pumps.

APPENDIX C: RESULTS OF DRILLING AND TESTING, KEOPU STATE WELL (3957-05). NORTH KONA, HAWAII BY WATER RESOURCE ASSOCIATES, SEPTEMBER 2007

RESULTS OF DRILLING & TESTING
KEOPU-STATE WELL (3957-05)
North Kona, Hawaii

Prepared for:

State of Hawaii
ENGINEERING DIVISION
Department of Land & Natural Resources
Honolulu, Hawaii

Prepared by:

WATER RESOURCE ASSOCIATES
1188 Bishop Street, Suite 1708
Honolulu, Hawaii 96813

Honolulu, Hawaii
April 2006
Revised September 2007

CONTENTS

FIGURES

APPENDICES

RESULTS OF DRILLING AND TESTING
KEOPU-STATE WELL 3957-05
Kailua, North Kona, Hawaii

SUMMARY AND CONCLUSIONS

The Keopu-State Well, a high-level ground water well, drilled in the Keauhou Aquifer System, was first completed to a depth of 1,690 ft. (89 ft. below sea level) and then pump tested. Drilling started in August 2000 and Step-Drawdown Test No. 1 was conducted on July 29, 2002, followed by Constant Rate Test No. 1 on August 5-9, 2002. The groundwater head measured 43.6 ft., msl, and chlorides were a pristine 7 mg/L. Before the well tests, the well had a severe sand (cinders?) problem which caused the test pump to freeze up and necessitated, subsequently, swabbing, block-surging, and bailing the well with a cable tool rig. For protection against further sand problems, the line-shaft test pump was outfitted with a long intake screen. Based on Step Test No.1, the hydraulic conductivity of the aquifer was calculated to be 1,435 ft./day and the well's specific capacity to be 506 gpm per foot of drawdown (1,518 gpm at approximately 3.0 ft. drawdown). A semi-log plot of the constant rate test data showed that the slope of the drawdown curve changed (from near stable to declining) after 2,000 to 3,000 minutes of pumping at an average rate of 1,460 gpm, indicating that a hydrologic boundary was encountered. The semi-log graph was used to calculate an aquifer transmissivity of 2,392,300 gpd/ft., which compares favorably with 2,565,200 gpd/ft. derived from Step Test No. 1 data. Based on a projection of the drawdown curve, drawdown in the well at the interim depth of -89 ft., msl, would stabilize at 4.9 ft. after 400 days of constant pumping at a rate of 1,468 gpm. Chlorides in the well presumably would remain at 7 to 9 mg/L.

After the No. 1 well tests were completed, it was decided to deepen the well an additional 110 ft., from 1,690 ft. to 1,800 ft.(-199 ft., msl) to possibly develop additional yield and stabilize drawdown. Unfortunately, "gel pellets"(bentonite?) and cement had to be used in removing loose material from the existing open hole and overcoming slow drilling caused by loose material (cinders?). Interestingly, water level in the well rose 12.9 ft. (from 43.6 ft. to 56.5 ft., msl), indicating an artesian condition which was later corroborated by evidence of up-hole flow in the open-hole section of the well as noted in the final video log of October 7, 2003. In all likelihood, the use of gel pellets, drilling polymers, and some cement had an adverse effect on well yield as indicated by the anomalous results of Step Test No. 2 and Constant Rate Test No. 2. The specific capacity of the deepened well (at a pumping rate of 1,000 gpm) was significantly reduced to 137 gpm per foot of drawdown from an original 506 gpm per foot of drawdown.

The No. 2 step-drawdown and constant-rate well tests give the final results of the well. At an average pumping rate of 1,650 gpm (2.35 mgd), drawdown in the well stabilized at 9.4 ft. after 1,000 minutes of pumping and continued to be stable until the end of the 4.3 day test. The well recovered instantly to within 2.5 ft. of the initial water level. Daily chlorides ranged from 7 to 9 mg/L. The "sand" problem apparently was resolved by all the swabbing, surging, and bailing as indicated by the results of a Rossum Sand Content Tester which was installed during the constant rate test and which showed "no measurable amount of sand."

Water quality analyses required by the Department of Health for new potable sources were not performed. However, the high-level water body tapped by the Keopu-State Well presumably is of excellent potable quality, based on its pristine 9 mg/L chlorides and that of other nearby high-level wells.

The effect on the nearby Haseko Well (3957-01), located approximately 800 ft. away, was a discernible drawdown of 0.6 ft., based on data logger monitoring before, during, and after the well test.

The results of drilling and testing the Keopu-State Well indicate that the high-level aquifer at Keopu is capable of yielding at least 2 mgd of potable water from an individual well and that an undefined volcanic layer encountered in the aquifer section confines, or partially confines, groundwater under artesian conditions as evidenced by a 56.5 ft. rise in water level after the well was deepened to its final depth.

Postscript: Since the April 2006 completion of this report, additional well data and analyses of the high-level aquifer at Keopu were completed and presented in a report by Water Resource Associates (March 2007). Also, the Hawaii Department of Water Supply plans to convert the Haseko Well (3957-01) into a production well.

DESCRIPTION OF WELL

The Keopu-State Well (3957-05) was drilled on State land (TMK 7-5-13:22) on the steep slopes above Kailua Town in the Keopu area of North Kona. The well is located approximately 2.65 miles inland from the coast at an elevation of 1,600.6 ft. (see Fig. 1). The main purpose of the well was to explore and test the high-level groundwater aquifer underlying State-owned land and to gather geologic and hydrologic data sufficient to determine the feasibility of developing a large, reliable source of municipal water by means of a deep underground well-pumping station that would connect to the surface by a horizontal tunnel extending seaward. The horizontal tunnel would be large enough to provide vehicular access for maintenance as well as transmission of water by pipeline. The well was drilled by Waieli Drilling & Development Co. and was completed in June, 2003 to a total depth of 1,799 feet (-198 ft., msl). The well was cased with an 18-inch diameter solid steel casing to a depth of 1,561 ft. (+40 ft., msl) and louvered screen casing to a depth of 1,641 ft. (-40 ft., msl). At first, the well was drilled to an interim open hole depth of 1,690 ft.

(-89 ft., msl), followed by a failed pump test in February 2002. The pump failed due to clogging by excessive basalt fines. Five months later the 12" open hole was drilled out to 1672 ft. (-71 ft., msl) and the well was tested on July 29, 2002. In June 2003, the open hole was extended to its final depth of 1,799 ft. The annular space between the casing and the drill hole is grouted from the surface to a depth of 1,529 ft. (+72 ft., msl). Below the grout, there is a 16 ft. grout seal followed below by 96 ft. of gravel packing (see Figure 2).

GEOLOGY

The Keopu-State Well is located on the steep western slopes of dormant Hualalai Volcano, which consists of relatively young alkalic lava flows (1,000 to 13,000 years old) deposited as a veneer of alkalic basalts covering an older theoleiitic shield core.

Some indication of the water-bearing properties of the basaltic aquifer can be seen in the Driller's Log (Appendix A). The log shows that the rotary drilling rate of the 12" pilot hole ranged between 10 to 16 ft. per hour between the surface and a depth of 1,588 ft. (+13 ft., msl) to a range of 6.7 to 7.8 ft./hour, below 13 ft., msl.

HYDROLOGY

The well taps the high-level groundwater body of the Keauhou Aquifer System, one of two systems that comprise the Hualalai Hydrologic Sector, which is delineated by the surface rocks of Hualalai Volcano. The Keauhou Aquifer System embraces the western and southern slopes of the volcano and broadly includes a coastal basal aquifer and an inland high-level

aquifer. The Keauhou System has an estimated sustainable yield of 38 mgd according to the State Commission on Water Resource Management (CWRM).

Median rainfall on the highly permeable basaltic slopes mauka of the well ranges between 50 and 75 inches a year.

Basal and High-Level Water Aquifers. Data from over two dozen North Kona wells indicate that a thin basal water lens occurs beneath the entire stretch of the North Kona coastal area. The lens consist of fresh and brackish water which floats upon salt water in highly permeable lava flows and, as a consequence, is subject to the dynamics of ocean tides and salt water intrusion in pumping basal water wells. Based upon existing well data, the basal lens, or aquifer, extends from the coast to Mamalahoa Highway, with the exception of the Kahaluu Shaft which lies nearer to the coast. In a narrow, unexplored zone a half mile or so wide and coincident with Mamalahoa Highway, the basal aquifer in North Kona makes a somewhat abrupt transition into a high-level groundwater aquifer. This unexplored coastal stretch is underlain by a geologic discontinuity which impedes groundwater flow from the high-level aquifer to the lower-level basal aquifer. The alignment of the discontinuity coincides somewhat with Mamalahoa Highway, based upon existing well data.

Water Levels. Existing well data suggest that the high-level groundwater aquifer probably consists of interconnected bodies of high-level water having different water levels. For example, the water level in the Keopu-State Well (3957-05) stands at elevation 50 ft. above mean sea level (msl), or 1,551 ft. below ground level. Four thousand feet north, the Komo Tank Site Monitor Well (3957-02) has a head of 42 ft., msl; 800 ft. northeast, the Keopu-Haseko Well (3957-01) has a head of 47 ft., msl; and finally 5,800 ft. south, the DWS-Waiaha Well (3857-04) has a head of 60 ft., msl. Although these head measurements were made independently, they reasonably suggest the occurrence of a hydrologic sink in the Keopu area of the high-level water body.

SUMMARY OF DRILLING ACTIVITIES

Ground elevation =1,600.6 ft., msl. From Appendix A and other records:

August 8, 2000 - Begin drilling.
October 9, 2000 - Drill 12" hole to 1628 ft.
October 11, 2000 - WL @ 49.6 ft., msl (1,600.6 – 1,551 GL)
October 19, 2000 – Drill 12" hole to 1,698 ft. RKB.
December 11, 2000 – Ream to 17.5" hole to 1,649 ft. RKB, 1,640 GL
February 8, 2001 – Ream to 24" hole to 1,652 ft.
March 5, 2001 – Install casing to 1,641 ft. (-41 ft., msl)
March 8, 2001 - Install rock packing to 1,545 ft. & grout seal to 1,529 ft.
March 16, 2001 – Cement grout from 1,529 ft. to surface.
WL @ 43.6 ft. (1,600.6 – 1,557).
July 16, 2001 – Clean 12" hole 1,640ft. to 1,690 ft. (-89 ft., msl)
July 19, 2001 – Demobilize Rotary Rig
January 29, 2002 – Install test pump.
January 30 - May 20, 2002 – (RECORD MISSING)
May 21-24 2002 – Swab and bail well with cable tool rig.
May 28 – June 7, 2002 – Surge well (with surge block) and bail
June 10, 2002 – Run camera in hole. Bottom of hole @ 1,676 ft. (-75 ft., msl)
June 11, 2002 – Run cable tool bit in well to 1,500 ft.
June 17, 2002 – Drill out 12" open hole and bail to 1,672 ft. (-71 ft., msl)
June 21-26, 2002 – Run in hole with magnet and bail hole clean.
July 2, 2002 – Demobilize Cable Tool Rig
July 9, 2002 – WL @ 43.6 ft., msl (1,600.6 – 1,557 GL)
July 17, 2002 – Complete pump installation.
July 29, 2002 – Begin Step Test No.1
August 5, 2002 – Begin Constant Rate Test No.1
August 22 – September 3, 2002 – Remove test pump
September 4, 2002 – May 4, 2003 (Record missing)
May 05 – June 28, 2003 – Drill out cone bit and drill 15" open hole to 1799 ft., (-198 ft., msl) using cable tool rig and bentonite pellets throughout.
June 19, 2003 – WL @ 56.5 ft., msl (1,600.6 -1,544.1)
June 29, 2003 – Demobilize Cable Tool Rig.
July 1, 2003 – Install test pump
August 11, 2003 – Begin Step Drawdown Test No. 2 and Constant Rate Test. No.2

WELL TESTS

INTERIM WELL DEPTH

In May 2001, the Keopu-State Well was completed with 1,641 ft. of casing (-40 ft., msl) and 49 ft. of 12" open hole (-89 ft., msl). Earlier, on March 16, 2001 the static water level measured 43.6 ft., msl. In February 2002, nine months after the well was completed to its interim depth, a test pump was installed. However, the pump froze due to a severe sand problem. Consequently, no well tests were performed. Several months later, a cable tool rig was mobilized and the well was swabbed and surged (with a surge block) for a number of days in May and June 2002. On July 2, 2002, the cable tool rig was demobilized after the well had been drilled out and bailed clean to a depth of 1,672 ft. (-71 ft., msl), which was shy of the 1,690 depth completed by rotary drilling in July 2001.

Step Drawdown Test No. 1 - July 29, 2002. On July 29, 2002, with a well depth of 1,672 ft. (-71 ft., msl) and a static water level of 43.6 ft., msl (measured earlier on July 9, 2002), a step drawdown test was performed at pumping rates ranging from 430 gpm to 1,518 gpm, with corresponding drawdowns ranging from approximately 0.58 feet to 3.00 feet (see Fig. 3). The step test record is shown in Appendix B. Based on the step test data, the hydraulic conductivity of the aquifer was calculated to be 1,435 ft/day and the percentage of total head loss attributable to laminar flow to be 55.4% (see Appendix C).

Constant Rate Test No.1 – August 5-9, 2002. A week after the step drawdown test, on August 5, 2002, the pumping rate was set at 1,500 gpm (2.14 mgd), but after the first day it was reduced to 1,460 gpm for the remainder of the test. The overall average pumping rate was 1,468 gpm (2.1 mgd). The constant rate test record is shown in Appendix D. A semi-log plot of the drawdown data is shown in Figure 4. The transmissivity (T_1, Figure 4) of the aquifer, based on the interpreted slope, Δs_1, of the first 1,000 minutes of pumping, was calculated to be 2,392,300 gpd/ft. This compares with 2,565,200 ft^2/day calculated from the Step Test No.1 data (Appendix C). The slope of the drawdown curve increased after approximately 2,000 to 3,000 minutes of pumping, indicating a hydrologic boundary was encountered. Based upon the interpreted slope, Δs_2, an apparent transmissivity of 430,600 gpd/ft. (T_2, Figure 4) was calculated. Drawdown in the well would have become essentially stable at 4.9 ft., after

approximately 400 days of constant pumping at an average rate of 1,468 gpm, based upon a projection of the interpreted slope, Δs_2. However, this estimate assumes that no other hydrologic boundaries would be encountered during the 400-day period.

FINAL WELL DEPTH

After analyzing the results of Constant Rate Test No.1, it was decided to deepen the well to 1,800 ft. (-199 ft., msl) to develop additional yield and stabilize drawdown. Approximately eight months later, beginning on May 5, 2003, a cable tool rig was mobilized onsite to clean out loose sand-size material (probably cinders) and a lost rotary cone bit by bailing. Red cinders were reported between 1,700 - 1,707 ft. depths. Unfortunately "gel pellets" (bentonite ?) were used frequently, not only to recover pieces of the rotary bit, but also overcome slow drilling progress caused by loose "cinders" falling into the hole especially when drilling through hard layers. Cement was used on a couple of occasions. Almost two months later, on June 29, 2003, the 15 inch diameter open hole was tagged at 1,795 ft. and cleaned to 1,799 ft. (-198 ft., msl).

On June 19, 2003, with well depth at 1,775 ft. (-174 ft., msl), the static water level measured 56.5 ft., msl (1,600.6-1,544.1), a rise of 12.9 ft. from the 43.6 ft. head measured earlier when the well was shallower at 1,690 ft. (-89 ft., msl). The nature and thickness of the low permeability or "restraining" layer was not clearly discernible in the video log, but it obviously occurs somewhere between -89 ft. and -174 ft., msl and presumably dips seaward. A 27 ft. thick layer of yellowish brown material (weathered ash and cinder?) was noted at -138 ft., msl, to -165 ft., msl, depths in the final video log (October 7, 2003). Evidence of up-hole flow in the open-hole section of the well was noted in the video log and corroborates the artesian condition.

Step Drawdown Test No. 2 – August 11, 2003. With the well deeper by an additional 127 ft.(from 1,672 ft. to 1,799 ft.) of open hole and with a 12.9 ft. higher head of 56.5 ft., msl, a second step drawdown test was performed on August 11, 2003 at pumping rates ranging from 800 gpm to 1,780 gpm. Drawdowns were unexpectedly greater than in Step Test No. 1 and ranged from 6.5 feet to 9.4 feet as shown in Figure 5. The step test record is shown in Appendix E. As in Step Test No. 1, drawdown measurements were made using an airline

system with a specially made large diameter pressure gage with division marks of tenth-of-a-foot of water. Based on the Step Test No. 2 data, the hydraulic conductivity of the aquifer was calculated to be 8,482 ft./day, which is too high, and the percentage of total head loss attributable to laminar flow was calculated to be 97.3%, which also is too high. The results raise the question of whether the data represents true aquifer conditions. The results of Step Drawdown Test No. 2 clearly are abnormal because the well was deepened 127 ft. in permeable basalts, and yet the drawdowns were greater, not less, than in Step Test No. 1 (see Figure 6). The apparent loss of yield in Step Test No. 2 may be due partly to the use of gel pellets (bentonite?), EZ Mud (anionic drilling polymer), and cement during the cleaning and drilling of the open hole. Based upon the step tests, the specific capacity of the well was originally **578** gpm per foot of drawdown (at 1,000 gpm) but was reduced to **137** gpm per foot of drawdown after the well was deepened 127 ft. to 1,799 ft. depth.

Constant Rate Test No. 2 – August 11-15, 2003. Constant Rate Test No. 2 began at 3:00 pm on August 11th, two hours after Step Test No. 2. The pumping rate was set at 1,650 gpm (2.35 mgd) and continued for 6,185 minutes (4.3 days) with one interruption of 80 minutes occurring 1,710 minutes after the start. A linear plot of the drawdown measured mostly at one-hour intervals with the same airline system used in Test No.1, is shown in Figure 7a. The test record is shown in Appendix E. Although diurnal fluctuations obscure the results, drawdown apparently stabilized at 9.4 ft. approximately 1,000 minutes after pumping started. Based on 1,650 gpm and a 9.4 ft. drawdown, the specific capacity of the well was **175** gpm per foot of drawdown. The well recovered instantly to within 2.5 ft. of the initial water level and to within 2.0 ft., 24 hours after pumping stopped.

In addition to the airline system, water level in the Keopu-State Well was also measured with a data logger. Water level was also measured with a data logger in the Haseko Well (3957-01) for a period of time before, during, and after the No. 2 tests. Data in both wells were recorded at 15 minute intervals and linear plots of drawdown in the two wells are shown in Figure 7b. Compared to the 9.4 ft. airline-determined drawdown in Figure 7a, the data logger-determined drawdown in Figure 7b stabilized at 9.8 ft. approximately 1,000 minutes after the start of pumping. The 0.4 ft. difference between the airline and data logger data is attributed to the difference in accuracies of the pressure gage and data logger.

Drawdown in the Haseko Well (3957-01) and the Keopu-State Well are synchronously plotted in Figure 7b. Assuming no regional trend, drawdown in the Haseko Well reached 0.6 ft. by the end of the constant rate test and recovered approximately 0.2 ft. the following day.

WATER QUALITY

The Keopu-State Well pumps high-level ground water that is of pristine quality in terms of salinity, having a chloride content of only 7 to 9 mg/L. The temperature of the pumped water measured 72 to 73° F. No other water quality tests were performed.

REFERENCES

Commission on Water Resource Management, Department of Land and Natural Resources, 2003, A Study of the Ground-Water Conditions in North and South Kona and South Kohala Districts, Island of Hawaii, 1991-2002. Prepared by Glenn R. Bauer.

Oki, Delwyn S., 1999, Geohydrology and Numerical Simulations of the Ground-Water Flow System of Kona, Island of Hawaii. U.S. Geological Survey Water-Resources Investigations Report 99-4073.

Water Resource Associates, March 2007, Hydrogeologic Feasibility Study for a High-Level Water Development Shaft at Keopu, North Kona, Hawaii. Prepared for Engineering Division, Department of Land and Natural Resources.

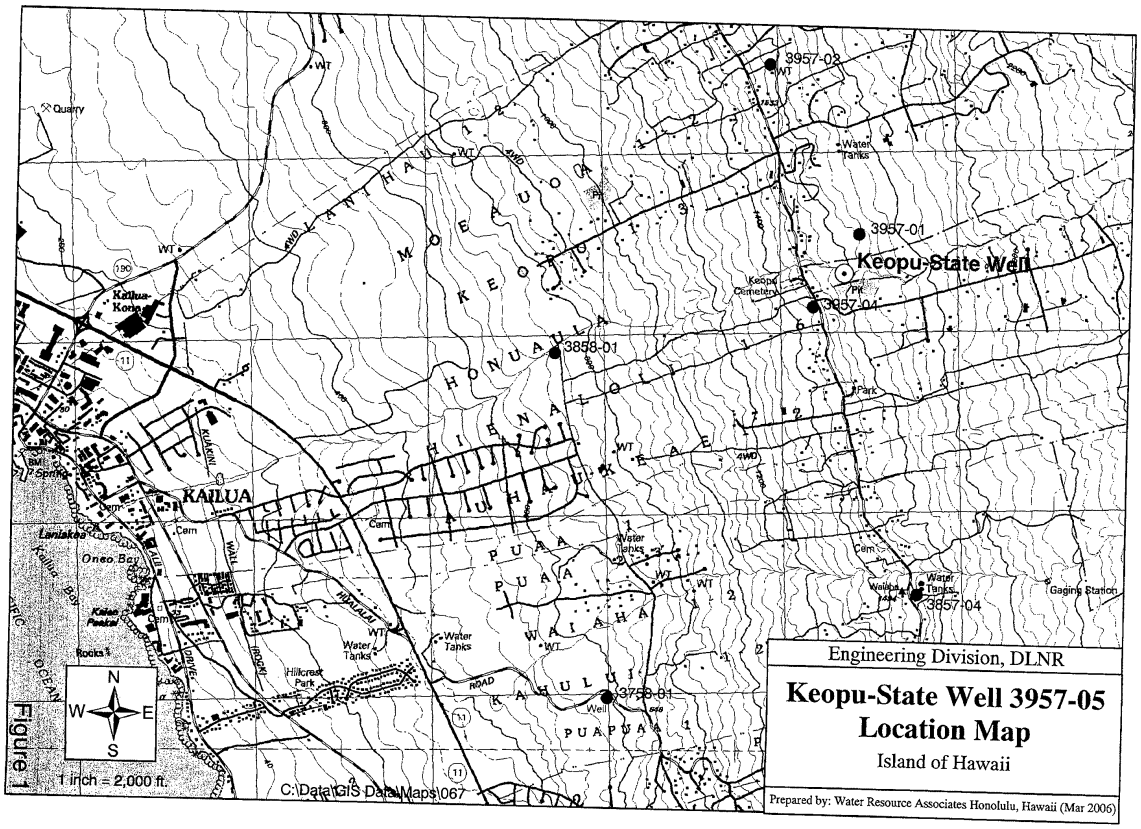
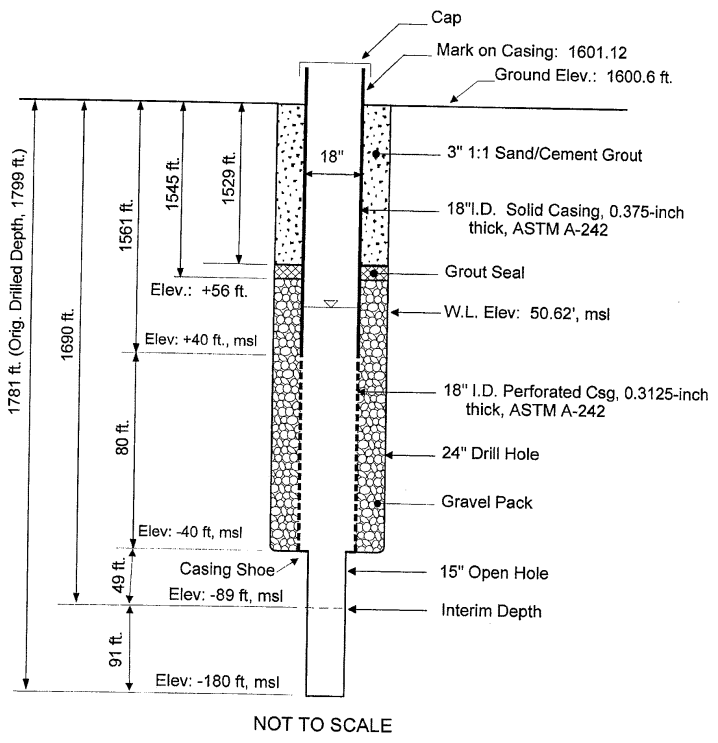


Figure 1

FIGURES

KEOPU EXPLORATORY WELL (3957-05), NORTH KONA, HAWAII
(TMK 7-5-13:22)

As-Built Section

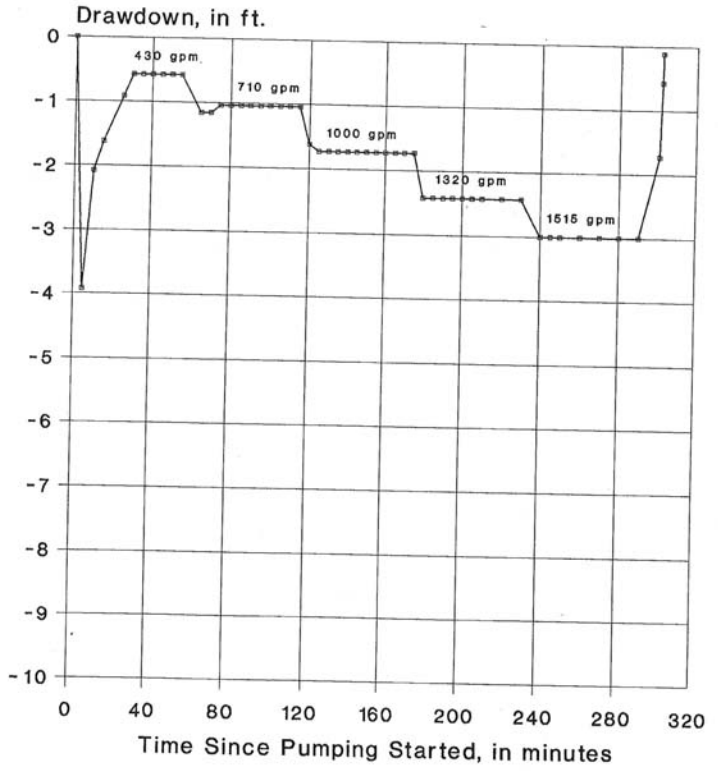


NOT TO SCALE

Water Resource Associates
067\keopu well report\Asbuilt

Figure 2

STEP DRAWDOWN CURVE, TEST NO.1
Keopu-State Well (3957-05), North Kona
Test: 7/29/2002 Depth=1672'(-71',msl)



Water Resource Associates
067SDC1

Figure 3

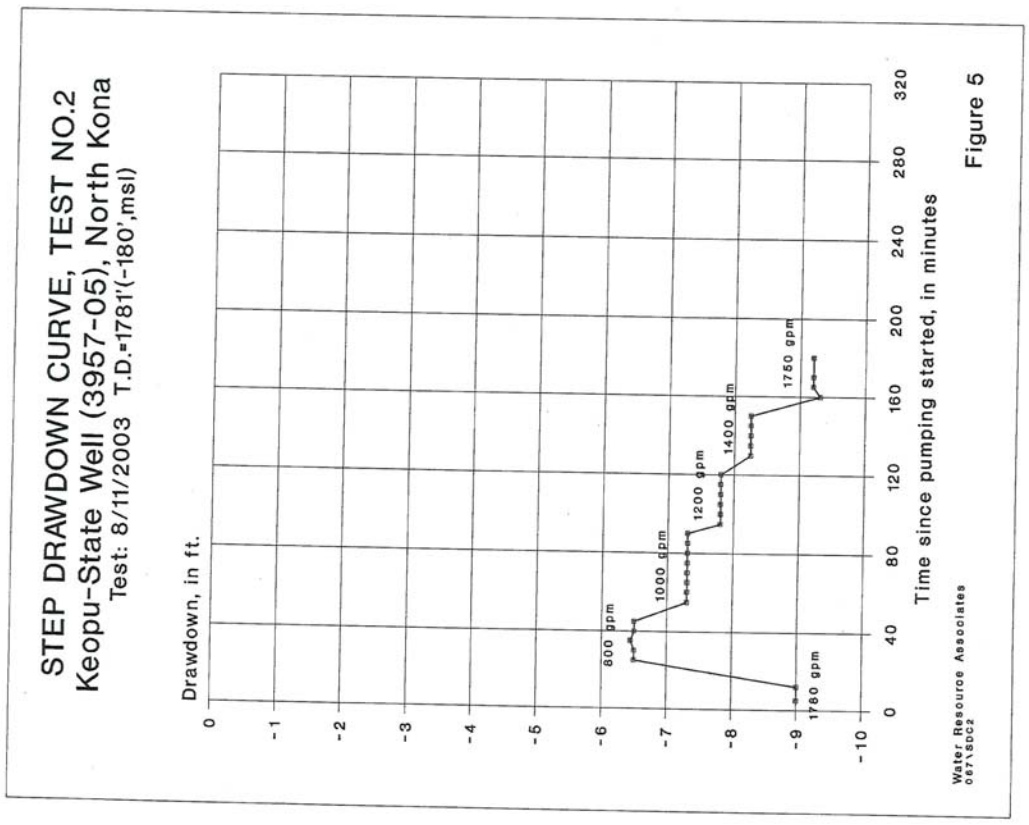


Figure 4. Time Drawdown Curve for Keopu-State Well (3957-05)
Constant Rate Test 1, August 5-9, 2002
North Kona, Hawaii

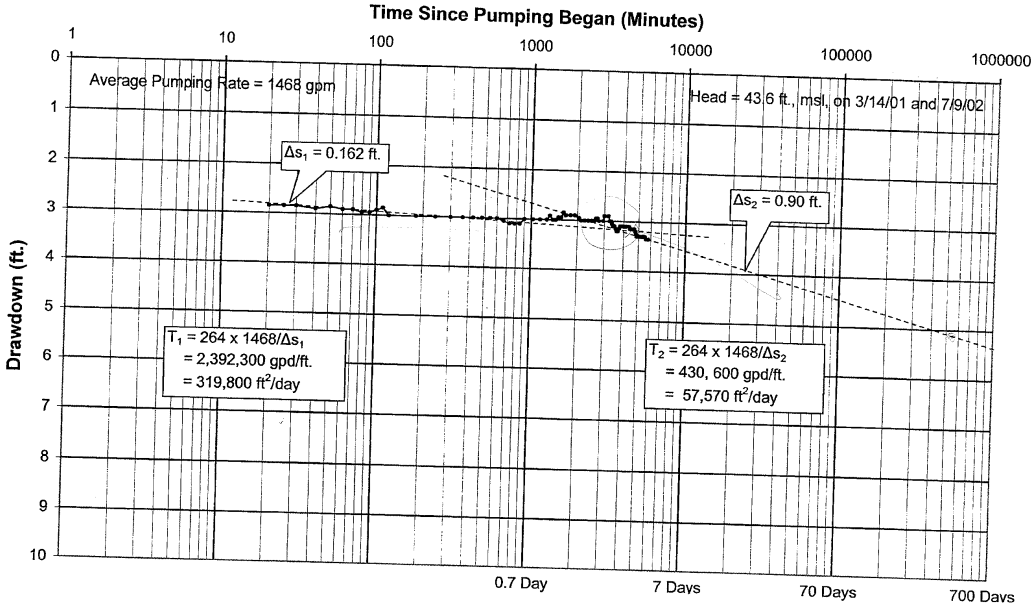


Figure 4

Water Resource Associates
067\Keopu Well Rpt\Figure 4.xls

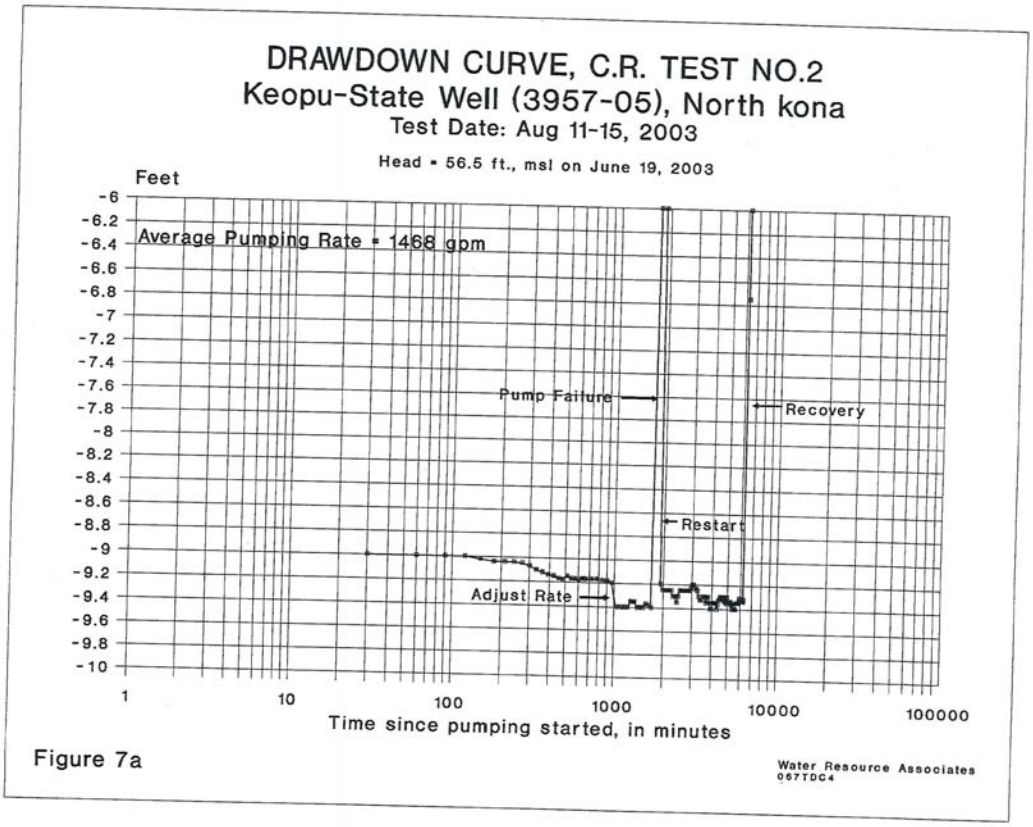


Figure 7a

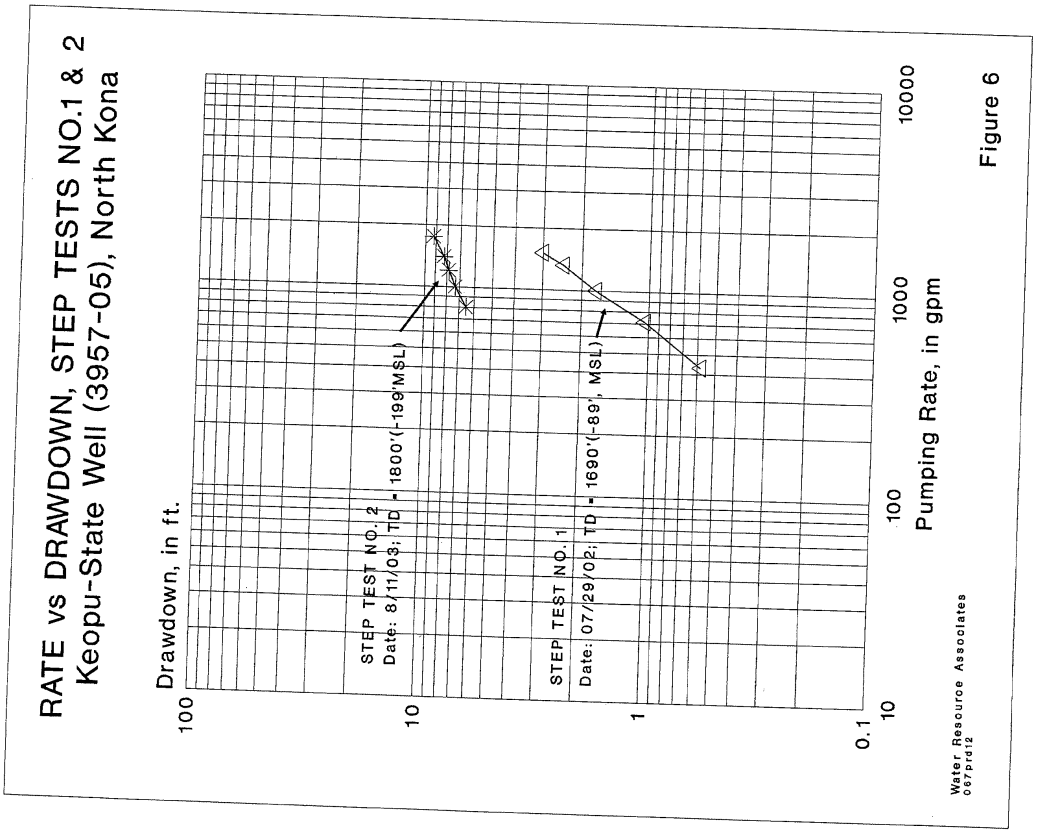


Figure 6

APPENDICES

Figure 7b. TIME-DRAWDOWN CURVE, CONSTANT-RATE TEST 2
Keopu-State Well (3957-05)
North Kona, Hawaii
4.3-Day Pumping Test: August 11-15, 2003

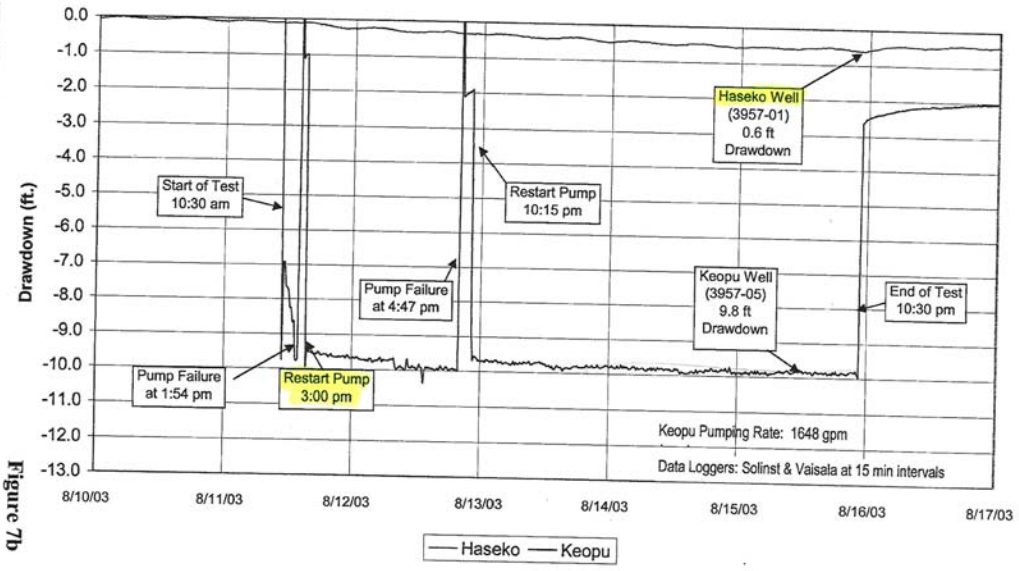


Figure 7b

WRA\067\KeopuWellReport\TestPeriod215 Min.xls\Aug11-15 '03 Recalculated

DRILLER'S LOG

Keopu-State Well (3957-05), North Kona, Hawaii

Date	Depth (ft) From	To	Interval Drilled (ft)	Drlg Time (hr)	Drlg Rate (ft/hr)	Driller's Remarks
7/27/2000						7/27 to 8/10 (Mobilization)
8/14/2000	18	22	4	2	2.0	Drill 12-1/4" hole
8/15/2000	22	32	10	4	2.5	Drill 12-1/4" hole. Mostly hard rock
8/17/2000	32	52	10	6.5	1.5	"
8/22/2000	52	60	8	4.5	1.8	"
8/23/2000	60	84	24	7.5	3.2	"
8/24/2000	84	119	35	8	4.4	"
8/28/2000	119	170	51	6.5	7.8	"
8/29/2000	170	210	40	4.5	8.9	"
8/30/2000	210	233	23	6.5	3.5	"
8/31/2000						Cement hole
9/5/2000	180	233				Drlg out cement, tag cement at 180.
9/5/2000	233	274	41	3.5	11.7	Drill 12-1/4" hole
9/6/2000	274	368	94	8	11.8	"
9/7/2000	368	430	62	7	8.9	"
9/13/2000	430	475	45	4.5	10.0	"
9/14/2000	475	554	79	7	11.3	"
9/18/2000	554	595	41	4	10.3	"
9/19/2000	595	662	67	7.5	8.9	"
9/20/2000	662	736	74	4.5	16.4	"
9/21/2000	736	808	72	7.5	9.6	"
9/25/2000	808	855	47	7.5	6.3	"
9/26/2000	855	953	98	8.5	11.5	"
9/27/2000	953	1075	122	7.5	16.3	"
9/28/2000	1075	1194	119	7.5	15.9	"
10/2/2000	1194	1290	96	7	13.7	" Run camera
10/3/2000	1290	1383	93	5.5	16.9	"
10/4/2000	1383	1475	92	7.5	12.3	"
10/5/2000	1475	1588	113	8	14.1	"
10/9/2000	1588	1628	40	6	6.7	"
10/11/2000						Water level at 1551 ground level (1600.6-1551=49.6', msl). TD = -27.4', msl.
10/17/2000	1628	1655	27	2.5	10.8	Drill 12-1/4" hole
10/19/2000	1630	1655				Ream 25' to bottom
10/19/2000	1655	1698	43	5.5	7.8	Drill 12-1/4" hole, RKB 1698
10/23/2000	20	23	3	0.5	6.0	Open hole to 17-1/2"
10/24/2000	23	118	95	9	10.6	"

APPENDIX A

Date	Depth (ft) From	To	Interval Drilled (ft)	Drlg Time (hr)	Drlg Rate (ft/hr)	Driller's Remarks
10/25/2000	118	168	50	8.5	5.9	Open hole to 17-1/2"
10/31/2000	218	230	12	6	2.0	"
11/1/2000	230	239	9	6.5	1.4	"
11/3/2000	239	280	41	4.5	9.1	"
11/6/2000	280	326	46	7.5	6.1	"
11/7/2000	326	410	84	9	9.3	"
11/8/2000	410	497	87	8	10.9	"
11/9/2000	497	597	100	8	12.5	2 hrs, open hole 17-1/2; 4 hrs open hole to cir.
11/13/2000	597	655	58	7.5	7.7	Open hole to 17-1/2"
11/14/2000	655	685	30	7.5	4.0	"
11/20/2000	685	755	70	7	10.0	"
11/21/2000	755	781	26	6	4.3	"
11/22/2000	781	848	67	2	33.5	Open hole to 17-1/2"
11/27/2000	848	932	84	7	12.0	"
11/28/2000	932	1026	94	8.5	11.1	"
11/29/2000	1026	1126	100	6.5	15.4	"
11/30/2000	1126	1248	122	8	15.3	"
12/4/2000	1248	1341	93	7.5	12.4	"
12/5/2000	1341	1465	124	8	15.5	"
12/6/2000	1465	1556	91	8	11.4	"
12/7/2000	1556	1641	85	8	10.6	"
12/11/2000	1641	1649	8	1	8.0	"
						Drilled 17-1/2" hole to 1649 RKB, 1640 gl
12/11/2000	20	25	5	1	5.0	Open hole to 24"
12/12/2000	25	84	59	9	6.6	"
12/13/2000	84	130	46	9	5.1	"
12/14/2000	130	190	60	9	6.7	"
12/18/2000	190	220	30	8.5	3.5	"
12/19/2000	220	232	12	8	1.5	"
12/20/2000	232	283	51	8	6.4	"
12/21/2000	283	329	46	7.5	6.1	"
1/2/2001	329	376	47	7.5	6.3	"
1/3/2001	376	432	56	8.5	6.6	"
1/4/2001	432	500	68	9	7.6	"
1/8/2001	500	581	81	4.5	18.0	"
1/9/2001	581	669	88	8	11.0	"
1/10/2001	669	750	81	8	10.1	"
1/11/2001	750	805	55	7.5	7.3	"
1/16/2001	805	815	10	4.5	2.2	"
1/17/2001	815	863	48	7.5	6.4	"

Date	Depth (ft) From	To	Interval Drilled (ft)	Drlg Time (hr)	Drlg Rate (ft/hr)	Driller's Remarks
1/18/2001	863	914	51	8	6.4	Open hole to 24"
1/19/2001	914	970	56	7.5	7.5	"
1/29/2001	1196	1250	54	7	7.7	"
1/30/2001	1250	1314	64	6.5	9.8	"
1/31/2001	1314	1407	93	7	13.3	"
2/1/2001	1407	1478	71	6.5	10.9	"
2/6/2001	1478	1560	82	7.5	10.9	"
2/7/2001	1560	1605	45	5	9.0	"
2/8/2001	1605	1652	47	6.5	7.2	"
2/15/2001						Rigup camera and RIH and run plumbness test
2/21/2001						Run camera in open hole; run in hole with camera to catch water sample. Note: water dirty, no picture in water.
2/22/2001						Run camera in open hole.
2/26/2001						Start running 18" casing in hole.
2/27/2001						9.5 hrs., run casing
2/28/2001						6.5 hrs., run casing
3/1/2001						7.5 hrs., run casing
3/5/2001						3 hrs., weld csg to beam; 3.5 hrs RIH w/tremie pipe
3/6/2001						4.5 hrs, rig up camera on RIH & start adding gravel down backside of csg
3/7/2001						9.5 hrs, add rock down backside of csg
3/8/2001						5.5 hrs, add more rock, watch w/camera inside csg; 4 hrs, add sand seal, add 8 sks of cement.
3/12/2001						Rig up camera and RIH inside of casing.
3/12/2001						7:30 - 8:30, Add 4 yds of cement
						2:00 - 2:30, Add 8 yds of cement
3/13/2001						7:00 - 8:00, Add 8 yds of cement down back side of casing; 2:00 - 3:00, Add 8 yds of cement
3/14/2001						7 - 8, add 8 yds of cement down back side of csg; 2 - 3, add 8 yds of cement. Note: With new water probe, we came out with water level at 1557' (1600.6-1557=43.6',msl). TD = -51.4', msl.
3/15/2001						7 - 8, Add 8 yds of cement
						2 - 3, Add 8 yds of cement
3/16/2001						7 - 8, Add 8 yds of cement
						10 - 11, Add 8 yds of cement
7/11/2001	0	1060				RIH to 1060

Date	Depth (ft) From	To	Interval Drilled (ft)	Drlg Time (hr)	Drlg Rate (ft/hr)	Driller's Remarks
7/12/2001	1060	1640				RIH & started cleaning 12-1/4" pilot
7/16/2001						Cleaning 12-1/4" pilot pass 1640-1690'
7/19/2001						Demob. drilling equipment & secure location
1/15/2002						Begin installing test pump
1/16/2002						Install test pump. Airline & monitor tube @ top of pump.
1/17/2002						" " "
1/21/2002						" " "
1/22/2002						" " "
1/23/2002						" " "
1/24/2002						" " "
1/25/2002						" " "
1/28/2002						Install right angle drive on discharge head
1/29/2002						Complete 1609.08' pump assembly (19.33' pump). Airline set at 1590', W.L. = 1555' (1600.6-1555=45.6', msl). TD = -39.4', msl.
1/30 to 5/20/02 - (NO DRILLER'S LOG)						
5/21/2002 (Four months later, use cable tool rig)						Bail well to 1655' TOOH (trip out of hole); swab 1570' to 1600' & back to 1555'
5/22/2002						Swab well to 1600'. RIH with bailer. Bailing 1672' & swab again.
5/23/2002						Swab well and bail (7 hrs.)
5/24/2002						Bail well (5 hrs.)
5/28/2002						Surge well with surge block to 1610' T.O.O.H. and bail to 1680' (7 hrs.)
5/29/2002						Bail well clean to 1680'. RIH with surge block & surged 1560'-1630' (7 hrs.)
5/30/2002						Bail and surge well (7 hrs.). Bringing out more fine material. Now surge block seems to be working good.
5/31/2002						Surge and bail well 1560' - 1630'(7 hrs.)
6/30/2002						Surging and bailing well (7 hrs.)
6/4/2002						" " " " (7 hrs.)
6/5/2002						" " " " (7 hrs.)
6/6/2002						" " " " (8 hrs.)
6/7/2002						" " " " (5 hrs.)
6/10/2002						Run camera in hole. Water was clear. Bottom of hole 1676'.
6/11/2002						Run drilling tools in hole to 1500'.
6/12/2002						Run drilling tools in hole to 1570'.
6/13/2002						Work on clutch on 36L cable tool rig.
6/17/2002						Drill out pilot hole 1670' - 1672' (1 hr.)
6/18/2002						Drill out pilot hole at 1672' (3 hrs.)
6/19/2002						Drill out and bail well (7 hrs.)
6/21/2002						RIH with magnet and bail hole (4-1/2 hrs.)

Date	Depth (ft) From	To	Interval Drilled (ft)	Drlg Time (hr)	Drlg Rate (ft/hr)	Driller's Remarks
6/24/2002						RIH with magnet and bail hole (7 hrs.)
6/25/2002						Bail hole clean (6 hrs.)
6/26/2002						Bail hole clean (6 hrs.)
7/2/2002						Rig down 36L cable tool.
7/9/2002						Sound well with probe. W.L. at 1557' GL (1600.6-1557=43.6',msl). TD = -71.4', msl. Begin installing test pump: screen 31.80', pump bowls 19.33', 5' joint.
7/10/2002						Installing test pump.
7/11/2002						" " "
7/12/2002						" " "
7/15/2002						" " "
7/16/2002						" " "
7/17/2002						Complete pump installation. Pump suction set at 1609'. No. 1 airline at 1590'. No. 2 airline at 1615'. Water level at 1557' GL (1600.6-1557=43.6', msl). TD =- 71.4', msl.
7/29/2002						Prepare to run pump test.
8/8/2002						Pump test.
8/9/2002						Pump test.
8/20/2002						Rig down. Sound wall.
8/21/2002						Begin removing test pump.
8/22/2002						Removing test pump.
9/3/2002						" " "
9/4/2002						TOOH with test pump.
5/5/2003						Clean out hole with bailer and bit, 36L cable tool rig.
5/6/2003						Clean out hole with bailer and bit, 36L rig. Getting lots of buttons out and good size piece of bearing race.
5/7/2003						Mix gell pills and try to break up cone bit and bail out buttons. Bailing out cone bit.
5/8/2003						Continue busting cone and bailing.
5/9/2003						Continue bailing and stirring up bottom. Something fell in tools, tight hole, got loose, add gell pellet slug to sit over weekend.
5/12/2003						RIH with bit and worked to bottom of hole. TOOH with bit and bail more junk.
5/13/2003	1700	1707				Red cinders.
5/14/2003	1707	1715				" "
5/15/2003	1715					Hit something hard. Bailing out red and black cinders. Hard to make hole.
5/16/2003	1715					Check hole. Two feet of fill. Place 3-sacks of cement. Tag 2 1/2' to 3' higher. Sitr it up. TOOH.
5/20/2003	1717	1720				Drill out cement. Piece of bit broke off.

Date	Depth (ft) From	To	Interval Drilled (ft)	Drlg Time (hr)	Drlg Rate (ft/hr)	Driller's Remarks
5/21/2003	1720	1725				Mixed EZ mud slug and chase it to bottom of hole.
5/22/2003	1725	1728				RIH to 1722', drill to 1728'.
5/23/2003	1728					Not drilling good. Place a gell slug in hole at end of shift.
5/27/2003	1728	1730				Drill 15" hole. Pounding and bailing.
5/28/2003	1730					RIH with bit. EZ mud sweep. Mix and go to drilling hard.
6/2/2003	1730	1734				Drill 15" hole.
6/3/2003	1734	1737				Bail out 2' of fill and drill.
6/4/2003	1737	1744				Bail fines, cinder, sand.
6/5/2003	1744	1750				Drill and bail.
6/6/2003	1750	1755				Drill 15" hole and bail.
6/9/2003	1755	1760				Mix gel and EZ mud pills and placein hole with bit. 9' of fill. Place another pill with bit. Drill out fill and 5" of new hole. Bail hole clean.
6/10/2003	1760	1765				Drill out 2' of fill and 5' new hole.
	1765	1768				Firm rock. Add EZ mud and drill to 1768'.
	1768	1770				Soft rock. Bail but not much cuttings.
6/12/2003	1770	1775				
6/13/2003	1775					1' of fill. Drilling but no progress. 15" hole.
6/14/2003	1775					Add 5 bags cement, gel pellets, and 2 gallons EZ mud.
6/16/2003	1775					Tag cement high. Hit it and bit fell to bottom. About 3' fill. Bailed mostly water.
6/19/2003	1775					1' fill. HARD rock, no progress drilling. Measure W.L. with probe: 1545.6' to top of casing, 1544.1' GL (1600.6-1544.1=56.5', msl). TD = -174.4', msl.
6/23/2003	1775	1779				Place one can of gel pellets in hole. RIH with 15" bit, no fill, drill to 1779'.
6/24/2003	1779	1790				No fill, drill to 1790'
6/26/2003	1790	1800				Drill 15" hole. Bail clean.
6/28/2003						Tagged hole at 1795'. Clean hole to 1799'.
6/29/2003						Demobilize cable tool rig.
7/1/2003						Prepare test pump.

WRA\067\Drillog.xls

STEP DRAWDOWN TEST NO. 1 RECORD

July 29, 2002

Well Name Keopu-State
Project _____
DEPTH (Below Ground Surface):
18" Solid Csg: 1561' Perforated Csg: 1641'
Total Depth: Bailed to 1690' (1698' orig TD)
Depth to Water: 1557' Airline: 1590'*
*Remarks: Driller's info
TEST PUMP:
Type: Line shaft Intake Depth: 1609' (-8',msl)
DISCHARGE MEASUREMENT: X Flowmeter __ Other_____
PRESENT AT TEST: Dan Lum

State Well No. 3957-05
Island Hawaii
ELEVATIONS (Mean Sea Level):
Ground Surface: 1600.6 ft.
Top of Casing: _____ ft. Rotary Table: _____ ft.
Bot. of Solid Csg: +40' msl Bot. of Perf. Csg: -40' msl
Bot. of Well: -89' msl Static Water Level: 41.61'*
DRAWDOWN MEASUREMENT:
_ Manometer X Pressure Gage _ Elect. Probe

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Reading (psi)	DTW Reading (feet)	Observed Drawdown (feet)	Sample No.	Chlorides (mg/L)	Temp. (°F)	Cond. (μmhos 25°C)
	7/29/02								
	11:10 am	0	13.2						
	11:35		13.3						
	11:50	0	13.25		0				
0	12:00 N	START PUMP - ADJUST TO 400 gpm							
5	12:05 pm		11.55		3.93				
10	12:10		12.35		2.08				
15	12:15		12.55		1.62				
20	12:20	430						70.0	
25	12:25		12.85		0.92				
30	12:30	422	13.00		0.58				
35	12:35		13.0		0.58				
40	12:40	423	13.0		0.58				
45	12:45		13.0		0.58				
50	12:50	428	13.0		0.58				
55	12:55	433	13.0		0.58				
60	1:00	Adjust rate	13.0						
65	1:05		12.75		1.16				
70	1:10	712	12.75		1.16			70.5	
75	1:15		12.80		1.04				

APPENDIX B

Step Drawdown Test No. 1 Record (Cont'd)
Well Name: Keopu-State State Well No. 3957-05 July 29, 2002

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Reading (psi)	DTW Reading (feet)	Observed Drawdown (feet)	Sample No.	Chlorides (mg/L)	Temp. (°F)	Cond. (μmhos 25°C)
	7/29/02								
80	1:20 pm	714	12.80		1.04	1			
85	1:25		12.80		1.04				
90	1:30		12.80		1.04				
95	1:35		12.80		1.04			71.5	
100	1:40	711	12.80		1.04				
105	1:45		12.80		1.04				
110	1:50		12.80		1.04				
115	1:55	708	12.80		1.04				
120	2:00	Adjust rate	12.55		1.62				
125	2:05	998	12.50		1.73				
130	2:10		12.50		1.73				
135	2:15	1001	12.50		1.73			70.0	
140	2:20		12.50		1.73				
145	2:25		12.50		1.73				
150	2:30	1002	12.50		1.73				
155	2:35		12.50		1.73				
160	2:40		12.50		1.73				
165	2:45	1003	12.50		1.73				
170	250		12.50		1.73				
175	2:55		12.50		1.73				
180	3:00	Adjust rate	12.20		2.42			70.0	
185	3:05	1331	12.20		2.42				
190	3:10	1320	12.20		2.42				
195	3:15		12.20		2.42				
200	3:20		12.20		2.42				
205	3:25		12.20		2.42				
210	3:30	1322	12.20		2.42				
220	3:40		12.20		2.42				
230	3:50	1313	12.20		2.42			70.0	
240	4:00	Adjust rate	11.95		3.00				

Step Drawdown Test Record (Cont'd)

Well Name: Keopu-State State Well No. 3957-05 July 29, 2002

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Reading (psi)	DTW Reading (feet)	Observed Drawdown (feet)	Sample No.	Chlorides (mg/L)	Temp. (°F)	Cond. (μmhos 25°C)
	7/29/02								
245	4:05 pm	1529	11.95		3.00				
250	4:10	1514	11.95		3.00				
260	4:20		11.95		3.00				
270	4:30	1518	11.95		3.00			70.0	
280	4:40	1516	11.95		3.00	2	9 (lab)		
290	4:50		11.95		3.00				
300	5:00	0	STOP PUMP - RECOVERY						
0.5			12.5		1.73				
1.83			13.00		0.58				
2.00			13.2		0.12				
2.5			13.35		+0.23				
2.83			13.5		+0.58				
3.67			13.65		+0.92				
4.16			13.70		+1.04				
4.83			13.70		+1.04				
5.42			13.70		+1.04				
6.25			13.65		+0.92				
7.00			13.50		+0.58				
7.75			13.40		+0.35				
8.50			13.30		+0.12				
9.16			13.40		+0.35				
10.16			13.30		+0.12				

HYDRAULIC CONDUCTIVITY, K

Keopu-State Well (3957-05)
Step-Drawdown Test No. 1: July 29, 2002
TD = 1690 ft. (-89 ft., msl)

From s/Q Curve:

$B = 109 \times 10^{-5}$

$C = 5.81 \times 10^{-7}$

$s_{total} = s_{aq} + s_{well}$

$= BQ + CQ^2$ (Jacob's Eqn)

$s_{aq} = BQ = 109 \times 10^{-5} \times 1515 \text{ gpm} = 1.65 \text{ ft.}$

$s_{well} = CQ^2 = 5.81 \times 10^{-7} \times 2.29 \times 10^6 = 1.33 \text{ ft.}$

$s_{total} = 1.65 + 0.81 = 2.98$ ft.; compares w/3.00 ft. obs'd at 1515 gpm

$r_d = 1.0$ ft.

$$r_h = \frac{D}{\ln(D \div r_d)}$$

where D = active length of well = 115 ft.
(43.6 ft. hd + T.D. = -71.4 ft., below msl)

$$0 = \frac{115}{\ln(115 \div 1)} = \frac{115}{4.74} = 24.3 \text{ ft.}$$

$$K = \frac{Q}{2\pi r_h s_{well}} = \frac{2.916 \times 10^5}{6.286 \times 24.3 \times 1.33}$$

Q = 1515 gpm x 1440/7.48
$= 2.916 \times 10^5$

$= 1{,}435$ ft/day

$T = Kb = 1{,}435 \times 43.6 \times 41 = 2{,}565{,}200 \text{ ft}^2/\text{d}$

Lp = Percentage of total head loss attributable to laminar flow.

$$= \frac{BQ \times 100}{BQ + CQ^2} = \frac{1.65 \times 100}{1.65 + 1.33} = 55.4\%$$

Dan Lum (10/08/07)
067\Keopu Well Rpt\Rev. Appendix C.doc

APPENDIX C

CONSTANT RATE TEST NO. 1 RECORD

August 5, 2002

Well Name: Keopu-State
Project: _____
DEPTH (Below Ground Surface):
18" Solid Csg: 1561' Perforated Csg: 1641'
Total Depth: Bailed to 1690' (1698' orig. TD)
Depth to Water: _____ *
*Remarks: _____
TEST PUMP:
Type: Line Shaft Intake Elev: 1609' (-8', msl)
DISCHARGE MEASUREMENT: X Flowmeter _ Other _____
PRESENT AT TEST: Dan Lum and Jack Lindeberg

State Well No. 3957-05
Island: Hawaii
ELEVATIONS (Mean Sea Level):
Ground Surface: 1600.6 ft.
Top of Casing: _____ ft. Rotary Table: _____ ft.
Bot. of Solid Csg: +40', msl Bot. of Perf. Csg: -40', msl
Bot. of Well: -89', msl Static Water Level: _____
DRAWDOWN MEASUREMENT:
_ Manometer X Pressure Gage _ Elect. Probe
Begin Meter: 951,000 gals
End Meter: 9,257,000 gals
Total Pumped: 8,306,000 gals
Ave. Rate: 1,468 gpm

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Reading (ft.)	Observed Drawdown (feet)	Sample No.	Chlorides (mg/L)	Temp (°F)	Cond. (μmhos 25°C)
	8/5/02							
	9:40 am	0	29.80					
	9:50		29.85					
	10:00		29.75					
	10:10		29.80					
	10:20		29.80					
	10:30		29.80					
	10:40		29.75					
	10:50	0	29.75					
0	11:00		29.70	START PUMP				
5	11:05	1538	25.70	4.00				
10	11:10	1538	25.95	3.75				
15	11:15	1538	26.35	3.35				
20	11:20	1500	26.85	2.85				
25	11:25	1500	26.85	2.85				
30	11:30	1500	26.85	2.85				
40	11:40	1500	26.80	2.90				
50	11:50	1500	26.85	2.85				
60	12:00 N	1500	26.80	2.90	1	7.3 (lab)		139 (lab)
70	12:10 pm	1500	26.80	2.90				
80	12:30	1500	26.75	2.95			0.5	130

APPENDIX D

Constant Rate Test No. 1 Record (Cont'd)
Well Name: Keopu-State State Well No. 3957-05 August 5, 2002

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Reading (feet)	Observed Drawdown (feet)	Sample No.	Chlorides (mg/L)	Temp (°F)	Cond. (μmhos 25°C)
	8/5/02							
90	12:30pm	1500	26.75	2.95			9.5	
100	12:40	1500	26.80	2.90				
110	12:40	1500	26.85	2.85				
120	1:00	1500	26.70	3.00				130
180	2:00	1500	26.70	3.00			70.0	140
240	3:00	1500	26.70	3.00			70.0	140
300	4:00	1500	26.70	3.00				
360	5:00	1500	26.70	3.00				
420	6:00	1500	26.70	3.00				140
480	7:00	1500	26.70	3.00				
540	8:00	1500	26.70	3.00				
600	9:00	1500	26.70	3.00				
660	10:00	1500	26.65	3.05				
720	11:00	1500	26.60	3.10				
780	12:00 M	1500	26.60	3.10				
	8/6/02							
840	1:00am	1500	26.60	3.10				
900	2:00	1500	26.70	3.00				
960	3:00	1500	26.70	3.00				
1020	4:00	1500	26.70	3.00				
1080	5:00	1500	26.70	3.00				
1140	6:00	1500	26.70	3.00			70.0	140
1200	7:00	1500	26.70	3.00	2	--		176 (lab)
1260	8:00	1500	26.70	3.00			70.0	140
1320	9:00	1500	26.80	2.90			70.0	130
1380	10:00	1500	26.70	3.00				
1440	11:00	1463	26.70	3.00				
1500	12:00 N	1463	26.75	2.95			70.0	140

Constant Rate Test No. 1 Record (Cont'd)
Well Name: Keopu-State State Well No. 3957-05 August 5, 2002

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Reading (feet)	Observed Drawdown (feet)	Sample No.	Chlorides (mg/L)	Temp (°F)	Cond. (μmhos 25°C)
	8/6/02							
1560	1:00 pm	1463	26.75	2.95				
1620	2:00	1425	26.85	2.85			70.0	140
1680	3:00	1428	26.80	2.90			70.0	140
1740	4:00	1442	26.80	2.90				
1800	5:00	1431	26.80	2.90				
1860	6:00	1433	26.80	2.90			70.0	140
1920	7:00	1462	26.80	2.90				
1980	8:00	1462	26.80	2.90				
2040	9:00	1462	26.80	2.50				
2100	10:00	1433	26.70	3.00				
2160	11:00	1464	26.70	3.00				
2220	12:00 M	1463	26.70	3.00			70.0	140
	8/7/02							
2280	1:00 am	1463	26.70	3.00				
2340	2:00	1463	26.70	3.00				
2400	3:00	1463	26.70	3.00				
2460	4:00	1463	26.70	3.00				
2520	5:00	1460	26.70	3.00			70.0	140
2580	6:00	1463	26.70	3.00				
2640	7:00	1463	26.75	2.95				
2700	8:00	1456	26.75	2.95	3	7.0 (lab)	70.0	150
2760	9:00	1456	26.70	3.00				
2820	10:00	1431	26.70	3.00				
2880	11:00	1425	26.70	3.00			70.0	140
2940	12:00 N	1425	26.70	3.00				
3000	1:00 pm	1435	26.80	2.90				
3060	2:00	1435	26.80	2.90			70.0	140
3120	3:00	1435	26.80	2.90				

Constant Rate Test No. 1 Record (Cont'd)
Well Name: Keopu-State State Well No. 3957-05 August 5, 2002

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Reading (feet)	Observed Drawdown (feet)	Sample No.	Chlorides (mg/L)	Temp (°F)	Cond. (μmhos 25°C)
	8/7/02							
3180	4:00 pm	1428	26.80	2.90				
3240	5:00	1456	26.70	3.00			70.0	140
3300	6:00	1456	26.70	3.00				
3360	7:00	1463	26.65	3.05				
3420	8:00	1464	26.60	3.10				
3480	9:00	1459	26.60	3.10			70.0	140
3540	10:00	1464	26.55	3.15				
3600	11:00	1464	26.50	3.20				
3660	12:00 M	1464	26.50	3.20				
	8/8/02							
3720	1:00 am	1463	26.55	3.15				
3780	2:00	1463	26.60	3.10				
3840	3:00	1464	26.60	3.10			70.0	140
3900	4:00	1463	26.60	3.10				
3960	5:00	1463	26.60	3.10				
4020	6:00	1463	26.60	3.10				
4080	7:00	1463	26.60	3.10	4	9.2 (lab)	70.0	140
4140	8:00	1463	26.60	3.10				
4200	9:00	1459	26.60	3.10				
4260	10:00	1449	26.60	3.10			70.0	140
4320	11:00	1463	26.00	3.10				
4380	12:00 N	1463	26.55	3.15				
4440	1:00 pm	1463	26.55	3.15			70.0	140
4500	2:00	1463	26.55	3.15				
4560	3:00	1463	26.55	3.15				
4620	4:00	1470	26.55	3.15			70.5	140
4680	5:00	1470	26.55	3.15				
4740	6:00	1470	26.50	3.20				

Constant Rate Test No. 1 Record (Cont'd)
Well Name: Keopu-State State Well No. 3957-05 August 5, 2002

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Reading (feet)	Observed Drawdown (feet)	Sample No.	Chlorides (mg/L)	Temp (°F)	Cond. (μmhos 25°C)
	8/8/02							
4800	7:00 pm	1481	26.45	3.25			70.0	140
4860	8:00	1496	26.40	3.30				
4920	9:00	1500	26.40	3.30				
4980	10:00	1500	26.40	3.30				
5040	11:00	1500	26.40	3.30				
5100	12:00 M	1500	26.40	3.30				
	8/9/02							
5160	1:00 am	1496	26.40	3.30				
5220	2:00	1496	26.40	3.30				
5280	3:00	1496	26.40	3.30				
5340	4:00	1496	26.40	3.30				
5400	5:00	1496	26.40	3.30				
5460	6:00	1496	26.40	3.30			70.0	140
5520	7:00	1481	26.40	3.30	5	6.5 (lab)	70.0	140
5580	8:00	1481	26.35	3.35				
5640	9:00	1481	26.35	3.35				
5700	10:00	1470	26.35	3.35			70.0	140
5760	11:00	STOP PUMP						
0		RECOVERY						
0.47			28.2	1.5				
1.0			30.0	+0.3				
2.0			30.2	+0.5				
2.5			30.55	+0.85				
3			30.55	+0.85				
3.5			30.3	+0.6				
4			30.15	+0.45				
5			30.15	+0.45				
6			29.9	+0.2				

Constant Rate Test No. 1 Record (Cont'd)
Well Name: Keopu-State State Well No. 3957-05 August 5, 2002

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Reading (feet)	Observed Drawdown (feet)	Sample No.	Chlorides (mg/L)	Temp (°F)	Cond. (μmhos 25°C)
	8/9/02							
7			30.0	+0.3				
8			29.45	0.25				
9			29.30	0.4				
10			29.25	0.45				
11			29.1	0.6				
12			29.2	0.5				
13			29.55	0.15				
14			29.4	0.3				
15			29.15	0.55				
16			29.1	0.6				
17								
18								
19			29.25	0.45				
20			29.15	0.55				
25			29.25	0.45				
30			29.3	0.4				
35			29.35	0.35				
40			29.35	0.35				
45			29.35	0.35				

STEP DRAWDOWN & CONSTANT RATE TEST NO. 2 RECORD

Test No. 2
Date: Aug. 11, 2003

Well Name: Keopu-State
Project:
Depth (below ground surface, in ft):
Solid Csg: 1561
Perforated Csg: 1641
Total Depth: 1800
Depth to Water*:
*Remarks:
Test Pump:
Type:
Intake Elev.:
Discharge Measurement:
■ Flowmeter □ Other: _____
Present at Test: Derrick, Craig, Bob, Dan

State Well No.: 3957-05
Island: Hawaii
Elevations (mean sea level, in ft):
Ground Surface: 1601.12
Top of Casing:
Rotary Table:
Bottom of Solid Csg: +40
Bottom of Perf. Csg: -40
Bottom of Well:
Static Water Level:
DRAWDOWN MEASUREMENT:
□ Manometer ■ Pressure Gage □ Elect. Probe
Begin Meter (gals): 10,207,000
End Meter (gals): 20,433,000

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Rdg (psi)		Observed Drawdown (ft)	Sample No.	Chlorides (mg/L)	Temp. (°F)	Cond. (µmhos 25°C)
	8/11/03	1750							
	10:25 AM	0	37.60		0				
	10:27	0	37.60		0				
	10:30			Start pump					
	10:35	1780	28.60		9.00				
	10:42	1780	28.30		9.30				
	10:55	800	31.10		6.50				
	11:00		31.10		6.50				
	11:05		31.15		6.45				
	11:10		31.10		6.50				
	11:15		31.10		6.50				
	11:20	900	30.75		6.85				
	11:25	1000	30.30		7.30				
	11:30		30.30		7.30				
	11:35		30.30		7.30				
	11:40		30.30		7.30				
	11:45		30.30		7.30				
	11:50		30.30		7.30				
	11:55		30.30		7.30				
	12:00 N		30.30		7.30				
	12:05 PM	1200	29.80		7.80				
	12:10		29.80		7.80				
	12:15		29.80		7.80				
	12:20		29.80		7.80				
	12:25		29.80		7.80				
	12:30		29.80		7.80				
	12:35	1400	29.30		8.30				

APPENDIX E

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Rdg (psi)		Observed Drawdown (ft)	Sample No.	Chlorides (mg/L)	Temp. (°F)	Cond. (µmhos 25°C)
	12:40		29.35		8.25				
	12:45		29.35		8.25				
	12:50		29.35		8.25				
	12:55		29.35		8.25				
	1:00		29.35		8.25				
	1:10	1750	28.30		9.30				
	1:15		28.40		9.20				
	1:20		28.40		9.20				
	1:30		28.40		9.20	1	9		190
	1:54	0		Pump Motor Automatic Shutdown - overheated					
	3:00			Start Pump					
	3:30	1650	28.60		9.00				
	4:00	1635	28.60		9.00	(meter rdg: 10,552,000 gals)			
	4:30	1645	28.60		9.00				
	5:00	1645	28.60		9.00				
	5:30	1645	28.58		9.02				
	6:00	1645	28.56		9.04				
	6:30	1640	28.56		9.04				
	7:00	1645	28.56		9.04				
	7:30	1645	28.55		9.05				
	8:00	1640	28.53		9.07				
	8:30	1640	28.50		9.10				
	9:00	1640	28.48		9.12				
	9:30	1645	28.46		9.14				
	10:00	1630	28.45		9.15				
	10:30	1630	28.43		9.17				
	11:00	1625	28.42		9.18				
	11:30	1625	28.45		9.15				
	8/12/03								
	12:00 AM	1625	28.43		9.17				
	12:30	1630	28.43		9.17				
	1:00	1625	28.42		9.18				
	1:30	1625	28.43		9.17				
	2:00	1625	28.43		9.17				
	3:00	1640	28.43		9.17				
	4:00	1630	28.43		9.17				
	5:00	1640	28.42		9.18				
	6:00	1630	28.42		9.18				
	7:00	1635	28.40		9.20				
	8:00	1650	28.20		9.40	2	9		189
	9:00	1650	28.20		9.40				
	10:00	1650	28.20		9.40				
	11:00	1650	28.20		9.40				
	12:00 N	1660	28.25		9.35				
	1:00 PM	1650	28.25		9.35				
	2:00	1645	28.20		9.40				
	3:00	1650	28.20		9.40			73	
	4:00	1650	28.20		9.40			72	
	5:00	1650	28.23		9.37			73	
	6:00	1655	28.22		9.38			73	

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Rdg (psi)		Observed Drawdown (ft)	Sample No.	Chlorides (mg/L)	Temp. (°F)	Cond. (µmhos 25°C)
	7:00	1650	28.20		9.40			73	
	8:00	1645	28.20	Pump shutdown due to air filter glowing red hot.					
	10:15			Start Pump					
	11:00	1650	28.40		9.20				
	8/13/03								
	12:00 M	1645	28.40		9.25			72	
	1:00 AM	1650	28.35		9.25			72	
	2:00	1655	28.35		9.25			72	
	3:00	1660	28.35		9.25			72	
	4:00	1655	28.35		9.25			72	
	5:00	1650	28.30		9.30			72	
	6:00	1655	28.30		9.30			72	
	7:00	1660	28.25		9.35			72	
	8:00	1650	28.30		9.30	3	9	72	195
	9:00	1650	28.35		9.25				
	10:00	1650	28.35		9.25				
	11:00	1645	28.35		9.25			74	
	12:00 N	1655	28.35		9.25			74	
	1:00 PM	1655	28.35		9.25			74	
	2:00	1660	28.35		9.25			74	
	3:00	1655	28.35		9.25			74	
	4:00	1650	28.37		9.23			73	
	5:00	1650	28.40		9.20			73	
	6:00	1650	28.40		9.20			73	
	7:00	1650	28.37		9.23			73	
	8:00	1645	28.37		9.23			73	
	9:00	1650	28.35		9.25			73	
	10:00	1650	28.30		9.30			73	
	11:00	1650	28.27		9.33			73	
	12:00 M	1640	28.30		9.33			72	
	8/14/03								
	1:00 AM	1630	28.30		9.30			72	
	2:00	1640	28.30		9.30			72	
	3:00	1640	28.30		9.30			73	
	4:00	1640	28.25		9.35			72	
	5:00	1650	28.30		9.30			72	
	6:00	1645	28.30		9.30			72	
	7:00	1645	28.25		9.35			72	
	8:00	1655	28.20		9.40	4	9	72	196
	9:00	1650	28.20		9.40			72	
	10:00	1650	28.25		9.35			72	
	11:00	1655	28.25		9.35			72	
	12:00 N	1655	28.25		9.35			72	
	1:00 PM	1640	28.25		9.35			72	
	2:00	1655	28.20		9.40			72	
	3:00	1650	28.24		9.36			73	
	4:00	1650	28.27		9.33			73	
	5:00	1650	28.28		9.32			73	
	6:00	1650	28.30		9.30			73	
	7:00	1645	28.28		9.32			73	

Elapsed Time (min.)	Date & Time	Pumping Rate (gpm)	Airline Rdg (psi)		Observed Drawdown (ft)	Sample No.	Chlorides (mg/L)	Temp. (°F)	Cond. (µmhos 25°C)
	8:00	1645	28.29		9.31			73	
	9:00	1640	28.30		9.30			73	
	10:00	1645	28.27		9.33			73	
	11:00	1650	28.26		9.34			73	
	12:00 M	1640	28.25		9.35			73	
	8/15/03								
	1:00 AM	1655	28.30		9.30			73	
	2:00	1650	28.25		9.35			73	
	3:00	1650	28.25		9.34			73	
	4:00	1650	28.25		9.34			72	
	5:00	1640	28.25		9.34			72	
	6:00	1650	28.24		9.36			72	
	7:00	1640	28.24		9.36			72	
	8:00	1655	28.20		9.40	5	8	72	192
	9:00	1650	28.20		9.40			72	
	10:00	1645	28.20		9.40			72	
	11:00	1645	28.20		9.40			72	
	12:00 N	1635	28.25		9.35			72	
	1:00 PM	1650	28.25		9.35			72	
	2:00	1650	28.25		9.35			72	
	3:00	1650	28.25		9.35			72	
	4:00	1640	28.27		9.33			73	
	5:00	1650	28.29		9.31			73	
	6:00	1645	28.27		9.33			73	
	7:00	1645	28.25		9.32			73	
	8:00	1645	28.26		9.34			73	
	9:00	1645	28.26		9.34			73	
	10:00	1645	28.26		9.34	6	9	73	194
0	10:35		28.28		9.32				
Shutdown - Recovery									
5	10:40		30.85 ft.		6.75				
10			35.20 ft.		2.40				
15			35.20 ft.		2.40				
20			35.15 ft.		2.45				
25			35.15 ft.		2.45				
30			35.20 ft.		2.40				
35			35.20 ft.		2.40				
40			35.20 ft.		2.40				
45			35.20 ft.		2.40				
50			35.20 ft.		2.40				
55			35.20 ft.		2.40				
60			35.20 ft.		2.40				
90			35.20 ft.		2.40				
120			35.25 ft.		2.35				
180			35.35 ft.		2.35				
420			36.00 ft.		1.60				

APPENDIX D: USGS KOMO MONITOR WELL

State of Hawaii
COMMISSION ON WATER RESOURCE MANAGEMENT
Department of Land and Natural Resources

8-3957-02
Kailua (Komo), HI

WELL COMPLETION REPORT

2/27/98 WCR Form

Part I. Well Construction & Part II. Permenant Pump Installation

Instructions: Please print or type and submit completed report within 60 days after well completion to the Commission on Water Resource Management, P.O. Box 621, Honolulu, Hawaii 96809. An as-built drawing of the well and chemical analysis should also be submitted. For assistance call the Commission Regulation Branch at 587-0225, or 1-800-468-4644 Extension 70225.

1. State Well No.: 3957-01 (3957-02 see attached) Well Name: KAILUA OBSERVATION WELL Island: HAWAII
2. Location/Address: DWS TANK SITE NEAR KOMO STORE, MAMAHAHOA HWY. MOEAVOA Tax Map Key: 7-5-01-55

PART I. WELL CONSTRUCTION REPORT

3. Drilling Company: U.S. GEOLOGICAL SURVEY
4. Name of driller who performed work: JOHN SNYDER, USGS WR DRILLING CHIEF
5. Type of rig/construction: FAILING 2000 KELLY DRIVE RIG
6. Date(s) Well Construction and pump tests (if any) completed: 6-19-91 DRILLING AND CASING
7. GROUND ELEVATION (referenced to mean sea level, msl): 1600 ft.
   Well Bench Mark (description/location): _____ Elevation(msl): _____ ft.
8. DRILLER'S LOG: *Please attach geologic log (if available or if required by permit)* - DRILLER'S LOG ATTACHED

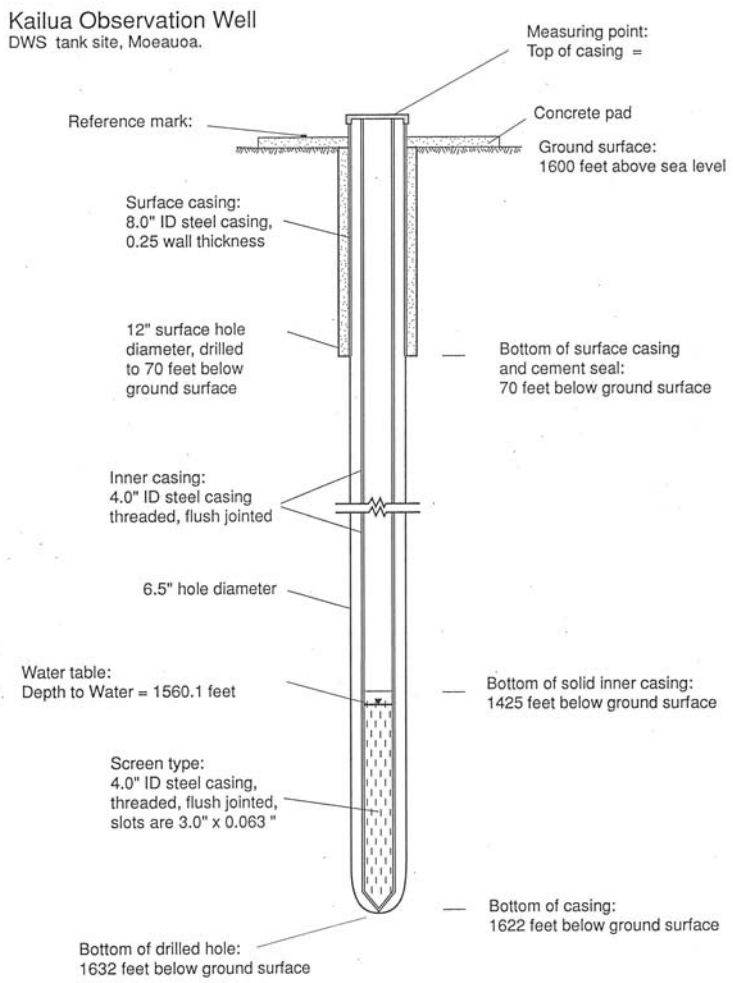
Depths (ft.)	Rock Description, Water Level, Dates, etc.	Depths (ft.)	Rock Description, Water Level, Dates, etc.
____ to ____		____ to ____	
____ to ____		____ to ____	

(If more space is needed, continue on back.)

9. Total depth of well below ground: 1622.5 ft.
10. Hole size: 12 inch dia. from 0 ft. to 70 ft. below ground
    6.5 inch dia. from 70 ft. to 1632 ft. below ground
    _____ inch dia. from _____ ft. to _____ ft. below ground
11. Casing installed: 4 in. I.D. x 0.25 in. wall solid section to 1425 ft. below ground
    4 in. I.D. x 0.25 in. wall perforated section to 1622 ft. below ground
    Casing Material/Slot Size: STEEL, 3" x 0.063" SLOTS (WITH 8" SURFACE CASING)
12. Annulus: Grouted from 0 ft. below ground to 70 ft. below ground
    Gravel packed from _____ ft. below ground to _____ ft. below ground
13. Initial water level: 1560.1 ft. below ground. Date and time of measurement: 7-5-1991
14. Initial chloride: — ppm Date and time of sampling: _____
15. Initial temperature: — °F Date and time of measurement: _____
16. PUMPING TESTS: Reference Point (R.P.) used: —, which elevation is _____ ft.
    (1) Step-Drawdown Test Date —
    Start water level — ft. below R.P.
    End water level — ft. below R.P.
    (2) Long-term Aquifer Test Date _____
    Start water level _____ ft. below R.P.
    End water level _____ ft. below R.P.
17. Pump Test Procedures data & graphs *(12/17/97 SDPTD & CRPTD Forms)* attached? __ Yes __ No
18. As-built drawings attached attached? X Yes __ No
19. Other remarks/comments: *(On back of this form)* CALIPER LOG ATTACHED

HOLE ENDED AT BOTTOM 10 FT BELOW CASING SET.

Well Drilling Contractor (print) US GEOLOGICAL SURVEY C-57 Lic. No. _____
Signature _____ Date _____
Surveyor (print) WILL BE SUBMITTED Lic. No. _____
Signature BY MARCH 2000 Date _____
Applicant (print) U.S. GEOLOGICAL SURVEY
Signature _____ Date _____



USGS K. Komo Store exploratory well
Driller's logs

from ft	to ft	description
0	40	soft
40	78	loose,soft
78	79	hard
79	82	soft
82	84	hard
84	96	soft
96	98	hard
98	120	soft
120	125	mostly hard
125	130	soft
130	145	hard
145	147	soft
147	150	hard
150	154	soft
154	160	klinkers
160	165	soft
165	180	hard
180	200	soft
200	220	hard
220	225	soft
225	234	hard
234	240	hard
240	260	soft
260	268	hard
268	275	soft
275	280	hard
280	338	soft
338	340	klinkers
340	398	soft
398	402	hard
402	410	soft
410	412	hard
412	423	soft
423	425	hard
425	435	soft
435	440	hard
440	449	soft
449	451	hard
451	460	soft
460	465	hard
465	480	soft
480	495	soft
495	498	hard
498	510	klinkers
510	515	hard
515	517	klinkers
517	520	hard
520	560	soft

560	565	soft
565	570	hard
570	580	hard
580	583	hard
583	589	soft
589	605	hard
605	620	soft
620	623	soft
623	625	hard
625	629	soft
629	635	hard
635	640	soft
640	645	hard
645	650	soft
650	660	soft
660	664	soft
664	670	hard
670	675	hard
675	682	soft
682	685	hard
685	695	soft
695	700	hard
700	715	soft
715	730	hard
730	735	soft
735	740	hard
740	752	hard
752	755	soft
755	770	hard
770	774	soft
774	776	hard
776	790	soft
790	795	hard
795	799	soft
799	800	hard
800	827	soft
827	832	loose
832	840	hard
840	845	hard
845	855	klinker
855	864	hard
864	865	soft
865	870	hard
870	914	hard
914	928	soft
928	929	hard
929	939	soft
939	945	hard
945	949	soft
949	962	hard
962	973	soft
973	979	soft
979	984	hard
984	995	soft

995	1000	hard
1000	1002	soft
1002	1005	hard
1005	1010	soft
1010	1015	hard
1015	1020	soft
1020	1039	hard
1039	1040	soft
1040	1115	hard, prchd wtr.
1115	1124	soft
1124	1130	hard
1130	1185	soft
1185	1223	hard
1223	1230	soft
1230	1236	hard
1236	1240	soft
1240	1250	hard
1250	1254	soft
1254	1259	soft
1259	1267	hard
1267	1270	soft
1270	1280	hard
1280	1285	soft
1285	1295	hard
1295	1300	soft
1300	1304	hard
1304	1307	soft
1307	1310	hard
1310	1316	soft
1316	1323	hard
1323	1346	soft
1346	1359	hard
1359	1365	soft
1365	1372	hard
1372	1376	hard
1376	1379	spft
1379	1386	hard
1386	1388	soft
1388	1390	soft
1390	1407	soft
1407	1409	hard
1409	1418	klinker
1418	1427	real soft
1427	1432	hard
1432	1488	soft
1488	1493	hard
1493	1498	soft
1498	1508	hard
1508	1513	soft
1513	1515	hard
1515	1518	soft
1518	1532	hard
1532	1537	hard
1537	1551	soft

1551	1554	soft
1554	1560	hard
1560	1562	hard
1562	1612	soft
1612	1617	hard
1617	1622	klinkers
1622	1632	soft

To: "Jill D Torikai, Hydrologist, Honolulu, HI" <jtorikai>
Subject: wells
Date: Sat, 23 Oct 1999 06:09:55 -1000
From: "Gordon W Tribble, Associate District Chief, Honolulu, HI" <gtribble>

------- Forwarded Message

To: w_roy_hardy@exec.state.hi.us
Subject: well completion reports
Date: Fri, 22 Oct 1999 13:27:11 -1000
From: "Todd K Presley, Hydrologist, Honolulu, HI" <tkpresle>

Roy,

There are 3 small discrepancies on the 4 well completion reports that I submitted yesterday.

The Kailua Observation Well (State No. 3957-02) was recorded as 3957-01 in the well completion report we submitted. Please change to 3957-02. Some of our early records show this well as being 3957-01, but another well may have been drilled or completed before it.

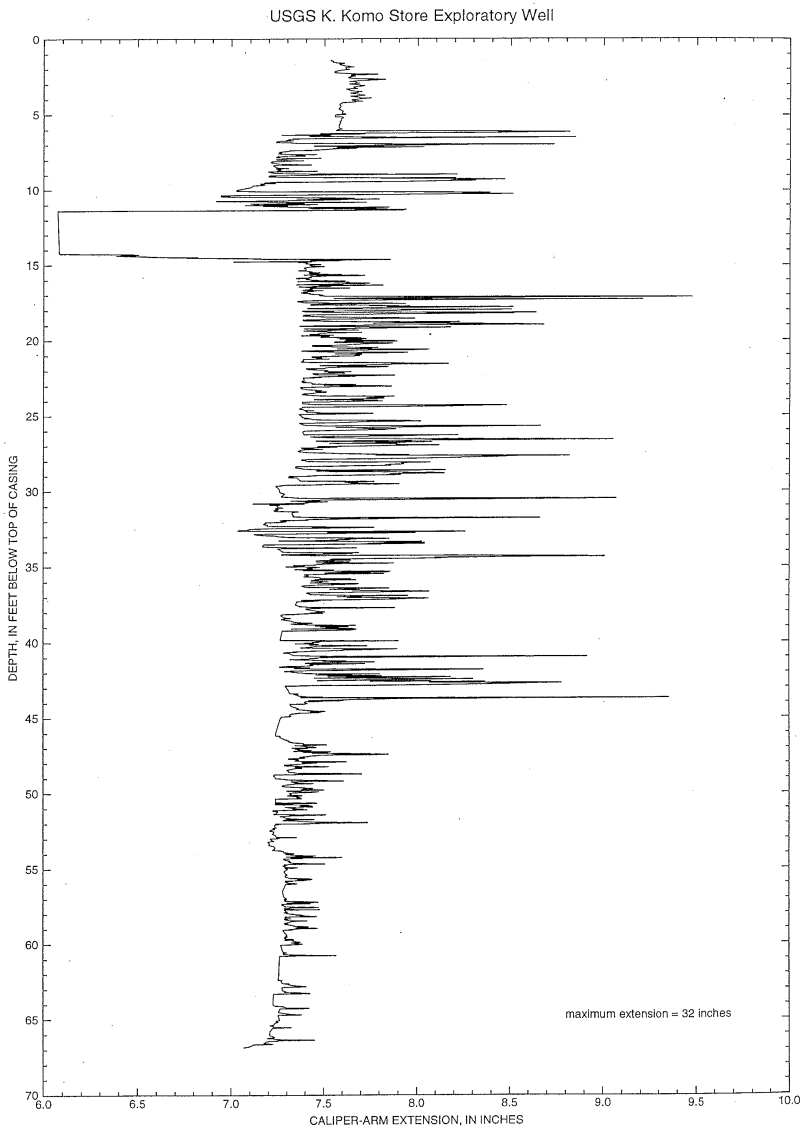
The Kainaliu Observation Well (State no. 3255-01) has the wrong tax map key recorded on the well completion report. The tax map key should be 7-9-008-3, which is the same as the well completion report form submitted to us from CWRM that has the location, well name, and number already printed at the top of the form. The preprinted form, however, has the location printed as Dorris Farms. The land owner is William Paris, and this should be changed to William Paris Ranch, as is listed on the form we submitted.

My apologies for the corrections, and please call if you have any questions.

Thanx,

Todd

------- End of Forwarded Message



U. S. DEPARTMENT OF THE INTERIOR
Geological Survey
WATER RESOURCES DIVISION

Form 9-275
(July 1957)

STATION NUMBER 8-3957-02

LEVEL NOTES

STREAM Well 8-3957-02 Kailua
LOCALITY Mokauea Tank nr. K. Komo Store
PARTY CJET, CB # DATE March 21, 19 2000

STATION	B. S.	HT. INST.	F. S.	ELEVATION	REMARKS
BM	0.944	1536.284		1535.34	Top of Fire Hydrant Nr. K. Komo Store
TP#1			8.037	1528.247	
	0.596	1528.843			
TP#2			3.489	1525.354	
	11.384	1536.738			
TP#3			0.555	1586.183	
	11.864	1548.047			
TP#4			0.375	1547.672	
	12.404	1560.076			
TP#5			0.160	1559.916	
	10.853	1570.769			
TP#6			0.329	1570.440	
	11.174	1581.614			
TP#7			0.467	1581.147	
	11.601	1592.751			
TP#8			0.481	1592.270	
	12.278	1604.548			
BM-1			1.030	1603.518	Brass Tablet on conc base of tank.
			3.170	1601.378	Paint mark on SE corner of conc pad
BM-1	1.013			1603.518	
		1604.531			
TP#8			12.261	1592.270	-

NO. 1 OF 3 SHEETS COMP. BY CJE CK. BY CJE
D. Yeatts

U. S. DEPARTMENT OF THE INTERIOR
Geological Survey
WATER RESOURCES DIVISION

Form 9-276 (July 1967)

STATION NUMBER 83957-02

LEVEL NOTES

STREAM Well 8-3957-02
LOCALITY Tank nr. K. Komo Store
PARTY CJE T, CB ϕ DATE March 21, 1972

STATION	B. S.	HT. INST.	F. S.	ELEVATION	REMARKS
TP#8				1592.270	
	0.277	1592.547			
TP#7			11.402	1581.145	
	0.262	1581.407			
TP#6			10.967	1570.440	
	0.335	1570.775			
TP#5			10.859	1559.916	
	0.140	1560.056			
TP#4			12.382	1547.674	
	0.011	1547.685			
TP#3			11.499	1536.186	
	0.481	1536.667			
TP#2			11.316	1525.351	
	3.601	1528.952			
TP#1			0.702	1528.250	
	8.051	1536.301			
BM			0.963	1535.338	
		Closure = 0.002			

Note BM Elevation established by Renaldo B. Hurelio - Licensed Land Surveyor No. 7564 State of Hawaii. Employed by DWS, Hilo, Hawaii.

NO. 2 OF 3 SHEETS COMP. BY CJE CHK. BY CJE
D. Yeatts

U. S. DEPARTMENT OF THE INTERIOR
Geological Survey
WATER RESOURCES DIVISION

Form 9-276 (July 1967)

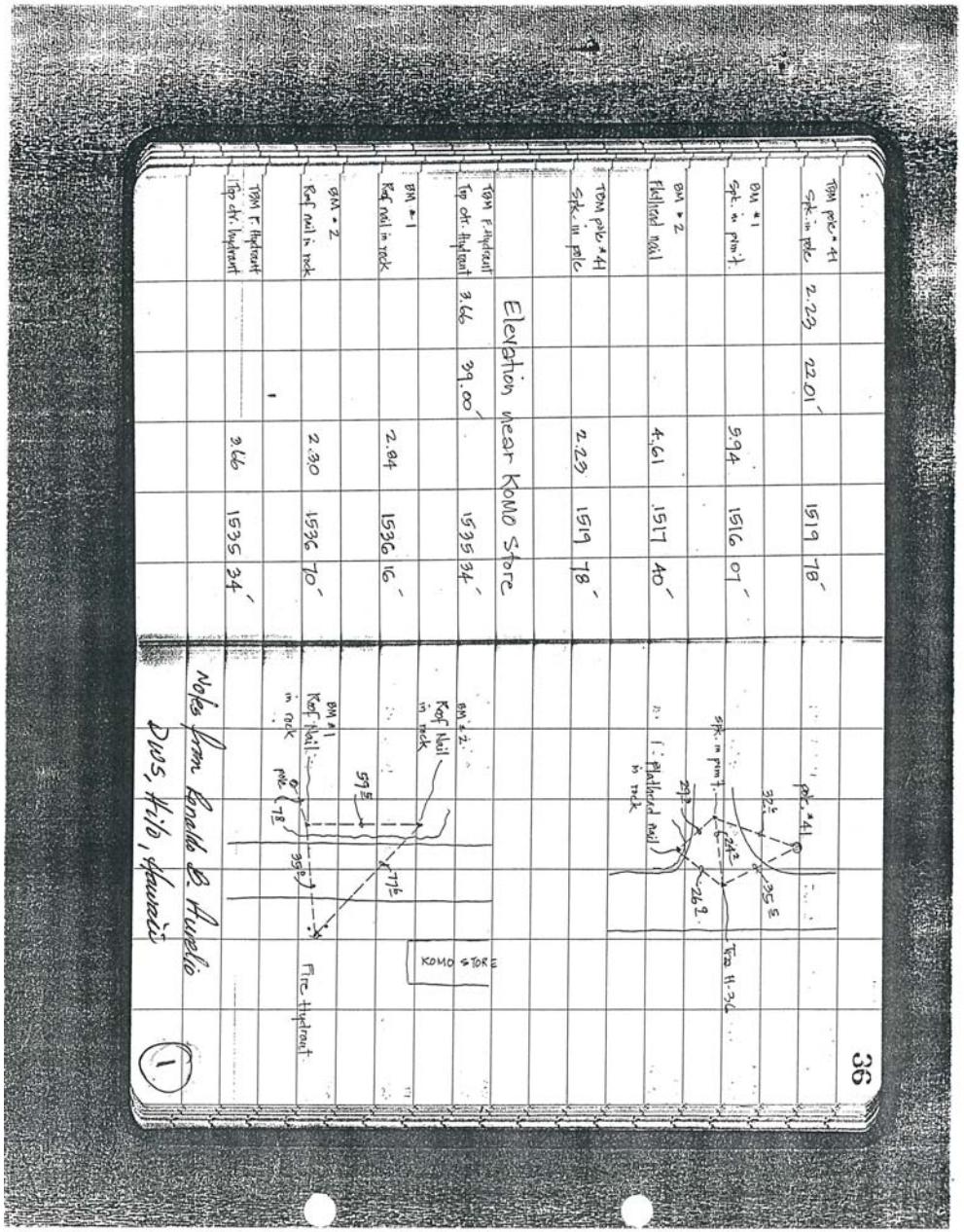
STATION NUMBER 8-3957-02

LEVEL NOTES

STREAM Well 8-3957-02
LOCALITY Mosauoa Tank nr. K. Komo Store
PARTY CJE T, CB ϕ DATE 4/18/2008, 19

STATION	B. S.	HT. INST.	F. S.	ELEVATION	REMARKS
BM	4.412	1607.930		1603.518	Brass Tablet on base of Conc. Tank
Slab		6.551	6.551	1601.379	Paint mark SE corner of slab
TOC 8"	Dig	5.354	5.354	1602.576	TOC 8" casing Paint mark
TOC 4"		6.087	6.087	1601.843	TOP 4" Casing Paint mark
TOC 4"	6.280	1608.123			TOC 4" paint
TOC 8"			5.547	1602.576	TOC 8" paint
Slab			6.744	1601.379	
BM			4.605	1603.518	Brass tablet
					Closure 0.000
				MP=	1601.84

NO. 3 OF 3 SHEETS COMP. BY CJE CHK. BY CJE
D. Yeatts



1DATE: 03/16/00

C001	Site ID (station number)	1939471555733301
C900	Station name	8-3957-02 Kailua (Komo), HI
C004	Source agency code	USGS
C005	Project number	--
C032	Record ready for web flag	C
C007	State code	15
C008	County code	001
C020	Hydrologic unit code	20010000
C009	Latitude	193947
C010	Longitude	1555733
C011	Lat-long accuracy code	S
C035	Method Lat/Long Determined	M
C036	Lat/Long Datum	NAD27
C802	Station-type codes	NNNNNYNNNNNNNNNNNNN
C002	Type of site	W
C023	Primary use of site	O
C711	Date site established/inventoried	--
C805	Flags-instruments at site	NNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN
C003	Record classification	C
C813	Mean Greenwich time offset	-10
C814	Local standard time flag	N
C016	Altitude of land surface	1600
C018	Altitude accuracy	10
C017	Method altitude determined	M
C022	Altitude Datum	NGVD29
C806	Station remark fields	USGS Exploratory Well (KP3)
C021	Date well constructed	19910601
C027	Hole depth	1632
C028	Depth of well	1622.5
C029	Source of depth data	Z
C303	Date site record created	19920831000000
C040	Date site record last updated	20000316075628

3/16/00

Dale -
Pls. correct your files.
8-3957-01 Haseko well
8-3957-02 USGS well

Correction made in NWIS for USGS well. Previously was coded as 8-3957-01, but now the USGS well is 8-3957-02.
- Jill

APPENDIX E: SEWER

Appendix -Sewer System

Criteria

The sewer system criteria for the Kamakana Villages follow the Hawaii County Department of Environmental Managements criteria as shown below unless otherwise noted:

1. Quantity of Wastewater

Average Sewer Flow =	80 gallons per capita per day
School Sewer Flow =	25 gallons per capita per day
Park[+] Sewer Flow =	5 gallons per capita per day

Land Use	Densities
Single Family	4 persons per unit
Multi-Family	2.8 persons per unit
Neighborhood Commercial*	40 capita/acre
Schools**	550 students
Parks***	100 capita per 5 acres

[+]-Sewer Flow for Parks was estimated based on discussions with the Department of Environmental Management (DEM). Since there is no flow quantity standard for parks, assumptions were made based on the flow quantity for picnic parks (5 gallons per capita per day) given by the State Department of Health “Wastewater Systems” design flows.

*-The proposed zoning for the commercial district will be for Neighborhood Commercial.

**-School Density was estimated based on an assumed student population of 550 per school.

***-Because not all parks will have comfort stations, only usable park space with nearby comfort stations were taken into account for calculation purposes.

2. Pipeline sizing:

a. Size pipes to convey the design peak flow.
b. Minimum size of pipe is8-inches for mains in roadway areas.
c. Minimum velocity in the sewer line flowing full is2.0 feet per second.
d. Maximum velocity in the sewer line flowing full is 10 feet per second.
e. Minimum and maximum slopes for sewer lines flowing full:

Pipe Diameter	Minimum Slope	Maximum Slope
8"	0.00444	0.1110
10"	0.00331	0.0827
12"	0.00259	0.0648
15"	0.00192	0.0479
18"	0.00160	0.0377
21"	0.00092	0.0231
24"	0.00077	0.0193
27"	0.00066	0.0165
30"	0.00057	0.0143

3. Manhole Spacing:
a. 350 feet -pipes up to and including 30 inches in diameter in street areas.
b. 250 feet -pipes up to and including 18 inches in diameter in easement areas.
c. 350 feet -pipes larger than 18 inches and up to and including 30 inches in diameter in easement areas.

KAMAKANA VILLAGES

Sewer Flows – Daily Demands – Post-Phase 1

Average Sewer Flows	80 gallons/capita per day
School Sewer Flows	25 gallons/capita per day
Park Sewer Flows	5 gallons/capita per day

Single Family Residential =	4 persons/unit
Multi-family Residential =	2.8 persons/unit
Neighborhood Commercial =	40 capita/acre
Schools =	550 students
Parks =	100 persons/5 acres

Phase 1	Units	Capita per Unit	Capita	Sewer Flow (gallons/day)	Average Demand (gallons)
Single Family	76	4	304	80	24,320
Multi-Family	340	2.8	952	80	76,160
Commercial	0.96	40	38	80	3,072
Schools	0	550	0	25	0
Parks	0.4	100	40	5	200
Total			1,334		103,752

Average Wastewater Flow:	103,752 gallons/day	
Maximum Wastewater Flow:	479,334 gallons/day	(Flow Factor =4.62)
Dry Weather Infiltration/Inflow:	6,668 gallons/day	
Design Average Flow:	**110,420 gallons/day <--Capacity Required at Plant**	
Design Maximum Flow:	486,002 gallons/day	
Wet Weather Infiltration/Inflow:	62,863 gallons/day	
Design Peak Flow:	548,865 gallons/day	

Sewer Flows – Daily Demands – Post-Phase 2

Average Sewer Flows	80 gallons/capita per day
School Sewer Flows	25 gallons/capita per day
Park Sewer Flows	5 gallons/capita per day
Single Family Residential =	4 persons/unit
Multi-family Residential =	2.8 persons/unit
Neighborhood Commercial =	40 capita/acre
Schools =	550 students
Parks =	100 persons/5 acres

Phases 1 & 2	Units	Capita per Unit	Capita	Sewer Flow (gallons/day)	Average Demand (gallons)
Single Family	170	4	680	80	54,400
Multi-Family	777	2.8	2,176	80	174,048
Commercial	1.52	40	61	80	4,864
Schools	1	550	550	25	13,750
Parks	1.59	100	159	5	795
Total			3,625		247,857

Average Wastewater Flow:	247,857 gallons/day	
Maximum Wastewater Flow:	1,003,821 gallons/day	(Flow Factor =4.05)
Dry Weather Infiltration/Inflow:	18,123 gallons/day	
Design Average Flow:	**265,980 gallons/day <--Capacity Required at Plant**	
Design Maximum Flow:	1,021,944 gallons/day	
Wet Weather Infiltration/Inflow:	119,613 gallons/day	
Design Peak Flow:	1,141,556 gallons/day	

KAMAKANA VILLAGES

Sewer Flows – Daily Demands – Post-Phase 3

Average Sewer Flows	80 gallons/capita per day
School Sewer Flows	25 gallons/capita per day
Park Sewer Flows	5 gallons/capita per day
Single Family Residential =	4 persons/unit
Multi-family Residential =	2.8 persons/unit
Neighborhood Commercial =	40 capita/acre
Schools =	550 students
Parks =	100 persons/5 acres

Phases 1-3	Units	Capita per Unit	Capita	Sewer Flow (gallons/day)	Average Demand (gallons)
Single Family	346	4	1,384	80	110,720
Multi-Family	979	2.8	2,741	80	219,296
Commercial	2.27	40	91	80	7,264
Schools	2	550	1,100	25	27,500
Parks	1.59	100	159	5	795
Total			5,475		365,575

Average Wastewater Flow:	365,575 gallons/day	
Maximum Wastewater Flow:	1,444,021 gallons/day	(Flow Factor =3.95)
Dry Weather Infiltration/Inflow:	27,371 gallons/day	
Design Average Flow:	**392,946 gallons/day <--Capacity Required at Plant**	
Design Maximum Flow:	1,471,392 gallons/day	
Wet Weather Infiltration/Inflow:	186,750 gallons/day	
Design Peak Flow:	1,658,142 gallons/day	

Sewer Flows – Daily Demands – Post-Phase 4

Average Sewer Flows	80 gallons/capita per day
School Sewer Flows	25 gallons/capita per day
Park Sewer Flows	5 gallons/capita per day
Single Family Residential =	4 persons/unit
Multi-family Residential =	2.8 persons/unit
Neighborhood Commercial =	40 capita/acre
Schools =	550 students
Parks =	100 persons/5 acres

Phases 1-4	Units	Capita per Unit	Capita	Sewer Flow (gallons/day)	Average Demand (gallons)
Single Family	442	4	1,768	80	141,440
Multi-Family	1,257	2.8	3,520	80	281,568
Commercial	2.27	40	91	80	7,264
Schools	2	550	1,100	25	27,500
Parks	1.59	100	159	5	795
Total			6,637		458,567

Average Wastewater Flow:	458,567 gallons/day	
Maximum Wastewater Flow:	1,719,626 gallons/day	(Flow Factor =3.75)
Dry Weather Infiltration/Inflow:	33,183 gallons/day	
Design Average Flow:	**491,750 gallons/day <--Capacity Required at Plant**	
Design Maximum Flow:	1,752,809 gallons/day	
Wet Weather Infiltration/Inflow:	222,475 gallons/day	
Design Peak Flow:	1,975,284 gallons/day	

KAMAKANA VILLAGES

Sewer Flows – Daily Demands – Post-Phase 5

Average Sewer Flows	80 gallons/capita per day
School Sewer Flows	25 gallons/capita per day
Park Sewer Flows	5 gallons/capita per day
Single Family Residential =	4 persons/unit
Multi-family Residential =	2.8 persons/unit
Neighborhood Commercial =	40 capita/acre
Schools =	550 students
Parks =	100 persons/5 acres

Phases 1-5	Units	Capita per Unit	Capita	Sewer Flow (gallons/day)	Average Demand (gallons)
Single Family	522	4	2,088	80	167,040
Multi-Family	1,516	2.8	4,245	80	339,584
Commercial	2.27	40	91	80	7,264
Schools	2	550	1,100	25	27,500
Parks	3.04	100	304	5	1,519
Total			7,827		542,907

Average Wastewater Flow:	542,907 gallons/day	
Maximum Wastewater Flow:	1,943,607 gallons/day	(Flow Factor =3.58)
Dry Weather Infiltration/Inflow:	39,133 gallons/day	
Design Average Flow:	**582,040 gallons/day <--Capacity Required at Plant**	
Design Maximum Flow:	1,982,740 gallons/day	
Wet Weather Infiltration/Inflow:	287,425 gallons/day	
Design Peak Flow:	2,270,165 gallons/day	

Sewer Flows – Daily Demands – Full Development

Average Sewer Flows	80 gallons/capita per day
School Sewer Flows	25 gallons/capita per day
Park Sewer Flows	5 gallons/capita per day

Single Family Residential =	4 persons/unit
Multi-family Residential =	2.8 persons/unit
Neighborhood Commercial =	40 capita/acre
Schools =	550 students
Parks =	100 persons/5 acres

Phases 1-6 (Full Development)	Units	Capita per Unit	Capita	Sewer Flow (gallons/day)	Average Demand (gallons)
Single Family	661	4	2,644	80	211,520
Multi-Family	1,669	2.8	4,673	80	373,856
Commercial	4.52	40	181	80	14,464
Schools	2	550	1,100	25	27,500
Parks	3.45	100	345	5	1,726
Total			8,943		629,066

Average Wastewater Flow:	629,066 gallons/day	
Maximum Wastewater Flow:	2,170,278 gallons/day	(Flow Factor =3.45)
Dry Weather Infiltration/Inflow:	44,712 gallons/day	
Design Average Flow:	**673,778 gallons/day <--Capacity Required at Plant**	
Design Maximum Flow:	2,214,769 gallons/day	
Wet Weather Infiltration/Inflow:	340,488 gallons/day	
Design Peak Flow:	2,555,477 gallons/day	

APPENDIX D TRAFFIC IMPACT ANALYSIS REPORT

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED

KAMAKANA VILLAGES

AT KEAHUOLU

TAX MAP KEY: (3) 7-4-021:020

PREPARED FOR

FOREST CITY HAWAI`I KONA, LLC

DECEMBER 22, 2009

PREPARED BY

TMC THE TRAFFIC MANAGEMENT CONSULTANT

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED

KAMAKANA VILLAGES

AT KEAHUOLU

TAX MAP KEY: (3) 7-4-021:020

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

SIGNATURE

04/30/2010
EXPIRATION DATE OF LICENSE

TMC THE TRAFFIC MANAGEMENT CONSULTANT

RANDALL S. OKANEKU, P.E., PRINCIPAL • 1188 BISHOP STREET, SUITE 1907 • HONOLULU, HI 96813

Table of Contents

Table of Contents (Cont'd.)

Table of Contents (Cont'd.)

List of Figures

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED
KAMAKANA VILLAGES
AT KEAHUOLU
TAX MAP KEY: (3) 7-4-021:020

I. Introduction

A. Purpose of the Study

The purpose of this traffic study is to analyze the traffic impacts resulting from the development of the Kamakana Villages at Keahuolu in Kailua-Kona, North Kona, Hawai`i by the Hawai`i Housing Finance & Development Corporation (HHFDC). This report presents the findings and recommendations of the traffic impact analysis, and is intended to meet the requirements of Section 25-2-46 (d) of the Hawaii County Code. This Traffic Impact Analysis Report (TIAR) is certified as having been conducted in accordance with best practices of the engineering profession.

B. Background

HHFDC has entered into a development agreement with Forest City Hawai`i Kona, LLC to develop a mixed-use affordable housing project known as Kamakana Villages at Keahuolu. Formerly known as Keahuolu Affordable Housing Project, the Final Environmental Impact Statement – Keahuolu Affordable Housing Project (FEIS) was prepared by Belt Collins Hawai`i for HHFDC and published in October, 2008. The FEIS evaluated three alternative conceptual plans (Concept Plans A, B and C), and included a traffic analysis of each concept plan. The Traffic Study for the Keahuolu Affordable Housing Master Plan was prepared by Fehr & Peers/Kaku Associates, dated January, 2008, and was incorporated into the FEIS. HHFDC and Forest City Hawai`i Kona LLC have selected a variation of Concept Plan C as the development plan for Kamakana Villages.

C. Scope of the Study

1. Evaluation of existing roadways and traffic conditions.
2. Development of trip generation characteristics of the proposed project.
3. Description of the project environs, relative to other proposed projects in the vicinity and relevant future and ongoing roadway improvements.

4. Evaluation of future roadway and traffic conditions without the proposed project.
5. Recommendations of traffic improvements, as necessary, that would mitigate the future highway deficiencies without the proposed project.
6. Identification and analysis of traffic impacts resulting from the development of the proposed project.
7. Recommendations of traffic improvements, as necessary, that would mitigate the traffic impacts identified in this traffic study.

D. Project Description

Kamakana Villages will consist of 2,330 single-family and multi-family dwelling units (DU), an elementary school, a charter/private school, and three separate commercial developments, totaling 197,000 square feet of gross floor area (SFGFA). The 272-acre property is identified as Tax Map Key: (3) 7-4-021:020. The project site is located on the northeast quadrant of Palani Road and the proposed Ane Keohokalole Highway. The vicinity of the proposed project is depicted on Figure 1.

More than half of the residential units at Kamakana Villages will be affordable housing units (e.g., offered for rent or sale at no more than 140 percent of the median income in the County of Hawaii). Therefore, the development of Kamakana Villages will entail at least two times the number of affordable housing credits required under Chapter 11, Hawaii County Code. As a result, under Hawaii County Code Section 25-2-46(h)(1), HHFDC/Forest City Hawai`i Kona, LLC shall not be required to perform any area mitigation traffic improvements (defined as "improvements which increase the capacity of an arterial or other major road, such as additional lanes, in the general region containing the project, or construction of a new arterial or collector road in the general area containing the project, or improvements to public transportation such as buses or park-and-ride facilities, sufficient to offset the traffic demand generated by the project.").

Access is proposed via three intersections on Ane Keohokalole Highway and three intersections on Palani Road. Full access is proposed at two of the three intersections on Ane Keohokalole Highway, while the third intersection will be restricted to right-turn-in and right-turn-out movements only. Full access is proposed at one of the three intersections on Palani Road, while the other two intersections will be restricted to right-turn-in and right-turn-out movements only. Figure 2 depicts the conceptual master plan.

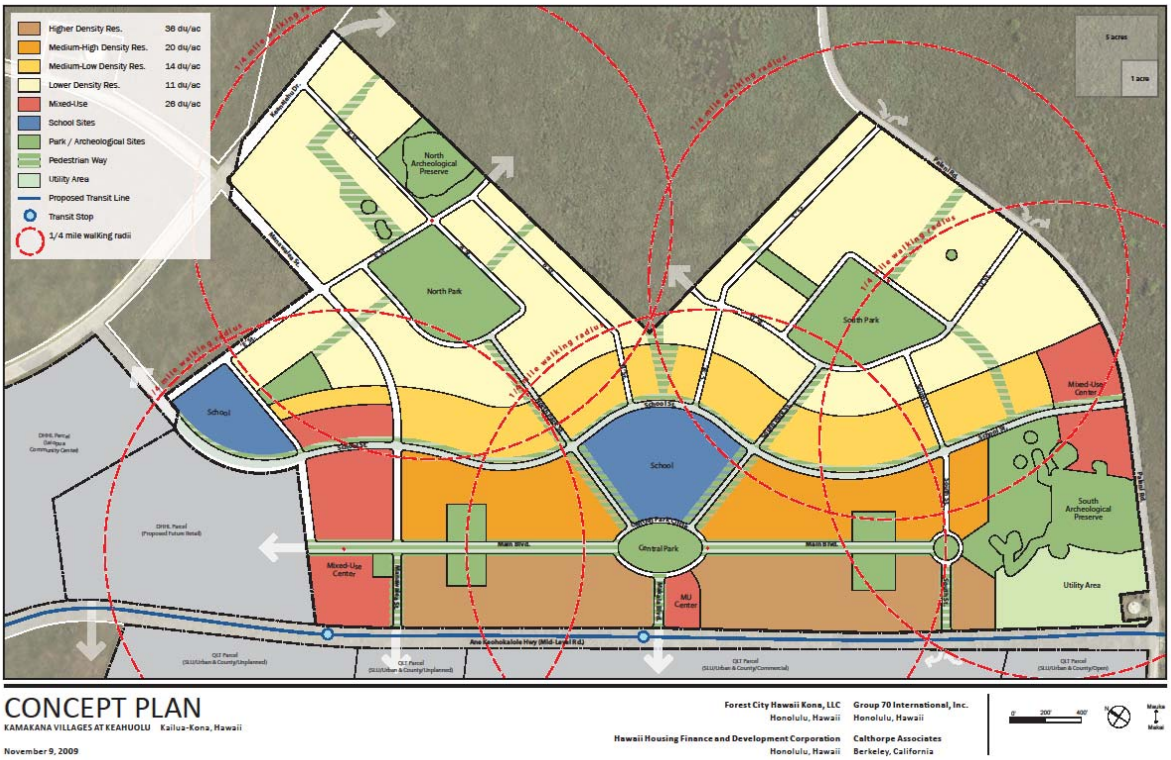


Figure 2. Kamakana Villages at Keahuolu Conceptual Plan

Figure 1. Location Map

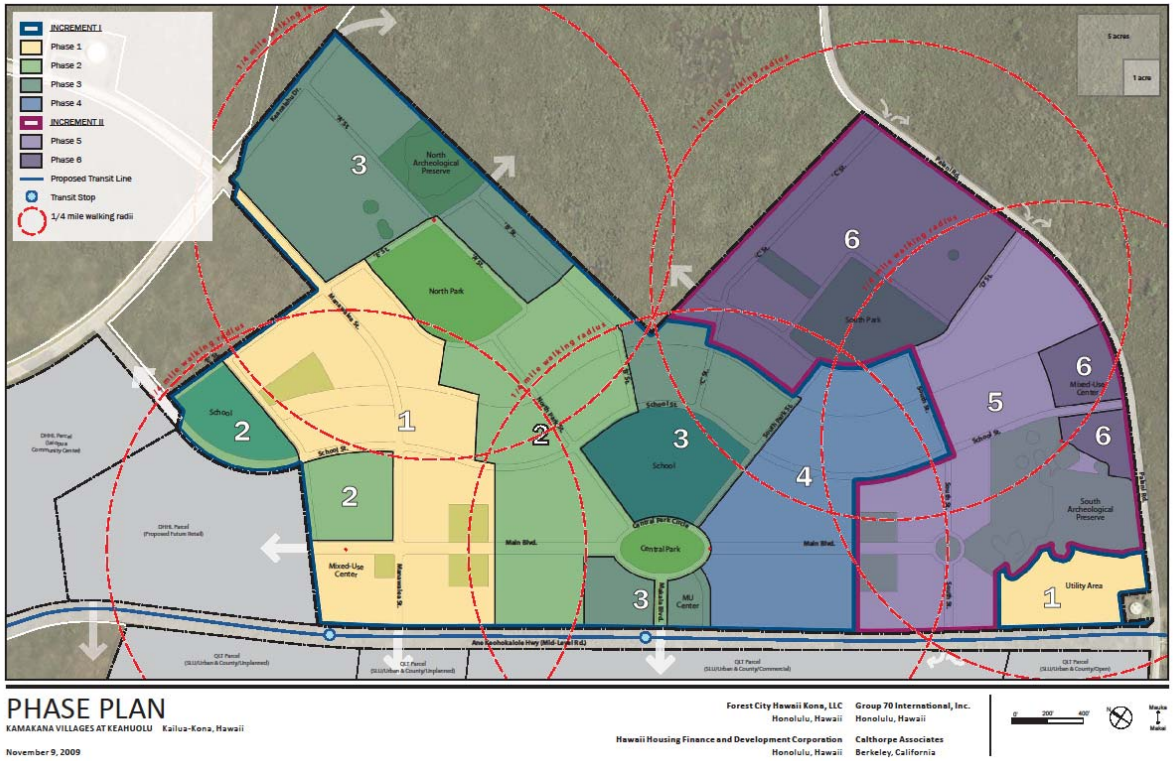


Figure 3. Kamakana Villages at Keahuolu Phasing Plan

The proposed project will be developed in six (6) phases, between the Years 2012 and 2028, beginning at the north side of the project site and progressing toward Palani Road. For the purpose of this traffic impact analysis, the development phases were consolidated into 5-year, 10-year, and 20-year planning horizons. Table 1 summarizes the land use summary.

Table 1. Land Use Summary

Analysis Year	Phase	Land Use	Units
2014	1	Single-Family Units	76 DU
		Multi-Family Units	340 DU
		Retail	41,833 SFGFA
2019	2-3	Single Family Units	153 DU
		Multi-Family Units	495 DU
		Retail	57,167 SFGFA
2029	3-6	Single Family Units	432 DU
		Multi-Family Units	910 DU
		Retail	98,000 SFGFA
		Schools	N/A
Totals		Single Family Units	661 DU
		Multi-Family Units	1669 DU
		Retail	197,000 SFGFA
		Schools	N/A

The Phasing Plan is depicted on Figure 3.

E. Environs

The Villages of La`i`opua is a residential development, which is located immediately north of the project. Further to the north, the West Hawai`i Civic Center, which is under construction at this writing, will be located at the north terminus of Ane Keohokalole Highway. Kona International Airport is located about eight miles to the north of the project site. Kailua Village is located immediately to the south of the project site.

F. Methodologies

1. Capacity Analysis Methodology

The highway capacity analysis, performed for this study, is based upon procedures presented in the Highway Capacity Manual (HCM), published by the Transportation Research Board.

HCM defines Level of Service (LOS) as "a quality measure describing operational conditions within a traffic stream". Several factors are included in determining LOS such as: speed, travel time, freedom to maneuver, traffic interruptions, driver comfort, and convenience. LOS's "A", "B", and "C" are considered satisfactory Levels of Service. LOS "D" is generally considered a "desirable minimum" operating Level of Service. LOS "E" is an undesirable condition, and LOS "F" is an unacceptable condition. Intersection LOS is primarily based upon delay. Table 2 summarizes the LOS criteria.

Table 2. Intersection Level of Service Criteria (HCM)

LOS	Signalized Intersections		Unsignalized Intersections	
	Delay *d* (sec/veh)	Description	Delay *d* (sec/veh)	Description
A	$d \leq 10$	Few stops, little or no delay	$d \leq 10$	Little or no delays
B	$10 < d \leq 20$	Good progression, short cycle lengths	$10 < d \leq 15$	Short delays
C	$20 < d \leq 35$	Cycle failures begin to occur, i.e., vehicles stop at more than one red phase	$15 < d \leq 25$	Average delays
D	$35 < d \leq 55$	Noticeable number of cycle failures, unfavorable progression	$25 < d \leq 35$	Long delays
E	$55 < d \leq 80$	Frequent cycle failures, poor progression, long delays	$35 < d \leq 50$	Very long delays
F	$d > 80$	Over saturation, many cycle failures, high delays	$d > 50$	Extreme delays

"Volume-to-capacity" (v/c) ratio is a measure indicating the relative traffic demand to the roadway's capacity. HCM defines capacity as "the maximum number of vehicles that can pass a given point during a specified period under prevailing

roadway, traffic flow, and traffic control conditions." A v/c ratio of 0.50 indicates that the traffic demand is utilizing 50 percent of the roadway's capacity. Worksheets for the capacity analysis, performed throughout this report, are compiled in the Appendix.

2. Trip Generation Methodology

The trip generation methodology is based upon generally accepted techniques developed by the Institute of Transportation Engineers (ITE) and published in Trip Generation, 8th Edition. ITE trip rates are developed by correlating the total vehicle trip generation data with various activity/land use characteristics, such as the vehicle trips per hour (vph) per dwelling unit (DU).

The trip generation characteristics for the proposed project are based upon ITE trip rates for the respective land uses envisioned for the proposed master-planned development. Where trip rates for certain types of land uses were not developed by ITE, trips rates for similar uses were used. The trip rates used in this analysis were developed from the average peak hour trip rates.

The total trips generated by a commercial development can be defined as driveway trips, i.e., traffic entering and exiting the project site. A percentage of the PM peak hour trips, generated by a commercial development, are considered to be "pass-by" trips, i.e., traffic already on the road stopping at a "secondary" destination. The "new" or primary trips generated by the project are trips, whose primary destination would be the proposed commercial development. The percentages of pass-by trips were taken from studies that were compiled by ITE. The results of the analysis were published in the Trip Generation Handbook, October 1998.

Travel surveys that were conducted at mixed-use centers have indicated that the trip generation rates were 20 to 25 percent lower than the sum of the trip generation rates of the free-standing land use activities. The trip generation characteristics of mixed-use developments have been documented by several publications, including Transportation and Land Development, written by Stover and Koepke, and published by the Institute of Transportation Engineers. The mixed-use concept encourages multi-purpose trips without leaving the site. The opportunities for "internal" trips are further increased where multi-family dwelling units are included in the mixed-use development in a "live/work" environment, where second floor apartments are situated over commercial spaces on the ground floor.

For the purpose of this traffic impact analysis, the peak hour trip generation rates for the commercial activities were reduced by a "capture rate" of 25 percent to account for the internal trips that do not leave the project site. The AM peak hour capture rate for a mixed-use "destination" trips is applied directly to the AM peak hour "origin" trip rates for apartments, since the AM peak hour traffic primarily involves the home to work trips. The PM peak hour capture rate for mixed-use trips is allocated over all the dwelling units in the project, which will be equivalent to a 7 percent reduction in residential trips.

The elementary school was also assumed to generate trips from within the proposed project during the AM peak hour of traffic, i.e., parents dropping off children before going to work. The PM peak hour trips generated by the elementary school were assumed to be externally generated. The AM and PM peak hour trips generated by the charter/private school also were assumed to be externally generated.

II. Existing Conditions

A. Area Roadway System

Queen Kaahumanu Highway is a two-way, two- to four-lane, high quality arterial highway between Kailua-Kona and Kawaihae. Queen Kaahumanu Highway is the primary arterial highway along the South Kohala and North Kona coasts. Queen Kaahumanu Highway is a four-lane divided highway between Henry Street and Kealakehe Parkway. The State Department of Transportation (DOT) is planning the second phase of the Queen Kaahumanu Highway widening, from two lanes to four lanes, between Kealakehe Parkway and the Kona International Airport Access Road.

Kealakehe Parkway is a two- to three-lane, two-way arterial highway between Honokohau Harbor and Keanalehu Drive. Kealakehe Parkway is signalized at its four-legged intersection with Queen Kaahumanu Highway.

Makala Boulevard is a two-way, two- to four-lane collector road between Kuakini Highway and Makalapa Center. Makala Boulevard intersects Queen Kaahumanu Highway at a four-legged signalized intersection.

Palani Road is a two-way, two- to four-lane roadway, between Kuakini Highway and Mamalahoa Highway. Palani Road is signalized at Henry Street, and at Queen Kaahumanu Highway.

Ane Keohokalole Highway is a two-lane, two-way roadway which extends from the future West Hawai`i Civic Center on Kealakehe Parkway to Puohulihuli Street. The County of Hawaii will extend Ane Keohokalole Highway from Puohulihuli Street to Palani Road.

Henry Street is a two-way, four-lane divided roadway between Palani Road and Kuakini Highway. Henry Street is signalized at Palani Road and at Queen Kaahumanu Highway.

B. Existing Traffic Volumes and Operating Conditions

1. Field Investigation

The field investigation was conducted on September 22-23, 2009 and on October 22, 2009, during the morning peak period of traffic between the hours of 6:00 AM and 9:00 AM, and during the afternoon peak period of traffic between the hours of 3:00 PM and 6:00 PM. The following intersections were surveyed:

a. Queen Kaahumanu Highway and Kealakehe Parkway

b. Kealakehe Parkway and Ane Keohokalole Highway

c. Queen Kaahumanu Highway and Makala Boulevard

d. Queen Kaahumanu Highway and Palani Road

e. Queen Kaahumanu Highway and Henry Street

f. Palani Road and Henry Street

2. Existing AM Peak Hour Traffic

The existing AM peak hour of traffic occurred from 7:15 AM to 8:15 AM. Queen Kaahumanu Highway carried between 1,400 vehicles per hour (vph) and 2,000 vph, total for both directions, during the existing AM peak hour of traffic. Mauka of Henry Street, Palani Road carried about 1,700 vph, total for both directions.

The intersection of Queen Kaahumanu Highway and Kealakehe Parkway operated at LOS "C" and a v/c ratio of 0.86, during the existing AM peak hour of traffic. The shared left-turn/through movement on westbound (makai bound) Kealakehe Parkway operated at LOS "E". The other traffic movements at the intersection operated at satisfactory Levels of Service, i.e., LOS "C" or better.

The Queen Kaahumanu Highway and Makala Boulevard intersection also operated at LOS "C" with a v/c ratio of 0.58. The left-turn movements in both directions on Queen Kaahumanu Highway and on makai bound Makala Boulevard operated at LOS "D". The other traffic movements at the intersection operated at satisfactory Levels of Service, during the existing AM peak hour of traffic.

The intersection of Queen Kaahumanu Highway and Palani Road operated at LOS "C" with a v/c ratio of 0.62, during the existing AM peak hour of traffic. The left-turn movement on all approaches to intersection operated at LOS "D". The other traffic movements at the intersection operated at satisfactory Levels of Service.

The intersection of Queen Kaahumanu Highway and Henry Street operated at LOS "C" with a v/c ratio of 0.72. The left-turn movements on all approaches to the intersection operated at LOS "D". The mauka bound through movement on Henry

Street also operated at LOS "D". The other traffic movements at the intersection operated at satisfactory Levels of Service, during the existing AM peak hour of traffic.

The Palani Road and Henry Street intersection operated at capacity (v/c=1.00) with a LOS "C", during the existing AM peak hour of traffic. The dominant traffic movements were between Henry Street and the mauka leg of Palani Road. The left-turn movement from makai bound Palani Road onto Henry Street operated at LOS "D". The other traffic movements at the intersection operated at satisfactory Levels of Service.

The intersection of Kealakehe Parkway and Ane Keohokalole Highway operated at satisfactory Levels of Service. Figure 4 depicts the existing AM peak hour traffic volumes.

3. Existing PM Peak Hour Traffic

The existing PM peak hour of traffic occurred between 3:30 PM and 4:30 PM. Queen Kaahumanu Highway carried between, 1,800 vph and 2,400 vph, total for both directions, during the existing PM peak hour of traffic. Mauka of Henry Street, Palani Road carried about 1,700 vph, total for both directions.

The Queen Kaahumanu Highway and Kealakehe Parkway intersection operated at capacity (v/c = 1.16) with a LOS "E", during the existing PM peak hour of traffic. The left-turn movement on northbound Queen Kaahumanu Highway and the shared left-turn/through movement on makai bound Kealakehe Parkway operated at LOS "F". The southbound through movement on Queen Kaahumanu Highway and the mauka bound approach of Kealakehe Parkway operated at LOS "E".

Queen Kaahumanu Highway and Makala Boulevard operated at LOS "D" with a v/c ratio of 0.89, during the existing PM peak hour of traffic. The left-turn movements on northbound Queen Kaahumanu Highway and on makai bound Makala Boulevard operated at LOS "E". The shared through/right-turn movements in both directions on Makala Boulevard at Queen Kaahumanu Highway also operated at LOS "E".

The intersection of Queen Kaahumanu Highway and Palani Road operated at LOS "C" with a v/c ratio of 0.84. The left-turn movements on northbound Queen Kaahumanu Highway and mauka bound Palani Road operated at LOS "E", during the existing PM peak hour of traffic.

During the existing PM peak hour of traffic, the intersection of Queen Kaahumanu Highway and Henry Street operated at LOS "D" with a v/c ratio of 0.80. The left-turn movements in both directions on Queen Kaahumanu Highway operated at LOS "E". The through movement on mauka bound Henry Street also operated at LOS "E".

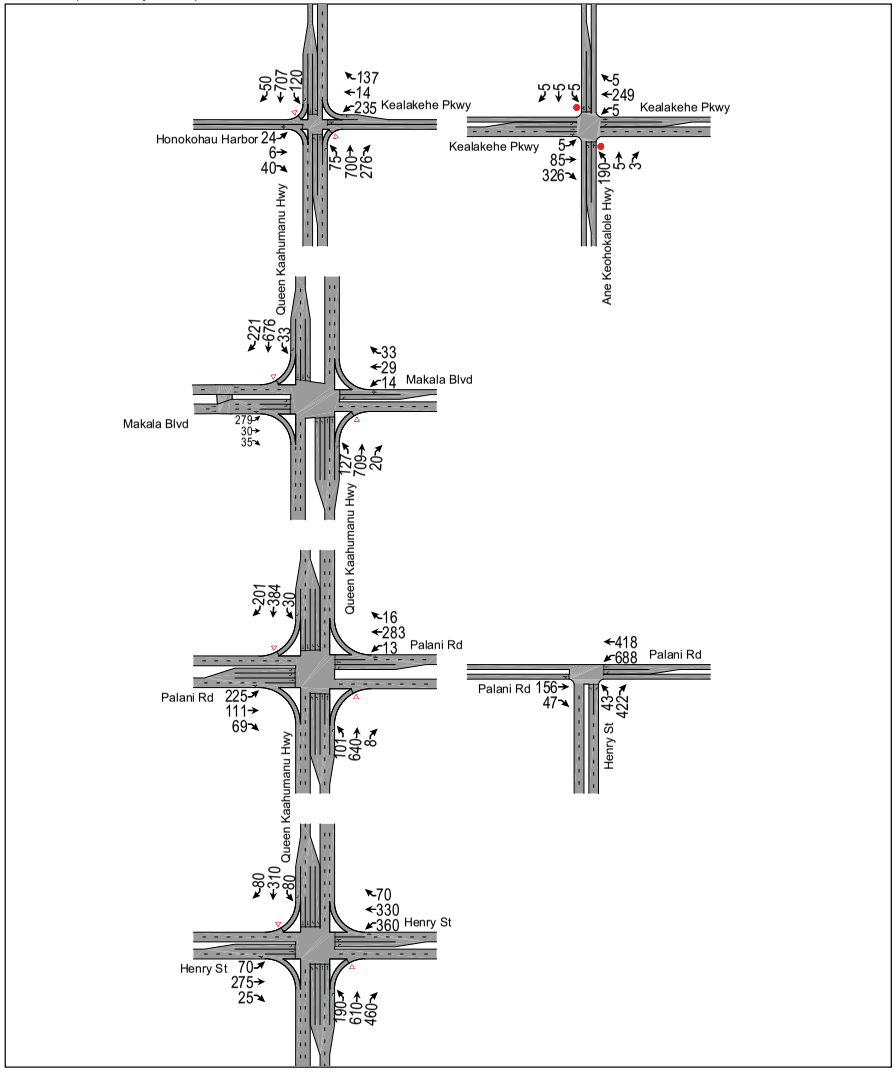


Figure 4. Existing AM Peak Hour Traffic

The Palani Road and Henry Street intersection operated at LOS "C" with a v/c ratio of 0.93. Mauka bound Palani Road operated at LOS "D", during the existing PM peak hour of traffic. The other traffic movements at the intersection operated at satisfactory Levels of Service.

The Kealakehe Parkway and Ane Keohokalole Highway intersection operated at satisfactory Levels of Service. The existing PM peak hour traffic volumes are depicted on Figure 5.

III. Future Highway Improvements

A. Queen Kaahumanu Highway Widening

The State of Hawai`i Department of Transportation (DOT) recently completed the first phase of the widening of Queen Kaahumanu Highway from a two-lane highway to a four-lane, divided highway from Henry Street to Kealakehe Parkway. DOT is continuing with the second phase of the Queen Kaahumanu Highway widening from Kealakehe Parkway to the Kona International Airport Access Road. According to DOT, the second phase of the Queen Kaahumanu Highway widening should be completed by the Year 2014.

B. Ane Keohokalole Highway

The County of Hawai`i is in the construction bidding process of Phases 1 and 1A of Ane Keohokalole Highway, also known as the Mid-Level Road. The Final Environmental Assessment for the Ane Keohokalole Mid-Level Highway Project was prepared by Belt Collins Hawai`i and accepted in November, 2009. The County of Hawaii will construct the first phase of Ane Keohokalole Highway using Federal Stimulus Funding. The first phase of Ane Keohokalole Highway will be constructed as a two-way, two-, three-, and four- lane roadway from the existing south terminus of the Highway at Puohulihuli Street to Palani Road, opposite Henry Street. The first phase of the Ane Keohokalole Highway project also will include the widening of Palani Road between Ane Keohokalole Highway/Henry Street and Kamakaeha Avenue to include exclusive left-turn lanes on mauka bound Palani Road at Ane Keohokalole Highway and at Kamakaeha Avenue. The next segment of Ane Keohokalole Highway would continue in the northerly direction to Hina Lani Street.

Ane Keohokalole Highway will ultimately be constructed as a four-lane divided arterial roadway with a 120-foot right-of-way. For the purpose of this traffic impact analysis, it was assumed that a two-way, two-lane Ane Keohokalole Highway would be constructed from Puohulihuli Street to Palani Road within the next 5-year time frame. Furthermore, it was assumed that the four-lane, divided Ane Keohokalole Highway would be constructed between Palani Road and Hina Lani Street within the subsequent 15-year time frame.

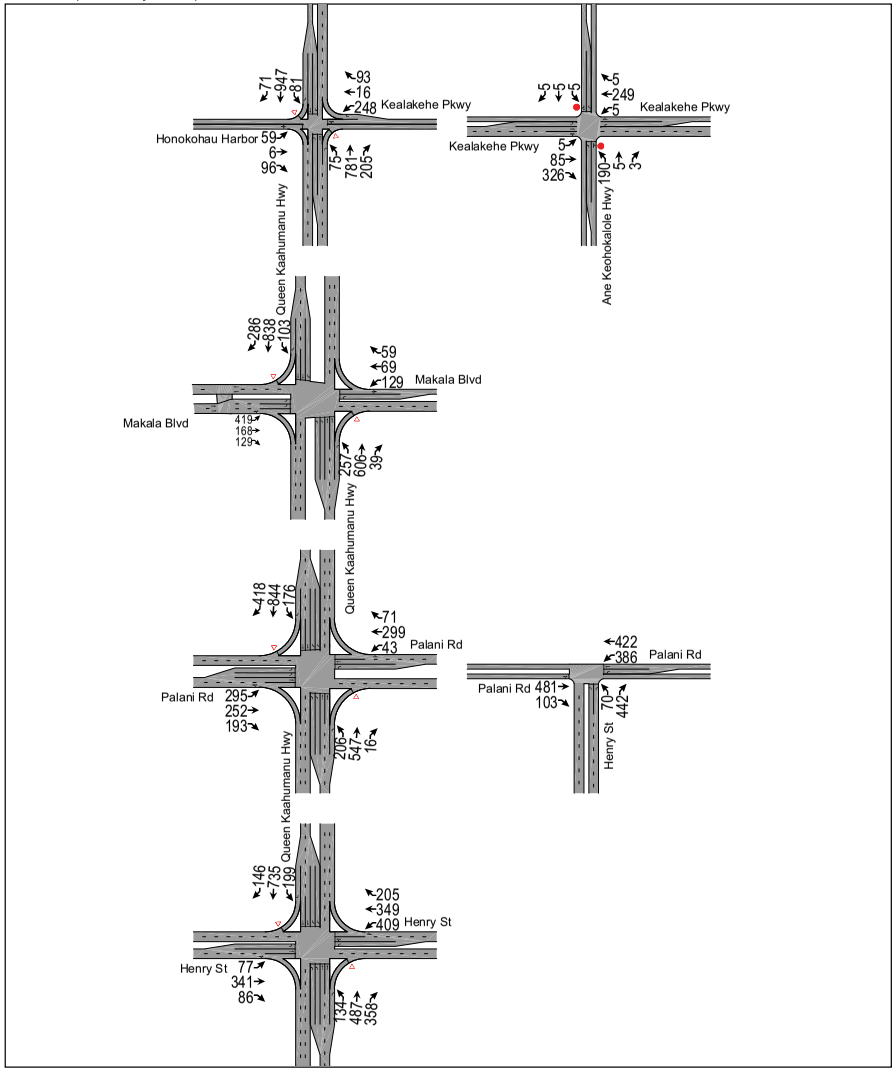


Figure 5. Existing PM Peak Hour Traffic

C. Kealakehe Parkway

The first phase of the Kealakehe Parkway has been completed, as part of the development of the State of Hawai`i Villages of La`i`opua. The mauka portion of Kealakehe Parkway provides access to the initial phases of the Villages of La`i`opua and Kealakehe High School. Kealakehe Parkway is ultimately envisioned as a four-lane arterial roadway through the Kealakehe area between Queen Kaahumanu Highway and Palani Road/Mamalahoa Highway. The future extension of Kealakehe Parkway to Palani Road/Mamalahoa Highway is not included in this traffic impact analysis.

IV. Future Peak Hour Traffic

A. External Traffic

Historical traffic count data – from 1984 to 2008 – were taken by DOT on Queen Kaahumanu Highway at Kealakehe Parkway and on Mamalahoa Highway at Old Mamalahoa Highway. Linear regression analysis of the DOT data indicated that regional traffic has grown at an average annual rate of 2.7 percent. Multiplier factors of 1.135, 1.27, and 1.54 were uniformly applied to the existing traffic in the study area to estimate growth in the Years 2014, 2019, and 2029 traffic demands, respectively. Specific approved projects in the immediate vicinity of the proposed Kamakana Villages were included in the traffic forecast.

B. Future Development

1. Villages of La`i`opua

The State of Hawai`i Department of Hawaiian Homelands (DHHL) is continuing its development of the Villages of La`i`opua in Kealakehe, North Kona, Hawaii. For the purpose of this analysis, 400 additional single-family dwelling units are assumed to be developed over the next 20 years.

2. Kaloko Industrial Park

Kaloko Industrial Park is being expanded in the mauka direction of the existing Phases I and II. The Traffic Impact Report for the Kaloko Industrial Park Phases III and IV, dated May, 2000, was prepared for TSA International, Ltd. by Wilson Okamoto & Associates. Approximately 102.3 acres are planned for mixed commercial and light industrial uses, which will be located mauka of the existing light industrial subdivision. The trip generation and the traffic assignment developed in the Kaloko traffic study were adopted for use in this traffic impact analysis.

3. West Hawai`i Business Park

Lanihau Partners is planning the development of a mixed commercial/industrial 280-acre site on the mauka side of Queen Kaahumanu Highway, directly across from the Kaloko-Honokohau National Historic Park. The Traffic Management Consultant prepared the Traffic Impact Analysis Report for the Proposed Kaloko-Honokohau

Business Park, dated January 9, 2001. The Lanihau project has since been renamed West Hawai`i Business Park. TMC prepared the Traffic Impact Analysis Report Update for the Proposed West Hawai`i Business Park, dated February 23, 2007.

4. West Hawai`i Civic Center

The West Hawai`i Civic Center is under construction at this writing. The Traffic Impact Analysis Report – West Hawai`i Civic Center was prepared by M&E Pacific, Inc., dated November, 2006. The West Hawai`i Civic Center will be located on the northwest corner of the intersection of Kealakehe Parkway and Ane Keohokalole Highway. The West Hawai`i Civic Center will include: a town hall; buildings for the County Council and other County departments; a library, a museum; and meeting rooms, totaling about 100,000 SFGFA. The trip generation analysis and traffic assignment developed for the West Hawai`i Civic Center project were adopted for use in this traffic impact analysis.

C. Year 2014 Peak Hour Traffic Analysis Without Project

The widening of Queen Kaahumanu Highway, from two lanes to four lanes between Kealakehe Parkway and the Kona International Airport Access Road, is expected to be completed by the Year 2014 by the State Department of Transportation. Furthermore, the initial phase of the two-way, two- to four-lane Ane Keohokalole Highway from Puohulihuli Street to Palani Road and the widening of Palani Road from Ane Keohokalole Highway/Henry Street to Kamakaeha Avenue are expected to be completed by the County of Hawaii. The baseline roadway conditions for the Year 2014 without the proposed project include the following improvements on Ane Keohokalole Highway/ Henry Street, which are part of the County of Hawaii's initial phase of the Ane Keohokalole Highway project:

- Mauka bound Palani Road will be widened to provide an exclusive left-turn lane to Ane Keohokalole Highway.
- Mauka bound Palani Road will be widened to provide an exclusive right-turn lane to Henry Street.
- The southbound approach of Ane Keohokalole Highway at Palani Road will provide an exclusive left-turn lane, a through-only lane, and a shared through/right-turn lane.
- The north leg of Ane Keohokalole Highway at Palani Road will provide two northbound lanes up to the future Makala Boulevard Extension.
- Henry Street will be restriped to provide a shared left-turn/through lane and a shared right-turn/through lane at Palani Road.
- The traffic signal phasing will be modified to provide protected-permissive left-turn phases on all approaches to the intersection of Palani Road and Ane Keohokalole Highway/Henry Street.

- Provide a median lane for left-turn lanes on Ane Keohokalole Highway at the future extensions Makala Boulevard and Manawalea Street.

1. Year 2014 AM Peak Hour Traffic Analysis Without Project

During the Year 2014 AM peak hour of traffic without the proposed project, the intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "C" with a v/c ratio of 0.85. The shared left-turn/through movement on westbound (makai bound) Kealakehe Parkway is expected to operate at LOS "D". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service.

The Queen Kaahumanu Highway and Makala Boulevard intersection is expected to operate at LOS "C" with a v/c ratio of 0.86. The left-turn movements in both directions on Queen Kaahumanu Highway are expected to operate at LOS "D". The left-turn and through movements on makai bound Makala Boulevard also are expected to operate at LOS "D". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service, during the Year 2014 AM peak hour of traffic without the proposed project.

The Queen Kaahumanu Highway and Palani Road intersection is expected to operate at LOS "C" with a v/c ratio of 0.85, during the Year 2014 AM peak hour of traffic without the proposed project. The left-turn movements on all approaches to the intersection are expected to operate at LOS "D". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service.

The intersection of Queen Kaahumanu Highway and Henry Street is expected to operate at LOS "D" with a v/c ratio of 0.86. The left-turn movements on northbound and southbound Queen Kaahumanu Highway, and on makai bound Henry Street are expected to operate at LOS "E", during the Year 2014 AM peak hour of traffic without the proposed project.

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "C" with a v/c ratio of 0.88, during the Year 2014 AM peak hour of traffic without the proposed project. The mauka bound through movement on Palani Road is expected to operate at LOS "E". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service.

The left-turn movements on northbound and southbound Ane Keohokalole Highway at Kealakehe Parkway are expected to operate at LOS "F" and LOS "D", respectively. The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service. Figure 6 depicts the Year 2014 AM peak hour traffic without the proposed project.

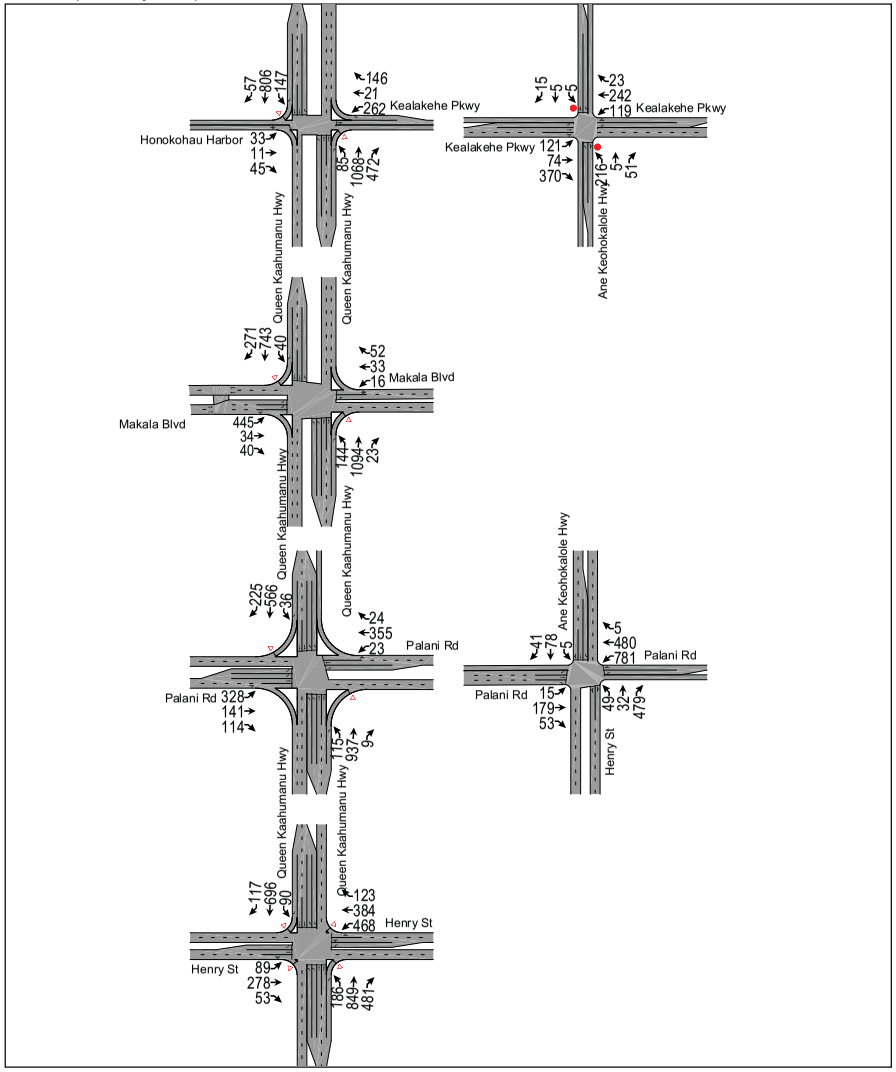


Figure 6. Year 2014 AM Peak Hour Traffic Without Project

2. Year 2014 PM Peak Hour Traffic Analysis Without Project

During the Year 2014 PM peak hour of traffic without the proposed project, the intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "F". The traffic demand is expected to far exceed the capacity of the intersection. The makai bound approach of Kealakehe Parkway and the southbound approach of Queen Kaahumanu Highway are expected to operate at LOS "F".

The intersection of Queen Kaahumanu Highway and Makala Boulevard is expected to operate at LOS "D" with a v/c ratio of 1.04, during the Year 2014 PM peak hour of traffic without the proposed project. The left-turn movements in both directions on Makala Boulevard and on northbound Queen Kaahumanu Highway are expected to operate at LOS "F". The makai bound through movement also is expected to operate at LOS "F". The through movement on southbound Queen Kaahumanu Highway and the left-turn movement on northbound Queen Kaahumanu Highway are expected to operate at LOS "E".

During the Year 2014 PM peak hour of traffic without the proposed project, the intersection of Queen Kaahumanu Highway and Palani Road is expected to operate at LOS "D" with a v/c ratio of 0.99. The left-turn movements on all approaches to the intersection are expected to operate at LOS "E". The through movement on makai bound Palani Road also is expected to operate at LOS "E".

The intersection of Queen Kaahumanu Highway and Henry Street is expected to operate at LOS "D" with a v/c ratio of 0.97, during the Year 2014 PM peak hour of traffic without the proposed project. The left-turn movement on northbound Queen Kaahumanu Highway is expected to operate at LOS "F". The left-turn movement on makai bound Henry Street and the through movement on mauka bound Henry Street and the left-turn movement on northbound Queen Kaahumanu Highway are expected to operate at LOS "E".

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "D" with a v/c ratio of 0.99. During the Year 2014 PM peak hour of traffic without the proposed project, the left-turn movement on makai bound Palani Road and the shared through/left-turn movement on northbound Henry Street are expected to operate at LOS "E".

The northbound left-turn movement on Ane Keohokalole Highway is expected to operate at LOS "D". The other movements at the intersection are expected to operate at satisfactory Levels of Service. The Year 2014 PM peak hour traffic without the proposed project is depicted on Figure 7.

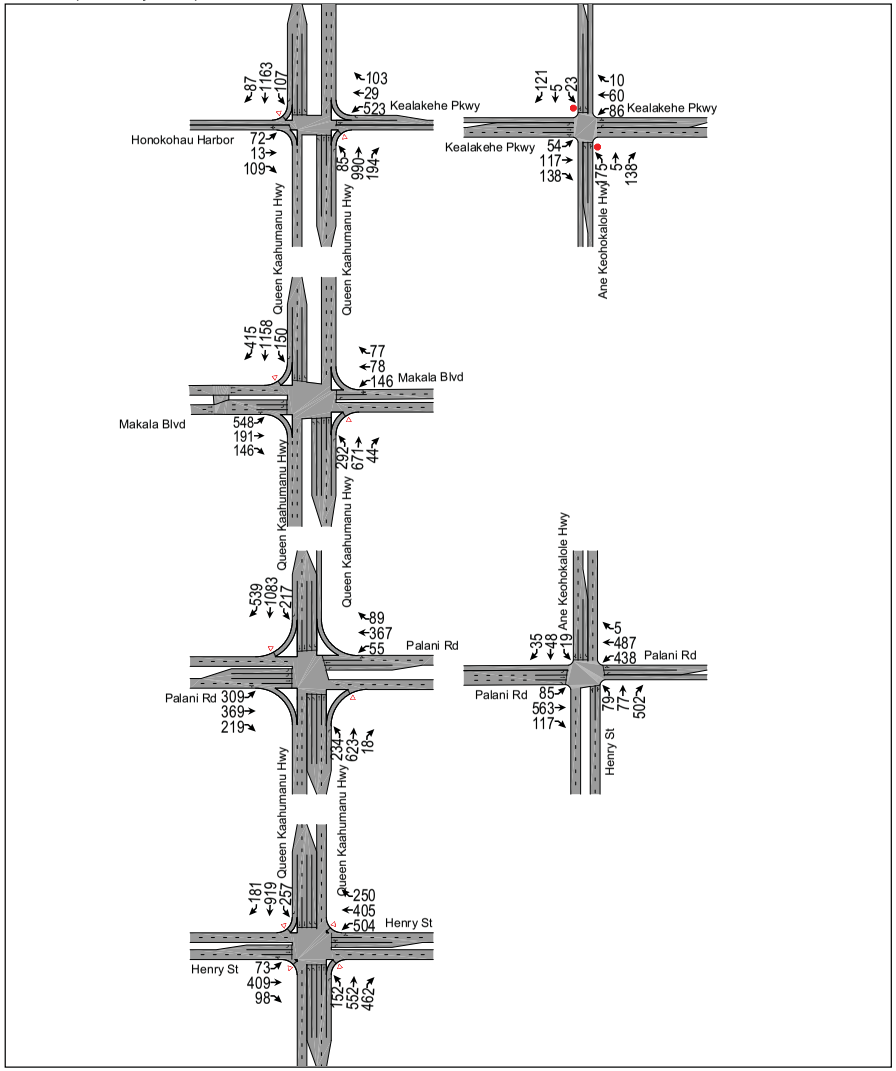


Figure 7. Year 2014 PM Peak Hour Traffic Without Project

3. Year 2014 Proposed Traffic Improvements Without Project

The following improvements are proposed to mitigate highway deficiencies expected by the Year 2014 without the proposed project:

a. Kealakehe Parkway and Queen Kaahumanu Highway

- Widen makai bound Kealakehe Parkway to provide double left-turn lanes onto southbound Queen Kaahumanu, in addition to the existing through lane and right-turn lane.
- Widen mauka bound Kealakehe Parkway to provide a left-turn lane onto northbound Queen Kaahumanu, in addition to the existing shared through/right-turn lane.
- Modify the traffic signal phasing to provide protected left-turn phases on both approaches on Kealakehe Parkway.

b. Makala Boulevard and Queen Kaahumanu Highway

- Restripe the right-turn only lane on mauka bound Makala Boulevard at Queen Kaahumanu Highway to a shared through/right-turn lane to provide two through lanes across the intersection.
- Restripe/widen makai bound Makala Boulevard at Queen Kaahumanu Highway to provide double left-turn lanes and a through-only lane, in addition to the existing shared through/right-turn lane.
- Modify the traffic signal phasing to provide an eight-phase operation with protected left-turn phases on all approaches.

c. Henry Street and Queen Kaahumanu Highway

- Widen makai bound Henry Street to provide double left-turn lanes in addition to a through-only lane and a shared through/right-turn lane.
- Modify the traffic signal phasing to provide an eight-phase operation with protected left-turn phases on all approaches.

d. Palani Road and Henry Street/Ane Keohokalole Highway

- Widen makai bound Palani Road to provide double left-turn lanes onto Henry Street.
- Modify the traffic signal phasing to include protected left-turn phases in both directions on Palani Road.

e. Ane Keohokalole Highway and Kealakehe Parkway

- Signalize the intersection, when warranted.

D. Year 2019 Peak Hour Traffic Analysis Without Project

The traffic improvements, which are proposed in the previous section, are assumed to implemented by the Year 2019 without the proposed project.

1. Year 2019 AM Peak Hour Traffic Analysis Without Project

During the Year 2019 AM peak hour of traffic without the proposed project, the intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "C" with a v/c ratio of 0.93. The left-turn movement on makai bound Kealakehe Parkway and the left-turn movement on southbound Queen Kaahumanu Highway are expected to operate at LOS "E".

The Queen Kaahumanu Highway and Makala Boulevard intersection is expected to operate at LOS "C" with a v/c ratio of 0.92. The left-turn movement on all approaches to the intersection are expected to operate at LOS "D", during the Year 2019 AM peak hour of traffic without the proposed project.

The Queen Kaahumanu Highway and Palani Road intersection is expected to operate at LOS "C" with a v/c ratio of 0.89, during the Year 2019 AM peak hour of traffic without the proposed project. The left-turn movements on all approaches to the intersection are expected to operate at LOS "D". The through movement on northbound Queen Kaahumanu Highway and the through movement on makai bound Palani Road also are expected to operate at LOS "D".

The Queen Kaahumanu Highway and Henry Street intersection is expected to operate at LOS "D" with a v/c ratio of 0.89. The left-turn movements in both directions on Queen Kaahumanu Highway are expected to operate at LOS "E", during the Year 2019 AM peak hour of traffic without the proposed project.

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "C" with a v/c ratio of 0.81, during the Year 2019 AM peak hour of traffic without the proposed project. The left-turn and through movements on mauka bound Palani Road are expected to operate at LOS "D". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service.

The intersection of Ane Keohokalole Highway at Kealakehe Parkway is expected to operate at satisfactory Levels of Service. Figure 8 depicts the Year 2019 AM peak hour traffic without the proposed project.

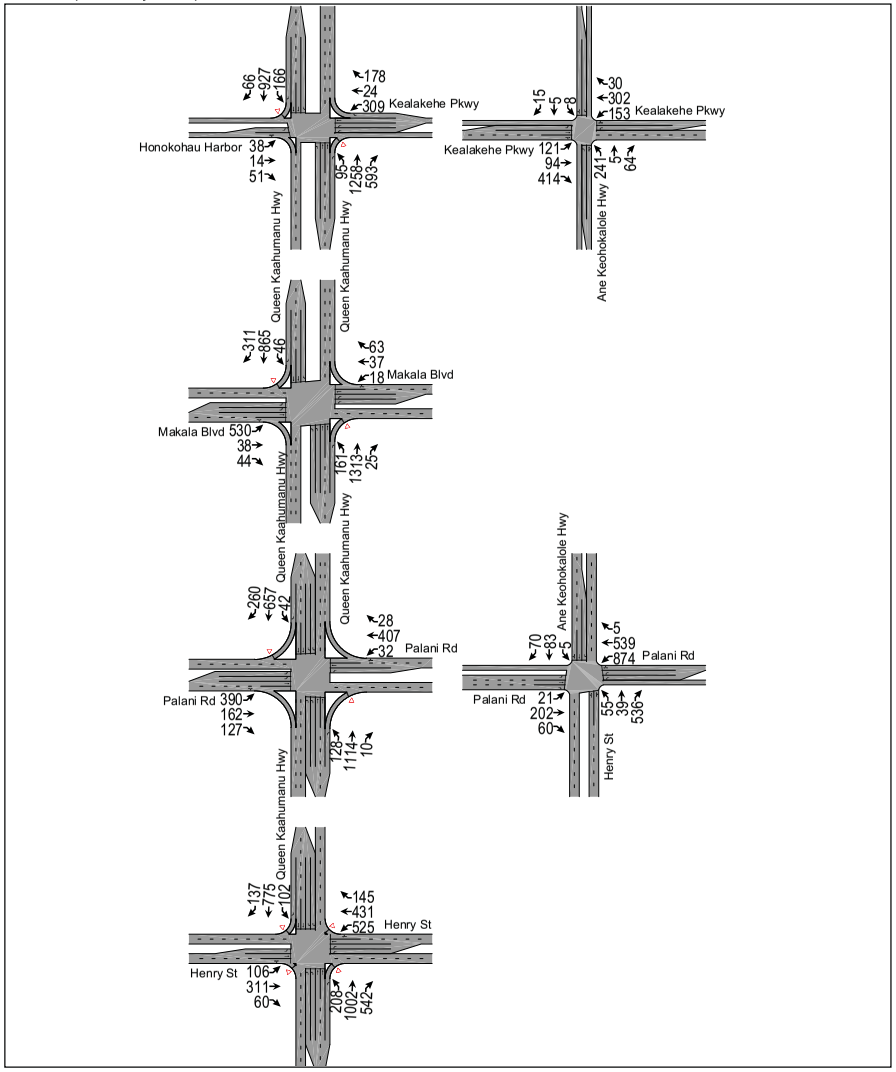


Figure 8. Year 2019 AM Peak Hour Traffic Without Project

2. Year 2019 PM Peak Hour Traffic Analysis Without Project

The intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "D" with a v/c ratio of 1.07, during the Year 2019 PM peak hour of traffic without the proposed project. The left-turn movement on makai bound Kealakehe Parkway and the through movement on mauka bound Kealakehe Parkway are expected to operate at LOS "F". The through movement on southbound Queen Kaahumanu Highway is expected to operate at LOS "E".

The intersection of Queen Kaahumanu Highway and Makala Boulevard is expected to operate at LOS "E" with a v/c ratio of 1.03, during the Year 2019 PM peak hour of traffic without the proposed project. The left-turn movements in both directions on Makala Boulevard and on northbound Queen Kaahumanu Highway are expected to operate at LOS "F". The makai bound through movement on Makala Boulevard also is expected to operate at LOS "F".

During the Year 2019 PM peak hour of traffic without the proposed project, the intersection of Queen Kaahumanu Highway and Palani Road is expected to operate at LOS "E" with a v/c ratio of 1.08. The left-turn movements on mauka bound Palani Road and on northbound Queen Kaahumanu Highway are expected to operate at LOS "F".

The intersection of Queen Kaahumanu Highway and Henry Street is expected to operate at LOS "D" with a v/c ratio of 1.02. The left-turn movement on northbound Queen Kaahumanu Highway is expected to operate at LOS "F". The left-turn movement on makai bound Henry Street and the through movement on mauka bound Henry Street are expected to operate at LOS "E". The left-turn and through movements on southbound Queen Kaahumanu Highway also are expected to operate at LOS "E".

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "E" with a v/c ratio of 1.05. The left-turn movement on makai bound Palani Road is expected to operate at LOS "F".

The intersection of Kealakehe Parkway and Ane Keohokalole Highway is expected to operate at satisfactory Levels of Service. The Year 2019 PM peak hour traffic without the proposed project is depicted on Figure 9.

3. Year 2019 Proposed Traffic Improvements Without Project

The following improvements are proposed to mitigate highway deficiencies expected by the Year 2019 without the proposed project:

a. Queen Kaahumanu Highway

- Widen Queen Kaahumanu Highway from four lanes to six lanes from Kealakehe Parkway to Henry Street.

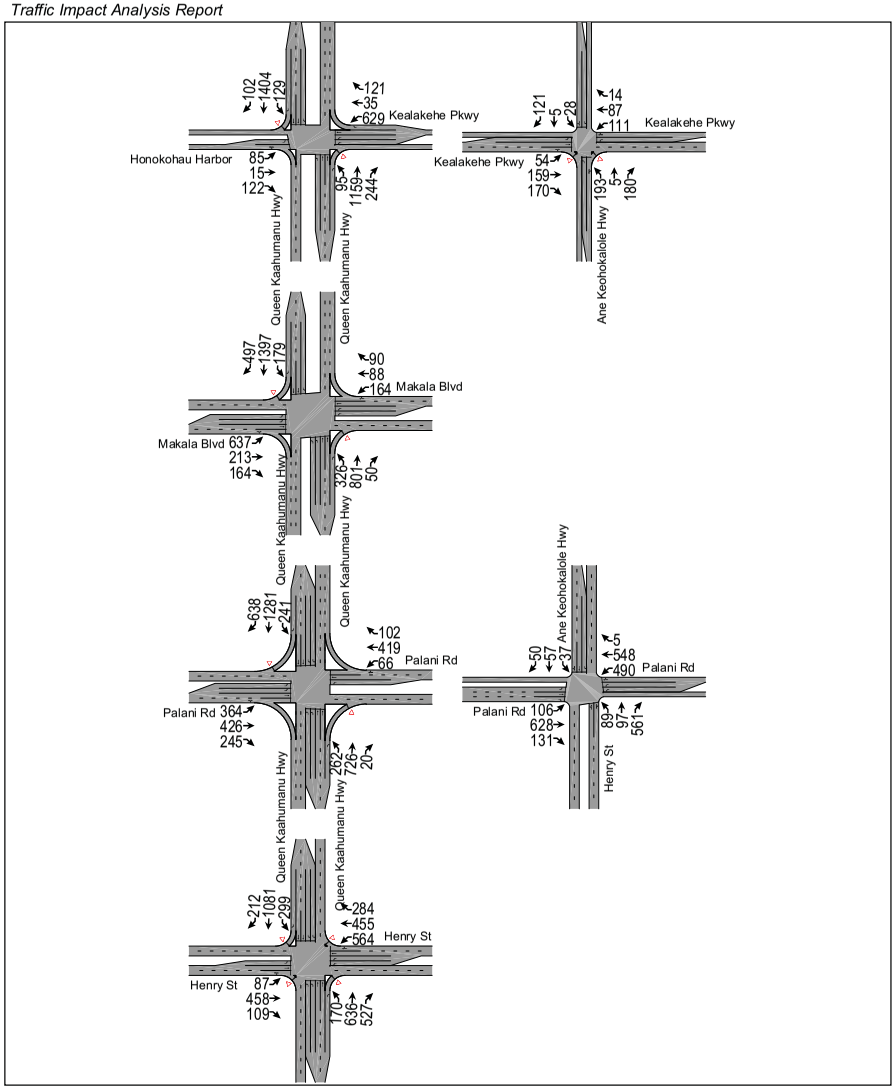


Figure 9. Year 2019 PM Peak Hour Traffic Without Project

b. Palani Road and Henry Street/Ane Keohokalole Highway

The following improvements were recommended in the Final Environmental Assessment for the Ane Keohokalole Mid-Level Highway Project:

- Widen northbound Henry Street to provide an exclusive left-turn lane onto makai bound Palani Road.
- Restripe the exclusive right-turn lane on mauka bound Palani Road to a shared through/right-turn lane to provide two mauka bound lanes.
- Widen the mauka leg of Palani Road to provide two lanes in the mauka bound direction.

E. Year 2029 Peak Hour Traffic Analysis Without Project

1. Year 2029 Traffic Improvements Without Project

In addition to the traffic improvements which are proposed in the previous section, the following roadway improvements are assumed to be implemented by the Year 2029 without the proposed project, as recommended in the Final Environmental Assessment for the Ane Keohokalole Mid-Level Highway Project:

a. Ane Keohokalole Highway

- Widen Ane Keohokalole Highway to a four-lane divided highway from Palani Road to Kealakehe Parkway.
- Provide separate left-turn and right-turn lanes in both directions on Ane Keohokalole Highway at Kealakehe Parkway.
- Extend the four-lane divided Ane Keohokalole Highway to Hina Lani Street.

b. Makala Boulevard

- Extend Makala Boulevard from Makalapa Shopping Center to Ane Keohokalole Highway.
- Provide a separate left-turn lane on Ane Keohokalole Highway to Makala Boulevard.

c. Palani Road and Ane Keohokalole Highway/Henry Street

- Provide an exclusive right-turn lane on Ane Keohokalole Highway at Palani Road.
- Widen makai bound Palani Road to provide two through lanes at Ane Keohokalole Highway/Henry Street.

2. Year 2029 AM Peak Hour Traffic Analysis Without Project

During the Year 2029 AM peak hour of traffic without the proposed project, the intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "C" with a v/c ratio of 0.95 The left-turn movement on southbound Queen Kaahumanu Highway is expected to operate at LOS "F". The left-turn movements in both directions on Kealakehe Parkway are expected to operate at LOS "E".

The Queen Kaahumanu Highway and Makala Boulevard intersection is expected to operate at LOS "C" with a v/c ratio of 0.91. The left-turn movement on southbound Queen Kaahumanu Highway and the through/right-turn movement on makai bound Makala Boulevard are expected to operate at LOS "E", during the Year 2029 AM peak hour of traffic without the proposed project.

The Queen Kaahumanu Highway and Palani Road intersection is expected to operate at LOS "D" with a v/c ratio of 0.89, during the Year 2029 AM peak hour of traffic without the proposed project. The left-tum movement on makai bound Palani Road is expected to operate at LOS "E". The left-turn movements on the other approaches to the intersection are expected to operate at LOS "D". The through movement on northbound Queen Kaahumanu Highway and the through movement on makai bound Palani Road also are expected to operate at LOS "D".

The Queen Kaahumanu Highway and Henry Street intersection is expected to operate at LOS "E" with a v/c ratio of 1.14. The right-turn movement on northbound Queen Kaahumanu Highway and the left-turn movement on southbound Queen Kaahumanu Highway are expected to operate at LOS "F". Both approaches on Henry Street are expected to operate at LOS "F", during the Year 2029 AM peak hour of traffic without the proposed project.

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "C" with a v/c ratio of 0.86, during the Year 2029 AM peak hour of traffic without the proposed project. Mauka bound Palani Road is expected to operate at LOS "D". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service.

The intersection of Ane Keohokalole Highway at Kealakehe Parkway is expected to operate at LOS C with v/c ratio of 0.90. The left-turn movement on northbound Ane Keohokalole Highway and the through movement on makai bound Kealakehe Parkway are expected to operate at LOS "D". Figure 10 depicts the Year 2029 AM peak hour traffic without the proposed project.

3. Year 2029 PM Peak Hour Traffic Analysis Without Project

The intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "D", with a v/c of 0.96, during the Year 2029 PM peak hour of traffic without the proposed project.

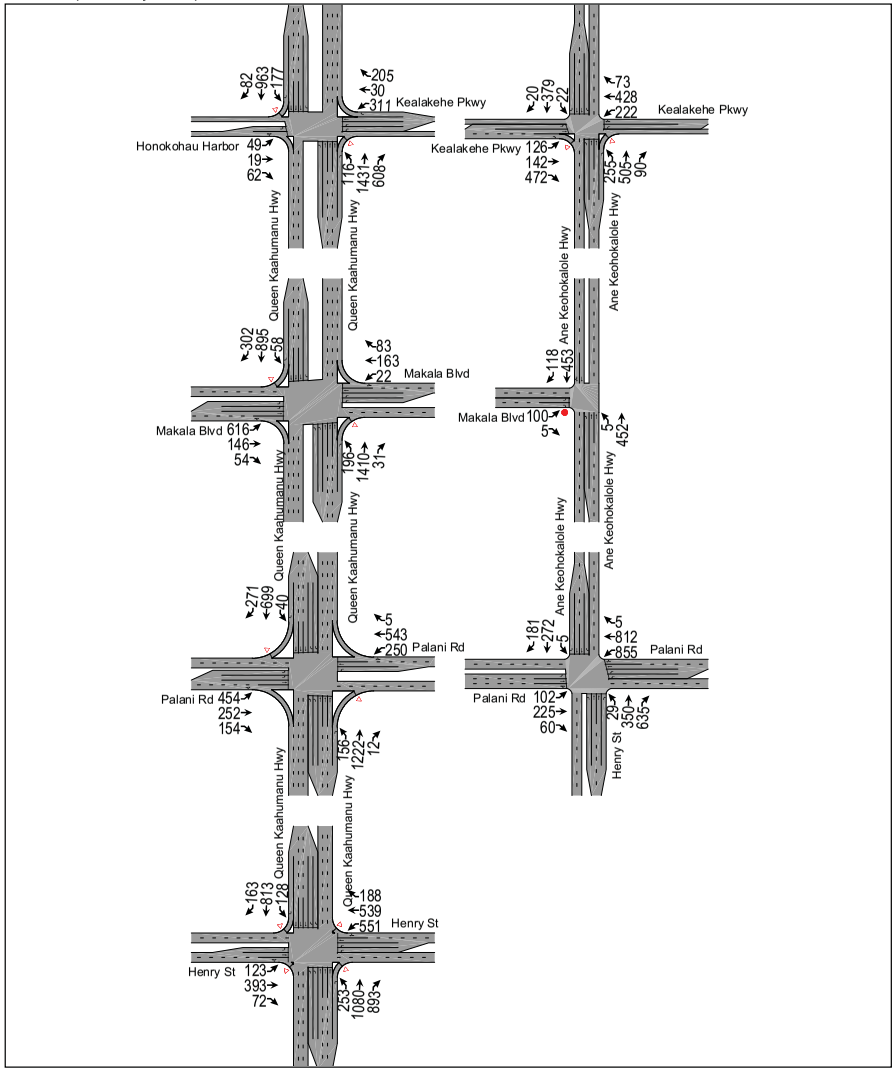


Figure 10. Year 2029 AM Peak Hour Traffic Without Project

The intersection of Queen Kaahumanu Highway and Makala Boulevard is expected to operate at LOS "D" with a v/c ratio of 1.16, during the Year 2029 PM peak hour of traffic without the proposed project. The left-turn movement on northbound Queen Kaahumanu Highway and the makai bound through movement on Makala Boulevard are expected to operate at LOS "F".

During the Year 2029 PM peak hour of traffic without the proposed project, the intersection of Queen Kaahumanu Highway and Palani Road is expected to operate at LOS "E" with a v/c ratio of 1.09. The left-turn movements on makai bound Palani Road and on northbound Queen Kaahumanu Highway are expected to operate at LOS "F". The through movement on makai bound Palani Road also is expected to operate at LOS "F".

The intersection of Queen Kaahumanu Highway and Henry Street is expected to operate at LOS "F". The Year 2029 PM peak hour traffic demands are expected to far exceed the capacity of the intersection.

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "D" with a v/c ratio of 0.97. The left-turn movement on mauka bound Palani Road is expected to operate at LOS "E".

The intersection of Kealakehe Parkway and Ane Keohokalole Highway is expected to operate at LOS "B" with a v/c ratio of 0.77. The left-turn movement on makai bound Kealakehe Parkway is expected to operate at LOS "D". The Year 2029 PM peak hour traffic without the proposed project is depicted on Figure 11.

V. Traffic Impact Analysis

A. Trip Generation Characteristics

The trip generation characteristics for the proposed Kamakana Villages at Keahuolu were developed for the individual land uses. Internal trip generation between the land use activities are expected to reduce the overall trip generation. For the purpose of this traffic impact analysis, it was assumed that 25 percent of the commercial trips would be generated within the proposed project. The residential trips were adjusted for the reduction in internally generated trips.

The proposed Kamakana Villages at Keahuolu is expected to generate a total of 1,478 vph during the AM peak hour of traffic – 415 vph entering the site and 1,063 vph exiting the site. During the PM peak hour of traffic, the proposed project is expected to generate a total of 2,094 vph – 1,251 vph entering the site and 843 vph exiting the site. The trip generation characteristics for the proposed project are summarized in Table 3.

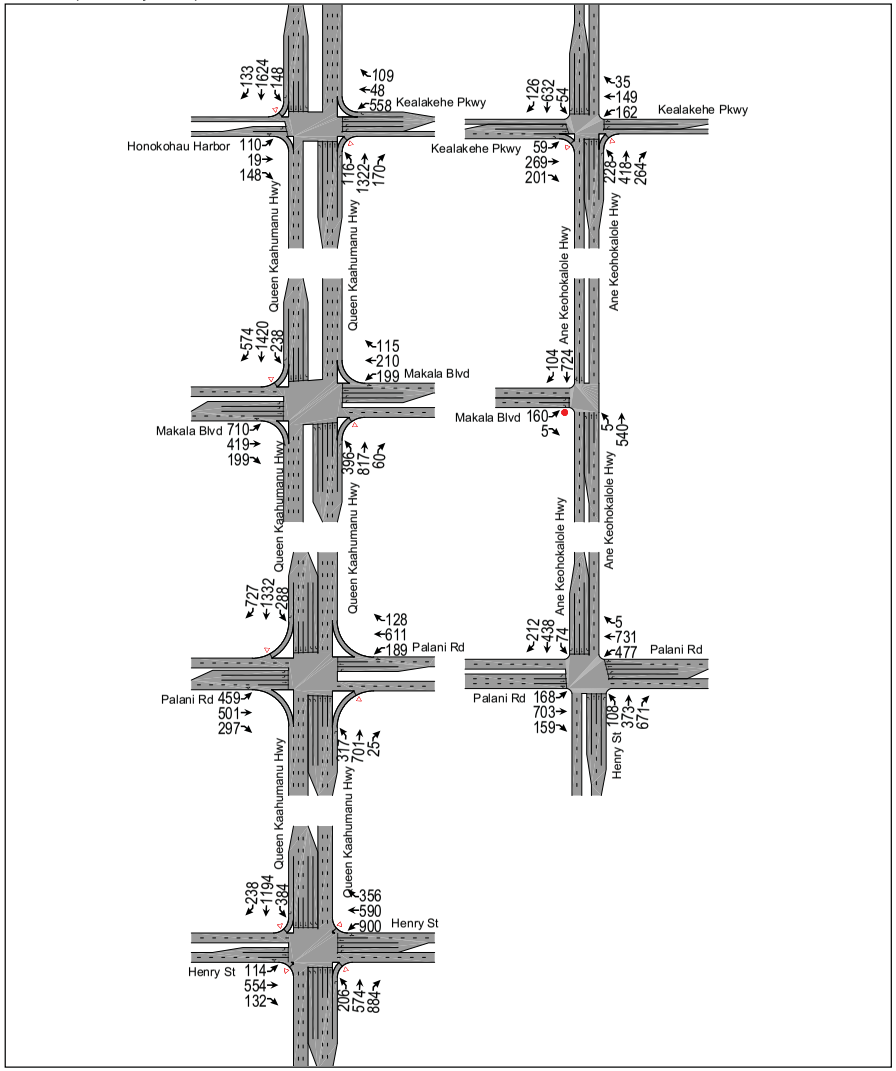


Figure 11. Year 2029 PM Peak Hour Traffic Without Project

Table 3. Trip Generation Characteristics

Year	Land Use (ITE Code)	Units	AM Peak Hour (vph)			PM Peak Hour (vph)		
			Enter	Exit	Total	Enter	Exit	Total
2014	Single-Family Housing (210)	76 DU	14	43	57	45	26	71
	Residential Condominiums (230)	191 DU	14	70	84	67	33	100
	Apartments (220)	149 DU	11	46	57	56	30	86
	Shopping Center (820)	41,833 SFGFA	20	13	33	56	61	117
		Subtotals	59	172	231	224	150	374
2019	Single-Family Housing (210)	153 DU	29	86	115	90	53	143
	Residential Condominiums (230)	324 DU	24	119	143	105	51	156
	Apartments (220)	180 DU	14	56	70	67	37	104
	Shopping Center (820)	57,167 SFGFA	27	17	44	34	41	75
		Subtotals	94	278	372	296	182	478

Table 3. Trip Generation Characteristics (Cont'd.)

Year	Land Use (ITE Code)	Units	AM Peak Hour (vph)			PM Peak Hour (vph)		
			Enter	Exit	Total	Enter	Exit	Total
2029	Single-Family Housing (210)	432 DU	79	236	315	246	144	390
	Residential Condominiums (230)	733 DU	46	225	271	199	97	296
	Apartments (220)	92 DU	15	60	75	73	39	112
	Shopping Center (820)	98,000 SFGFA	46	30	76	132	143	275
	Elementary School (220)	550 Students	N/A	N/A	N/A	40	42	82
	Charter/Private School (820)	150 Students	76	62	138	41	46	87
		Subtotals	262	613	875	731	511	1,242
		Project Totals	415	1,063	1,478	1,251	843	2,094

A portion of the PM peak hour traffic, generated from the retail component of Kamakana Villages at Keahuolu, can be expected to be "pass-by" trips, i.e., traffic already on the road, stopping at a "secondary" destination. The percentages of pass-by trips vary by size of the shopping center. The retail components of Phases 1 and 2 will total 66,333 SFGFA and generate 31.9 percent pass-by traffic. The Phase 3 retail component will total 32,667 SFGFA and generate 53.9 percent pass-by traffic. The Phase 6 retail component will total 98,000 SFGFA and generate 39.1 percent pass-by traffic. Therefore, of the total 2,094 vph generated during the PM peak hour of traffic, 246 vph are expected to be pass-by trips.

B. Year 2014 Peak Hour Traffic Impact Analysis With Project

1. Year 2014 Local Mitigation Traffic Improvements With Project

Manawalea Street will be constructed with separate left-turn and right-turn lanes to intersect Ane Keohokalole Highway at a stop-controlled Tee-intersection to provide access to the project. The project civil engineer's estimated cost of this Year 2014 local mitigation traffic improvement is $70,000.

2. Year 2014 Peak Hour Traffic Assignment

The AM and PM peak hour site-generated traffic assignments were developed based upon existing traffic circulation patterns and anticipated patterns resulting from future roadways in the vicinity of the proposed project. The Year 2014 AM and PM peak hour site-generated traffic assignments are depicted on Figures 12 and 13, respectively.

3. Year 2014 AM Peak Hour Traffic Impact Analysis With Project

The intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "C" with a v/c ratio of 0.86, during the Year 2014 AM peak hour of traffic with the proposed project. The left-turn movement on southbound Queen Kaahumanu Highway and the left-turn/through movement on makai bound Kealakehe Parkway are expected to operate at LOS "D". The other traffic movements at the intersection are expected to operate at the same Levels of Service as the Year 2014 AM peak hour of traffic without the proposed project.

The Queen Kaahumanu Highway and Makala Boulevard intersection is not expected to be affected by traffic generated from the proposed project, during the Year 2014 AM peak hour of traffic with the proposed project, since Makala Boulevard is not expected to be extended to Ane Keohokalole Highway by the Year 2014.

The Queen Kaahumanu Highway and Palani Road intersection also is not expected be significantly affected by traffic generated from the proposed project, during the Year 2014 AM peak hour of traffic with the proposed project.

The intersection of Queen Kaahumanu Highway and Henry Street is expected to operate at the same Levels of Service as the Year 2014 AM peak hour of traffic without the proposed project.

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "C" with a v/c ratio of 0.92, during the Year 2014 AM peak hour of traffic with the proposed project. The left-turn movement on makai bound Palani Road and the opposing through movement on mauka bound Palani Road are expected to operate at LOS "D". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service, or at the same Levels of Service as the Year 2014 AM peak hour of traffic without the proposed project.

Manawalea Street is expected to operate at satisfactory Levels of Service, during the Year 2014 AM peak hour of traffic with the proposed project.

The traffic movements at the intersection of Ane Keohokalole Highway at Kealakehe Parkway are expected to operate at the same Levels of Service as the Year 2014 AM peak hour of traffic without the proposed project. Figure 14 depicts the Year 2014 AM peak hour traffic with the proposed project.

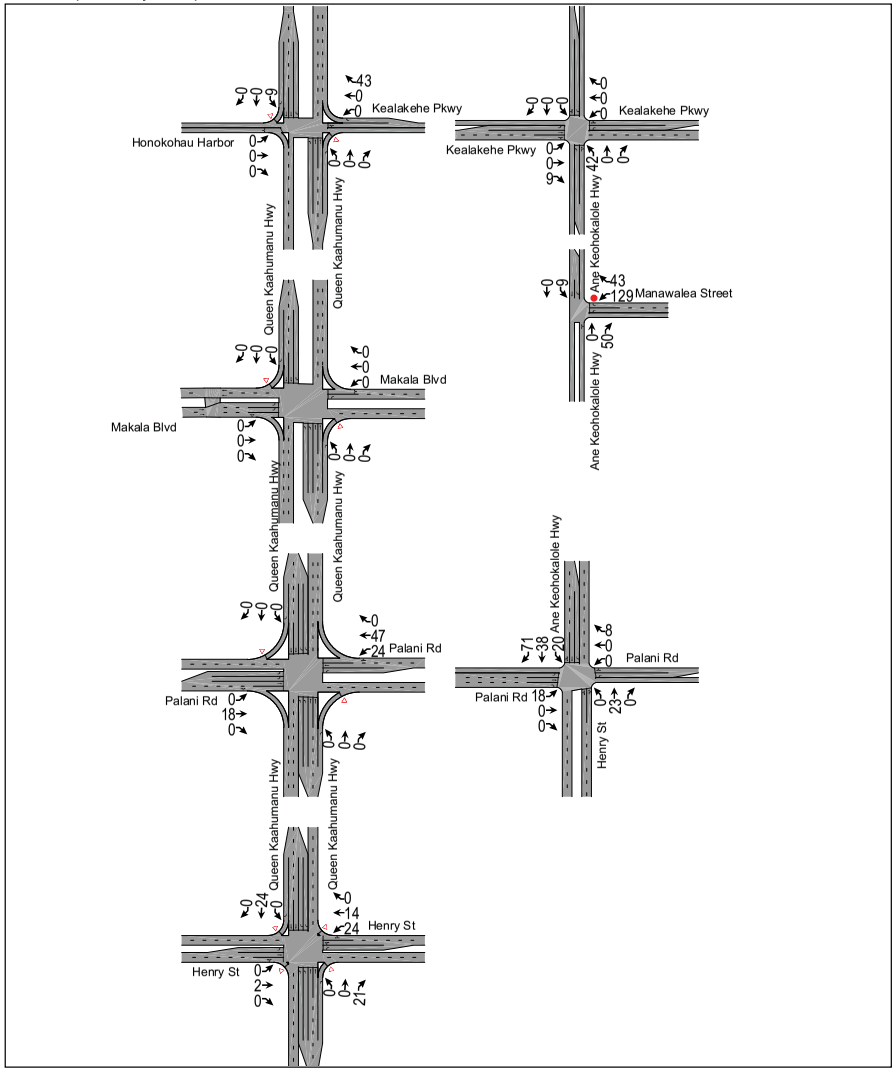


Figure 12. Year 2014 AM Peak Hour Site Traffic

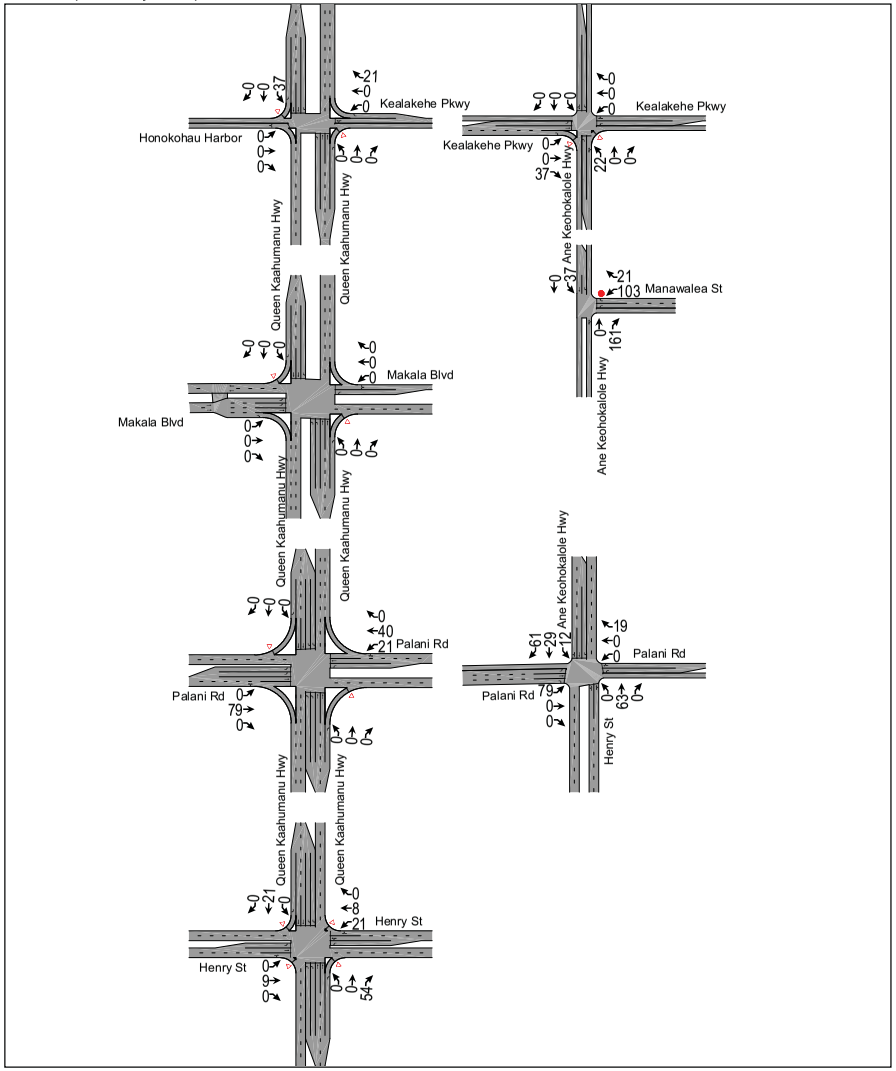


Figure 13. Year 2014 PM Peak Hour Site Traffic

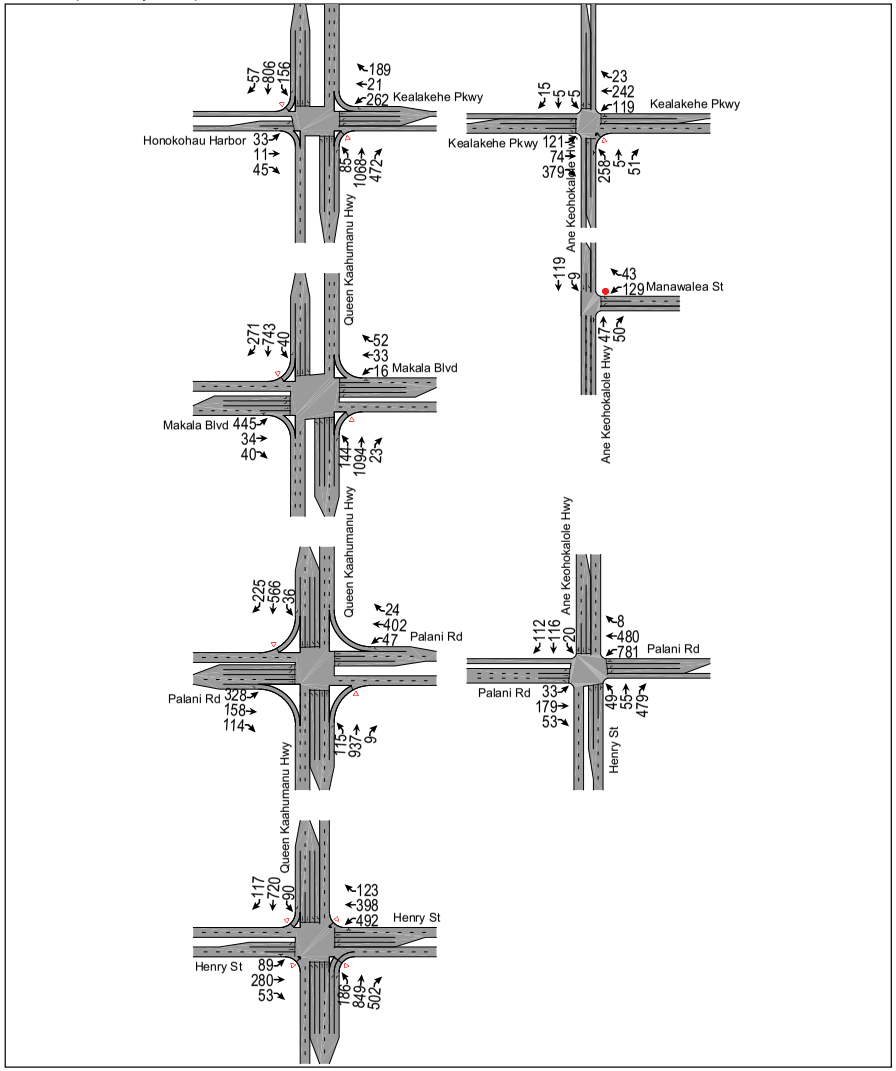


Figure 14. Year 2014 AM Peak Hour Traffic With Project

4. Year 2014 PM Peak Hour Traffic Analysis With Project

During the Year 2014 PM peak hour of traffic with the proposed project, the intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at the same Levels of Service as the Year 2014 PM peak hour of traffic without the proposed project.

The Queen Kaahumanu Highway and Makala Boulevard intersection is not expected to be affected by traffic generated from the proposed project, during the Year 2014 PM peak hour of traffic with the proposed project.

During the Year 2014 PM peak hour of traffic with the proposed project, the intersection of Queen Kaahumanu Highway and Palani Road is expected to operate at LOS "D" with a v/c ratio of 1.04. The through movement on mauka bound Palani Road is expected to operate at LOS "D". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service, or at the same Levels of Service as the Year 2014 PM peak hour of traffic without the proposed project.

The intersection of Queen Kaahumanu Highway and Henry Street is expected to operate at LOS "D" with a v/c ratio of 1.00. The through movement on mauka bound Henry Street and the left-turn movement on northbound Queen Kaahumanu Highway are expected to operate at LOS "F". The through movement on southbound Queen Kaahumanu Highway is expected to operate at LOS "E". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service, or at the same Levels of Service as the Year 2014 PM peak hour of traffic without the proposed project.

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "D" with a v/c ratio of 1.02. During the Year 2014 PM peak hour of traffic with the proposed project, the left-turn movement on makai bound Palani Road and the through movement on mauka bound Palani Road are expected to operate at LOS "E".

Manawalea Street is expected to operate at satisfactory Levels of Service, during the Year 2014 PM peak hour of traffic with the proposed project.

The northbound left-turn movement on Ane Keohokalole Highway at Kealakehe Parkway is expected to operate at LOS "E". The other traffic movements at the intersection are expected to operate at satisfactory Levels of Service, or at the same Levels of Service as the Year 2014 PM peak hour of traffic without the proposed project. The Year 2014 PM peak hour traffic with the proposed project is depicted on Figure 15.

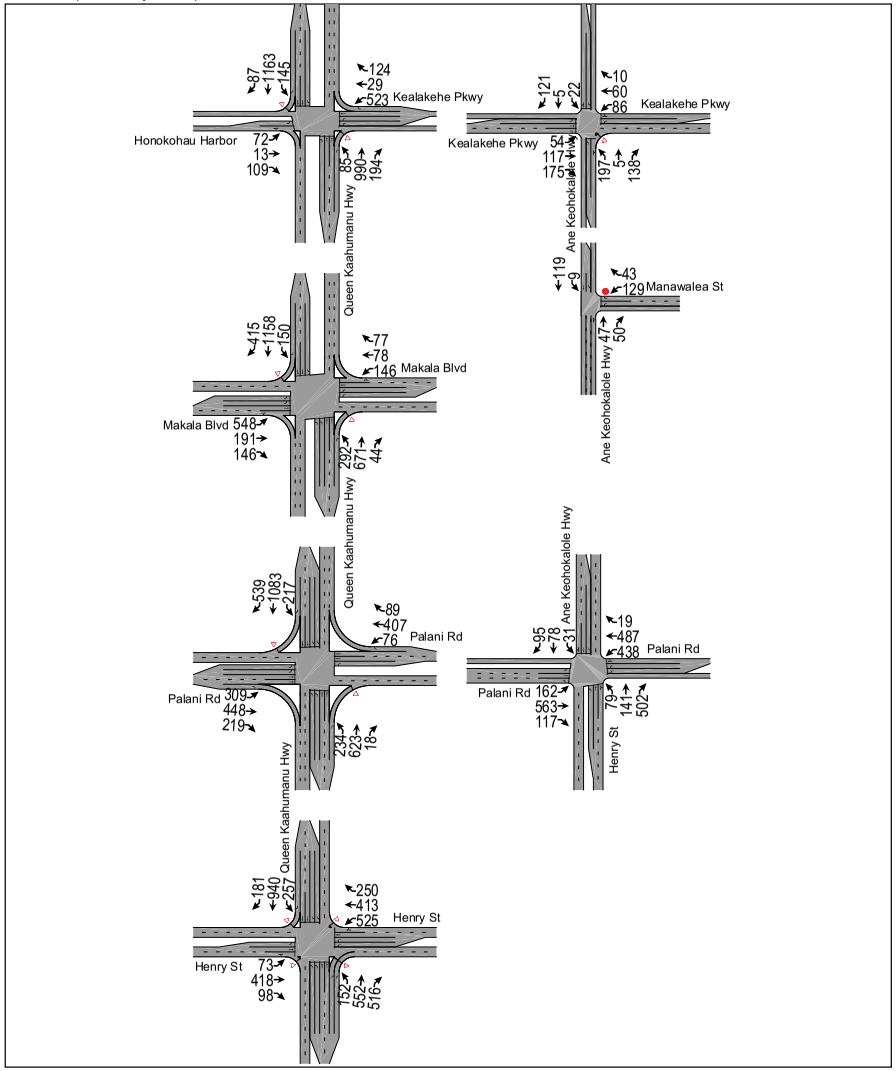


Figure 15. Year 2014 PM Peak Hour Traffic With Project

5. Year 2014 Area Mitigation Traffic Improvements With Project

In addition to the proposed improvements recommended for the Year 2014 without the proposed project, the following area mitigation traffic improvements are proposed to maintain minimum LOS "D" conditions up to the Year 2014 with the proposed project:

a. Palani Road and Queen Kaahumanu Highway

- Widen makai bound Palani Road at Queen Kaahumanu Highway to provide an exclusive right-turn lane.

b. Henry Street and Queen Kaahumanu Highway

- Widen northbound Queen Kaahumanu Highway to provide double right-turn lanes at Henry Street.

c. Palani Road and Henry Street/Ane Keohokalole Highway

- Widen northbound Henry Street at Palani Road to provide an exclusive left-turn lane.

C. Year 2019 Peak Hour Traffic Analysis With Project

1. Year 2019 Local Mitigation Traffic Improvements With Project

The traffic improvements, proposed in the previous section, are assumed to be implemented by the Year 2019 with the proposed project. The local mitigation traffic improvements are recommended at the intersection of Ane Keohokalole Highway and Makala Boulevard to provide access to the proposed project. The project civil engineer's total estimated cost of the following Year 2019 local mitigation traffic improvements is $90,000.

a. Makala Boulevard and Ane Keohokalole Highway

- Construct the east leg of Makala Boulevard with separate left-turn and right-turn lanes, intersecting Ane Keohokalole Highway at a stop-controlled Tee-intersection.

- Restripe the median to provide a shelter lane on southbound Ane Keohokalole Highway at Makala Boulevard.

b. Manawalea Street and Ane Keohokalole Highway

- Restripe southbound Ane Keohokalole Highway to provide a median shelter lane at Manawalea Street.

2. Year 2019 Peak Hour Traffic Assignment

The AM and PM peak hour site-generated traffic assignments were developed based upon existing traffic circulation patterns and anticipated traffic circulation patterns resulting from future roadways in the vicinity of the proposed project. The Year 2019 AM and PM peak hour site-generated traffic assignments are depicted on Figures 16 and 17, respectively.

3. Year 2019 AM Peak Hour Traffic Analysis With Project

During the Year 2019 AM peak hour of traffic with the proposed project, the intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "C" with a v/c ratio of 0.89. The left-turn movements in both directions on Kealakehe Parkway and on southbound Queen Kaahumanu Highway are expected to operate at LOS "D". The through movement on makai bound Kealakehe Parkway also is expected to operate at LOS "D".

The Queen Kaahumanu Highway and Makala Boulevard intersection is not expected to be affected by traffic generated from the proposed project, during the Year 2019 AM peak hour of traffic with the proposed project, since Makala Boulevard is not expected to be extended to Ane Keohokalole Highway by the Year 2019.

The Queen Kaahumanu Highway and Palani Road intersection is expected to operate at LOS "D" with a v/c ratio of 0.94, during the Year 2019 AM peak hour of traffic with the proposed project. The left-turn movements on both approaches of Palani Road are expected to operate at LOS "E".

The Queen Kaahumanu Highway and Henry Street intersection is expected to operate at LOS "D" with a v/c ratio of 0.95. The left-turn movement on northbound Queen Kaahumanu Highway is expected to operate at LOS "F", during the Year 2019 AM peak hour of traffic with the proposed project. The left-turn movements on the other approaches to the intersection are expected to operate at LOS "E".

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "C" with a v/c ratio of 0.89, during the Year 2019 AM peak hour of traffic with the proposed project. The left-turn movements on all approaches to the intersection are expected to operate at LOS "D". The through movements in both directions on Palani Road are also expected to operate at LOS "D".

The Makala Boulevard intersection, the Manawalea Street intersection, and the Kealakehe Parkway intersection on Ane Keohokalole Highway are expected to operate at satisfactory Levels of Service, during the Year 2019 AM peak hour of traffic with the proposed project. Figure 18 depicts the Year 2019 AM peak hour traffic with the proposed project.

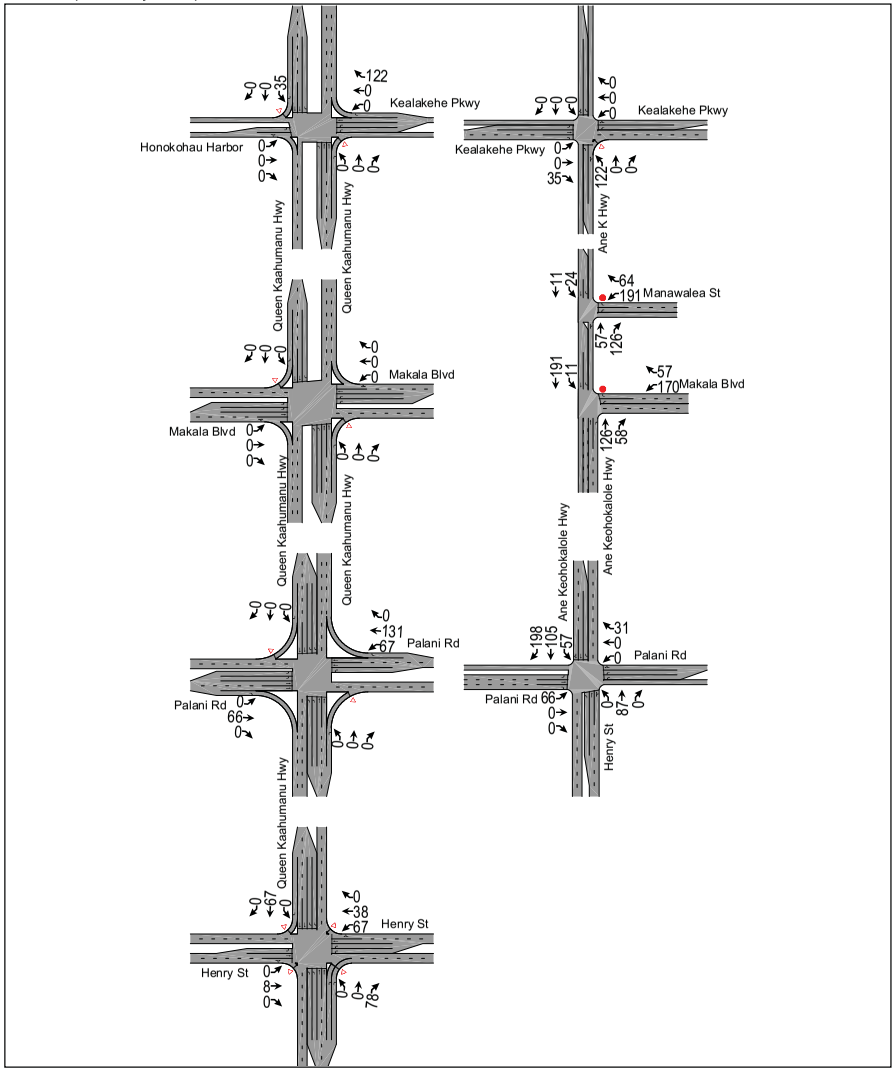


Figure 16. Year 2019 AM Peak Hour Site Traffic

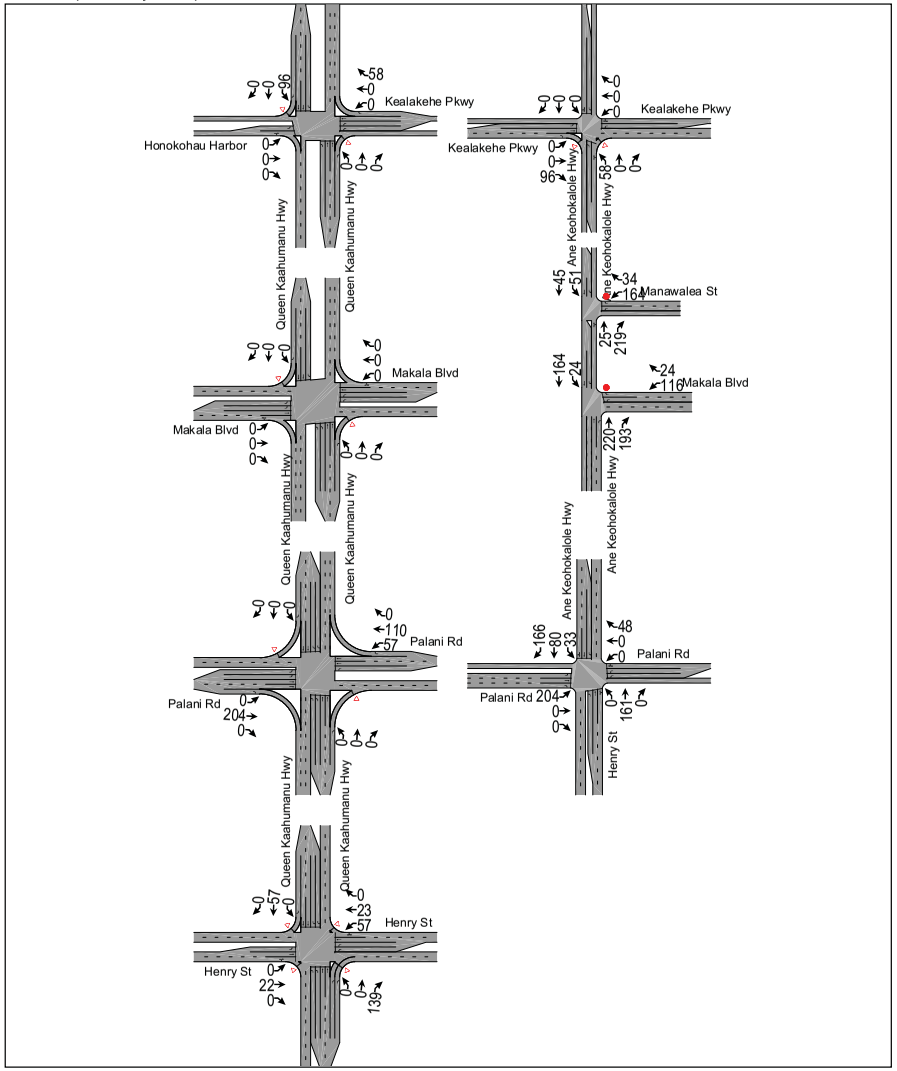


Figure 17. Year 2019 PM Peak Hour Site Traffic

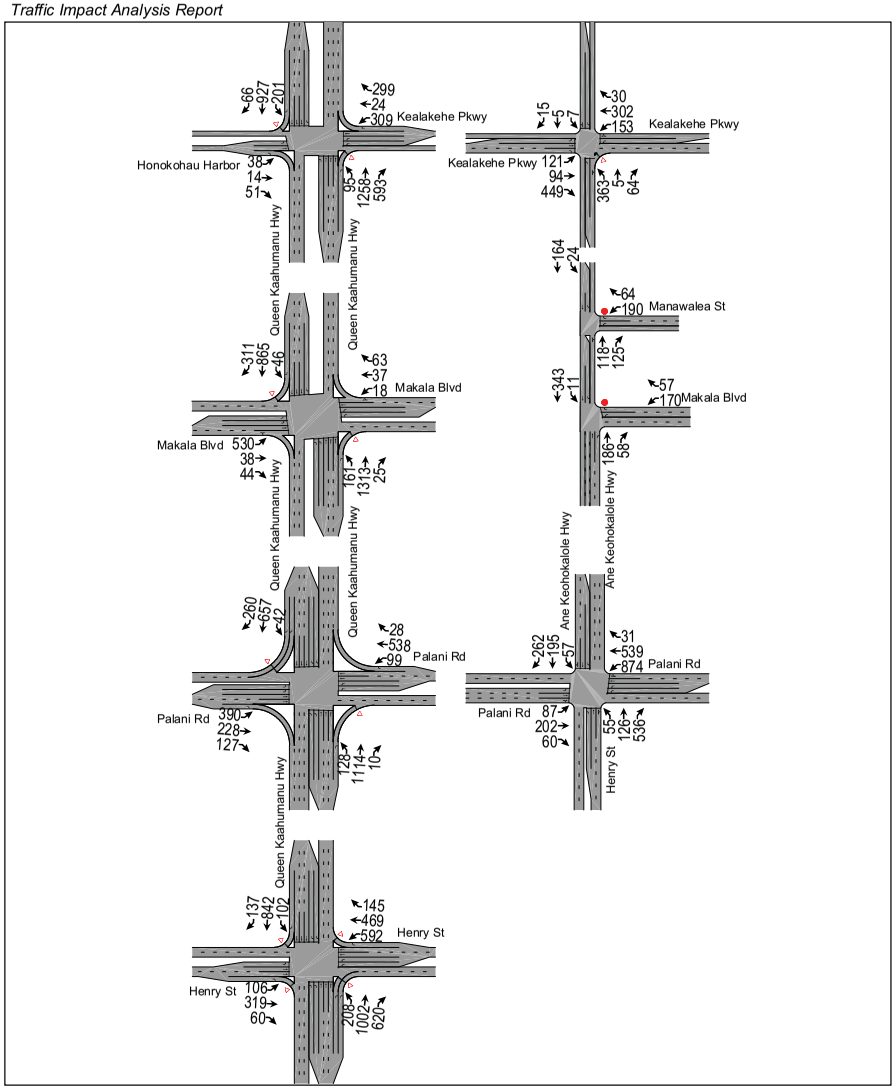


Figure 18. Year 2019 AM Peak Hour Traffic With Project

4. Year 2019 PM Peak Hour Traffic Analysis With Project

The intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "E" with a v/c ratio of 1.10, during the Year 2019 PM peak hour of traffic with the proposed project. The left-turn movement on makai bound Kealakehe Parkway and the through movement on mauka bound Kealakehe Parkway are expected to operate at LOS "F". The left-turn movement on southbound Queen Kaahumanu Highway also is expected to operate at LOS "F".

The Queen Kaahumanu Highway and Makala Boulevard intersection is not expected be affected by traffic generated from the proposed project, during the Year 2019 PM peak hour of traffic with the proposed project.

During the Year 2019 PM peak hour of traffic with the proposed project, the intersection of Queen Kaahumanu Highway and Palani Road is expected to operate at LOS "E" with a v/c ratio of 1.07. The left-turn and through movements on makai bound Palani Road and the left-turn movement on mauka bound Palani Road are expected to operate at LOS "F".

The intersection of Queen Kaahumanu Highway and Henry Street is expected to operate at LOS "D" with a v/c ratio of 1.07. The left-turn movement on northbound Queen Kaahumanu Highway is expected to operate at LOS "F". The left-turn movement and the through movement on mauka bound Henry Street also are expected to operate at LOS "F".

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "E" with a v/c ratio of 1.08. The left-turn and through movements on makai bound Palani Road are expected to operate at LOS "F". The left-turn movement on mauka bound Palani Road also is expected to operate at LOS "F".

The intersections of Makala Boulevard at Ane Keohokalole Highway and Manawalea Street at Ane Keohokalole Highway are expected to operate at satisfactory Levels of Service, during the Year 2019 PM peak hour of traffic with the proposed project.

The intersection of Kealakehe Parkway and Ane Keohokalole Highway is expected to operate at satisfactory Levels of Service. The Year 2019 PM peak hour traffic with the proposed project is depicted on Figure 19.

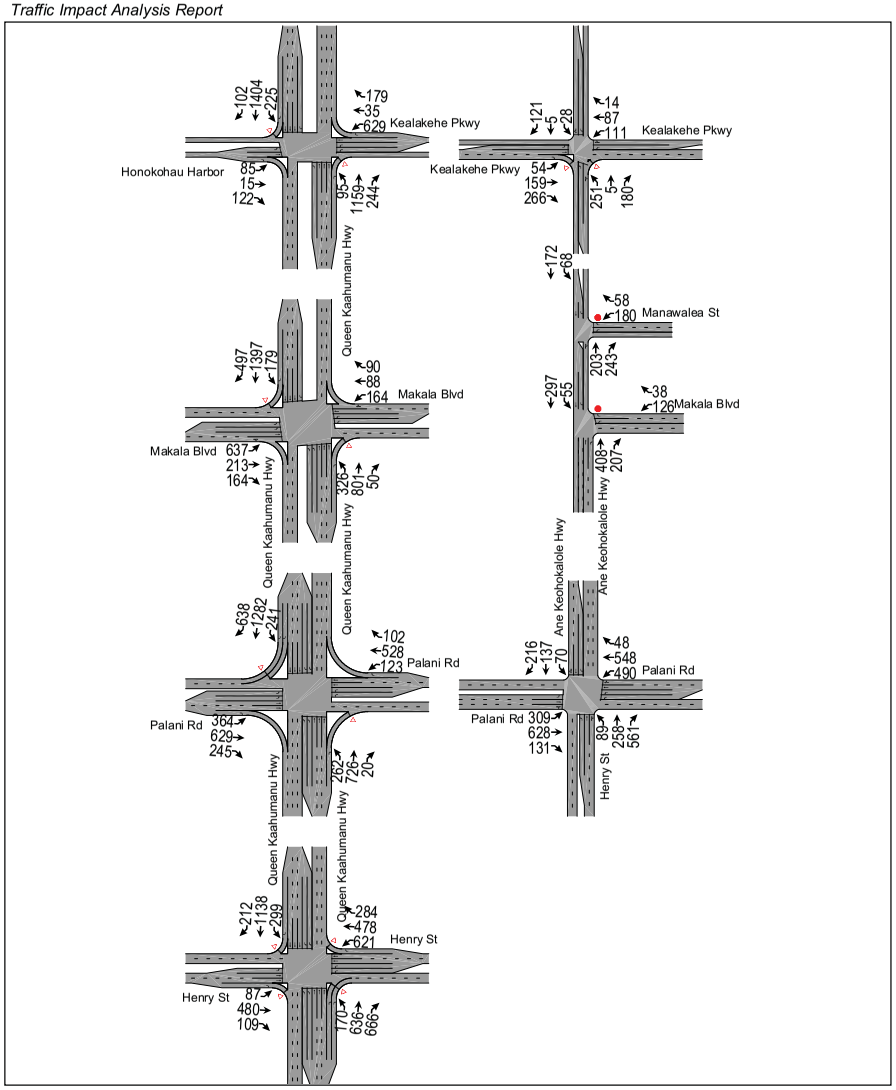


Figure 19. Year 2019 PM Peak Hour Traffic With Project

5. Year 2019 Proposed Area Mitigation Traffic Improvements With Project

In addition to the proposed improvements recommended for the Year 2019 without the proposed project and for the Year 2014 with the proposed project, the following area mitigation traffic improvements are proposed to accommodate the Year 2019 traffic demands with the proposed project:

a. Kealakehe Parkway and Queen Kaahumanu Highway

- Widen mauka bound Kealakehe Parkway at Queen Kaahumanu Highway to provide an exclusive right-turn lane.

b. Palani Road and Queen Kaahumanu Highway

- Widen makai bound Palani Road to provide double left-turn lanes onto Queen Kaahumanu Highway.
- Widen southbound Queen Kaahumanu Highway to provide double right-turn lanes to Palani Road.

c. Henry Street and Queen Kaahumanu Highway

- Widen mauka bound Henry Street to provide an exclusive right-turn lane to Queen Kaahumanu Highway.
- Widen makai bound Henry Street to provide an exclusive right-turn lane to Queen Kaahumanu Highway.

d. Palani Road and Henry Street/Ane Keohokalole Highway

- Widen/restripe both approaches on Palani Road to provide two through lanes in each direction at Ane Keohokalole Highway/Henry Street, as recommended in the Final Environmental Assessment for the Ane Keohokalole Mid-Level Highway Project:
- Widen northbound Henry Street to provide an exclusive left-turn lane.

D. Year 2029 Peak Hour Traffic Impact Analysis With Project

1. Year 2029 Proposed Area Mitigation Traffic Improvements With Project

The proposed improvements recommended for the Year 2019 without and with the proposed project are assumed to be implemented by the Year 2029. The following area mitigation traffic improvements are proposed to accommodate the Year 2029 traffic demands with the proposed project:

a. Makala Boulevard and Queen Kaahumanu Highway

- Widen southbound Queen Kaahumanu Highway to provide a double left-turn lane to mauka bound Makala Boulevard.
- Widen makai bound Makala Boulevard to provide an exclusive right-turn lane to northbound Queen Kaahumanu Highway.
- Widen mauka bound Makala Boulevard to provide an exclusive right-turn lane to southbound Queen Kaahumanu Highway.

b. Palani Road and Henry Street/Ane Keohokalole Highway

- Widen mauka bound Palani Road to provide double left-turn lanes at Ane Keohokalole Highway/Henry Street.
- Widen mauka bound Palani Road to provide an exclusive right-turn lane, in addition to the two through lanes at Ane Keohokalole Highway/Henry Street.
- Widen makai bound Palani Road to provide an exclusive right-turn lane at Ane Keohokalole Highway/Henry Street.

2. Year 2029 Local Mitigation Traffic Improvements With Project

The local mitigation traffic improvements are recommended to provide access to the proposed project. The project civil engineer's total estimated cost of the following Year 2029 local mitigation traffic improvements is $1,670,000.

a. Ane Keohokalole Highway and Manawalea Street

- Signalize the intersection when warranted.

b. Ane Keohokalole Highway and Makala Boulevard

- Signalize the intersection when warranted.

c. Ane Keohokalole Highway and South Street

- South Street will be constructed to intersect Ane Keohokalole Highway at a stop-controlled Tee-intersection, which will be restricted to right-turn-in and right-turn-out movements only.

d. Palani Road and School Street

- Construct School Street with separate left-turn and right-turn lanes, which will intersect Palani Road at a Tee-intersection.
- Widen mauka bound Palani Road to provide an exclusive left-turn lane at School Street.

- Widen makai bound Palani Road to provide an exclusive right-turn lane at School Street.
- Signalize the intersection of School Street and Palani Road when warranted.

e. Palani Road and D Street

- Construct D Street to intersect Palani Road at a stop-controlled Tee-intersection, which will be restricted to right-turn-in and right-turn-out movements only.
- Widen makai bound Palani Road to provide a right-turn deceleration lane to D Street.

f. Palani Road and C Street

- Construct C Street to intersect Palani Road at a stop-controlled Tee-intersection, which will be restricted to right-turn-in and right-turn-out movements only.
- Widen makai bound Palani Road to provide a right-turn deceleration lane to C Street.

3. Year 2029 Peak Hour Traffic Assignment

The AM and PM peak hour site-generated traffic assignments were developed based upon existing traffic circulation patterns and anticipated traffic circulation patterns resulting from future roadways in the vicinity of the proposed project. The Year 2029 AM and PM peak hour site-generated traffic assignments are depicted on Figures 20 and 21, respectively.

4. Year 2029 AM Peak Hour Traffic Analysis With Project

During the Year 2029 AM peak hour of traffic with the proposed project, the intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "C" with a v/c ratio of 0.89. The traffic movements at the intersection are expected to operate LOS "D" or better.

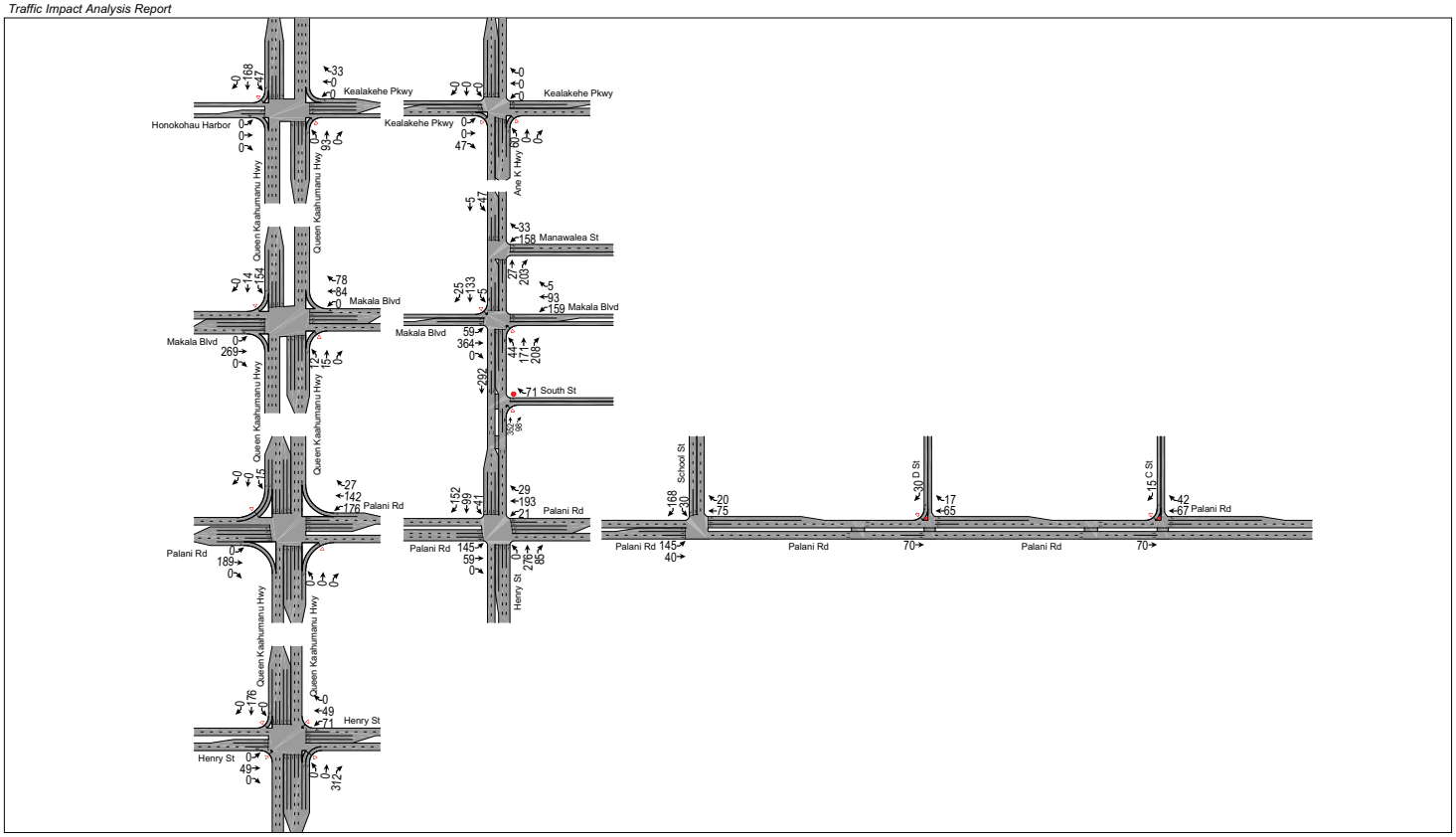


Figure 21. Year 2029 PM Peak Hour Site Traffic

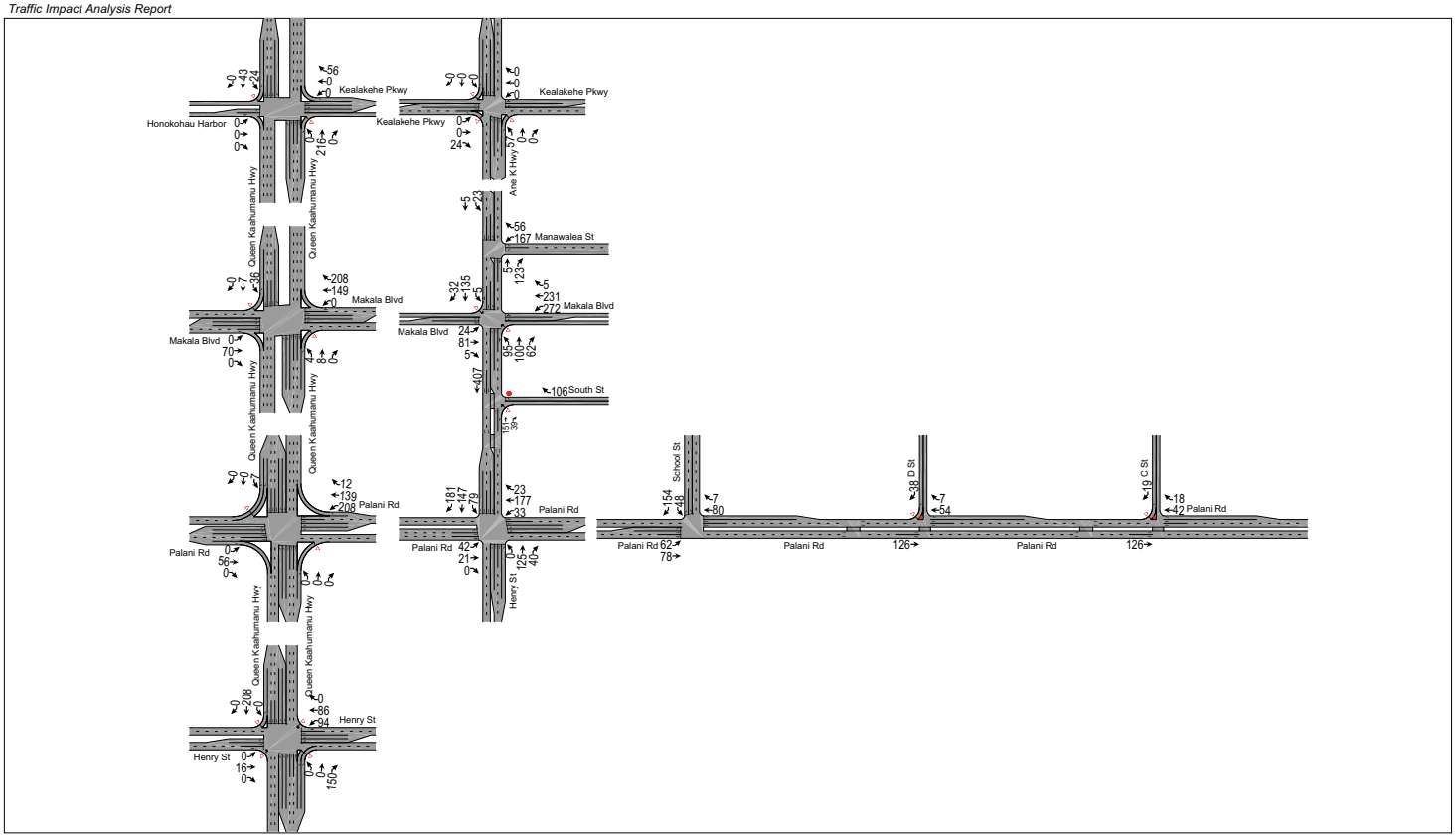


Figure 20. Year 2029 AM Peak Hour Site Traffic

The Queen Kaahumanu Highway and Makala Boulevard intersection is expected to operate at LOS "D" with a v/c ratio of 0.93, during the Year 2029 AM peak hour of traffic with the proposed project. The traffic movements at the intersection are expected to operate LOS "D" or better.

The Queen Kaahumanu Highway and Palani Road intersection is expected to operate at LOS "D" with a v/c ratio of 0.93, during the Year 2029 AM peak hour of traffic with the proposed project. The traffic movements at the intersection are expected to operate LOS "D" or better.

The intersection of Queen Kaahumanu Highway and Henry Street is expected to operate at LOS "D" with a v/c ratio of 0.89, during the Year 2029 AM peak hour of traffic with the proposed project. The traffic movements at the intersection are expected to operate LOS "D" or better.

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "C" with a v/c ratio of 0.87, during the Year 2029 AM peak hour of traffic with the proposed project. The traffic movements at the intersection are expected to operate at LOS "D" or better.

During the Year 2029 AM peak hour of traffic with the proposed project, the intersection of Kealakehe Parkway and Ane Keohokalole Highway is expected to operate at LOS "C" with a v/c ratio of 0.91. The traffic movements at the intersection are expected to operate at LOS "D" or better.

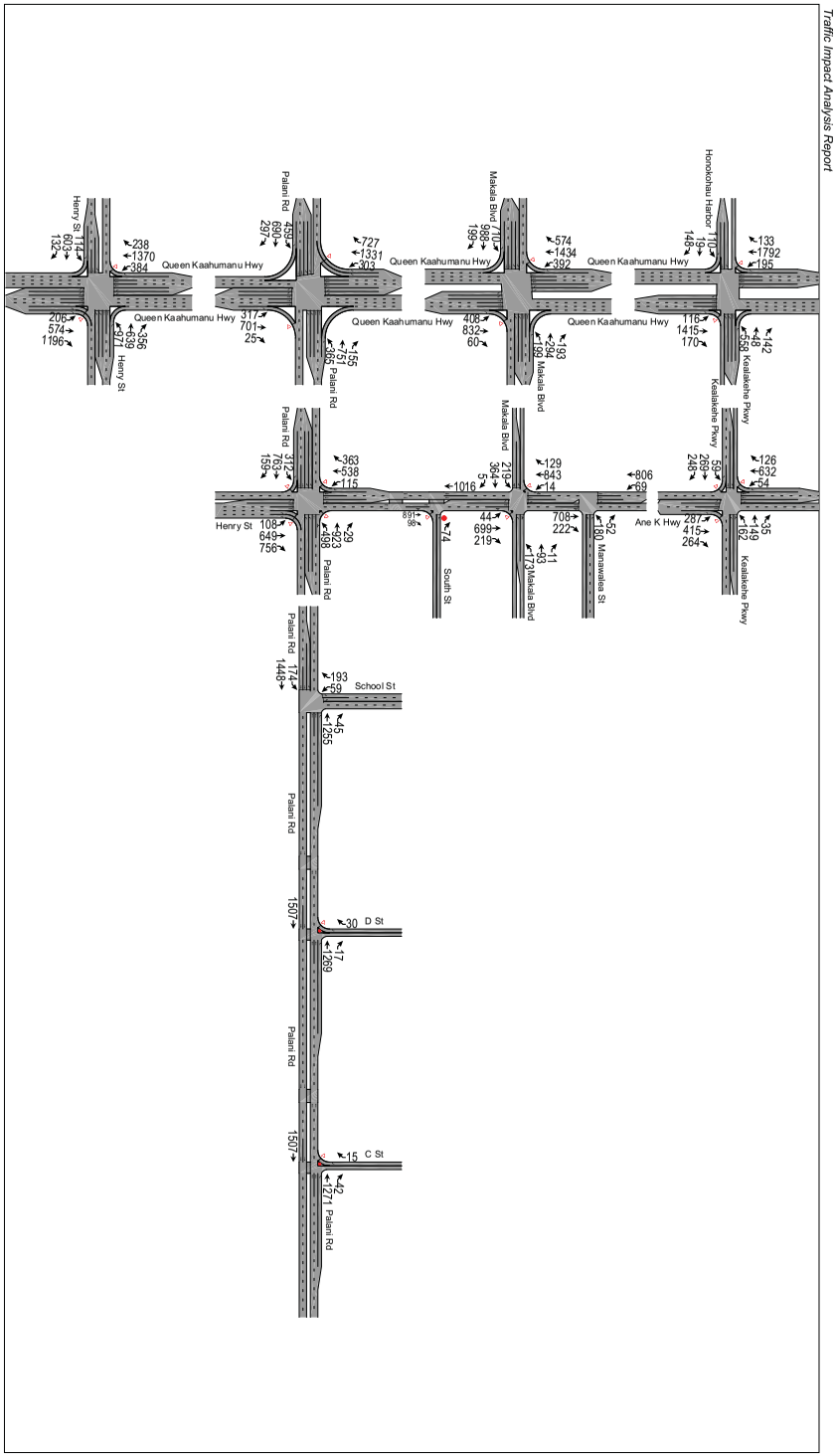
The other intersections in the study area are expected to operate at satisfactory Levels of Service, during the Year 2029 AM peak hour of traffic with the proposed project. Figure 22 depicts the Year 2029 AM peak hour traffic with the proposed project.

5. Year 2029 PM Peak Hour Traffic Analysis With Project

The intersection of Queen Kaahumanu Highway and Kealakehe Parkway is expected to operate at LOS "D" with a v/c ratio of 0.90, during the Year 2029 PM peak hour of traffic with the proposed project. The left-turn movements in both directions on Queen Kaahumanu Highway are expected to operate at LOS "E". The left-turn movement on makai bound Kealakehe Parkway and the through movement on mauka bound Kealakehe Parkway also are expected to operate at LOS "D".

During the Year 2029 PM peak hour of traffic with the proposed project, the Queen Kaahumanu Highway and Makala Boulevard intersection is expected to operate at LOS "D" with a v/c ratio of 0.99. The left-turn movements on all approaches are expected to operate at LOS "E". The through movements on makai bound Makala Boulevard and on northbound Queen Kaahumanu Highway also are expected to operate LOS "E", during the Year 2029 PM peak hour of traffic with the proposed project.

Figure 22. Year 2029 AM Peak Hour Traffic With Project



The intersection of Queen Kaahumanu Highway and Palani Road is expected to operate at LOS "E" with a v/c ratio of 1.02. The left-turn movements on all approaches are expected to operate at LOS "E". The through movements on southbound Queen Kaahumanu Highway and on makai bound Palani Road also are expected to operate LOS "E", during the Year 2029 PM peak hour of traffic with the proposed project.

The intersection of Queen Kaahumanu Highway and Henry Street is expected to operate at LOS "E" with a v/c ratio of 1.05. The left-turn movement on northbound Queen Kaahumanu Highway is expected to operate at LOS "F". The left-turn movement on makai bound Henry Street and the through movement on mauka bound Henry Street also are expected to operate at LOS "F".

The Palani Road and Henry Street/Ane Keohokalole Highway intersection is expected to operate at LOS "D" with a v/c ratio of 0.97, during the Year 2029 PM peak hour of traffic with the proposed project. The traffic movements at the intersection are expected to operate at LOS "D" or better.

The other intersections in the study area are expected to operate at satisfactory Levels of Service, during the Year 2029 PM peak hour of traffic with the proposed project. The Year 2029 PM peak hour traffic with the proposed project is depicted on Figure 23.

VI. Conclusions

The Phase 1 improvements on Queen Kaahumanu Highway improved traffic operations up to Kealakehe Parkway. It is expected that the second Phase of the Queen Kaahumanu Highway widening project will likewise improve traffic flow up to the Kona International Airport Access Road. Further improvements will be required on the cross streets on Queen Kaahumanu Highway to minimize delays and optimize intersection operations. By the Year 2019 without the proposed project, Queen Kaahumanu Highway will require additional widening, from four lanes to six lanes, from south of Henry Street to north of Kealakehe Parkway.

The Year 2029 PM peak hour traffic demands at the Queen Kaahumanu Highway intersections at Palani Road, and at Henry Street are expected to reach the limits of capacity for an at-grade intersection. Ane Keohokalole Highway is expected to provide some relief to Queen Kaahumanu Highway. Additional capacity on the north-south highway corridor can be provided by the planned extension of Kuakini Highway from Makala Boulevard to Kealakehe Parkway. The extension of Kuakini Highway was not included in this traffic impact analysis.

Palani Road is expected to require an additional mauka bound lane by the Year 2019 without the proposed project, followed by an additional makai bound lane by the Year 2019 with the proposed project. Additional capacity in the mauka-makai directions can be provided by the extension of Kealakehe Parkway to Mamalahoa Highway/Palani Road. The extension of Kealakehe Parkway was not included in this traffic impact analysis. Together

with the extension of Kuakini Highway to Kealakehe Parkway, this second access route to and from Kailua Town would relieve the heavily traveled Palani Road.

Kamakana Villages will provide pedestrian, bicycle, and bus facilities, as well as provide connectivity to the surrounding street network. Kamakana Villages will provide affordable housing that will be located in proximity to schools, shopping centers, and employment centers. Table 4 summarizes the capacity analysis prepared for this traffic impact analysis.

Kamakana Villages will provide more than twice the number of affordable housing credits required under Chapter 11, Hawaii County Code. Therefore, under Hawaii County Code Section 25-2-46(h)(1), HHFDC/Forest City Hawai`i Kona, LLC shall not be required to perform any area mitigation traffic improvements, as discussed herein.

Table 4. Summary of Capacity Analysis

Scenario	Intersection	Condition	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
Existing AM Peak Hour	Queen Kaahumanu Highway and Kealakehe Parkway	Existing	LOS	B			E		A	B	C	A	B	C	A	C
			Delay	18.8			59.7		7.8	13.1	26.9	2.5	15.4	30	3.3	25.0
			v/c	0.21			0.83		0.29	0.38	0.79	0.40	0.56	0.86	0.06	0.86
	Queen Kaahumanu Highway and Makala Boulevard	Existing	LOS	C	B		D	C		D	B	A	D	C	A	C
			Delay	30.5	17.8		37.3	26.0		36.1	17.7	7.1	37.4	21.7	4.3	20.9
			v/c	0.47	0.20		0.19	0.40		0.36	0.56	0.04	0.19	0.58	0.33	0.58
	Queen Kaahumanu Highway and Palani Road	Existing	LOS	D	A		D	C		D	C	B	D	C	A	C
			Delay	36.1	9.8		37.2	28.5		37.1	21	10.4	35.1	25.1	5.6	22.5
			v/c	0.55	0.16		0.13	0.57		0.38	0.58	0.02	0.14	0.62	0.46	0.62
	Queen Kaahumanu Highway and Henry Street	Existing	LOS	D	D		D	C		D	C	A	D	C	A	C
			Delay	37.2	40.8		39.9	32.3		49.5	32.6	6.6	47.8	33.8	7.6	31.0
			v/c	0.32	0.72		0.68	0.66		0.58	0.64	0.6	0.37	0.58	0.29	0.72
	Kealakehe Parkway and Ane Keohokalole Highway	Existing	LOS	A	A	A	A	A		C	B		B	B		A
			Delay	7.8	0.0	0.0	8.3	0.0		23.8	12.1		11.4	13.0		5.5
			v/c	0.0	0.04	0.23	0	0.16		0.52	0.02		0.01	0.02		0.52
	Palani Road and Henry Street	Existing	LOS	N/A	C		D	A	N/A	C	N/A	B	N/A	N/A	N/A	C
			Delay	N/A	26.8		47.9	8.0	N/A	23.6	N/A	10.8	N/A	N/A	N/A	26.0
			v/c	N/A	0.59		1.00	0.49	N/A	0.17	N/A	0.73	N/A	N/A	N/A	1.00
Existing PM Peak Hour	Queen Kaahumanu Highway and Kealakehe Parkway	Existing	LOS	E			F		C	F	D	B	C	E	A	E
			Delay	77.3			129.6		26.7	190.3	47.4	13.3	28.1	78.9	6.9	70.0
			v/c	0.73			1.02		0.17	1.16	0.80	0.22	0.49	1.00	0.10	1.16
	Queen Kaahumanu Highway and Makala Boulevard	Existing	LOS	D	E		E	E		E	C	A	D	D	A	D
			Delay	37.9	55.1		67.1	63.0		64.0	28.1	8.3	54.7	41.6	4.9	40.0
			v/c	0.60	0.86		0.71	0.78		0.81	0.50	0.07	0.57	0.89	0.45	0.89
	Queen Kaahumanu Highway and Palani Road	Existing	LOS	E	B		D	D		E	C	A	D	C	A	C
			Delay	55.7	17.9		53.2	41.3		68.2	26	9.4	47.9	34.5	9.7	33.3
			v/c	0.76	0.44		0.37	0.71		0.80	0.49	0.03	0.54	0.84	0.54	0.84
	Queen Kaahumanu Highway and Henry Street	Existing	LOS	D	E		D	D		E	D	A	E	D	A	D
			Delay	46.4	55.5		53.7	41.4		67.3	39.9	7.2	65.2	46.8	6.7	42.1
			v/c	0.29	0.80		0.79	0.75		0.68	0.54	0.60	0.67	0.79	0.34	0.80
	Kealakehe Parkway and Ane Keohokalole Highway	Existing	LOS	A	A	A	A	A		C	B		B	B		A
			Delay	7.8	0.0	0.0	8.3	0.0		23.8	12.1		11.4	13.0		5.5
			v/c	0.0	0.04	0.23	0	0.16		0.52	0.02		0.01	0.02		0.52
	Palani Road and Henry Street	Existing	LOS	N/A	D		C	A	N/A	C	N/A	B	N/A	N/A	N/A	C
			Delay	N/A	45.7		33.4	6.5	N/A	26.6	N/A	11.7	N/A	N/A	N/A	26.3
			v/c	N/A	0.93		0.86	0.37	N/A	0.3	N/A	0.76	N/A	N/A	N/A	0.93

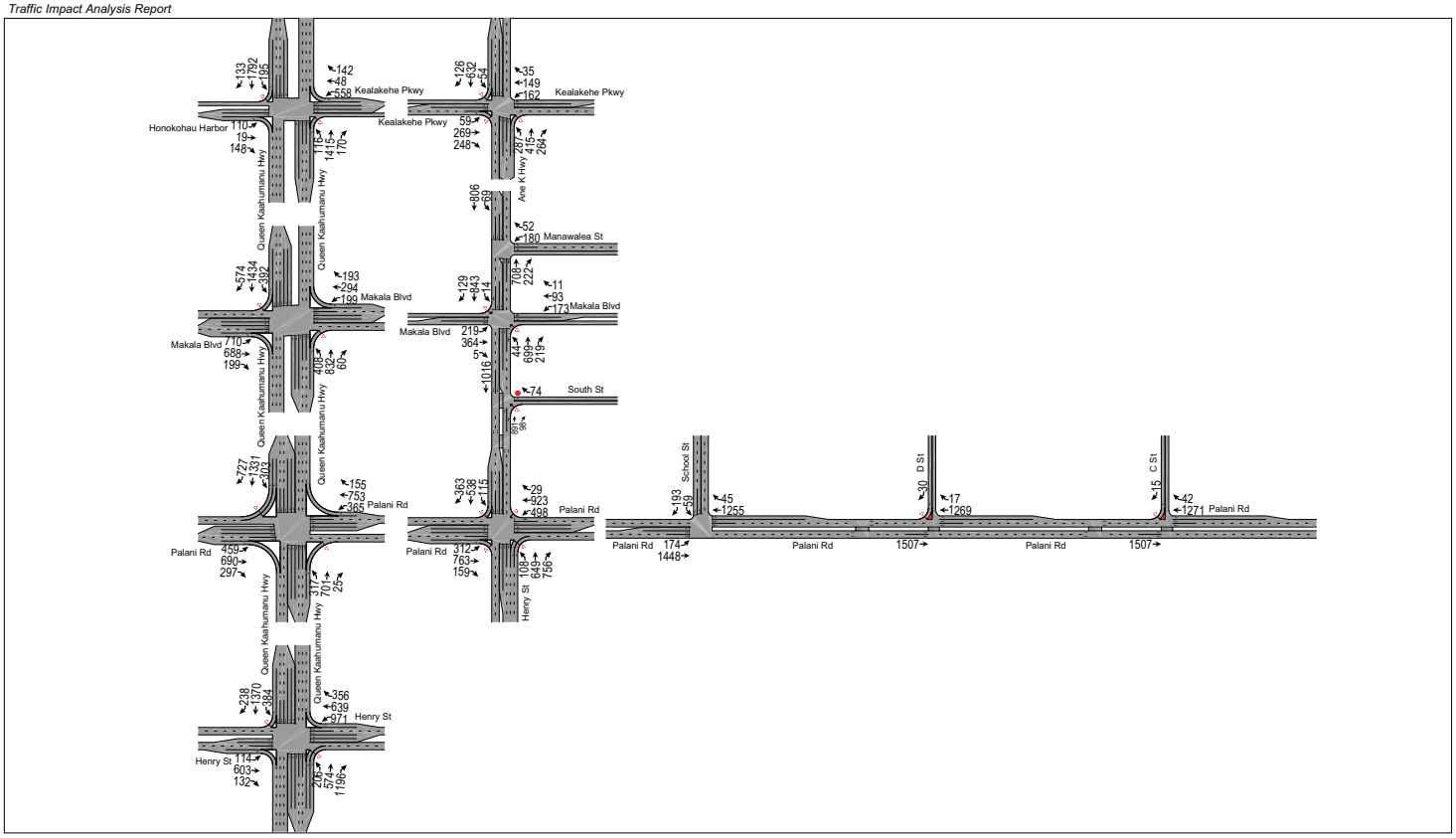


Figure 23. Year 2029 PM Peak Hour Traffic With Project

Table 4. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	Condition	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
2014 PM Peak Hour Without Project	Queen Kaahumanu Highway and Kealakehe Parkway	Baseline	LOS	C			F		A	F	E	A	F	F	A	F
			Delay	27.4			171.5		6.1	134.6	78.6	6.0	115.9	136.7	6.7	107.2
			v/c	0.68			1.29		0.12	1.05	1.02	0.32	1.00	1.19	0.21	1.29
		Improved	LOS	D	D		D	C	A	C	C	A	C	D	A	D
			Delay	43.8	38.5		52.6	31.6	9.0	31.9	26.0	3.8	26.1	40.2	4.1	34.0
			v/c	0.50	0.75		0.93	0.19	0.27	0.66	0.76	0.26	0.62	0.95	0.17	0.95
	Queen Kaahumanu Highway and Makala Boulevard	Baseline	LOS	F	E	A	F	F		F	C	A	D	E	A	D
			Delay	88.1	56.4	9.1	102.9	116.2		100.5	26.9	7.4	51.0	56.3	4.1	54.5
			v/c	1.04	0.78	0.40	0.92	1.04		1.01	0.55	0.08	0.64	1.01	0.53	1.04
		Improved	LOS	E	C		E	D		E	C	A	E	D	A	D
			Delay	63.7	34.4		56.1	54.7		76.4	24.2	6.4	58.9	39.2	3.7	39.7
			v/c	0.92	0.66		0.57	0.80		0.89	0.47	0.07	0.68	0.93	0.51	0.93
	Queen Kaahumanu Highway and Palani Road	Baseline	LOS	E	C		E	E		E	C	A	E	D	C	D
			Delay	79.3	33		78.8	55.2		72.9	26.9	8.5	55.9	53.6	20.8	46.1
			v/c	0.91	0.66		0.61	0.85		0.82	0.50	0.03	0.64	0.99	0.70	0.99
	Queen Kaahumanu Highway and Henry Street	Baseline	LOS	D	E		E	D		F	D	A	E	D	A	D
			Delay	48.8	79.2		71.0	51.4		101.6	43.0	7.7	72.0	53.6	5.9	51.8
			v/c	0.30	1.00		0.90	0.90		0.90	0.60	0.70	0.80	0.90	0.40	0.97
		Improved	LOS	D	D		D	C		D	C	B	D	D	A	D
			Delay	44.5	50.6		52.0	30.9		51.8	31.3	14.6	53.8	48.1	5.6	38.4
			v/c	0.48	0.88		0.86	0.70		0.68	0.58	0.76	0.75	0.93	0.38	0.93
	Palani Road and Henry Street/Ane Keohokalole Highway	Baseline	LOS	B	E	A	E	B		C			C	B		D
			Delay	12.2	60.3	6.5	64.4	16.5		22.8			30.6	18.5		36.9
			v/c	0.23	0.96	0.19	0.99	0.52		0.85			0.16	0.14		0.99
		Improved	LOS	D	D	A	D	C		C			C	B		D
			Delay	51.1	44.9	5.2	53.1	22.9		30.4			25.1	15.4		35.6
			v/c	0.55	0.9	0.18	0.88	0.62		0.92			0.14	0.11		0.90
	Kealakehe Parkway and Ane Keohokalole Highway	Baseline	LOS	A	A	A	A	A		D	A		C	A		A
			Delay	7.5	0.0	0.0	7.6	0.0		34.5	9.9		15.5	9.5		11.1
			v/c	0.04	0.07	0.08	0.06	0.05		0.63	0.17		0.07	0.15		0.63
		Improved	LOS	B	B	A	B	A		A	A		A	A		A
			Delay	11.4	11.5	4.4	12.8	10.0		9.9	2.7		7.3	2.7		7.5
			v/c	0.18	0.25	0.27	0.29	0.18		0.33	0.18		0.04	0.16		0.33

Table 4. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	Condition	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
2014 AM Peak Hour Without Project	Queen Kaahumanu Highway and Kealakehe Parkway	Baseline	LOS	B			D		A	B	C	A	C	B	A	C
			Delay	15.8			52.4		6.0	11.5	26.9	4.7	29.1	19.5	4.5	21.2
			v/c	0.26			0.85		0.28	0.29	0.78	0.64	0.7	0.6	0.07	0.85
		Improved	LOS	D	D		D	C	A	B	C	B	D	C	A	C
			Delay	40.2	51.2		52.0	29.1	7.7	15.2	34.4	13.2	53.2	25.0	5.5	29.6
			v/c	0.23	0.78		0.77	0.05	0.31	0.36	0.90	0.77	0.80	0.70	0.09	0.88
	Queen Kaahumanu Highway and Makala Boulevard	Baseline	LOS	C	B		D	D		D	C	A	D	C	A	C
			Delay	31.2	15.3		44.6	40.4		36	29.1	6.7	45.6	22.8	4.4	0.86
			v/c	0.66	0.20		0.36	0.68		0.45	0.86	0.04	0.38	0.60	0.37	26.4
		Improved	LOS	D	B		D	C		D	C	A	D	C	A	C
			Delay	40.0	17.9		43.8	25.1		41.8	21.8	5.5	48.7	21.4	3.8	24.2
			v/c	0.72	0.10		0.22	0.44		0.45	0.76	0.04	0.34	0.58	0.36	0.76
	Queen Kaahumanu Highway and Palani Road	Baseline	LOS	D	B		D	C		D	C	B	D	C	A	C
			Delay	48.7	11.4		37.8	31.6		38.9	33.9	10.9	38.2	27.5	5.7	29.3
			v/c	0.79	0.21		0.19	0.67		0.42	0.85	0.02	0.2	0.64	0.48	0.85
	Queen Kaahumanu Highway and Henry Street	Baseline	LOS	D	D		E	D		E	D	A	E	D	A	D
			Delay	40.4	49.3		55.9	41.0		58.5	38.6	6.3	62	42.5	6.9	38.5
			v/c	0.43	0.83		0.86	0.83		0.71	0.82	0.64	0.6	0.83	0.26	0.86
		Improved	LOS	D	D		D	C		D	C	A	D	D	A	C
			Delay	41.0	39.4		42.1	28.2		47.6	32.6	7.4	51.6	37.0	6.5	31.9
			v/c	0.52	0.77		0.78	0.57		0.63	0.78	0.65	0.53	0.81	0.25	0.81
	Palani Road and Henry Street/Ane Keohokalole Highway	Baseline	LOS	B	E	B	C	B		B			C	C		C
			Delay	19.4	74.4	14	25.8	10.8		13.9			30.2	22.3		22.4
			v/c	0.09	0.86	0.25	0.88	0.52		0.77			0.04	0.26		0.88
		Improved	LOS	D	D	B	C	B		A			C	B		B
			Delay	35.4	36.9	10.5	25.7	15.6		9.9			20.6	15.8		19.4
			v/c	0.14	0.6	0.19	0.78	0.62		0.69			0.03	0.21		0.78
	Kealakehe Parkway and Ane Keohokalole Highway	Baseline	LOS	A	A	A	A	A		F	B		D	C		F
			Delay	8.2	0.0	0.0	8.8	0.0		414.8	12.0		25.8	16.4		74.4
			v/c	0.10	0.03	0.25	0.12	0.17		1.73	0.11		0.03	0.06		1.73
		Improved	LOS	B	A		B	B		B	A		A	A		A
			Delay	13.9	3.4		16.6	13.0		14.9	4.3		8.6	5.9		9.8
			v/c	0.39	0.39		0.47	0.50		0.53	0.11		0.01	0.04		0.53

Table 4. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	Condition	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
2019 PM Peak Hour Without Project	Queen Kaahumanu Highway and Kealakehe Parkway	Baseline	LOS	D	F		F	D	A	D	D	A	D	E	A	D
			Delay	47.8	93.9		88.3	36.8	9.6	53.0	35.5	3.6	39.7	65.3	3.7	54.0
			v/c	0.54	0.99		1.07	0.24	0.32	0.82	0.90	0.31	0.75	1.05	0.18	1.07
		Improved	LOS	D	C		D	C	A	D	D	A	D	D	A	D
			Delay	47.5	34.2		51.4	33.5	8.5	54.1	35.4	5.3	51.7	49.6	5.4	40.9
			v/c	0.54	0.76		0.93	0.2	0.28	0.66	0.83	0.38	0.66	0.98	0.23	0.98
	Queen Kaahumanu Highway and Makala Boulevard	Baseline	LOS	F	D		F	F		F	C	A	E	E	A	E
			Delay	90.3	45.1		84.2	90.6		115.2	28.2	6.2	72.7	59.7	3.6	56.5
			v/c	1.02	0.70		0.78	0.97		1.03	0.52	0.07	0.75	1.02	0.56	1.03
		Improved	LOS	D	C		D	D		D	C	A	D	D	A	D
			Delay	53.9	26.6		46.8	47.0		52.9	27.4	7.9	48.1	54.5	7.0	41.1
			v/c	0.92	0.63		0.55	0.79		0.78	0.52	0.1	0.67	1.01	0.66	1.01
	Queen Kaahumanu Highway and Palani Road	Baseline	LOS	F	D		E	E		F	C	A	E	E	C	E
			Delay	118.5	38.4		79.1	65.0		119.3	29.8	8.5	56.0	68.8	27.2	58.4
			v/c	1.08	0.76		0.65	0.93		1.05	0.60	0.04	0.66	1.05	0.82	1.08
		Improved	LOS	D	C		D	D		D	C	A	D	D	C	D
			Delay	54.2	29.5		52.4	52.7		54.1	29.1	9.8	49.1	53.9	27.1	42.9
			v/c	0.80	0.69		0.47	0.89		0.73	0.53	0.05	0.65	0.99	0.80	0.99
	Queen Kaahumanu Highway and Henry Street	Baseline	LOS	D	E		E	D		F	C	C	E	E	A	D
			Delay	44.9	65.5		64.5	36.0		107.9	33.7	22.2	66.2	64.7	5.2	50.1
			v/c	0.52	0.97		0.95	0.80		1.02	0.67	0.86	0.87	1.02	0.41	1.02
		Improved	LOS	D	D		D	C		D	C	D	D	D	A	D
			Delay	41.9	52.5		53.1	30.9		51.4	32.6	36.1	49.3	43.5	6.6	40.3
			v/c	0.51	0.92		0.90	0.75		0.72	0.59	0.95	0.75	0.9	0.47	0.95
	Palani Road and Henry Street/Ane Keohokalole Highway	Baseline	LOS	E	E	A	F	C		D			C	B		E
			Delay	56.3	70.4	5	88.6	33.1		52.7			27.2	13.7		55.8
			v/c	0.65	1.02	0.2	1.05	0.80		1.04			0.26	0.13		1.05
		Improved	LOS	D	D		D	D		C	B		C	B		C
			Delay	48.9	38.9		47.2	38.5		21.8	15.7		20.9	16.6		33.7
			v/c	0.61	0.87		0.87	0.83		0.31	0.90		0.22	0.20		0.87
	Kealakehe Parkway and Ane Keohokalole Highway	Baseline	LOS	B	A		B	A		B	A	0	A	A		A
			Delay	10.8	5.9		15.5	10.0		13.4	3.3	0.0	8.8	3.4		8.2
			v/c	0.17	0.32		0.43	0.24		0.47	0.28	0.00	0.07	0.20		0.47

Table 4. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	Condition	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
2019 AM Peak Hour Without Project	Queen Kaahumanu Highway and Kealakehe Parkway	Baseline	LOS	D	C		E	C	B	B	C	B	E	B	A	C
			Delay	47.2	29.0		59.2	31.1	12.8	12.0	24.7	11.4	62.5	16.8	3.6	23.8
			v/c	0.40	0.52		0.88	0.09	0.51	0.39	0.84	0.80	0.93	0.65	0.08	0.93
		Improved	LOS	E	D		E	D	B	D	B	C	E	B	A	C
			Delay	62.1	35.7		71.4	37.7	11.9	48.6	19.7	22.4	68.9	14.9	3.8	26.3
			v/c	0.47	0.57		0.92	0.10	0.51	0.52	0.60	0.88	0.86	0.44	0.08	0.92
	Queen Kaahumanu Highway and Makala Boulevard	Baseline	LOS	D	B		D	C		D	C	A	D	C	A	C
			Delay	50.3	17.6		45.8	26.6		43.2	33.4	5.5	49.5	24.3	3.8	31.2
			v/c	0.86	0.10		0.28	0.55		0.52	0.92	0.04	0.38	0.66	0.40	0.92
		Improved	LOS	D	B		C	B		C	C	A	D	C	A	C
			Delay	35.5	12.6		34.1	16.1		34.5	25.0	7.2	45.5	24.4	5.7	24.9
			v/c	0.78	0.10		0.21	0.35		0.48	0.79	0.05	0.43	0.65	0.48	0.79
	Queen Kaahumanu Highway and Palani Road	Baseline	LOS	D	B		D	D		D	D	A	D	C	A	C
			Delay	53.3	14.8		48.1	44.5		48.1	37.1	9.7	48.6	31.7	9.3	34.7
			v/c	0.81	0.25		0.28	0.80		0.49	0.89	0.02	0.28	0.71	0.55	0.89
		Improved	LOS	D	B		D	C		D	C	B	D	C	B	C
			Delay	41.7	11.5		43.1	34.2		43.5	30.7	11.5	42.0	28.4	12.7	29.1
			v/c	0.73	0.22		0.27	0.72		0.49	0.78	0.03	0.24	0.57	0.46	0.78
	Queen Kaahumanu Highway and Henry Street	Baseline	LOS	D	D		D	D		E	D	B	E	D	A	D
			Delay	46.0	50.0		54.8	39		59.1	35.4	10.7	62.4	35.3	5.6	37.5
			v/c	0.60	0.87		0.89	0.78		0.76	0.85	0.72	0.65	0.79	0.26	0.89
		Improved	LOS	D	C		D	C		D	C	A	D	C	A	C
			Delay	37.8	32.8		41.4	27.7		49.1	30.4	8.9	52.9	33.8	7.2	30.4
			v/c	0.49	0.65		0.83	0.64		0.72	0.75	0.70	0.62	0.76	0.32	0.83
	Palani Road and Henry Street/Ane Keohokalole Highway	Baseline	LOS	D	D	B	C	C		B			C	B		C
			Delay	37.6	42.2	10.3	27.4	20		10.6			20.4	13.5		21.5
			v/c	0.21	0.69	0.21	0.81	0.71		0.74			0.03	0.26		0.81
		Improved	LOS	D	C		C	C		C	A		B	B		C
			Delay	38.8	33.0		27.2	24.1		22.2	6.3		19.8	18.0		21.8
			v/c	0.20	0.60		0.83	0.76		0.22	0.59		0.03	0.33		0.83
	Kealakehe Parkway and Ane Keohokalole Highway	Baseline	LOS	B	A		C	B		B	A		A	A		B
			Delay	13.5	3.3		20.4	14.0		17.5	4.4		9.6	6.4		10.9
			v/c	0.38	0.41		0.59	0.57		0.59	0.13		0.02	0.04		0.59

Table 4. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	Condition	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
2014 AM Peak Hour With Project	Queen Kaahumanu Highway and Kealakehe Parkway	Baseline	LOS	B			D		A	B	C	A	D	C	A	C
			Delay	13.4			42.0		9.6	14.4	28.1	5.0	50.9	20.2	5.0	22.3
			v/c	0.23			0.79		0.35	0.34	0.80	0.65	0.86	0.62	0.08	0.86
		Improved	LOS	D	C		D	C	A	A	C	A	C	B	A	B
			Delay	39.5	23.8		38.0	27.2	9.9	9.6	23.5	5.4	28.2	16.6	4.3	18.6
			v/c	0.31	0.43		0.67	0.07	0.48	0.28	0.80	0.66	0.72	0.61	0.07	0.80
	Queen Kaahumanu Highway and Makala Boulevard	Baseline	LOS	C	B		D	D		D	C	A	D	C	A	C
			Delay	31.2	15.3		44.6	40.4		36.0	29.1	6.7	45.6	22.8	4.4	26.4
			v/c	0.66	0.20		0.36	0.68		0.45	0.86	0.04	0.38	0.60	0.37	0.86
		Improved	LOS	C	B		D	C		D	C	A	D	C	A	C
			Delay	31.5	14.0		36.0	20.9		35.9	28.8	6.7	45.5	22.6	4.4	25.5
			v/c	0.66	0.10		0.20	0.41		0.45	0.86	0.04	0.38	0.60	0.37	0.86
	Queen Kaahumanu Highway and Palani Road	Baseline	LOS	D	B		D	C		D	C	B	D	C	A	C
			Delay	50.9	13.9		39.5	33.8		39.9	33.8	10.7	38.9	27.6	5.6	30.1
			v/c	0.81	0.25		0.32	0.72		0.43	0.85	0.02	0.20	0.63	0.47	0.85
		Improved	LOS	D	C	A	D	C	A	D	C	B	D	C	A	C
			Delay	50.2	22.2	6.3	39.4	33.4	9.5	39.6	33.4	10.7	38.8	27.4	5.6	29.7
			v/c	0.80	0.15	0.2	0.32	0.69	0.1	0.42	0.85	0.02	0.2	0.63	0.47	0.85
	Queen Kaahumanu Highway and Henry Street	Baseline	LOS	D	D		E	D		E	D	A	E	D	A	D
			Delay	40.4	49.9		59.1	43.1		59.0	38.6	6.5	62.4	44.4	6.9	39.5
			v/c	0.43	0.83		0.89	0.85		0.72	0.82	0.66	0.60	0.85	0.26	0.89
		Improved	LOS	D	D		D	C		D	C	A	D	D	A	C
			Delay	41.6	35.8		46.7	25.9		51.5	34.8	8.6	47.3	39.1	6.5	32.8
			v/c	0.55	0.74		0.85	0.57		0.7	0.82	0.36	0.51	0.85	0.25	0.85
	Palani Road and Henry Street/Ane Keohokalole Highway	Baseline	LOS	C	D	B	C	B		B			D	B		C
			Delay	20.5	53.2	12.5	31.8	14.7		17.1			36	19.4		24.1
			v/c	0.18	0.68	0.21	0.92	0.56		0.80			0.18	0.41		0.92
		Improved	LOS	D	C	A	D	C		C	A		C	B		C
			Delay	42.2	33.0	9.3	38.0	21.4		21.8	7.7		20.7	17.0		24.2
			v/c	0.32	0.55	0.18	0.88	0.69		0.20	0.61		0.12	0.44		0.88
	Kealakehe Parkway and Ane Keohokalole Highway	Baseline	LOS	A	A	A	A	A		F	B		D	C		F
			Delay	8.2	0.0	0.0	8.8	0.0		568.5	12.0		25.9	16.5		115.5
			v/c	0.1	0.03	0.26	0.12	0.17		2.09	0.11		0.03	0.07		2.09
		Improved	LOS	B	B	A	B	B		B	A		A	A		B
			Delay	14.3	10.1	4.4	12.5	13.4		16.4	4.3		8.6	5.8		10.7
			v/c	0.39	0.14	0.53	0.32	0.5		0.6	0.1		0.01	0.04		0.60

Table 4. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	Condition	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
2029 AM Peak Hour Without Project	Queen Kaahumanu Highway and Kealakehe Parkway	Baseline	LOS	E	D		E	D	B	D	C	C	F	B	A	C
			Delay	77.3	40.1		78.6	39.3	13.9	48.2	20.9	30.1	80.8	16.0	3.8	29.6
			v/c	0.63	0.66		0.95	0.16	0.60	0.57	0.66	0.93	0.93	0.46	0.10	0.95
	Queen Kaahumanu Highway and Makala Boulevard	Baseline	LOS	D	B		D	E		D	C	A	E	C	A	C
			Delay	49.8	19.0		41.6	58.2		39.6	26.0	5.8	72.0	24.4	4.9	30.7
			v/c	0.90	0.22		0.31	0.91		0.56	0.82	0.06	0.65	0.59	0.44	0.91
	Queen Kaahumanu Highway and Palani Road	Baseline	LOS	D	C		E	D		D	C	B	D	C	B	D
			Delay	48.2	22.5		68.6	43.6		48.2	34.9	10.9	45.7	34.0	17.3	37.0
			v/c	0.81	0.50		0.89	0.84		0.58	0.83	0.04	0.26	0.69	0.52	0.89
	Queen Kaahumanu Highway and Henry Street	Baseline	LOS	F	F		F	F		E	C	F	F	C	A	E
			Delay	101.6	131.8		115.3	85.4		71.8	26.6	82.6	155.8	31.7	4.7	73.2
			v/c	0.89	1.14		1.08	1.01		0.71	0.48	1.10	1.04	0.42	0.24	1.14
	Palani Road and Henry Street/Ane Keohokalole Highway	Improved	LOS	D	D		C	C		B	C	A	B	C	A	C
			Delay	52.5	46.3		27.1	30.3		17.9	24.6	3.3	16.6	26.0	7.5	24.7
			v/c	0.66	0.79		0.82	0.86		0.11	0.50	0.55	0.02	0.45	0.43	0.86
	Kealakehe Parkway and Ane Keohokalole Highway	Improved	LOS	C	B	B	B	D		D	C	A	B	C	B	C
			Delay	28.8	19.9	17.6	18.7	44.6		45.5	21.8	6.3	14.7	27.6	10.3	27.6
			v/c	0.63	0.29	0.76	0.51	0.90		0.84	0.50	0.17	0.09	0.58	0.07	0.90
2029 PM Peak Hour Without Project	Queen Kaahumanu Highway and Kealakehe Parkway	Baseline	LOS	D	D		D	D	B	D	C	A	D	D	A	D
			Delay	49.5	36.6		51.5	38.1	10.6	52.7	31.1	4.5	54.4	41.6	4.4	37.2
			v/c	0.59	0.8		0.89	0.18	0.34	0.64	0.82	0.27	0.71	0.96	0.22	0.96
	Queen Kaahumanu Highway and Makala Boulevard	Baseline	LOS	E	D		E	F		F	C	A	E	D	B	D
			Delay	77.3	43.5		64.7	132.9		90.8	32.8	7.9	59.9	47.3	12.3	54.0
			v/c	1.03	0.87		0.81	1.16		1.02	0.67	0.14	0.84	0.97	0.75	1.16
	Queen Kaahumanu Highway and Palani Road	Baseline	LOS	E	D		F	F		F	D	B	E	E	D	E
			Delay	55.9	47.3		90.1	99.8		128.0	41.8	12.7	60.5	66.6	49.5	65.8
			v/c	0.78	0.87		0.90	1.08		1.09	0.60	0.06	0.73	1.00	0.96	1.09
	Queen Kaahumanu Highway and Henry Street	Baseline	LOS	F	F		F	E		F	D	F	F	D	A	F
			Delay	82.4	165.1		136.3	55.9		81.3	38.4	108.1	172.0	46.0	5.4	90.6
			v/c	0.71	1.23		1.17	0.92		0.78	0.39	1.16	1.22	0.77	0.37	1.23
	Palani Road and Henry Street/Ane Keohokalole Highway	Improved	LOS	E	D		D	C		D	D	C	C	D	A	D
			Delay	55.6	54.5		39.4	28.2		41.3	36.7	34.8	28.8	39.7	8.0	38.5
			v/c	0.74	0.97		0.74	0.70		0.62	0.61	0.90	0.37	0.71	0.47	0.97
	Kealakehe Parkway and Ane Keohokalole Highway	Improved	LOS	B	C	A	D	B		B	B	A	A	C	A	B
			Delay	18.5	24.7	5.3	44.5	18.6		17.5	13.3	3.5	8.9	21.7	5.0	17.2
			v/c	0.21	0.61	0.38	0.77	0.42		0.63	0.30	0.34	0.15	0.68	0.25	0.77

Table 4. Summary of Capacity Analysis (Cont'd.)																
Scenario	**Intersection**	**Condition**	**MOE**	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**	**Intersection**
2019 AM Peak Hour With Project	**Queen Kaahumanu Highway and Kealakehe Parkway**	**Baseline**	**LOS**	D	C		D	D	C	B	C	B	D	B	A	C
			Delay	51.5	31.6		52.2	38.1	30.8	11.3	29.2	12.1	54.2	17.5	3.5	25.8
			v/c	0.34	0.52		0.76	0.09	0.78	0.34	0.84	0.80	0.89	0.61	0.08	0.89
		Improved	**LOS**	D	D	C	D	C	C	A	B	B	D	B	A	C
			Delay	52.1	41.4	20.8	53.3	32.6	27.6	9.9	19.8	17.0	40.1	14.4	3.8	22.1
			v/c	0.42	0.20	0.41	0.83	0.09	0.76	0.30	0.63	0.85	0.83	0.46	0.08	0.85
	Queen Kaahumanu Highway and Makala Boulevard	**Baseline**	**LOS**	D	B		D	C		D	C	A	D	C	A	C
			Delay	50.3	17.6		45.8	26.6		43.2	33.4	5.5	49.5	24.3	3.8	31.2
			v/c	0.86	0.10		0.28	0.55		0.52	0.92	0.04	0.38	0.66	0.40	0.92
		Improved	**LOS**	C	B		C	B		C	C	A	D	C	A	C
			Delay	30.1	12.6		33.9	19.5		34.1	25.2	7.2	44.7	22.2	5.2	23.7
			v/c	0.71	0.10		0.21	0.45		0.47	0.80	0.05	0.42	0.55	0.44	0.80
	Queen Kaahumanu Highway and Palani Road	**Baseline**	**LOS**	E	C	A	E	D	B	D	D	A	D	C	A	D
			Delay	62.1	28.1	6.7	65	54.4	10.7	48.7	37.2	9.4	48.9	31.6	7.6	37.8
			v/c	0.88	0.24	0.23	0.68	0.91	0.11	0.51	0.89	0.02	0.28	0.70	0.53	0.94
		Improved	**LOS**	D	C	A	D	D	A	D	C	B	D	C	B	C
			Delay	47.7	20.6	5.2	44.0	39.7	9.0	51.5	30.1	11.1	42.6	29.1	11.0	30.9
			v/c	0.80	0.20	0.20	0.44	0.82	0.10	0.61	0.76	0.03	0.25	0.61	0.28	0.82
	Queen Kaahumanu Highway and Henry Street	**Baseline**	**LOS**	E	D		E	C		F	D	B	E	D	A	D
			Delay	59.3	52.5		61.4	33.2		80.6	37.9	10.1	63.3	38.6	5.5	39.9
			v/c	0.73	0.89		0.95	0.72		0.90	0.87	0.43	0.66	0.85	0.26	0.95
		Improved	**LOS**	D	D	A	D	C	A	D	C	B	D	D	A	C
			Delay	39.1	36.6	8.4	42.9	28.8	6.5	47.4	32.1	10.6	51.2	39.3	7.5	30.9
			v/c	0.57	0.71	0.25	0.85	0.53	0.34	0.68	0.76	0.45	0.58	0.84	0.33	0.85
	Palani Road and Henry Street/Ane Keohokalole Highway	**Baseline**	**LOS**	D	D	B	D	D		C	B		C	B		C
			Delay	52.4	45.2	10.9	35.5	39.3		30.0	13.5		31.1	18.0		29.5
			v/c	0.56	0.64	0.20	0.87	0.89		0.33	0.76		0.36	0.64		0.89
		Improved	**LOS**	D	D		C	B		C	A		C	B		B
			Delay	35.4	36.9		27.4	17.1		24.3	7.2		30.2	10.4		19.4
			v/c	0.49	0.75		0.86	0.57		0.34	0.64		0.46	0.54		0.86
	Kealakehe Parkway and Ane Keohokalole Highway	**Baseline**	**LOS**	B	B	A	B	B		C	A		A	A		B
			Delay	16.3	10.9	4.7	14.5	16.4		24.8	4.0		8.9	5.9		13.8
			v/c	0.44	0.17	0.59	0.41	0.61		0.77	0.12		0.02	0.03		0.77

Table 4. Summary of Capacity Analysis (Cont'd.)																
Scenario	**Intersection**	**Condition**	**MOE**	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**	**Intersection**
2014 PM Peak Hour With Project	**Queen Kaahumanu Highway and Kealakehe Parkway**	**Baseline**	**LOS**	C			F		A	F	E	A	F	F	A	F
			Delay	27.4			171.5		6.0	134.6	78.6	6.0	231.8	136.7	6.7	111.4
			v/c	0.68			1.29		0.15	1.05	1.02	0.32	1.35	1.19	0.21	1.35
		Improved	**LOS**	D	D		D	C	A	C	C	A	C	D	A	D
			Delay	43.8	35.8		52.6	31.6	8.7	30.9	34.4	4.2	28.7	40.2	4.1	36.0
			v/c	0.50	0.73		0.93	0.19	0.31	0.65	0.88	0.29	0.68	0.95	0.17	0.95
	Queen Kaahumanu Highway and Makala Boulevard	**Baseline**	**LOS**	F	E	A	F	F		F	C	A	D	E	A	D
			Delay	88.1	56.4	9.1	102.9	116.2		100.5	26.9	7.4	51.0	56.3	4.1	54.5
			v/c	1.04	0.78	0.40	0.92	1.04		1.01	0.55	0.08	0.64	1.01	0.53	1.04
		Improved	**LOS**	E	C		E	D		E	C	A	E	D	A	D
			Delay	63.7	34.4		56.1	54.7		76.4	24.2	6.4	58.9	39.2	3.7	39.7
			v/c	0.92	0.66		0.57	0.80		0.89	0.47	0.07	0.68	0.93	0.51	0.93
	Queen Kaahumanu Highway and Palani Road	**Baseline**	**LOS**	F	D		E	D		F	C	A	D	E	B	D
			Delay	99.8	37.1		73.4	48.5		96.6	27.6	9.0	50.9	65.1	18.8	51.4
			v/c	1.01	0.76		0.67	0.84		0.96	0.55	0.04	0.62	1.04	0.71	1.04
		Improved	**LOS**	E	D	A	E	D	A	E	C	A	E	D	B	D
			Delay	78.1	43.1	8.4	61.3	53.2	9.8	72.0	26.5	8.5	55.7	52.0	17.7	43.4
			v/c	0.90	0.59	0.46	0.53	0.79	0.28	0.82	0.50	0.03	0.63	0.98	0.60	0.98
	Queen Kaahumanu Highway and Henry Street	**Baseline**	**LOS**	D	F		E	D		F	D	A	E	E	A	D
			Delay	49.0	86.0		73.1	52.6		103.9	43.2	9.9	72.7	55.8	5.9	53.4
			v/c	0.32	1.00		0.94	0.89		0.94	0.60	0.74	0.79	0.91	0.37	1.00
		Improved	**LOS**	D	D		D	C		D	C	B	D	D	A	D
			Delay	44.6	52.6		54.1	31.2		52.1	33.7	14.2	45.8	52.5	5.6	39.4
			v/c	0.48	0.90		0.88	0.70		0.68	0.62	0.45	0.64	0.95	0.38	0.95
	Palani Road and Henry Street/Ane Keohokalole Highway	**Baseline**	**LOS**	B	E	A	E	C		C			C	B		D
			Delay	13.7	71.2	6.5	74.3	22.9		30.7			32	14.2		42.0
			v/c	0.4	1.00	0.2	1.02	0.62		0.91			0.24	0.24		1.02
		Improved	**LOS**	D	D	A	D	C		C	B		C	B		D
			Delay	54.7	48.5	5.3	54.5	34		28.8	18.8		26.2	17.0		35.6
			v/c	0.72	0.91	0.19	0.88	0.78		0.34	0.77		0.21	0.33		0.91
	Kealakehe Parkway and Ane Keohokalole Highway	**Baseline**	**LOS**	A	A	A	A	A	A	E	A		C	A		A
			Delay	7.5	0.0	0.0	7.6	0.0	0.0	40.6	9.9		15.5	9.5		12.5
			v/c	0.04	0.04	0.10	0.06	0.05	0.05	0.71	0.17		0.07	0.15		0.71
		Improved	**LOS**	B	B	A	B	B		B	A		A	A		A
			Delay	11.6	11.7	4.5	13.1	10.2		10.2	2.7		7.3	2.7		7.6
			v/c	0.18	0.25	0.33	0.29	0.19		0.36	0.18		0.04	0.16		0.36

Table 4. Summary of Capacity Analysis (Cont'd.)																
Scenario	**Intersection**	**Condition**	**MOE**	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**	**Intersection**
2029 AM Peak Hour With Project	**Queen Kaahumanu Highway and Kealakehe Parkway**	**Baseline**	**LOS**	D	D	C	D	D	A	D	C	A	D	B	A	C
			Delay	48.7	48.4	23.7	51.9	38.8	0.3	48.7	31.4	8.1	53	17.1	4.0	25.6
			v/c	0.40	0.24	0.49	0.79	0.14	0.18	0.59	0.89	0.68	0.76	0.45	0.11	0.89
	Queen Kaahumanu Highway and Makala Boulevard	**Baseline**	**LOS**	E	C		E	E		E	D	A	F	D	A	D
			Delay	70.1	24.7		63.7	70.4		63.9	45.5	8.7	100	37.3	5.4	48.4
			v/c	0.94	0.22		0.22	0.98		0.65	0.89	0.06	0.82	0.61	0.45	0.98
		Improved	**LOS**	D	C	A	D	D	D	D	D	A	D	D	A	D
			Delay	51.1	20.9	6.8	45.9	44.2	51.5	51.6	44.3	8.7	53.6	36.5	6.3	40.2
			v/c	0.88	0.17	0.09	0.11	0.62	0.9	0.63	0.93	0.06	0.49	0.74	0.50	0.93
	Queen Kaahumanu Highway and Palani Road	**Baseline**	**LOS**	D	C	B	D	D	B	D	D	B	D	D	B	D
			Delay	51.5	33.7	10.9	46.4	54.7	12.4	49.6	37.5	11.5	53.3	38.5	14.6	40.0
			v/c	0.81	0.39	0.32	0.77	0.93	0.04	0.53	0.83	0.04	0.34	0.71	0.31	0.93
	Queen Kaahumanu Highway and Henry Street	**Baseline**	**LOS**	D	D	B	D	D	A	D	D	B	D	D	A	D
			Delay	52.2	52.6	11.0	47.6	38.1	6.4	51.8	37.2	15.4	54.7	46.6	6.8	36.4
			v/c	0.60	0.81	0.25	0.85	0.71	0.35	0.69	0.80	0.68	0.57	0.89	0.34	0.89
	Palani Road and Henry Street/Ane Keohokalole Highway	**Baseline**	**LOS**	D	C		D	D		C	D	B	D	D	A	C
			Delay	53.5	34.3		43.2	39.2		25.4	46.2	14.9	36.0	37.1	9.4	34.3
			v/c	0.69	0.56		0.92	0.92		0.16	0.81	0.73	0.50	0.64	0.63	0.92
		Improved	**LOS**	D	D	B	D	C		C	D	A	D	D	B	C
			Delay	47.5	41.4	11.7	37.8	31.1		26.9	43.3	5.7	36.6	37.2	17.8	30.3
			v/c	0.49	0.53	0.23	0.87	0.84		0.15	0.75	0.4	0.47	0.59	0.69	0.87
	Kealakehe Parkway and Ane Keohokalole Highway	**Baseline**	**LOS**	D	C	B	C	D		D	C	A	B	C	B	C
			Delay	38.1	21.0	19.4	20.1	47.8		51.1	22.4	5.9	16.0	32.8	11.4	30.8
			v/c	0.37	0.32	0.32	0.37	0.32		0.38	0.34	0.34	0.24	0.19	0.19	0.91

Table 4. Summary of Capacity Analysis (Cont'd.)																
Scenario	**Intersection**	**Condition**	**MOE**	**EBL**	**EBT**	**EBR**	**WBL**	**WBT**	**WBR**	**NBL**	**NBT**	**NBR**	**SBL**	**SBT**	**SBR**	**Intersection**
2019 PM Peak Hour With Project	**Queen Kaahumanu Highway and Kealakehe Parkway**	**Baseline**	**LOS**	D	F		F	D	A	D	D	A	F	E	A	E
			Delay	47.8	87.7		88.3	36.8	9.1	52.5	43.7	3.9	111.0	65.3	3.7	58.7
			v/c	0.54	0.97		1.07	0.24	0.42	0.81	0.95	0.33	1.10	1.05	0.18	1.10
		Improved	**LOS**	D	D	D	D	C	A	D	C	A	D	C	A	C
			Delay	47.6	46.9	39.9	52.1	33.6	7.9	39.4	33.4	5.0	50.1	29.7	4.3	33.8
			v/c	0.54	0.19	0.76	0.94	0.20	0.38	0.73	0.81	0.37	0.88	0.82	0.20	0.94
	Queen Kaahumanu Highway and Makala Boulevard	**Baseline**	**LOS**	F	D		F	F		F	C	A	E	E	A	E
			Delay	90.3	45.1		84.2	90.6		115.2	28.2	6.2	72.7	59.7	3.6	56.5
			v/c	1.02	0.70		0.78	0.97		1.03	0.52	0.07	0.75	1.02	0.56	1.03
		Improved	**LOS**	D	C		D	D		D	C	A	D	D	A	D
			Delay	51.4	28.5		47.5	51.0		52.9	27.9	7.9	50.5	51.9	6.3	40.2
			v/c	0.90	0.64		0.53	0.81		0.77	0.50	0.09	0.68	0.99	0.64	0.99
	Queen Kaahumanu Highway and Palani Road	**Baseline**	**LOS**	F	E	C	F	F	B	F	C	A	E	E	C	E
			Delay	110.7	70.1	26.9	130.9	107.5	10.9	136.9	29.6	8.0	71.8	61.4	20.3	63.9
			v/c	1.01	0.89	0.61	0.95	1.05	0.32	1.07	0.51	0.03	0.70	1.01	0.66	1.07
		Improved	**LOS**	E	D	B	E	E	A	E	C	A	D	D	B	D
			Delay	67	41.4	11.5	55.1	61.5	8.7	78.6	29	9.6	52.3	42.5	14.5	41.0
			v/c	0.87	0.72	0.49	0.52	0.92	0.29	0.89	0.48	0.05	0.64	0.93	0.43	0.93
	Queen Kaahumanu Highway and Henry Street	**Baseline**	**LOS**	E	F		F	D		F	D	B	D	D	A	D
			Delay	72.5	94.1		86.8	38.5		98.9	35.8	17.5	51.8	54.8	4.8	52.8
			v/c	0.74	1.07		1.04	0.83		0.97	0.65	0.56	0.71	0.97	0.39	1.07
		Improved	**LOS**	D	D	A	D	C	A	D	D	B	D	D	A	D
			Delay	44.7	50.8	8.7	49.3	29.3	5.8	50.4	36.3	18.2	43.8	51.7	6.7	36.7
			v/c	0.52	0.87	0.29	0.88	0.49	0.42	0.69	0.63	0.60	0.65	0.95	0.47	0.95
	Palani Road and Henry Street/Ane Keohokalole Highway	**Baseline**	**LOS**	F	E	A	F	F		C	D		D	B		E
			Delay	98.7	69.5	4.8	98.8	90.2		33.2	38.3		35.2	15.3		63.0
			v/c	1.04	1.01	0.2	1.08	1.08		0.45	0.94		0.47	0.50		1.08
		Improved	**LOS**	D	D		D	D		C	B		C	B		C
			Delay	54.7	42.6		47.8	36.9		24.7	19.8		26	12.9		34.3
			v/c	0.87	0.90		0.88	0.79		0.39	0.84		0.40	0.47		0.90
	Kealakehe Parkway and Ane Keohokalole Highway	**Baseline**	**LOS**	B	B	A	B	B		B	A		A	A		A
			Delay	11.8	12.7	4.6	14.8	10.9		14.3	3.0		8.4	3.2		9.0
			v/c	0.18	0.33	0.44	0.38	0.26		0.54	0.26		0.06	0.19		0.54

Table 5. Summary of Traffic Mitigation

Scenario	Facility	Type	Approach	Proposed Improvements
Year 2014 Without Project	Queen Kaahumanu Highway	Area	N/A	Widen Queen Kaahumanu Highway from two lanes to four lanes from Kealakehe Parkway to Kona International Airport Access Road.
	Ane Keohokalole Highway	Area	N/A	Extend Ane Keohokalole Highway from Puohulihuli Street to Palani Road.
			SB	Provide left-turn lane at future Makala Boulevard Extension.
			SB	Provide left-turn lane at future Manawalea Street Extension.
	Palani Rd and Ane Keohokalole Hwy/Henry St	Area	NB	Restripe Henry Street to provide a left-turn/through lane and a through/right-turn lane at Palani Road.
			SB	Construct a left-turn lane, a through-only lane, and a through/right-turn lane on Ane Keohokalole Highway at Palani Road.
			EB	Widen mauka bound Palani Road to provide exclusive left-turn and right-turn lanes at Ane Keohokalole Highway/Henry Street
			NB/SB	Modify the traffic signal phasing to provide protected-permissive left-turn phases on all approaches to the intersection.
			WB	Widen makai bound Palani Road to provide double left-turn lanes onto Henry Street.
			EB/WB	Modify the traffic signal phasing to include protected left-turn phases in both directions on Palani Road.
	Kealakehe Pkwy and Queen Kaahumanu Hwy	Area	WB	Widen Kealakehe Parkway to provide double left-turn lanes in addition to the existing through lane and right-turn lane.
			EB	Widen Kealakehe Parkway to provide a left-turn lane in addition to the existing through/right-turn lane.
			EB/WB	Modify the traffic signal phasing to provide protected-permissive left-turn phases.
	Makala Blvd and Queen Kaahumanu Hwy	Area	EB	Restripe Makala Boulevard the right-turn only to a through/right-turn lane.
			WB	Widen to provide two left-turn lanes and a through-only lane, in addition to the existing through/right-turn lane.
			All	Modify the traffic signal phasing to provide an eight-phase operation with protected left-turn phases on all approaches.
	Henry Street and Queen Kaahumanu Highway	Area	WB	Widen Henry Street to provide two left-turn lanes in addition to a through-only lane and a through/right-turn lane.
			All	Modify the traffic signal phasing to provide an eight-phase operation with protected left-turn phases on all approaches.
	Ane Keohokalole Hwy and Kealakehe Pkwy	Area	All	Signalize the intersection, when warranted.
Year 2019 Without Project	Queen Kaahumanu Highway	Area	N/A	Widen Queen Kaahumanu Highway from four lanes to six lanes from Henry Street to Kealakehe Parkway.
	Palani Rd and Henry St/Ane Keohokalole Hwy	Area	NB	Widen Henry Street to provide an exclusive left-turn lane.
		Area	EB	Restripe the exclusive right-turn lane on mauka bound Palani Road to a shared through/right-turn lane to provide two mauka bound lanes.
				Widen the east leg of Palani Road to provide two lanes in the eastbound direction.
Year 2029 Without Project	Ane Keohokalole Highway	Area	N/A	Widen Ane Keohokalole Highway from two lanes to four lanes from Kealakehe Parkway Puohulihuli Street to Makala Boulevard.
				Extend the four-lane divided Ane Keohokalole Highway to Hina Lani Street.
	Ane Keohokalole Hwy and Kealakehe Parkway	Area	NB/SB	Provide separate left-turn and right-turn lanes in both directions on Ane Keohokalole Highway.
	Makala Boulevard	Area	N/A	Extend Makala Boulevard from Makalapa Shopping Center to Ane Keohokalole Highway.
	Ane Keohokalole Highway and Makala Boulevard	Area	NB	Provide an exclusive left-turn lane on Ane Keohokalole Highway to Makala Boulevard.
	Palani Road and Ane Keohokalole Hwy/Henry St	Area	EB/WB	Widen both approaches on Palani Road to provide two through lanes in both directions at Ane Keohokalole Highway/Henry Street.
			SB	Provide right-turn lane on Ane Keohokalole Highway at Palani Road.

Table 4. Summary of Capacity Analysis (Cont'd.)

Scenario	Intersection	Condition	MOE	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	Intersection
2029 PM Peak Hour With Project	Queen Kaahumanu Highway and Kealakehe Parkway	Baseline	LOS	D	E	C	E	D	A	E	C	A	E	C	A	D
			Delay	48.4	59.7	29.8	58.6	46.6	0.1	75.6	32.2	4.2	71.7	33.5	3.6	36.2
			v/c	0.45	0.29	0.75	0.9	0.27	0.1	0.76	0.79	0.25	0.84	0.89	0.19	0.90
	Queen Kaahumanu Highway and Makala Boulevard	Baseline	LOS	E	E		F	F		F	E	B	F	E	B	E
			Delay	77.6	70.2		81.7	100.9		94.7	63.7	10.6	88.4	66.5	17	69.3
			v/c	1.01	1.01		0.86	1.08		1.01	0.95	0.18	1.01	1.02	0.79	1.08
		Improved	LOS	E	E	A	E	F	B	E	D	A	E	D	B	D
			Delay	74.1	56	7.1	71.6	101.4	16	75	37	8.1	58.6	51.9	13.9	51.3
			v/c	0.98	0.87	0.39	0.76	0.99	0.63	0.91	0.58	0.12	0.78	0.95	0.75	0.99
	Queen Kaahumanu Highway and Palani Road	Baseline	LOS	F	D	B	E	E	A	F	D	B	E	E	C	E
			Delay	86.8	51.6	15.2	69.2	71.1	7.1	95.7	42.3	13.0	61.9	65.1	23.8	56.0
			v/c	0.97	0.81	0.55	0.85	0.97	0.32	0.97	0.58	0.06	0.73	0.99	0.58	0.99
	Queen Kaahumanu Highway and Henry Street	Baseline	LOS	E	F	B	F	C	A	F	D	C	E	E	A	E
			Delay	73.9	99.9	13.5	87.4	34.9	4.9	136.2	52.1	33.8	64.6	76.9	6.1	60.3
			v/c	0.67	1.05	0.37	1.05	0.54	0.47	1.06	0.64	0.87	0.79	1.03	0.41	1.06
	Palani Road and Henry Street/Ane Keohokalole Highway	Baseline	LOS	F	E		D	D		E	E	D	F	E	B	E
			Delay	103.3	79.4		49.4	51.8		63.5	77.2	54.7	99	64.5	12.4	63.0
			v/c	0.99	1.00		0.64	0.88		0.71	0.94	0.97	0.91	0.81	0.65	1.00
		Improved	LOS	D	D	A	D	D		C	D	B	D	D	B	D
			Delay	54.7	48.9	6.7	50.4	50.5		31.5	46	15.4	41.3	37.6	19.8	39.5
			v/c	0.81	0.92	0.32	0.87	0.97		0.54	0.87	0.58	0.67	0.72	0.56	0.97
	Kealakehe Parkway and Ane Keohokalole Highway	Baseline	LOS	B	D	A	C	C		C	B	A	B	C	A	C
			Delay	19.7	49.4	8.8	33.9	27.9		29.7	16.8	3.6	13.1	32.1	6.0	24.2
			v/c	0.20	0.81	0.53	0.66	0.43		0.79	0.30	0.35	0.18	0.75	0.27	0.81

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED
KAMAKANA VILLAGES
AT KEAHUOLU

APPENDICES

Table 5. Summary of Traffic Mitigation (Cont'd.)

Scenario	Facility	Type	Approach	Proposed Improvements
Year 2014 With Project	Palani Road and Queen Kaahumanu Highway	Area	EB	Widen Palani Road at Queen Kaahumanu Highway to provide an exclusive right-turn lane.
	Henry Street and Queen Kaahumanu Highway	Area	NB	Widen Queen Kaahumanu Highway to provide double right-turn lanes at Henry Street.
	Palani Road and Henry St/Ane Keohokalole Hwy	Area	NB	Widen northbound Henry Street at Palani Road to provide an exclusive left-turn lane.
	Manawalea Street and Ane Keohokalole Highway	Local	WB	Construct Manawalea St with separate left-turn and right-turn lanes to intersect Ane Keohokalole Hwy at a stop-controlled intersection.
Year 2019 With Project	Makala Boulevard and Ane Keohokalole Highway	Local	WB	Construct Makala Blvd with separate left-turn and right-turn lanes to intersect Ane Keohokalole Hwy at a stop-controlled intersection.
			SB	Restripe Ane Keohokalole Highway at Makala Boulevard to provide a median shelter lane.
	Manawalea Street and Ane Keohokalole Highway	Local	SB	Restripe Ane Keohokalole Highway at Manawalea Street to provide a median shelter lane.
	Kealakehe Parkway and Queen Kaahumanu Hwy	Area	EB	Widen Kealakehe Parkway at Queen Kaahumanu Highway to provide an exclusive right-turn lane.
	Palani Road and Queen Kaahumanu Highway	Area	EB	Widen Palani Road to provide double left-turn lanes onto Queen Kaahumanu Highway.
			SB	Widen Queen Kaahumanu Highway to provide double right-turn lanes to Palani Road.
	Henry Street and Queen Kaahumanu Highway	Area	EB	Widen Henry Street to provide an exclusive right-turn lane to Queen Kaahumanu Highway.
			WB	Widen Henry Street to provide an exclusive right-turn lane to Queen Kaahumanu Highway.
	Palani Road and Henry St/Ane Keohokalole Hwy	Area	EB/WB	Widen Palani Road to provide two through lanes in both direction at Ane Keohokalole Highway/Henry Street.
			NB	Widen Henry Street to provide an exclusive left-turn lane.
Year 2029 With Project	Makala Boulevard and Queen Kaahumanu Hwy	Area	SB	Widen Queen Kaahumanu Highway to provide a double left-turn lane to mauka bound Makala Boulevard.
			WB	Widen Makala Boulevard to provide an exclusive right-turn lane to northbound Queen Kaahumanu Highway.
			EB	Widen Makala Boulevard to provide an exclusive right-turn lane to southbound Queen Kaahumanu Highway.
	Palani Road and Henry St/Ane Keohokalole Hwy	Area	EB	Widen Palani Road to provide double left-turn lanes at Ane Keohokalole Highway/Henry Street.
				Widen Palani Road to provide an exclusive right-turn lane at Ane Keohokalole Highway/Henry Street.
			WB	Widen Palani Road to provide an exclusive right-turn lane at Ane Keohokalole Highway/Henry Street.
				Widen Palani Road to provide an exclusive right-turn lane at Ane Keohokalole Highway/Henry Street.
	Ane Keohokalole Highway and Manawalea Street	Local	N/A	Signalize the intersection when warranted.
	Ane Keohokalole Highway and Makala Boulevard	Local	N/A	Signalize the intersection when warranted.
	Ane Keohokalole Highway and South Street	Local	WB	Construct South Street at Ane Keohokalole Hwy with stop-controls and restricted to right-turn-in and right-turn-out movements only.
	Palani Road and School Street	Local	SB	Construct School Street with separate left-turn and right-turn lanes, which will intersect Palani Road at a Tee-intersection.
			WB	Widen makai bound Palani Road to provide an exclusive right-turn lane at School Street.
			EB	Widen Palani Road to provide an exclusive left-turn lane at School Street.
			N/A	Signalize the intersection of School Street and Palani Road when warranted.
	Palani Road and D Street	Local	SB	Construct D Street at Palani Road with stop-controls and restricted to right-turn-in and right-turn-out movements only.
			WB	Widen Palani Road to provide a right-turn deceleration lane to D Street.
	Palani Road and C Street	Local	SB	Construct C Street at Palani Road with stop-controls and restricted to right-turn-in and right-turn-out movements only.
			WB	Widen Palani Road to provide a right-turn deceleration lane to C Street.

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED
KAMAKANA VILLAGES
AT KEAHUOLU

APPENDIX A
TRAFFIC COUNT DATA

TRAFFIC COUNT DATA **FILE NAME: QK-Kealakehe**

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Kealakehe Pkwy
N-S STREET: Queen Kaahumanu Hwy

PERIOD: AM Peak
NORTH:
TECHNICIAN: Jamie/Video
DATE: 9/23/09

		Kealakehe Pkwy						Queen Kaahumanu Hwy							
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY
6:00	6:15	0	0	0	10	2	20	10	133	10	0	0	0	185	
6:15	6:30	0	0	0	14	2	19	17	179	15	0	0	0	246	
6:30	6:45	3	3	7	14	1	42	14	243	38	12	89	15	481	
6:45	7:00	5	0	1	24	0	26	19	226	33	10	111	11	466	1378
7:00	7:15	3	0	3	24	2	23	18	185	36	23	129	8	454	1647
7:15	7:30	11	2	7	40	2	36	19	186	54	27	145	12	541	1942
7:30	7:45	4	1	13	40	6	29	23	171	63	32	183	20	585	2046
7:45	8:00	5	2	11	63	1	33	9	182	99	40	219	10	**674**	2254
8:00	8:15	4	1	9	92	5	39	24	161	60	21	160	8	584	**2384**
8:15	8:30	6	2	9	31	3	26	24	179	23	7	173	11	494	2337
8:30	8:45	6	2	9	14	4	27	27	178	25	8	158	9	467	2219
8:45	9:00	5	0	13	32	1	13	11	179	13	5	169	19	460	2005
AM PEAK HOUR															
7:15	**8:15**	**24**	**6**	**40**	**235**	**14**	**137**	**75**	**700**	**276**	**120**	**707**	**50**	**2384**	**2384**
PHF		**1.20**	**0.75**	**0.91**	**0.93**	**3.50**	**1.04**	**2.08**	**0.96**	**0.70**	**0.75**	**0.81**	**1.25**	**0.88**	**PHF**

TRAFFIC COUNT DATA **FILE NAME: QK-Kealakehe**

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Kealakehe Pkwy
N-S STREET Queen Kaahumanu Hwy

PERIOD: PM Peak
NORTH:
TECHNICIAN: Jamie/Video
DATE: 9/22/09

		Kealakehe Pkwy						Queen Kaahumanu Hwy							
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY
15:00	15:15				30	3	17	16	193	48					
15:15	15:30	9	0	28	69	3	26	23	171	48	28	213	20	638	
15:30	15:45	18	0	27	81	11	19	26	211	50	23	257	23	**746**	
15:45	16:00	16	1	21	42	3	24	12	163	44	13	232	11	582	
16:00	16:15	16	5	19	56	2	24	14	236	63	17	245	17	714	2680
16:15	16:30	15	1	21	32	2	19	15	164	45	27	184	16	541	**2583**
16:30	16:45	15	1	21	35	2	28	15	205	44	18	222	7	613	2450
16:45	17:00	14	9	16	38	2	19	8	175	29	14	242	14	580	2448
17:00	17:15	12	4	16	30	5	18	17	197	51	21	250	14	635	2369
17:15	17:30	9	0	21	42	4	21	14	155	46	27	234	8	581	2409
17:30	17:45	14	5	14	31	2	11	13	135	32	19	210	11	497	2293
17:45	18:00	4	4	17	24	2	11	12	155	41	17	163	5	455	2168
PM PEAK HOUR															
15:15	**16:15**	**59**	**6**	**95**	**248**	**19**	**93**	**75**	**781**	**205**	**81**	**947**	**71**	**2680**	**2680**
PHF		**0.82**	**N/A**	**0.88**	**0.77**	**0.43**	**1.22**	**0.72**	**0.93**	**1.03**	**0.88**	**0.92**	**0.77**	**0.90**	**PHF**

TRAFFIC COUNT DATA **FILE NAME: QK-Makala**

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Makala Blvd
N-S STREET: Queen Kaahumanu Hwy

PERIOD: AM Peak
NORTH:
TECHNICIAN: Bonnie/Video
DATE: 9/23/09

		Makala Blvd						Queen Kaahumanu Hwy								
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY	
6:00	6:15	8	4	4	0	0	0	0	0	0	1	20	4	41		
6:15	6:30	32	6	6	0	0	0	0	0	0	2	42	11	99		
6:30	6:45	39	4	3	3	3	6	17	217	4	4	53	13	366		
6:45	7:00	47	2	5	3	3	5	23	225	4	5	67	9	398	904	
7:00	7:15	71	7	9	3	4	8	21	168	1	11	86	42	431	1294	
7:15	7:30	44	4	10	4	10	8	20	187	2	1	96	34	420	1615	
7:30	7:45	64	9	9	1	5	7	27	207	5	6	137	38	515	1764	
7:45	8:00	66	8	6	9	8	11	35	203	6	8	171	42	**573**	1939	
8:00	8:15	77	5	6	1	7	6	26	156	5	7	182	75	553	2061	
8:15	8:30	72	8	14	3	9	9	39	143	4	12	186	66	565	**2206**	
8:30	8:45	63	21	16	5	11	5	42	131	3	14	128	52	491	2182	

AM PEAK HOUR

7:30	**8:30**	**279**	**30**	**35**	**14**	**29**	**33**	**127**	**709**	**20**	**33**	**676**	**221**	**2206**	**2206**
PHF		**1.06**	**0.94**	**1.46**	**0.39**	**0.91**	**0.75**	**0.91**	**0.87**	**0.83**	**1.03**	**0.99**	**1.32**	**0.96**	**PHF**

TRAFFIC COUNT DATA **FILE NAME: QK-Makala**

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Makala Blvd
N-S STREET Queen Kaahumanu Hwy

PERIOD: PM Peak
NORTH:
TECHNICIAN: Bonnie/Video
DATE: 9/22/09

		Makala Blvd						Queen Kaahumanu Hwy								
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY	
15:00	15:15	108	56	27	0	0	0	0	0	0	32	213	33	469		
15:15	15:30	61	27	26	0	0	0	0	0	0	21	149	45	329		
15:30	15:45	120	33	30	11	16	20	53	153	6	24	215	65	746		
15:45	16:00	113	54	36	6	18	7	62	153	10	25	258	84	**826**	2370	
16:00	16:15	114	35	30	7	16	18	83	147	8	30	182	89	759	2660	
16:15	16:30	72	46	33	5	19	14	59	153	15	24	183	48	671	**3002**	
16:30	16:45	93	42	35	10	15	9	42	158	13	18	185	62	682	2938	
16:45	17:00	106	34	41	7	17	14	55	134	8	15	198	77	706	2818	
17:00	17:15	99	31	46	8	14	11	49	150	9	18	208	64	707	2766	
17:15	17:30	72	30	37	6	14	14	45	121	9	19	183	59	609	2704	
17:30	17:45	74	43	40	7	19	7	36	102	11	24	164	54	581	2603	

PM PEAK HOUR

15:30	**16:30**	**419**	**168**	**129**	**29**	**69**	**59**	**257**	**606**	**39**	**103**	**838**	**286**	**3002**	**3002**
PHF		**0.93**	**0.78**	**0.90**	**1.21**	**0.96**	**2.11**	**1.04**	**0.99**	**0.98**	**1.03**	**0.81**	**0.85**	**0.91**	**PHF**

TRAFFIC COUNT DATA **FILE NAME: QK Palani**

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Palani Road
N-S STREET: Queen Kaahumanu Hwy

PERIOD: AM Peak
NORTH:
TECHNICIAN: Joseph/Tim
DATE: 9/23/09

		Palani Road						Queen Kaahumanu Hwy								
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY	
6:00	6:15	48	8	7	2	34	2	13	125	4	4	38	20	305		
6:15	6:30	62	16	10	1	36	3	17	131	2	4	39	21	342		
6:30	6:45	61	21	15	1	33	8	21	198	1	2	53	38	452		
6:45	7:00	53	17	14	2	48	6	24	177	1	8	58	40	448	1547	
7:00	7:15	41	18	20	4	77	5	19	139	2	16	68	42	451	1693	
7:15	7:30	58	30	18	2	66	2	24	156	2	13	79	34	484	1835	
7:30	7:45	59	32	10	3	72	4	23	170	1	10	89	47	520	1903	
7:45	8:00	53	29	17	3	80	6	26	170	3	4	108	72	**571**	2026	
8:00	8:15	55	20	24	5	65	4	28	144	2	3	109	48	507	**2082**	
8:15	8:30	41	29	18	2	65	9	33	101	3	18	61	62	442	2040	

AM Peak

7:15	**8:15**	**225**	**111**	**69**	**13**	**283**	**16**	**101**	**640**	**8**	**30**	**385**	**201**	**2082**	**2082**
PHF		**1.06**	**0.96**	**1.01**	**1.08**	**0.88**	**0.67**	**0.97**	**0.94**	**0.67**	**1.88**	**0.89**	**0.70**	**0.91**	**PHF**

TRAFFIC COUNT DATA **FILE NAME: QK Palani**

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Palani Road
N-S STREET Queen Kaahumanu Hwy

PERIOD: PM Peak
NORTH:
TECHNICIAN: Joseph/Tim
DATE: 9/22/09

		Palani Road						Queen Kaahumanu Hwy								
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY	
15:00	15:15	85	69	39	37	81	19	42	132	8	24	181	101	818		
15:15	15:30	73	48	34	6	58	17	44	144	6	33	183	119	765		
15:30	15:45	79	56	39	10	82	11	44	119	5	40	183	109	777		
15:45	16:00	70	56	53	11	84	20	50	150	5	35	237	105	**876**	3236	
16:00	16:15	74	74	54	6	73	19	50	145	2	52	175	99	823	3241	
16:15	16:30	72	66	47	19	60	21	62	133	4	49	139	105	777	**3253**	
16:30	16:45	69	77	45	12	69	9	32	132	8	35	152	108	748	3224	
16:45	17:00	47	81	46	11	60	4	42	121	3	40	139	93	687	3035	
17:00	17:15	74	76	51	10	46	5	44	116	3	39	178	80	722	2934	
17:15	17:30	51	48	28	1	57	2	50	105	1	27	148	109	627	2784	

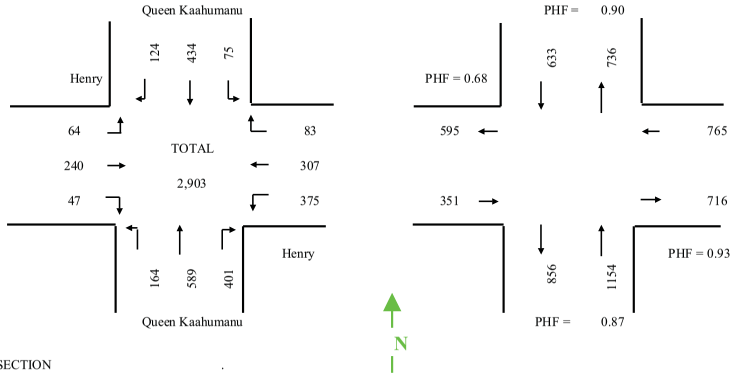
PM PEAK HOUR

15:30	**16:30**	**295**	**252**	**193**	**46**	**299**	**71**	**206**	**547**	**16**	**176**	**734**	**418**	**3253**	**3253**
PHF		**1.05**	**1.13**	**0.91**	**1.05**	**0.89**	**0.89**	**1.03**	**0.91**	**0.80**	**1.26**	**0.77**	**1.00**	**0.93**	**PHF**

INTERSECTION TURNING MOVEMENT SUMMARY

INTERSECTION:	**Queen Kaahumanu + Henry St**	**TIME:**	**6:30 AM to 8:30 AM**
JURISDICTION:		**DATE:**	**10-22-09, Thu**
PROJECT TITLE:		**PROJECT NO:**	

PEAK HOUR PERIOD: 7:15 AM to 8:15 AM
PEAK 15 MINUTE PERIO 7:30 AM to 7:45 AM



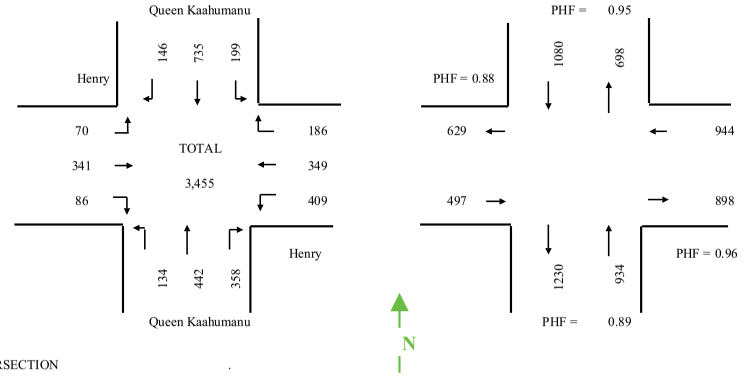
INTERSECTION .
PEAK HOUR FACTOR: 0.92

RUNNING COUNTS	Henry Eastbound			Henry Westbound			Queen Kaahumanu Northbound			Queen Kaahumanu Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Period End	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**TOTAL**
6:45 AM	18	29	9	75	22	8	42	150	51	2	36	6	448
7:00 AM	26	61	17	154	71	24	81	321	110	12	96	24	997
7:15 AM	48	96	28	230	134	33	106	460	210	28	174	34	1581
7:30 AM	63	131	36	329	190	55	146	595	300	53	297	55	2250
7:45 AM	86	219	54	428	257	81	181	749	417	65	410	88	3035
8:00 AM	101	287	62	525	346	100	233	916	530	82	495	117	3794
8:15 AM	112	336	75	605	441	116	270	1049	611	103	608	158	4484
8:30 AM	132	389	87	703	524	132	307	1184	690	127	691	178	5144
PERIOD COUNTS													
Period End	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**TOTAL**
6:45 AM	18	29	9	75	22	8	42	150	51	2	36	6	448
7:00 AM	8	32	8	79	49	16	39	171	59	10	60	18	549
7:15 AM	22	35	11	76	63	9	25	139	100	16	78	10	584
7:30 AM	15	35	8	99	56	22	40	135	90	25	123	21	669
7:45 AM	**23**	**88**	**18**	**99**	**67**	**26**	**35**	**154**	**117**	**12**	**113**	**33**	**785**
8:00 AM	15	68	8	97	89	19	52	167	113	17	85	29	759
8:15 AM	11	49	13	80	95	16	37	133	81	21	113	41	690
8:30 AM	20	53	12	98	83	16	37	135	79	24	83	20	660
PHF=	**0.70**	**0.68**	**0.65**	**0.95**	**0.81**	**0.80**	**0.79**	**0.88**	**0.86**	**0.75**	**0.88**	**0.76**	**0.92**
HOURLY TOTALS	0.70	0.68	0.65	0.95	1.15	0.80	1.17	0.96	0.86	1.56	0.96	0.94	
Beginning At	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**TOTAL**
6:30 AM	63	131	36	329	190	55	146	595	300	53	297	55	2250
6:45 AM	68	190	45	353	235	73	139	599	366	63	374	82	2587
7:00 AM	75	226	45	371	275	76	152	595	420	70	399	93	2797
7:15 AM	**64**	**240**	**47**	**375**	**307**	**83**	**164**	**589**	**401**	**75**	**434**	**124**	**2903**
7:30 AM	69	258	51	374	334	77	161	589	390	74	394	123	2894

INTERSECTION TURNING MOVEMENT SUMMARY

INTERSECTION:	**Queen Kaahumanu + Henry St**	**TIME:**	**3:00 PM to 5:00 PM**
JURISDICTION:		**DATE:**	**10-22-09, Thu**
PROJECT TITLE:		**PROJECT NO:**	

PEAK HOUR PERIOD: 4:00 PM to 5:00 PM
PEAK 15 MINUTE PERIO 4:45 PM to 5:00 PM



INTERSECTION .
PEAK HOUR FACTOR: 0.94

RUNNING COUNTS	Henry Eastbound			Henry Westbound			Queen Kaahumanu Northbound			Queen Kaahumanu Southbound			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Period End	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**TOTAL**
3:15 PM	28	70	18	103	88	55	44	110	72	34	163	22	807
3:30 PM	46	140	46	192	180	97	92	229	146	82	303	52	1605
3:45 PM	63	203	70	284	266	138	132	357	225	137	485	95	2455
4:00 PM	84	288	91	381	362	176	159	480	307	201	665	137	3331
4:15 PM	104	369	108	505	440	217	185	592	382	252	866	160	4180
4:30 PM	117	453	133	594	515	270	208	692	462	296	1035	196	4971
4:45 PM	131	528	160	685	614	318	247	815	555	358	1217	236	5864
5:00 PM	154	629	177	790	711	362	293	922	665	400	1400	283	6786
PERIOD COUNTS													
Period End	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**TOTAL**
3:15 PM	28	70	18	103	88	55	44	110	72	34	163	22	807
3:30 PM	18	70	28	89	92	42	48	119	74	48	140	30	798
3:45 PM	17	63	24	92	86	41	40	128	79	55	182	43	850
4:00 PM	21	85	21	97	96	38	27	123	82	64	180	42	876
4:15 PM	20	81	17	124	78	41	26	112	75	51	201	23	849
4:30 PM	13	84	25	89	75	53	23	100	80	44	169	36	791
4:45 PM	14	75	27	91	99	48	39	123	93	62	182	40	893
5:00 PM	**23**	**101**	**17**	**105**	**97**	**44**	**46**	**107**	**110**	**42**	**183**	**47**	**922**
PHF=	**0.76**	**0.84**	**0.80**	**0.82**	**0.88**	**0.88**	**0.73**	**0.90**	**0.81**	**0.80**	**0.91**	**0.78**	**0.94**
HOURLY TOTALS	0.76	0.84	1.26	0.97	0.90	1.06	0.73	1.03	0.81	1.18	1.00	0.78	0.94
Beginning At	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**TOTAL**
3:00 PM	84	288	91	381	362	176	159	480	307	201	665	137	3331
3:15 PM	76	299	90	402	352	162	141	482	310	218	703	138	3373
3:30 PM	71	313	87	402	335	173	116	463	316	214	732	144	3366
3:45 PM	68	325	90	401	348	180	115	458	330	221	732	141	3409
4:00 PM	**70**	**341**	**86**	**409**	**349**	**186**	**134**	**442**	**358**	**199**	**735**	**146**	**3455**

TRAFFIC COUNT DATA **FILE NAME: Palani-Henry**

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Palani Rd
N-S STREET: Henry St

PERIOD: AM Peak
NORTH:
TECHNICIAN: Shawn/Video
DATE: 9/23/09

		Palani Rd						Henry St							
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY
6:00	6:15	0	14	5	39	46	0	3	0	27	0	0	0	134	
6:15	6:30	0	17	2	75	55	0	3	0	29	0	0	0	181	
6:30	6:45	0	19	5	83	71	0	8	0	50	0	0	0	236	
6:45	7:00	0	34	4	122	90	0	16	0	54	0	0	0	320	871
7:00	7:15	0	34	6	141	93	0	8	0	83	0	0	0	365	1102
7:15	7:30	0	38	15	164	95	0	12	0	108	0	0	0	432	1353
7:30	7:45	0	42	8	181	105	0	11	0	124	0	0	0	471	1588
7:45	8:00	0	40	13	183	129	0	10	0	110	0	0	0	**485**	1753
8:00	8:15	0	36	11	160	89	0	10	0	80	0	0	0	386	**1774**
8:15	8:30	0	46	19	113	110	0	11	0	84	0	0	0	383	1725
8:30	8:45	0	48	15	135	107	0	14	0	68	0	0	0	387	1641
AM PEAK HOUR															
7:15	**8:15**	**0**	**156**	**47**	**688**	**418**	**0**	**43**	**0**	**422**	**0**	**0**	**0**	**1774**	
PHF		**N/A**	**0.98**	**0.90**	**0.94**	**0.81**	**N/A**	**1.08**	**N/A**	**0.96**	**N/A**	**N/A**	**N/A**	**0.91**	**PHF**

TRAFFIC COUNT DATA **FILE NAME: Palani-Henry**

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Palani Rd
N-S STREET Henry St

PERIOD: PM Peak
NORTH:
TECHNICIAN: Shawn/Video
DATE: 9/22/09

		Palani Rd						Henry St							
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY
15:00	15:15	0	47	17	44	48	0	3	0	48	0	0	0	207	
15:15	15:30	0	88	31	95	90	0	20	0	93	0	0	0	417	
15:30	15:45	0	99	24	94	94	0	16	0	107	0	0	0	434	
15:45	16:00	0	68	24	73	89	0	13	0	62	0	0	0	329	1387
16:00	16:15	0	121	44	81	106	0	17	0	108	0	0	0	477	1657
16:15	16:30	0	120	26	95	110	0	18	0	110	0	0	0	479	1719
16:30	16:45	0	125	18	109	104	0	19	0	114	0	0	0	489	1774
16:45	17:00	0	115	15	101	102	0	16	0	110	0	0	0	459	1904
17:00	17:15	0	116	25	100	98	0	19	0	103	0	0	0	461	1888
17:15	17:30	0	110	30	104	92	0	21	0	113	0	0	0	470	1879
17:30	17:45	0	85	22	85	75	0	13	0	83	0	0	0	363	1753
PM PEAK HOUR															
16:00	**17:00**	**0**	**481**	**103**	**386**	**422**	**0**	**70**	**0**	**442**	**0**	**0**	**0**	**1904**	
PHF		**N/A**	**0.96**	**1.43**	**0.89**	**1.01**	**N/A**	**0.92**	**N/A**	**0.97**	**N/A**	**N/A**	**N/A**	**0.97**	**PHF**

TRAFFIC COUNT DATA **FILE NAME: QK-Makala** Sec 3

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Kealakehe Pkwy
N-S STREET: Aneohokalole Hwy

PERIOD: AM Peak
NORTH:
TECHNICIAN: Shawn/Video
DATE: 9/23/09

		Kealakehe Pkwy						Aneohokalole Hwy							
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY
6:00	6:15	0	1	5	2	30	0	4	0	0	0	0	0	42	
6:15	6:30	0	7	7	0	41	0	7	0	0	0	0	0	62	
6:30	6:45	0	14	25	2	43	0	6	0	0	0	0	0	90	
6:45	7:00	0	10	25	0	43	0	9	0	0	0	0	0	87	281
7:00	7:15	0	18	34	0	48	0	16	0	0	0	0	0	116	355
7:15	7:30	0	20	48	0	49	0	28	0	0	0	0	0	145	438
7:30	7:45	0	24	71	0	52	0	29	0	0	0	0	0	176	524
7:45	8:00	0	25	111	0	79	0	64	0	2	0	0	0	**281**	718
8:00	8:15	0	16	96	0	69	0	69	0	1	0	0	0	251	**853**
8:15	8:30	0	14	16	0	25	0	11	0	1	0	0	0	67	775
8:30	8:45	0	11	14	0	32	0	6	0	0	0	0	0	63	662
AM PEAK HOUR															
7:15	**8:15**	**0**	**85**	**326**	**0**	**249**	**0**	**190**	**0**	**3**	**0**	**0**	**0**	**853**	
PHF		**N/A**	**0.85**	**0.73**	**N/A**	**0.79**	**N/A**	**0.74**	**N/A**	**0.38**	**N/A**	**N/A**	**N/A**	**0.76**	**PHF**
PHF			0.76			0.79			0.73			#####			

TRAFFIC COUNT DATA **FILE NAME: QK-Makala** Sec 3

PROJECT: Kamakana Villages at Keahuolu
LOCATION: Kona, Hawaii
E-W STREET Kealakehe Pkwy
N-S STREET Aneohokalole Hwy

PERIOD: PM Peak
NORTH:
TECHNICIAN: Shawn/Video
DATE: 9/22/09

		Kealakehe Pkwy						Aneohokalole Hwy							
TIME		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	TOTAL	HRLY
15:00	15:15	0	35	55	0	20	0	35	0	1	0	0	0	146	
15:15	15:30	0	25	50	0	65	0	99	0	8	0	0	0	247	
15:30	15:45	0	50	25	1	36	0	63	0	1	0	0	0	176	
15:45	16:00	0	34	31	0	32	0	47	0	0	0	0	0	144	713
16:00	16:15	0	52	21	1	24	0	36	0	1	0	0	0	135	702
16:15	16:30	0	42	30	1	19	0	27	0	0	0	0	0	119	574
16:30	16:45	0	36	24	0	27	0	38	0	0	0	0	0	125	523
16:45	17:00	0	34	30	1	15	0	31	0	0	0	0	0	111	**490**
17:00	17:15	0	46	29	1	21	0	31	0	0	0	0	0	128	483
17:15	17:30	0	36	32	3	29	0	23	0	0	0	0	0	123	487
17:30	17:45	0	32	23	1	28	0	26	0	1	0	0	0	111	473
17:45	18:00	0	23	14	0	4	0	12	0	0	0	0	0	53	415
PM PEAK HOUR															
16:00	**17:00**	**0**	**164**	**105**	**3**	**85**	**0**	**132**	**0**	**1**	**0**	**0**	**0**	**490**	
PHF		**N/A**	**1.14**	**1.09**	**N/A**	**0.79**	**N/A**	**0.87**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.98**	**PHF**

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED
KAMAKANA VILLAGES
AT KEAHUOLU

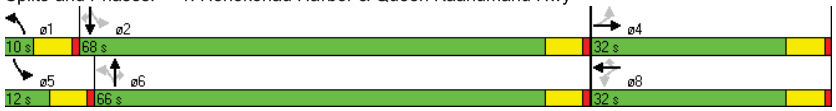
APPENDIX B
CAPACITY ANALYSIS WORKSHEETS
EXISTING PEAK HOUR TRAFFIC

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	24	6	40	235	14	137	75	700	276	120	707	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	550		0	300		550
Storage Lanes	0		0	0		1	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	0	1674	0	0	1779	1538	1770	1810	1583	1719	1810	1538
Flt Permitted		0.802			0.735		0.126			0.179		
Satd. Flow (perm)	0	1365	0	0	1369	1538	235	1810	1583	324	1810	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		44				137			394			50
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			900	
Travel Time (s)		22.7			22.7			22.7			20.5	
Peak Hour Factor	1.00	0.75	0.91	0.93	1.00	1.00	1.00	0.96	0.70	0.75	0.81	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	76	0	0	267	137	75	729	394	160	873	50
Turn Type	Perm			Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8		8	6		6	2		2
Detector Phase	4	4		8	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	32.0	32.0	0.0	32.0	32.0	32.0	10.0	66.0	66.0	12.0	68.0	68.0
Total Split (%)	29.1%	29.1%	0.0%	29.1%	29.1%	29.1%	9.1%	60.0%	60.0%	10.9%	61.8%	61.8%
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	4.0	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 Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None		None	None	None	None	None	None	None	None	None
Act Effct Green (s)		22.7			22.7	22.7	53.2	49.0	49.0	58.5	54.0	54.0
Actuated g/C Ratio		0.23			0.23	0.23	0.55	0.51	0.51	0.60	0.56	0.56
v/c Ratio		0.21			0.83	0.29	0.38	0.79	0.40	0.56	0.86	0.06
Control Delay		18.8			59.7	7.8	13.1	26.9	2.5	15.4	30.0	3.3
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		18.8			59.7	7.8	13.1	26.9	2.5	15.4	30.0	3.3
LOS		B			E	A	B	C	A	B	C	A
Approach Delay		18.8			42.1			18.0			26.6	
Approach LOS		B			D			B			C	
Queue Length 50th (ft)		17			172	0	17	373	0	39	493	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		43			#320	49	34	529	4	53	561	17
Internal Link Dist (ft)		920			920			920			820	
Turn Bay Length (ft)						200	550			300		550
Base Capacity (vph)		413			383	529	195	1168	1162	286	1207	1043
Starvation Cap Reductn		0			0	0	0	0	0	0	0	0
Spillback Cap Reductn		0			0	0	0	0	0	0	0	0
Storage Cap Reductn		0			0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.18			0.70	0.26	0.38	0.62	0.34	0.56	0.72	0.05

Intersection Summary	
Area Type:	Other
Cycle Length: 110	
Actuated Cycle Length: 96.7	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.86	
Intersection Signal Delay: 25.0	Intersection LOS: C
Intersection Capacity Utilization 78.9%	ICU Level of Service D
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 1: Honokohau Harbor & Queen Kaahumanu Hwy



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	279	30	35	14	29	33	127	709	20	33	676	221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	400		400	400		400
Storage Lanes	2		0	1		0	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3335	1717	0	1681	1594	0	3433	3438	1583	1719	3438	1538
Flt Permitted	0.950			0.950	0.998		0.950			0.950		
Satd. Flow (perm)	3335	1717	0	1681	1594	0	3433	3438	1583	1719	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		35			44				24			221
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		400			1000			1000			1000	
Travel Time (s)		9.1			22.7			22.7			22.7	
Peak Hour Factor	1.00	0.94	1.00	0.39	0.91	0.75	0.91	0.87	0.83	1.00	0.99	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)				10%								
Lane Group Flow (vph)	279	67	0	32	80	0	140	815	24	33	683	221
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		1	6		5	2	
Permitted Phases									6			2
Detector Phase	4	4		8	8		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		10.0	10.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	12.0	12.0	0.0	13.0	39.0	39.0	12.0	38.0	38.0
Total Split (%)	25.9%	25.9%	0.0%	14.1%	14.1%	0.0%	15.3%	45.9%	45.9%	14.1%	44.7%	44.7%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None		None	None		None	None	None	None	None	None
Act Effct Green (s)	11.8	11.8		6.6	6.6		7.5	27.8	27.8	6.6	22.4	22.4
Actuated g/C Ratio	0.18	0.18		0.10	0.10		0.11	0.42	0.42	0.10	0.34	0.34
v/c Ratio	0.47	0.20		0.19	0.40		0.36	0.56	0.04	0.19	0.58	0.33
Control Delay	30.5	17.8		37.3	26.0		36.1	17.7	7.1	37.4	21.7	4.3
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.5	17.8		37.3	26.0		36.1	17.7	7.1	37.4	21.7	4.3
LOS	C	B		D	C		D	B	A	D	C	A
Approach Delay		28.1			29.3			20.1			18.1	
Approach LOS		C			C			C			B	
Queue Length 50th (ft)	58	12		13	15		29	114	0	14	131	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	106	49		20	#68		66	228	13	45	198	43
Internal Link Dist (ft)		320			920			920			920	
Turn Bay Length (ft)							400		400	400		400
Base Capacity (vph)	922	500		174	204		415	1944	905	178	1885	943
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.13		0.18	0.39		0.34	0.42	0.03	0.19	0.36	0.23

Intersection Summary		
Area Type:	Other	
Cycle Length: 85		
Actuated Cycle Length: 65.7		
Natural Cycle: 65		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.58		
Intersection Signal Delay: 20.9	Intersection LOS: C	
Intersection Capacity Utilization 52.6%	ICU Level of Service A	
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

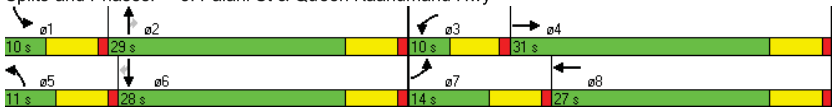
Splits and Phases: 2: Makala Blvd & Queen Kaahumanu Hwy

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	225	111	100	13	283	16	101	640	8	30	520	201
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3335	3261	0	1543	3077	0	3433	3438	1583	3335	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3335	3261	0	1543	3077	0	3433	3438	1583	3335	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		100			9				12			287
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	0.96	1.00	1.00	0.88	0.67	0.97	0.94	0.67	1.00	0.89	0.70
Heavy Vehicles (%)	5%	4%	2%	17%	17%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	225	216	0	13	346	0	104	681	12	30	584	287
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	27.0		10.0	27.0		10.0	27.0	27.0	10.0	27.0	27.0
Total Split (s)	14.0	31.0	0.0	10.0	27.0	0.0	11.0	29.0	29.0	10.0	28.0	28.0
Total Split (%)	17.5%	38.8%	0.0%	12.5%	33.8%	0.0%	13.8%	36.3%	36.3%	12.5%	35.0%	35.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	8.0	25.4		4.2	12.9		5.2	22.6	22.6	4.2	17.9	17.9
Actuated g/C Ratio	0.12	0.39		0.06	0.20		0.08	0.34	0.34	0.06	0.27	0.27
v/c Ratio	0.55	0.16		0.13	0.57		0.38	0.58	0.02	0.14	0.62	0.46
Control Delay	36.1	9.8		37.2	28.5		37.1	21.0	10.4	35.1	25.1	5.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.1	9.8		37.2	28.5		37.1	21.0	10.4	35.1	25.1	5.6
LOS	D	A		D	C		D	C	B	D	C	A
Approach Delay		23.3			28.8			22.9			19.3	
Approach LOS		C			C			C			B	
Queue Length 50th (ft)	47	15		5	69		22	102	0	6	113	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#92	46		23	110		49	207	7	20	176	17
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	423	1402		98	1029		272	1368	637	211	1198	723
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.15		0.13	0.34		0.38	0.50	0.02	0.14	0.49	0.40

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 65.7			
Natural Cycle: 75			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.62			
Intersection Signal Delay: 22.5		Intersection LOS: C	
Intersection Capacity Utilization 55.8%		ICU Level of Service B	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Palani St & Queen Kaahumanu Hwy

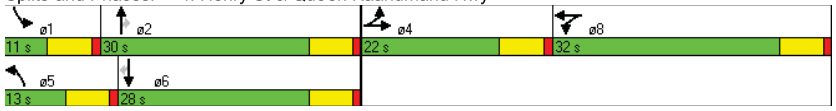


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	240	47	375	307	85	164	600	401	75	434	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	200		0	330		350	370		400
Storage Lanes	1		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3451	0	1610	3252	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950	0.988		0.950			0.950		
Satd. Flow (perm)	1770	3451	0	1610	3252	0	3433	3539	1583	3433	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			29				466			132
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.70	0.68	0.65	0.95	1.00	0.80	1.00	0.96	0.86	1.00	0.96	0.94
Shared Lane Traffic (%)				32%								
Lane Group Flow (vph)	93	425	0	269	539	0	164	625	466	75	452	132
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	32.0	32.0	0.0	13.0	30.0	30.0	11.0	28.0	28.0
Total Split (%)	23.2%	23.2%	0.0%	33.7%	33.7%	0.0%	13.7%	31.6%	31.6%	11.6%	29.5%	29.5%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	14.2	14.2		20.9	20.9		7.1	23.8	23.8	5.1	18.9	18.9
Actuated g/C Ratio	0.17	0.17		0.24	0.24		0.08	0.28	0.28	0.06	0.22	0.22
v/c Ratio	0.32	0.72		0.68	0.66		0.58	0.64	0.60	0.37	0.58	0.29
Control Delay	37.2	40.8		39.9	32.3		49.5	32.6	6.6	47.8	33.8	7.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.2	40.8		39.9	32.3		49.5	32.6	6.6	47.8	33.8	7.6
LOS	D	D		D	C		D	C	A	D	C	A
Approach Delay		40.2			34.8			25.2			30.1	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)	48	116		154	146		48	171	0	22	121	0
Queue Length 95th (ft)	73	124		249	203		#90	241	60	46	176	45

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	150			200			330		350	370		400
Base Capacity (vph)	338	678		500	1030		287	1015	786	205	930	513
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.28	0.63		0.54	0.52		0.57	0.62	0.59	0.37	0.49	0.26

Intersection Summary			
Area Type:	Other		
Cycle Length: 95			
Actuated Cycle Length: 85.6			
Natural Cycle: 80			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.72			
Intersection Signal Delay: 31.0		Intersection LOS: C	
Intersection Capacity Utilization 62.8%		ICU Level of Service B	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 4: Henry St & Queen Kaahumanu Hwy



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	156	47	688	418	43	422
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	150		0	0
Storage Lanes		0	1		1	1
Taper Length (ft)		100	100		100	100
Satd. Flow (prot)	1775	0	1543	1624	1770	1553
Flt Permitted			0.400		0.950	
Satd. Flow (perm)	1775	0	650	1624	1770	1553
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	22					440
Link Speed (mph)	30			30	30	
Link Distance (ft)	1000			1000	1000	
Travel Time (s)	22.7			22.7	22.7	
Peak Hour Factor	0.98	0.90	0.94	0.81	1.00	0.96
Heavy Vehicles (%)	4%	2%	17%	17%	2%	4%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	211	0	732	516	43	440
Turn Type			pm+pt			Perm
Protected Phases	4		3	8	2	
Permitted Phases			8			2
Detector Phase	4		3	8	2	2
Switch Phase						
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	22.0		10.0	22.0	22.0	22.0
Total Split (s)	22.0	0.0	26.0	48.0	22.0	22.0
Total Split (%)	31.4%	0.0%	37.1%	68.6%	31.4%	31.4%
Yellow Time (s)	5.0		5.0	5.0	5.0	5.0
All-Red Time (s)	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
Total Lost Time (s)	6.0	4.0	6.0	6.0	6.0	6.0
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None		None	None	Min	Min
Act Effct Green (s)	11.2		37.5	37.5	8.5	8.5
Actuated g/C Ratio	0.19		0.64	0.64	0.15	0.15
v/c Ratio	0.59		1.00	0.49	0.17	0.73
Control Delay	26.8		47.9	8.0	23.6	10.8
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	26.8		47.9	8.0	23.6	10.8
LOS	C		D	A	C	B
Approach Delay	26.8			31.4	11.9	
Approach LOS	C			C	B	
Queue Length 50th (ft)	57		143	67	13	0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Queue Length 95th (ft)	132		#481	159	38	68
Internal Link Dist (ft)	920			920	920	
Turn Bay Length (ft)			150			
Base Capacity (vph)	511		730	1188	493	750
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.41		1.00	0.43	0.09	0.59

Intersection Summary			
Area Type:	Other		
Cycle Length: 70			
Actuated Cycle Length: 58.2			
Natural Cycle: 80			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.00			
Intersection Signal Delay: 26.0		Intersection LOS: C	
Intersection Capacity Utilization 67.5%		ICU Level of Service C	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 5: Palani Rd & Henry St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	85	326	5	249	5	190	5	3	5	5	5
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	92	354	5	271	5	207	5	3	5	5	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)												
pX, platoon unblocked												
vC, conflicting volume	276			447			570	567	223	347	742	273
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	276			447			570	567	223	347	742	273
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 %	100			100			48	99	100	99	98	99
cM capacity (veh/h)	1284			1110			394	427	780	571	339	724

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	5	62	385	5	276	207	9	5	11
Volume Left	5	0	0	5	0	207	0	5	0
Volume Right	0	0	354	0	5	0	3	0	5
cSH	1284	1700	1700	1110	1700	394	515	571	462
Volume to Capacity	0.00	0.04	0.23	0.00	0.16	0.52	0.02	0.01	0.02
Queue Length 95th (ft)	0	0	0	0	0	74	1	1	2
Control Delay (s)	7.8	0.0	0.0	8.3	0.0	23.8	12.1	11.4	13.0
Lane LOS	A			A		C	B	B	B
Approach Delay (s)	0.1			0.2		23.3		12.4	
Approach LOS						C		B	

Intersection Summary				
Average Delay	5.5			
Intersection Capacity Utilization	37.3%	ICU Level of Service		A
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	59	6	96	248	16	93	75	781	205	81	947	71
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	550		0	300		550
Storage Lanes	0		0	0		1	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	0	1672	0	0	1783	1553	1770	1827	1583	1719	1810	1538
Flt Permitted		0.428			0.579		0.029			0.141		
Satd. Flow (perm)	0	730	0	0	1079	1553	54	1827	1583	255	1810	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		31				52			95			71
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			900	
Travel Time (s)		22.7			22.7			22.7			20.5	
Peak Hour Factor	0.82	0.92	0.88	0.77	0.43	1.00	0.72	0.93	1.00	0.88	0.92	0.77
Heavy Vehicles (%)	4%	2%	2%	2%	2%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	188	0	0	359	93	104	840	205	92	1029	92
Turn Type	Perm			Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8		8	6		6	2		2
Detector Phase	4	4		8	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	84.0	84.0	0.0	84.0	84.0	84.0	14.0	144.0	144.0	12.0	142.0	142.0
Total Split (%)	35.0%	35.0%	0.0%	35.0%	35.0%	35.0%	5.8%	60.0%	60.0%	5.0%	59.2%	59.2%
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	4.0	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 Optimize?												
Recall Mode	None	None		None	None	None	None	None	None	None	None	None
Act Effct Green (s)		78.0			78.0	78.0	146.0	138.0	138.0	142.0	136.0	136.0
Actuated g/C Ratio		0.32			0.32	0.32	0.61	0.58	0.58	0.59	0.57	0.57
v/c Ratio		0.73			1.02	0.17	1.16	0.80	0.22	0.49	1.00	0.10
Control Delay		77.3			129.6	26.7	190.3	47.4	13.3	28.1	78.9	6.9
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		77.3			129.6	26.7	190.3	47.4	13.3	28.1	78.9	6.9
LOS		E			F	C	F	D	B	C	E	A
Approach Delay		77.3			108.4			54.2			69.6	
Approach LOS		E			F			D			E	
Queue Length 50th (ft)		227			~602	46	~142	1038	80	57	~1636	15

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		354			276	101	#202	1245	132	85	#1958	33
Internal Link Dist (ft)		920			920			920			820	
Turn Bay Length (ft)						200	550			300		550
Base Capacity (vph)		258			351	540	90	1051	951	187	1026	902
Starvation Cap Reductn		0			0	0	0	0	0	0	0	0
Spillback Cap Reductn		0			0	0	0	0	0	0	0	0
Storage Cap Reductn		0			0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.73			1.02	0.17	1.16	0.80	0.22	0.49	1.00	0.10

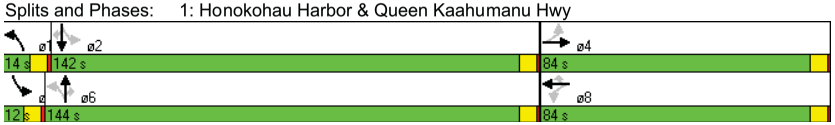
Intersection Summary

Area Type: Other
Cycle Length: 240
Actuated Cycle Length: 240
Natural Cycle: 130
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.16
Intersection Signal Delay: 70.0 Intersection LOS: E
Intersection Capacity Utilization 90.2% ICU Level of Service E
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Honokohau Harbor & Queen Kaahumanu Hwy

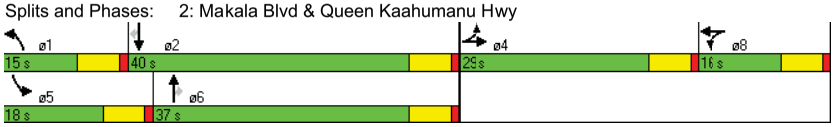


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	419	168	129	129	69	59	257	606	39	103	838	286
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	400		400	400		400
Storage Lanes	2		0	1		0	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3367	1751	0	1681	1642	0	3433	3471	1583	1719	3438	1538
Flt Permitted	0.950			0.950	0.996		0.950			0.950		
Satd. Flow (perm)	3367	1751	0	1681	1642	0	3433	3471	1583	1719	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		31			28				40			336
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		400			1000			1000			1000	
Travel Time (s)		9.1			22.7			22.7			22.7	
Peak Hour Factor	0.93	0.78	0.90	1.00	0.96	1.00	1.00	0.99	0.98	1.00	0.81	0.85
Heavy Vehicles (%)	4%	2%	2%	2%	2%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)				10%								
Lane Group Flow (vph)	451	358	0	116	144	0	257	612	40	103	1035	336
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		1	6		5	2	
Permitted Phases									6			2
Detector Phase	4	4		8	8		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		10.0	10.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	29.0	29.0	0.0	16.0	16.0	0.0	15.0	37.0	37.0	18.0	40.0	40.0
Total Split (%)	29.0%	29.0%	0.0%	16.0%	16.0%	0.0%	15.0%	37.0%	37.0%	18.0%	40.0%	40.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None		None	None		None	None	None	None	None	None
Act Effct Green (s)	21.6	21.6		9.5	9.5		9.0	34.6	34.6	10.2	32.9	32.9
Actuated g/C Ratio	0.22	0.22		0.10	0.10		0.09	0.36	0.36	0.11	0.34	0.34
v/c Ratio	0.60	0.86		0.71	0.78		0.81	0.50	0.07	0.57	0.89	0.45
Control Delay	37.9	55.1		67.1	63.0		64.0	28.1	8.3	54.7	41.6	4.9
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.9	55.1		67.1	63.0		64.0	28.1	8.3	54.7	41.6	4.9
LOS	D	E		E	E		E	C	A	D	D	A
Approach Delay		45.5			64.9			37.4			34.1	
Approach LOS		D			E			D			C	
Queue Length 50th (ft)	132	201		76	76		84	169	0	63	324	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	183	255		#163	#181		#151	227	24	117	352	46
Internal Link Dist (ft)		320			920			920			920	
Turn Bay Length (ft)							400		400	400		400
Base Capacity (vph)	800	440		174	194		319	1235	589	213	1208	759
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.81		0.67	0.74		0.81	0.50	0.07	0.48	0.86	0.44

Intersection Summary		
Area Type:	Other	
Cycle Length: 100		
Actuated Cycle Length: 97.1		
Natural Cycle: 80		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.89		
Intersection Signal Delay: 40.0	Intersection LOS: D	
Intersection Capacity Utilization 74.4%	ICU Level of Service D	
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 2: Makala Blvd & Queen Kaahumanu Hwy

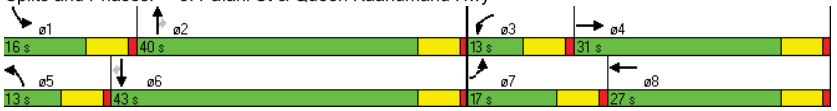


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	295	252	193	43	299	71	206	547	16	176	844	418
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3367	3295	0	1641	3220	0	3433	3471	1583	3335	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3367	3295	0	1641	3220	0	3433	3471	1583	3335	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		204			26				20			301
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	1.00	0.91	1.00	0.89	0.89	1.00	0.91	0.80	1.00	0.77	1.00
Heavy Vehicles (%)	4%	2%	2%	10%	10%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	295	464	0	43	416	0	206	601	20	176	1096	418
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	27.0		10.0	27.0		10.0	27.0	27.0	10.0	27.0	27.0
Total Split (s)	17.0	31.0	0.0	13.0	27.0	0.0	13.0	40.0	40.0	16.0	43.0	43.0
Total Split (%)	17.0%	31.0%	0.0%	13.0%	27.0%	0.0%	13.0%	40.0%	40.0%	16.0%	43.0%	43.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	10.8	26.0		6.6	16.6		7.0	33.4	33.4	9.2	35.6	35.6
Actuated g/C Ratio	0.11	0.28		0.07	0.18		0.07	0.35	0.35	0.10	0.38	0.38
v/c Ratio	0.76	0.44		0.37	0.71		0.80	0.49	0.03	0.54	0.84	0.54
Control Delay	55.7	17.9		53.2	41.3		68.2	26.0	9.4	47.9	34.5	9.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	55.7	17.9		53.2	41.3		68.2	26.0	9.4	47.9	34.5	9.7
LOS	E	B		D	D		E	C	A	D	C	A
Approach Delay		32.6			42.4			36.1			29.7	
Approach LOS		C			D			D			C	
Queue Length 50th (ft)	91	71		25	118		64	148	0	53	310	46

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#160	120		62	167		#132	213	13	90	335	140
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	395	1090		123	741		256	1265	590	356	1356	789
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.43		0.35	0.56		0.80	0.48	0.03	0.49	0.81	0.53

Intersection Summary		
Area Type:	Other	
Cycle Length: 100		
Actuated Cycle Length: 94.2		
Natural Cycle: 90		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.84		
Intersection Signal Delay: 33.3	Intersection LOS: C	
Intersection Capacity Utilization 68.2%	ICU Level of Service C	
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 3: Palani St & Queen Kaahumanu Hwy



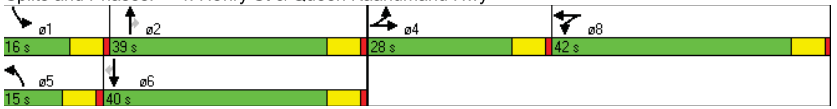
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	77	341	86	409	349	205	134	487	358	199	735	146
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	200		0	330		350	370		400
Storage Lanes	1		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3447	0	1610	3215	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950	0.994		0.950			0.950		
Satd. Flow (perm)	1770	3447	0	1610	3215	0	3433	3539	1583	3433	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		17			50				442			187
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.86	0.84	1.00	0.97	0.90	1.00	0.73	1.00	0.81	1.00	1.00	0.78
Shared Lane Traffic (%)				19%								
Lane Group Flow (vph)	90	492	0	342	673	0	184	487	442	199	735	187
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	28.0	28.0	0.0	42.0	42.0	0.0	15.0	39.0	39.0	16.0	40.0	40.0
Total Split (%)	22.4%	22.4%	0.0%	33.6%	33.6%	0.0%	12.0%	31.2%	31.2%	12.8%	32.0%	32.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	19.9	19.9		30.6	30.6		9.0	29.2	29.2	9.8	30.0	30.0
Actuated g/C Ratio	0.17	0.17		0.27	0.27		0.08	0.26	0.26	0.09	0.26	0.26
v/c Ratio	0.29	0.80		0.79	0.75		0.68	0.54	0.60	0.67	0.79	0.34
Control Delay	46.4	55.5		53.7	41.4		67.3	39.9	7.2	65.2	46.8	6.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.4	55.5		53.7	41.4		67.3	39.9	7.2	65.2	46.8	6.7
LOS	D	E		D	D		E	D	A	E	D	A
Approach Delay		54.1			45.5			31.4			43.4	
Approach LOS		D			D			C			D	
Queue Length 50th (ft)	63	194		274	247		75	176	0	81	285	0
Queue Length 95th (ft)	111	238		402	321		93	233	42	#134	362	32

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	150			200			330		350	370		400
Base Capacity (vph)	349	692		519	1069		276	1045	779	307	1077	612
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.71		0.66	0.63		0.67	0.47	0.57	0.65	0.68	0.31

Intersection Summary

Area Type: Other
Cycle Length: 125
Actuated Cycle Length: 114
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 42.1 Intersection LOS: D
Intersection Capacity Utilization 75.0% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Henry St & Queen Kaahumanu Hwy



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	481	103	386	422	70	442
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		0	150		0	0
Storage Lanes		0	1		1	1
Taper Length (ft)		100	100		100	100
Satd. Flow (prot)	1820	0	1770	1727	1770	1468
Flt Permitted			0.142		0.950	
Satd. Flow (perm)	1820	0	265	1727	1770	1468
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	15					456
Link Speed (mph)	30			30	30	
Link Distance (ft)	1000			1000	1000	
Travel Time (s)	22.7			22.7	22.7	
Peak Hour Factor	0.96	1.00	0.89	1.00	0.92	0.97
Heavy Vehicles (%)	2%	2%	2%	10%	2%	10%
Shared Lane Traffic (%)						
Lane Group Flow (vph)	604	0	434	422	76	456
Turn Type			pm+pt			Perm
Protected Phases	4		3	8	2	
Permitted Phases			8			2
Detector Phase	4		3	8	2	2
Switch Phase						
Minimum Initial (s)	4.0		4.0	4.0	4.0	4.0
Minimum Split (s)	22.0		10.0	22.0	22.0	22.0
Total Split (s)	28.0	0.0	20.0	48.0	22.0	22.0
Total Split (%)	40.0%	0.0%	28.6%	68.6%	31.4%	31.4%
Yellow Time (s)	5.0		5.0	5.0	5.0	5.0
All-Red Time (s)	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
Total Lost Time (s)	6.0	4.0	6.0	6.0	6.0	6.0
Lead/Lag	Lag		Lead			
Lead-Lag Optimize?	Yes		Yes			
Recall Mode	None		None	None	Min	Min
Act Effct Green (s)	22.1		41.9	41.9	9.2	9.2
Actuated g/C Ratio	0.35		0.66	0.66	0.15	0.15
v/c Ratio	0.93		0.86	0.37	0.30	0.76
Control Delay	45.7		33.4	6.5	26.6	11.7
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	45.7		33.4	6.5	26.6	11.7
LOS	D		C	A	C	B
Approach Delay	45.7			20.2	13.9	
Approach LOS	D			C	B	
Queue Length 50th (ft)	207		100	54	26	0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Queue Length 95th (ft)	#473		#297	140	59	73
Internal Link Dist (ft)	920			920	920	
Turn Bay Length (ft)			150			
Base Capacity (vph)	647		511	1155	451	714
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.93		0.85	0.37	0.17	0.64

Intersection Summary

Area Type: Other
Cycle Length: 70
Actuated Cycle Length: 63.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 26.2 Intersection LOS: C
Intersection Capacity Utilization 71.8% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Palani Rd & Henry St

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	85	326	5	249	5	190	5	3	5	5	5
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	92	354	5	271	5	207	5	3	5	5	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)												
pX, platoon unblocked												
vC, conflicting volume	276			447			570	567	223	347	742	273
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	276			447			570	567	223	347	742	273
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 %	100			100			48	99	100	99	98	99
cM capacity (veh/h)	1284			1110			394	427	780	571	339	724

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	5	62	385	5	276	207	9	5	11
Volume Left	5	0	0	5	0	207	0	5	0
Volume Right	0	0	354	0	5	0	3	0	5
cSH	1284	1700	1700	1110	1700	394	515	571	462
Volume to Capacity	0.00	0.04	0.23	0.00	0.16	0.52	0.02	0.01	0.02
Queue Length 95th (ft)	0	0	0	0	0	74	1	1	2
Control Delay (s)	7.8	0.0	0.0	8.3	0.0	23.8	12.1	11.4	13.0
Lane LOS	A			A		C	B	B	B
Approach Delay (s)	0.1			0.2		23.3		12.4	
Approach LOS						C		B	

Intersection Summary				
Average Delay	5.5			
Intersection Capacity Utilization	37.3%	ICU Level of Service		A
Analysis Period (min)	15			

TRAFFIC IMPACT ANALYSIS REPORT
FOR THE PROPOSED

KAMAKANA VILLAGES
AT KEAHUOLU

APPENDIX C

CAPACITY ANALYSIS WORKSHEETS

2014 PEAK HOUR TRAFFIC WITHOUT PROJECT

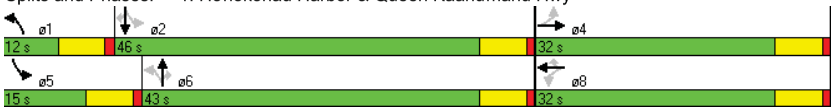
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	11	45	262	21	146	85	1068	472	147	806	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		200	550		550	300		550
Storage Lanes	0		0	0		1	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	0	1690	0	0	1781	1538	1770	3438	1583	1719	3438	1538
Flt Permitted		0.746			0.720		0.224			0.116		
Satd. Flow (perm)	0	1282	0	0	1341	1538	417	3438	1583	210	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		49				146			674			57
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			900	
Travel Time (s)		22.7			22.7			22.7			20.5	
Peak Hour Factor	1.00	0.75	0.91	0.93	1.00	1.00	1.00	0.96	0.70	0.75	0.81	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	97	0	0	303	146	85	1112	674	196	995	57
Turn Type	Perm			Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8		8	6		6	2		2
Detector Phase	4	4		8	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	32.0	32.0	0.0	32.0	32.0	32.0	12.0	43.0	43.0	15.0	46.0	46.0
Total Split (%)	35.6%	35.6%	0.0%	35.6%	35.6%	35.6%	13.3%	47.8%	47.8%	16.7%	51.1%	51.1%
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	4.0	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 Optimize?												
Recall Mode	None	None		None	None	None	None	None	None	None	None	None
Act Effct Green (s)		22.7			22.7	22.7	41.1	35.1	35.1	48.0	41.1	41.1
Actuated g/C Ratio		0.27			0.27	0.27	0.48	0.41	0.41	0.56	0.48	0.48
v/c Ratio		0.26			0.85	0.28	0.29	0.78	0.64	0.70	0.60	0.07
Control Delay		15.8			52.4	6.0	11.5	26.9	4.7	29.1	19.5	4.5
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		15.8			52.4	6.0	11.5	26.9	4.7	29.1	19.5	4.5
LOS		B			D	A	B	C	A	C	B	A
Approach Delay		15.8			37.3			18.2			20.3	
Approach LOS		B			D			B			C	
Queue Length 50th (ft)		20			158	0	20	282	0	49	225	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		44			#290	43	40	364	0	89	250	21
Internal Link Dist (ft)		920			920			920			820	
Turn Bay Length (ft)						200	550		550	300		550
Base Capacity (vph)		429			414	575	298	1510	1073	280	1660	772
Starvation Cap Reductn		0			0	0	0	0	0	0	0	0
Spillback Cap Reductn		0			0	0	0	0	0	0	0	0
Storage Cap Reductn		0			0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.23			0.73	0.25	0.29	0.74	0.63	0.70	0.60	0.07

Intersection Summary		
Area Type:	Other	
Cycle Length: 90		
Actuated Cycle Length: 85.1		
Natural Cycle: 75		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.85		
Intersection Signal Delay: 21.2	Intersection LOS: C	
Intersection Capacity Utilization 75.0%	ICU Level of Service D	
Analysis Period (min) 15		

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Honokohau Harbor & Queen Kaahumanu Hwy

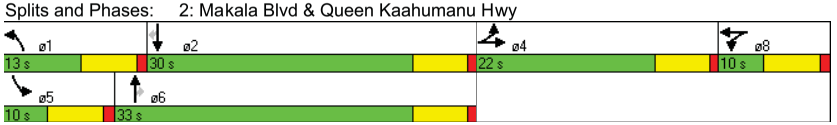


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	445	34	40	16	33	52	144	1094	23	40	743	271
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	400		400	400		400
Storage Lanes	2		0	1		0	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3335	1716	0	1681	1569	0	3433	3438	1583	1719	3438	1538
Flt Permitted	0.950			0.950	0.998		0.950			0.950		
Satd. Flow (perm)	3335	1716	0	1681	1569	0	3433	3438	1583	1719	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		40			69				28			271
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		400			1000			1000			1000	
Travel Time (s)		9.1			22.7			22.7			22.7	
Peak Hour Factor	1.00	0.94	1.00	0.39	0.91	0.75	0.91	0.87	0.83	1.00	0.99	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)				10%								
Lane Group Flow (vph)	445	76	0	37	109	0	158	1257	28	40	751	271
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		1	6		5	2	
Permitted Phases									6			2
Detector Phase	4	4		8	8		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		10.0	10.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	10.0	10.0	0.0	13.0	33.0	33.0	10.0	30.0	30.0
Total Split (%)	29.3%	29.3%	0.0%	13.3%	13.3%	0.0%	17.3%	44.0%	44.0%	13.3%	40.0%	40.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	None	None	None	None	None
Act Effct Green (s)	13.8	13.8		4.1	4.1		7.0	29.1	29.1	4.1	24.8	24.8
Actuated g/C Ratio	0.20	0.20		0.06	0.06		0.10	0.43	0.43	0.06	0.36	0.36
v/c Ratio	0.66	0.20		0.36	0.68		0.45	0.86	0.04	0.38	0.60	0.37
Control Delay	31.2	15.3		44.6	40.4		36.0	29.1	6.7	45.6	22.8	4.4
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.2	15.3		44.6	40.4		36.0	29.1	6.7	45.6	22.8	4.4
LOS	C	B		D	D		D	C	A	D	C	A
Approach Delay		28.9			41.5			29.5			18.9	
Approach LOS		C			D			C			B	
Queue Length 50th (ft)	97	14		17	20		36	~310	0	18	157	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	143	47		20	#101		65	#428	14	#54	217	49
Internal Link Dist (ft)		320			920			920			920	
Turn Bay Length (ft)							400		400	400		400
Base Capacity (vph)	806	445		102	160		363	1466	691	104	1289	746
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.55	0.17		0.36	0.68		0.44	0.86	0.04	0.38	0.58	0.36

Intersection Summary		
Area Type:	Other	
Cycle Length: 75		
Actuated Cycle Length: 68.2		
Natural Cycle: 75		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.86		
Intersection Signal Delay: 26.4	Intersection LOS: C	
Intersection Capacity Utilization 67.9%	ICU Level of Service C	
Analysis Period (min) 15		
~ Volume exceeds capacity, queue is theoretically infinite.		
Queue shown is maximum after two cycles.		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 2: Makala Blvd & Queen Kaahumanu Hwy

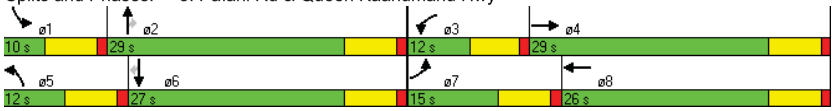


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	328	141	114	23	355	24	115	937	9	36	566	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3335	3270	0	1543	3074	0	3433	3438	1583	3335	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3335	3270	0	1543	3074	0	3433	3438	1583	3335	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		114			11				13			321
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	0.96	1.00	1.00	0.88	0.67	0.97	0.94	0.67	1.00	0.89	0.70
Heavy Vehicles (%)	5%	4%	2%	17%	17%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	328	261	0	23	439	0	119	997	13	36	636	321
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	26.0		10.0	26.0		10.0	27.0	27.0	10.0	27.0	27.0
Total Split (s)	15.0	29.0	0.0	12.0	26.0	0.0	12.0	29.0	29.0	10.0	27.0	27.0
Total Split (%)	18.8%	36.3%	0.0%	15.0%	32.5%	0.0%	15.0%	36.3%	36.3%	12.5%	33.8%	33.8%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	9.1	26.1		5.9	15.4		6.0	24.9	24.9	4.0	21.3	21.3
Actuated g/C Ratio	0.12	0.36		0.08	0.21		0.08	0.34	0.34	0.05	0.29	0.29
v/c Ratio	0.79	0.21		0.19	0.67		0.42	0.85	0.02	0.20	0.64	0.48
Control Delay	48.7	11.4		37.8	31.6		38.9	33.9	10.9	38.2	27.5	5.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.7	11.4		37.8	31.6		38.9	33.9	10.9	38.2	27.5	5.7
LOS	D	B		D	C		D	C	B	D	C	A
Approach Delay		32.2			32.0			34.2			20.9	
Approach LOS		C			C			C			C	
Queue Length 50th (ft)	78	22		10	98		27	239	0	8	138	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#156	57		34	141		55	#398	8	23	206	16
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	414	1251		128	857		284	1169	547	184	1020	682
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.21		0.18	0.51		0.42	0.85	0.02	0.20	0.62	0.47

Intersection Summary		
Area Type:	Other	
Cycle Length: 80		
Actuated Cycle Length: 73.2		
Natural Cycle: 80		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.85		
Intersection Signal Delay: 29.3	Intersection LOS: C	
Intersection Capacity Utilization 69.2%	ICU Level of Service C	
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 3: Palani Rd & Queen Kaahumanu Hwy



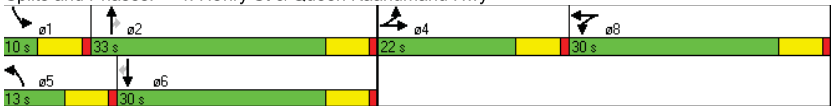
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	89	278	53	468	384	123	186	849	481	90	696	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	200		0	330		350	370		400
Storage Lanes	1		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3451	0	1610	3239	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950	0.989		0.950			0.950		
Satd. Flow (perm)	1770	3451	0	1610	3239	0	3433	3539	1583	3433	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21			35				559			124
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.70	0.68	0.65	0.95	1.00	0.80	1.00	0.96	0.86	1.00	0.96	0.94
Shared Lane Traffic (%)				30%								
Lane Group Flow (vph)	127	491	0	345	686	0	186	884	559	90	725	124
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	30.0	30.0	0.0	13.0	33.0	33.0	10.0	30.0	30.0
Total Split (%)	23.2%	23.2%	0.0%	31.6%	31.6%	0.0%	13.7%	34.7%	34.7%	10.5%	31.6%	31.6%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	15.3	15.3		22.9	22.9		7.0	28.1	28.1	4.0	22.8	22.8
Actuated g/C Ratio	0.17	0.17		0.25	0.25		0.08	0.31	0.31	0.04	0.25	0.25
v/c Ratio	0.43	0.83		0.86	0.83		0.71	0.82	0.64	0.60	0.83	0.26
Control Delay	40.4	49.3		55.9	41.0		58.5	38.6	6.3	62.0	42.5	6.9
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.4	49.3		55.9	41.0		58.5	38.6	6.3	62.0	42.5	6.9
LOS	D	D		E	D		E	D	A	E	D	A
Approach Delay		47.4			46.0			29.8			39.7	
Approach LOS		D			D			C			D	
Queue Length 50th (ft)	69	145		217	203		57	266	0	28	216	0
Queue Length 95th (ft)	95	143		#384	#281		#107	#375	60	#61	#287	43

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	150			200			330		350	370		400
Base Capacity (vph)	309	620		422	873		262	1078	871	150	926	506
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.79		0.82	0.79		0.71	0.82	0.64	0.60	0.78	0.25

Intersection Summary

Area Type: Other
Cycle Length: 95
Actuated Cycle Length: 92.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 38.5 Intersection LOS: D
Intersection Capacity Utilization 74.9% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Henry St & Queen Kaahumanu Hwy

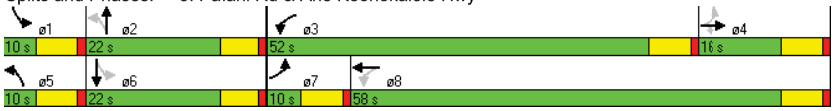


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	179	53	781	480	5	49	32	479	5	78	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	250		0	200		0	311		200
Storage Lanes	1		1	1		0	0		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	1827	1583	1543	1624	0	0	3023	0	1770	3355	0
Flt Permitted	0.439			0.363				0.911		0.252		
Satd. Flow (perm)	818	1827	1583	589	1624	0	0	2765	0	469	3355	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			59		1			499			45	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.92	0.98	0.90	0.94	0.81	0.92	1.00	0.92	0.96	0.92	0.92	0.92
Heavy Vehicles (%)	2%	4%	2%	17%	17%	2%	2%	2%	4%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	16	183	59	831	598	0	0	583	0	5	130	0
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8			2			6		
Detector Phase	7	4	4	3	8		5	2		1	6	
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	10.0	10.0	10.0	22.0		10.0	22.0		10.0	22.0	
Total Split (s)	10.0	16.0	16.0	52.0	58.0	0.0	10.0	22.0	0.0	10.0	22.0	0.0
Total Split (%)	10.0%	16.0%	16.0%	52.0%	58.0%	0.0%	10.0%	22.0%	0.0%	10.0%	22.0%	0.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		None	Min		None	Min	
Act Effct Green (s)	14.1	10.1	10.1	62.4	60.7			10.0		11.7	11.7	
Actuated g/C Ratio	0.16	0.12	0.12	0.72	0.70			0.12		0.14	0.14	
v/c Ratio	0.09	0.86	0.25	0.88	0.52			0.77		0.04	0.26	
Control Delay	19.4	74.4	14.0	25.8	10.8			13.9		30.2	22.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Total Delay	19.4	74.4	14.0	25.8	10.8			13.9		30.2	22.3	
LOS	B	E	B	C	B			B		C	C	
Approach Delay		57.2			19.5			13.9			22.6	
Approach LOS		E			B			B			C	
Queue Length 50th (ft)	5	95	0	252	101			21		2	21	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	15	#258	38	#743	341			78		12	45	
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)				250						311		
Base Capacity (vph)	178	213	237	939	1144			923		124	730	
Starvation Cap Reductn	0	0	0	0	0			0		0	0	
Spillback Cap Reductn	0	0	0	0	0			0		0	0	
Storage Cap Reductn	0	0	0	0	0			0		0	0	
Reduced v/c Ratio	0.09	0.86	0.25	0.88	0.52			0.63		0.04	0.18	

Intersection Summary		
Area Type:	Other	
Cycle Length: 100		
Actuated Cycle Length: 86.2		
Natural Cycle: 100		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.88		
Intersection Signal Delay: 22.4	Intersection LOS: C	
Intersection Capacity Utilization 88.9%	ICU Level of Service E	
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 5: Palani Rd & Ane Keohokalole Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	121	74	370	119	242	23	216	5	51	5	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)	132	80	402	129	263	25	235	5	55	5	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)												
pX, platoon unblocked												
vC, conflicting volume	288			483			1085	1091	241	896	1280	276
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	288			483			1085	1091	241	896	1280	276
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 %	90			88			0	97	93	97	96	98
cM capacity (veh/h)	1271			1076			136	168	760	178	130	722

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	132	54	429	129	288	235	61	5	22
Volume Left	132	0	0	129	0	235	0	5	0
Volume Right	0	0	402	0	25	0	55	0	16
cSH	1271	1700	1700	1076	1700	136	578	178	337
Volume to Capacity	0.10	0.03	0.25	0.12	0.17	1.73	0.11	0.03	0.06
Queue Length 95th (ft)	9	0	0	10	0	436	9	2	5
Control Delay (s)	8.2	0.0	0.0	8.8	0.0	414.8	12.0	25.8	16.4
Lane LOS	A			A		F	B	D	C
Approach Delay (s)	1.7			2.7		331.8		18.3	
Approach LOS						F		C	

Intersection Summary				
Average Delay	74.4			
Intersection Capacity Utilization	49.5%	ICU Level of Service		A
Analysis Period (min)	15			

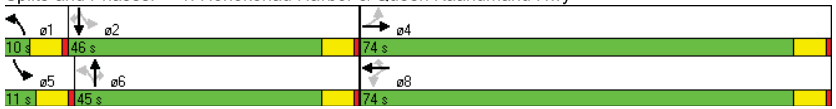
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	72	13	109	523	29	103	85	990	194	107	1163	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		100	200		200	550		550	300		550
Storage Lanes	0		0	0		1	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	0	1679	0	0	1781	1553	1770	3471	1583	1719	3438	1538
Flt Permitted		0.334			0.594		0.103			0.100		
Satd. Flow (perm)	0	572	0	0	1106	1553	192	3471	1583	181	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		71				72			194			113
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			900	
Travel Time (s)		22.7			22.7			22.7			20.5	
Peak Hour Factor	0.82	0.92	0.88	0.77	0.43	1.00	0.72	0.93	1.00	0.88	0.92	0.77
Heavy Vehicles (%)	4%	2%	2%	2%	2%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	226	0	0	746	103	118	1065	194	122	1264	113
Turn Type	Perm			Perm		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases		4			8		1	6		5	2	
Permitted Phases	4			8		8	6		6	2		2
Detector Phase	4	4		8	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	74.0	74.0	0.0	74.0	74.0	74.0	10.0	45.0	45.0	11.0	46.0	46.0
Total Split (%)	56.9%	56.9%	0.0%	56.9%	56.9%	56.9%	7.7%	34.6%	34.6%	8.5%	35.4%	35.4%
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	4.0	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 Optimize?												
Recall Mode	None	None		None	None	None	None	None	None	None	None	None
Act Effct Green (s)		68.0			68.0	68.0	43.0	39.0	39.0	45.0	40.0	40.0
Actuated g/C Ratio		0.52			0.52	0.52	0.33	0.30	0.30	0.35	0.31	0.31
v/c Ratio		0.68			1.29	0.12	1.05	1.02	0.32	1.00	1.19	0.21
Control Delay		27.4			171.5	6.1	134.6	78.6	6.0	115.9	136.7	6.7
Queue Delay		0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		27.4			171.5	6.1	134.6	78.6	6.0	115.9	136.7	6.7
LOS		C			F	A	F	E	A	F	F	A
Approach Delay		27.4			151.5			73.2			125.2	
Approach LOS		C			F			E			F	
Queue Length 50th (ft)		95			~800	12	~70	~501	0	~68	~677	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)		213			265	42	#124	#637	56	#181	#816	27
Internal Link Dist (ft)		920			920			920			820	
Turn Bay Length (ft)						200	550		550	300		550
Base Capacity (vph)		333			579	847	112	1041	611	122	1058	551
Starvation Cap Reductn		0			0	0	0	0	0	0	0	0
Spillback Cap Reductn		0			0	0	0	0	0	0	0	0
Storage Cap Reductn		0			0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.68			1.29	0.12	1.05	1.02	0.32	1.00	1.19	0.21

Intersection Summary	
Area Type:	Other
Cycle Length: 130	
Actuated Cycle Length: 130	
Natural Cycle: 130	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.29	
Intersection Signal Delay: 107.1	Intersection LOS: F
Intersection Capacity Utilization 98.7%	ICU Level of Service F
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Honokohau Harbor & Queen Kaahumanu Hwy



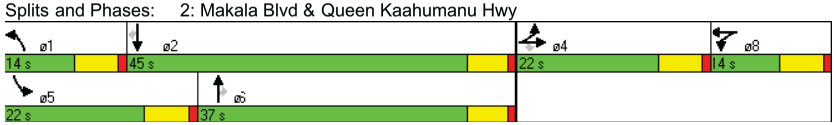
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	548	191	146	146	78	77	292	671	44	150	1158	415
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	200		0	400		400	400		400
Storage Lanes	2		1	1		0	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3367	1863	1583	1681	1630	0	3433	3471	1583	1719	3438	1538
Flt Permitted	0.950			0.950	0.996		0.950			0.950		
Satd. Flow (perm)	3367	1863	1583	1681	1630	0	3433	3471	1583	1719	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			162		33				45			488
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		400			1000			1000			1000	
Travel Time (s)		9.1			22.7			22.7			22.7	
Peak Hour Factor	0.93	0.78	0.90	1.00	0.96	1.00	1.00	0.99	0.98	1.00	0.81	0.85
Heavy Vehicles (%)	4%	2%	2%	2%	2%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)				10%								
Lane Group Flow (vph)	589	245	162	131	173	0	292	678	45	150	1430	488
Turn Type	Split		Perm	Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		1	6		5	2	
Permitted Phases			4						6			2
Detector Phase	4	4	4	8	8		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	10.0	10.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	22.0	14.0	14.0	0.0	14.0	37.0	37.0	22.0	45.0	45.0
Total Split (%)	23.2%	23.2%	23.2%	14.7%	14.7%	0.0%	14.7%	38.9%	38.9%	23.2%	47.4%	47.4%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		None	None	None	None	None	None
Act Effct Green (s)	16.0	16.0	16.0	8.0	8.0		8.0	34.0	34.0	13.0	39.0	39.0
Actuated g/C Ratio	0.17	0.17	0.17	0.08	0.08		0.08	0.36	0.36	0.14	0.41	0.41
v/c Ratio	1.04	0.78	0.40	0.92	1.04		1.01	0.55	0.08	0.64	1.01	0.53
Control Delay	88.1	56.4	9.1	102.9	116.2		100.5	26.9	7.4	51.0	56.3	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	88.1	56.4	9.1	102.9	116.2		100.5	26.9	7.4	51.0	56.3	4.1
LOS	F	E	A	F	F		F	C	A	D	E	A
Approach Delay		67.4			110.5			47.2			43.6	
Approach LOS		E			F			D			D	
Queue Length 50th (ft)	~198	143	0	84	~97		~93	171	0	86	~458	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#305	#193	54	#201	#236		#178	237	24	146	#507	44
Internal Link Dist (ft)		320			920			920			920	
Turn Bay Length (ft)				200			400		400	400		400
Base Capacity (vph)	567	314	401	142	167		289	1244	596	290	1411	919
Starvation Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.04	0.78	0.40	0.92	1.04		1.01	0.55	0.08	0.52	1.01	0.53

Intersection Summary

Area Type: Other
Cycle Length: 95
Actuated Cycle Length: 95
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.04
Intersection Signal Delay: 54.5 Intersection LOS: D
Intersection Capacity Utilization 84.4% ICU Level of Service E
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Makala Blvd & Queen Kaahumanu Hwy



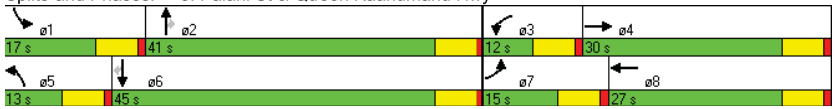
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	309	369	219	55	367	89	234	623	18	217	1083	539
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3367	3330	0	1641	3221	0	3433	3471	1583	3335	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3367	3330	0	1641	3221	0	3433	3471	1583	3335	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		143			27				22			244
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	1.00	0.91	1.00	0.89	0.89	1.00	0.91	0.80	1.00	0.77	1.00
Heavy Vehicles (%)	4%	2%	2%	10%	10%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	309	610	0	55	512	0	234	685	22	217	1406	539
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	27.0		10.0	27.0		10.0	27.0	27.0	10.0	27.0	27.0
Total Split (s)	15.0	30.0	0.0	12.0	27.0	0.0	13.0	41.0	41.0	17.0	45.0	45.0
Total Split (%)	15.0%	30.0%	0.0%	12.0%	27.0%	0.0%	13.0%	41.0%	41.0%	17.0%	45.0%	45.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	9.0	24.4		5.9	18.9		7.0	35.8	35.8	10.3	39.0	39.0
Actuated g/C Ratio	0.09	0.25		0.06	0.19		0.07	0.37	0.37	0.11	0.40	0.40
v/c Ratio	1.00	0.65		0.56	0.80		0.96	0.54	0.04	0.62	1.03	0.71
Control Delay	97.1	29.2		67.3	45.6		93.9	27.1	9.0	50.5	61.8	19.3
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	97.1	29.2		67.3	45.6		93.9	27.1	9.0	50.5	61.8	19.3
LOS	F	C		E	D		F	C	A	D	E	B
Approach Delay		52.1			47.7			43.3			50.1	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	~105	142		35	153		78	184	0	69	~516	158

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#194	204		#88	208		#156	242	13	107	#472	292
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	310	960		100	712		245	1267	592	375	1370	760
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.00	0.64		0.55	0.72		0.96	0.54	0.04	0.58	1.03	0.71

Intersection Summary	
Area Type:	Other
Cycle Length: 100	
Actuated Cycle Length: 98	
Natural Cycle: 100	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 48.8	Intersection LOS: D
Intersection Capacity Utilization 78.4%	ICU Level of Service D
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Palani St & Queen Kaahumanu Hwy

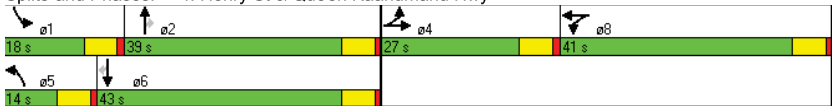


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	409	98	504	405	250	152	552	462	257	919	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	200		0	330		350	370		400
Storage Lanes	1		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3451	0	1610	3212	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950	0.993		0.950			0.950		
Satd. Flow (perm)	1770	3451	0	1610	3212	0	3433	3539	1583	3433	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		16			51				570			232
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.76	0.84	1.00	0.97	0.90	1.00	0.73	1.00	0.81	1.00	1.00	0.78
Shared Lane Traffic (%)				21%								
Lane Group Flow (vph)	96	585	0	411	809	0	208	552	570	257	919	232
Turn Type	Split			Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	4	4		8	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	27.0	27.0	0.0	41.0	41.0	0.0	14.0	39.0	39.0	18.0	43.0	43.0
Total Split (%)	21.6%	21.6%	0.0%	32.8%	32.8%	0.0%	11.2%	31.2%	31.2%	14.4%	34.4%	34.4%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag							Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	21.0	21.0		34.0	34.0		8.0	32.1	32.1	11.7	35.8	35.8
Actuated g/C Ratio	0.17	0.17		0.28	0.28		0.07	0.26	0.26	0.10	0.29	0.29
v/c Ratio	0.32	0.97		0.92	0.87		0.93	0.60	0.68	0.78	0.89	0.37
Control Delay	48.8	79.2		71.0	51.4		101.6	43.0	7.7	72.0	53.6	5.9
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.8	79.2		71.0	51.4		101.6	43.0	7.7	72.0	53.6	5.9
LOS	D	E		E	D		F	D	A	E	D	A
Approach Delay		74.9			58.0			37.0			49.1	
Approach LOS		E			E			D			D	
Queue Length 50th (ft)	69	245		353	323		88	205	0	106	372	0
Queue Length 95th (ft)	102	#326		#564	#431		#117	266	39	#168	#481	31

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	150			200			330		350	370		400
Base Capacity (vph)	303	604		460	953		224	952	842	336	1068	640
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.97		0.89	0.85		0.93	0.58	0.68	0.76	0.86	0.36

Intersection Summary		
Area Type:	Other	
Cycle Length: 125		
Actuated Cycle Length: 122.8		
Natural Cycle: 90		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.97		
Intersection Signal Delay: 51.8		Intersection LOS: D
Intersection Capacity Utilization 86.7%		ICU Level of Service E
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 4: Henry St & Queen Kaahumanu Hwy

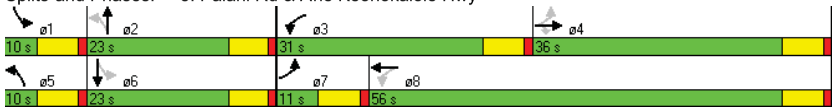


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	563	117	438	487	5	79	77	502	19	48	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	250		0	200		0	311		200
Storage Lanes	1		1	1		0	0		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	1827	1583	1543	1623	0	0	3075	0	1770	3316	0
Flt Permitted	0.484			0.106				0.897		0.208		
Satd. Flow (perm)	902	1827	1583	172	1623	0	0	2775	0	387	3316	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			113		1			473			38	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.92	0.96	1.00	0.89	1.00	0.92	0.92	0.92	0.97	0.92	0.92	0.92
Heavy Vehicles (%)	2%	4%	2%	17%	17%	2%	2%	2%	4%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	92	586	117	492	492	0	0	688	0	21	90	0
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8			2			6		
Detector Phase	7	4	4	3	8		5	2		1	6	
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	10.0	10.0	10.0	22.0		10.0	22.0		10.0	22.0	
Total Split (s)	11.0	36.0	36.0	31.0	56.0	0.0	10.0	23.0	0.0	10.0	23.0	0.0
Total Split (%)	11.0%	36.0%	36.0%	31.0%	56.0%	0.0%	10.0%	23.0%	0.0%	10.0%	23.0%	0.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		None	Min		None	Min	
Act Effct Green (s)	35.3	30.3	30.3	61.5	52.9			13.2			16.9	16.9
Actuated g/C Ratio	0.39	0.33	0.33	0.68	0.58			0.15			0.19	0.19
v/c Ratio	0.23	0.96	0.19	0.99	0.52			0.85			0.16	0.14
Control Delay	12.2	60.3	6.5	64.4	16.5			22.8			30.6	18.5
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0			0.0	0.0
Total Delay	12.2	60.3	6.5	64.4	16.5			22.8			30.6	18.5
LOS	B	E	A	E	B			C			C	B
Approach Delay		46.8			40.5			22.8			20.8	
Approach LOS		D			D			C			C	
Queue Length 50th (ft)	14	314	1	224	158			57			10	13

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	43	#626	42	#508	323			138		28	32	
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)				250						311		
Base Capacity (vph)	400	611	604	499	949			909		134	790	
Starvation Cap Reductn	0	0	0	0	0			0		0	0	
Spillback Cap Reductn	0	0	0	0	0			0		0	0	
Storage Cap Reductn	0	0	0	0	0			0		0	0	
Reduced v/c Ratio	0.23	0.96	0.19	0.99	0.52			0.76		0.16	0.11	

Intersection Summary			
Area Type:	Other		
Cycle Length: 100			
Actuated Cycle Length: 90.5			
Natural Cycle: 100			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.99			
Intersection Signal Delay: 36.9		Intersection LOS: D	
Intersection Capacity Utilization 92.9%		ICU Level of Service F	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 5: Palani Rd & Ane Keohokalole Hwy



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	54	117	138	86	60	10	175	5	138	23	5	121
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	1.00	1.00	0.92	0.79	0.92	0.89	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	59	117	138	93	76	11	197	5	150	25	5	132
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	87			117			632	508	117	505	503	81
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	87			117			632	508	117	505	503	81
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
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 %	96			94			37	99	84	93	99	87
cM capacity (veh/h)	1509			1471			311	421	935	366	424	978

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	59	117	138	93	87	197	155	25	137
Volume Left	59	0	0	93	0	197	0	25	0
Volume Right	0	0	138	0	11	0	150	0	132
cSH	1509	1700	1700	1471	1700	311	897	366	930
Volume to Capacity	0.04	0.07	0.08	0.06	0.05	0.63	0.17	0.07	0.15
Queue Length 95th (ft)	3	0	0	5	0	100	16	5	13
Control Delay (s)	7.5	0.0	0.0	7.6	0.0	34.5	9.9	15.5	9.5
Lane LOS	A			A		D	A	C	A
Approach Delay (s)	1.4			3.9		23.6		10.5	
Approach LOS						C		B	

Intersection Summary					
Average Delay	11.1				
Intersection Capacity Utilization	38.9%	ICU Level of Service		A	
Analysis Period (min)	15				

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	33	131	45	262	21	146	85	1068	472	147	806	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		100	200		200	550		550	300		550
Storage Lanes	1		0	2		1	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1719	1801	0	3433	1863	1538	1770	3438	1583	1719	3438	1538
Flt Permitted	0.950			0.950			0.167			0.116		
Satd. Flow (perm)	1719	1801	0	3433	1863	1538	311	3438	1583	210	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		14				146			480			57
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			900	
Travel Time (s)		22.7			22.7			22.7			20.5	
Peak Hour Factor	1.00	0.75	0.91	0.93	1.00	1.00	1.00	0.96	0.70	0.75	0.81	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	33	224	0	282	21	146	85	1112	674	196	995	57
Turn Type	Prot			Prot		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8	6		6	2		2
Detector Phase	7	4		3	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	14.0	20.0	0.0	15.0	21.0	21.0	12.0	37.0	37.0	13.0	38.0	38.0
Total Split (%)	16.5%	23.5%	0.0%	17.6%	24.7%	24.7%	14.1%	43.5%	43.5%	15.3%	44.7%	44.7%
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	None	None	None	None	None	None
Act Effct Green (s)	6.9	12.9		9.0	19.8	19.8	37.0	31.0	31.0	40.1	34.5	34.5
Actuated g/C Ratio	0.08	0.15		0.11	0.24	0.24	0.44	0.37	0.37	0.48	0.41	0.41
v/c Ratio	0.23	0.78		0.77	0.05	0.31	0.35	0.88	0.76	0.87	0.70	0.09
Control Delay	40.2	51.2		52.0	29.1	7.7	15.1	34.4	13.2	53.2	25.0	5.5
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.2	51.2		52.0	29.1	7.7	15.1	34.4	13.2	53.2	25.0	5.5
LOS	D	D		D	C	A	B	C	B	D	C	A
Approach Delay		49.8			36.5			25.9			28.6	
Approach LOS		D			D			C			C	
Queue Length 50th (ft)	17	108		77	9	0	22	288	78	57	240	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	44	147		#136	29	49	45	#411	73	#123	270	23
Internal Link Dist (ft)		920			920			920			820	
Turn Bay Length (ft)	100			200		200	550		550	300		550
Base Capacity (vph)	164	312		368	440	475	241	1270	887	226	1413	666
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.72		0.77	0.05	0.31	0.35	0.88	0.76	0.87	0.70	0.09

Intersection Summary		
Area Type:	Other	
Cycle Length: 85		
Actuated Cycle Length: 84		
Natural Cycle: 80		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.88		
Intersection Signal Delay: 29.6		Intersection LOS: C
Intersection Capacity Utilization 74.8%		ICU Level of Service D
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

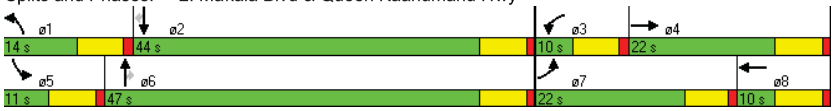
Splits and Phases: 1: Honokohau Harbor & Queen Kaahumanu Hwy

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	445	34	40	16	33	52	144	1094	23	40	743	271
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	2		0	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3335	3260	0	3433	3128	0	3433	3438	1583	1719	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3335	3260	0	3433	3128	0	3433	3438	1583	1719	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		40			69				28			271
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	0.94	1.00	0.39	0.91	0.75	0.91	0.87	0.83	1.00	0.99	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	445	76	0	41	105	0	158	1257	28	40	751	271
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases									6			2
Detector Phase	7	4		3	8		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		10.0	10.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	10.0	10.0	0.0	14.0	47.0	47.0	11.0	44.0	44.0
Total Split (%)	24.4%	24.4%	0.0%	11.1%	11.1%	0.0%	15.6%	52.2%	52.2%	12.2%	48.9%	48.9%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	None	None	None	None	None
Act Effct Green (s)	14.3	16.5		4.2	4.2		7.9	37.7	37.7	5.3	29.1	29.1
Actuated g/C Ratio	0.18	0.21		0.05	0.05		0.10	0.48	0.48	0.07	0.37	0.37
v/c Ratio	0.72	0.10		0.22	0.44		0.45	0.76	0.04	0.34	0.58	0.36
Control Delay	40.0	17.9		43.8	25.1		41.8	21.8	5.5	48.7	21.4	3.8
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.0	17.9		43.8	25.1		41.8	21.8	5.5	48.7	21.4	3.8
LOS	D	B		D	C		D	C	A	D	C	A
Approach Delay		36.8			30.3			23.7			18.0	
Approach LOS		D			C			C			B	
Queue Length 50th (ft)	124	8		11	10		44	311	0	22	161	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#179	28		12	37		76	378	13	55	215	44
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	727	809		187	236		374	1919	896	117	1779	927
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.61	0.09		0.22	0.44		0.42	0.66	0.03	0.34	0.42	0.29

Intersection Summary		
Area Type:	Other	
Cycle Length: 90		
Actuated Cycle Length: 77.8		
Natural Cycle: 75		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.76		
Intersection Signal Delay: 24.2		Intersection LOS: C
Intersection Capacity Utilization 67.9%		ICU Level of Service C
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 2: Makala Blvd & Queen Kaahumanu Hwy



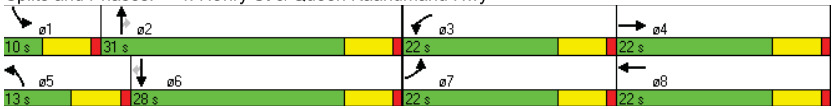
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	89	278	53	468	384	123	186	849	481	90	696	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	200		0	330		350	370		400
Storage Lanes	1		0	2		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3451	0	3433	3387	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3451	0	3433	3387	0	3433	3539	1583	3433	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		24			62				521			124
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.70	0.68	0.65	0.95	1.00	0.80	1.00	0.96	0.86	1.00	0.96	0.94
Shared Lane Traffic (%)												
Lane Group Flow (vph)	127	491	0	493	538	0	186	884	559	90	725	124
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	22.0	22.0	0.0	13.0	31.0	31.0	10.0	28.0	28.0
Total Split (%)	25.9%	25.9%	0.0%	25.9%	25.9%	0.0%	15.3%	36.5%	36.5%	11.8%	32.9%	32.9%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	11.2	14.7		15.0	21.5		7.0	26.1	26.1	4.0	20.8	20.8
Actuated g/C Ratio	0.14	0.18		0.18	0.26		0.09	0.32	0.32	0.05	0.25	0.25
v/c Ratio	0.52	0.77		0.78	0.57		0.63	0.78	0.65	0.53	0.81	0.25
Control Delay	41.0	39.4		42.1	28.2		47.6	32.6	7.4	51.6	37.0	6.5
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.0	39.4		42.1	28.2		47.6	32.6	7.4	51.6	37.0	6.5
LOS	D	D		D	C		D	C	A	D	D	A
Approach Delay		39.7			34.8			25.7			34.3	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)	64	124		129	119		50	232	15	24	190	0
Queue Length 95th (ft)	85	125		#187	#188		#91	#332	80	#53	255	40

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	150			200			330		350	370		400
Base Capacity (vph)	349	699		676	938		296	1132	860	169	959	519
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.70		0.73	0.57		0.63	0.78	0.65	0.53	0.76	0.24

Intersection Summary

Area Type: Other
Cycle Length: 85
Actuated Cycle Length: 81.7
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 31.9 Intersection LOS: C
Intersection Capacity Utilization 69.5% ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Henry St & Queen Kaahumanu Hwy

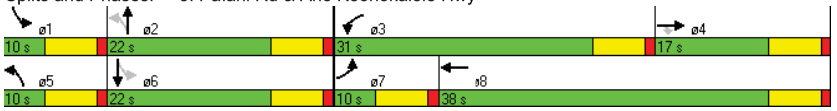


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	179	53	781	480	5	49	32	479	5	78	41
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	250		0	200		0	311		200
Storage Lanes	1		1	2		0	0		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	1827	1583	2993	1624	0	0	3023	0	1770	3355	0
Flt Permitted	0.950			0.950				0.911		0.260		
Satd. Flow (perm)	1770	1827	1583	2993	1624	0	0	2765	0	484	3355	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			59		1			499			45	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			3500	
Travel Time (s)		22.7			22.7			22.7			79.5	
Peak Hour Factor	0.92	0.98	0.90	0.94	0.81	0.92	1.00	0.92	0.96	0.92	0.92	0.92
Heavy Vehicles (%)	2%	4%	2%	17%	17%	2%	2%	2%	4%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	16	183	59	831	598	0	0	583	0	5	130	0
Turn Type	Prot		Perm	Prot			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4				2			6		
Detector Phase	7	4	4	3	8		5	2		1	6	
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	10.0	10.0	10.0	22.0		10.0	22.0		10.0	22.0	
Total Split (s)	10.0	17.0	17.0	31.0	38.0	0.0	10.0	22.0	0.0	10.0	22.0	0.0
Total Split (%)	12.5%	21.3%	21.3%	38.8%	47.5%	0.0%	12.5%	27.5%	0.0%	12.5%	27.5%	0.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		None	Min		None	Min	
Act Effct Green (s)	4.1	10.3	10.3	22.0	37.0			9.4		10.9	10.9	
Actuated g/C Ratio	0.07	0.17	0.17	0.36	0.60			0.15		0.18	0.18	
v/c Ratio	0.14	0.60	0.19	0.78	0.62			0.69		0.03	0.21	
Control Delay	35.4	36.9	10.5	25.7	15.6			9.9		20.6	15.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Total Delay	35.4	36.9	10.5	25.7	15.6			9.9		20.6	15.8	
LOS	D	D	B	C	B			A		C	B	
Approach Delay		30.8			21.5			9.9			16.0	
Approach LOS		C			C			A			B	
Queue Length 50th (ft)	6	63	0	130	96			14		2	14	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	27	#183	33	#308	#400			62		9	34	
Internal Link Dist (ft)		920			920			920			3420	
Turn Bay Length (ft)				250						311		
Base Capacity (vph)	118	336	339	1250	991			1104		171	1012	
Starvation Cap Reductn	0	0	0	0	0			0		0	0	
Spillback Cap Reductn	0	0	0	0	0			0		0	0	
Storage Cap Reductn	0	0	0	0	0			0		0	0	
Reduced v/c Ratio	0.14	0.54	0.17	0.66	0.60			0.53		0.03	0.13	

Intersection Summary	
Area Type:	Other
Cycle Length: 80	
Actuated Cycle Length: 61.8	
Natural Cycle: 80	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.78	
Intersection Signal Delay: 19.4	Intersection LOS: B
Intersection Capacity Utilization 67.9%	ICU Level of Service C
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 5: Palani Rd & Ane Keohokalole Hwy

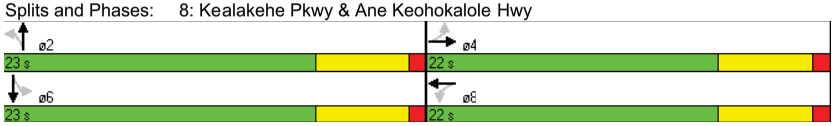


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	121	74	370	119	242	23	216	5	51	5	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	340		0	480		0	300		0	430		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3097	0	1770	1839	0	1770	1608	0	1770	1650	0
Flt Permitted	0.583			0.477			0.744			0.718		
Satd. Flow (perm)	1086	3097	0	889	1839	0	1386	1608	0	1337	1650	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		402			12			55			16	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			800			1000	
Travel Time (s)		22.7			22.7			18.2			22.7	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	132	482	0	129	288	0	235	60	0	5	21	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			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)	22.0	22.0		22.0	22.0		22.0	22.0		22.0	22.0	
Total Split (s)	22.0	22.0	0.0	22.0	22.0	0.0	23.0	23.0	0.0	23.0	23.0	0.0
Total Split (%)	48.9%	48.9%	0.0%	48.9%	48.9%	0.0%	51.1%	51.1%	0.0%	51.1%	51.1%	0.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	10.7	10.7		10.7	10.7		11.0	11.0		11.0	11.0	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.32	0.32		0.32	0.32	
v/c Ratio	0.39	0.39		0.47	0.50		0.53	0.11		0.01	0.04	
Control Delay	13.9	3.4		16.6	13.0		14.9	4.3		8.6	5.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	13.9	3.4		16.6	13.0		14.9	4.3		8.6	5.9	
LOS	B	A		B	B		B	A		A	A	
Approach Delay		5.6			14.1			12.7			6.4	
Approach LOS		A			B			B			A	
Queue Length 50th (ft)	17	5		18	38		32	1		1	1	
Queue Length 95th (ft)	58	30		61	102		91	17		5	10	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			720			920	
Turn Bay Length (ft)	340			480			300			430		
Base Capacity (vph)	532	1721		435	906		721	863		695	866	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.25	0.28		0.30	0.32		0.33	0.07		0.01	0.02	

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 34.2			
Natural Cycle: 45			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.53			
Intersection Signal Delay: 9.8		Intersection LOS: A	
Intersection Capacity Utilization 54.5%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 8: Kealakehe Pkwy & Ane Keohokalole Hwy



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	72	13	109	523	29	103	85	990	194	107	1163	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		100	200		200	550		550	300		550
Storage Lanes	1		0	2		1	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1736	1611	0	3433	1863	1553	1770	3471	1583	1719	3438	1538
Flt Permitted	0.950			0.950			0.124			0.129		
Satd. Flow (perm)	1736	1611	0	3433	1863	1553	231	3471	1583	233	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		109				103			194			113
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			900	
Travel Time (s)		22.7			22.7			22.7			20.5	
Peak Hour Factor	0.82	0.92	0.88	0.77	0.43	1.00	0.72	0.93	1.00	0.88	0.92	0.77
Heavy Vehicles (%)	4%	2%	2%	2%	2%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	88	138	0	679	67	103	118	1065	194	122	1264	113
Turn Type	Prot			Prot		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8	6		6	2		2
Detector Phase	7	4		3	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	15.0	10.0	0.0	23.0	18.0	18.0	10.0	36.0	36.0	11.0	37.0	37.0
Total Split (%)	18.8%	12.5%	0.0%	28.8%	22.5%	22.5%	12.5%	45.0%	45.0%	13.8%	46.3%	46.3%
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	None	None	None	None	None	None
Act Effct Green (s)	8.1	4.0		17.0	15.2	15.2	35.4	32.2	32.2	36.0	31.0	31.0
Actuated g/C Ratio	0.10	0.05		0.21	0.19	0.19	0.44	0.40	0.40	0.45	0.39	0.39
v/c Ratio	0.50	0.75		0.93	0.19	0.27	0.66	0.76	0.26	0.62	0.95	0.17
Control Delay	43.8	38.5		52.6	31.6	9.0	31.9	26.0	3.8	26.1	40.2	4.1
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.8	38.5		52.6	31.6	9.0	31.9	26.0	3.8	26.1	40.2	4.1
LOS	D	D		D	C	A	C	C	A	C	D	A
Approach Delay		40.5			45.6			23.4			36.3	
Approach LOS		D			D			C			D	
Queue Length 50th (ft)	42	14		172	30	0	29	247	0	30	314	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	78	#101		#199	30	42	43	327	39	#72	#457	20
Internal Link Dist (ft)		920			920			920			820	
Turn Bay Length (ft)	100			200		200	550		550	300		550
Base Capacity (vph)	195	184		730	354	379	179	1397	753	198	1332	665
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.75		0.93	0.19	0.27	0.66	0.76	0.26	0.62	0.95	0.17

Intersection Summary		
Area Type:	Other	
Cycle Length: 80		
Actuated Cycle Length: 80		
Natural Cycle: 80		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.95		
Intersection Signal Delay: 34.0		Intersection LOS: C
Intersection Capacity Utilization 79.2%		ICU Level of Service D
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

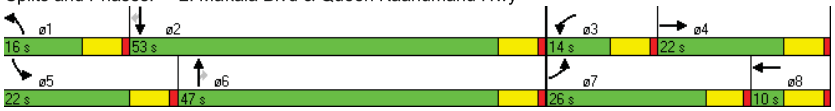
Splits and Phases: 1: Honokohau Harbor & Queen Kaahumanu Hwy

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	548	191	146	146	78	77	292	671	44	150	1158	415
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	2		0	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3367	3327	0	3433	3250	0	3433	3471	1583	1719	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3367	3327	0	3433	3250	0	3433	3471	1583	1719	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		126			77				45			488
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.93	0.78	0.90	1.00	0.96	1.00	1.00	0.99	0.98	1.00	0.81	0.85
Heavy Vehicles (%)	4%	2%	2%	2%	2%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	589	407	0	146	158	0	292	678	45	150	1430	488
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases									6			2
Detector Phase	7	4		3	8		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0		10.0	10.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	26.0	22.0	0.0	14.0	10.0	0.0	16.0	47.0	47.0	22.0	53.0	53.0
Total Split (%)	24.8%	21.0%	0.0%	13.3%	9.5%	0.0%	15.2%	44.8%	44.8%	21.0%	50.5%	50.5%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	None	None	None	None	None
Act Effct Green (s)	19.9	16.0		7.8	4.0		10.0	43.5	43.5	13.5	47.0	47.0
Actuated g/C Ratio	0.19	0.15		0.07	0.04		0.10	0.41	0.41	0.13	0.45	0.45
v/c Ratio	0.92	0.66		0.57	0.80		0.89	0.47	0.07	0.68	0.93	0.51
Control Delay	63.7	34.4		56.1	54.7		76.4	24.2	6.4	58.9	39.2	3.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	63.7	34.4		56.1	54.7		76.4	24.2	6.4	58.9	39.2	3.7
LOS	E	C		E	D		E	C	A	E	D	A
Approach Delay		51.7			55.4			38.4			32.3	
Approach LOS		D			E			D			C	
Queue Length 50th (ft)	202	94		49	28		101	173	0	97	465	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#304	117		82	#84		#178	233	23	162	478	42
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	642	616		262	198		327	1441	684	262	1541	959
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.92	0.66		0.56	0.80		0.89	0.47	0.07	0.57	0.93	0.51

Intersection Summary		
Area Type:	Other	
Cycle Length: 105		
Actuated Cycle Length: 104.9		
Natural Cycle: 90		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.93		
Intersection Signal Delay: 39.7		Intersection LOS: D
Intersection Capacity Utilization 80.6%		ICU Level of Service D
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 2: Makala Blvd & Queen Kaahumanu Hwy



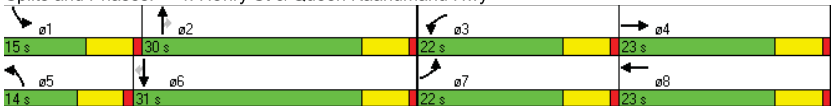
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	73	409	98	504	405	250	152	552	462	257	919	181
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	200		0	330		350	370		400
Storage Lanes	1		0	2		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3451	0	3433	3348	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3451	0	3433	3348	0	3433	3539	1583	3433	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		23			104				446			232
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.76	0.84	1.00	0.97	0.90	1.00	0.73	1.00	0.81	1.00	1.00	0.78
Shared Lane Traffic (%)												
Lane Group Flow (vph)	96	585	0	520	700	0	208	552	570	257	919	232
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	23.0	0.0	22.0	23.0	0.0	14.0	30.0	30.0	15.0	31.0	31.0
Total Split (%)	24.4%	25.6%	0.0%	24.4%	25.6%	0.0%	15.6%	33.3%	33.3%	16.7%	34.4%	34.4%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	10.2	16.7		15.7	24.7		8.0	24.0	24.0	9.0	25.0	25.0
Actuated g/C Ratio	0.11	0.19		0.18	0.28		0.09	0.27	0.27	0.10	0.28	0.28
v/c Ratio	0.48	0.88		0.86	0.70		0.68	0.58	0.76	0.75	0.93	0.38
Control Delay	44.5	50.6		52.0	30.9		51.8	31.3	14.6	53.8	48.1	5.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.5	50.6		52.0	30.9		51.8	31.3	14.6	53.8	48.1	5.6
LOS	D	D		D	C		D	C	B	D	D	A
Approach Delay		49.8			39.9			27.4			42.2	
Approach LOS		D			D			C			D	
Queue Length 50th (ft)	52	165		148	165		60	143	56	74	267	0
Queue Length 95th (ft)	80	#225		#231	#279		76	196	124	#129	#389	31

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	150			200			330		350	370		400
Base Capacity (vph)	318	676		615	1001		308	952	752	346	991	610
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.87		0.85	0.70		0.68	0.58	0.76	0.74	0.93	0.38

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 89.3
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 38.4 Intersection LOS: D
Intersection Capacity Utilization 78.6% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 4: Henry St & Queen Kaahumanu Hwy



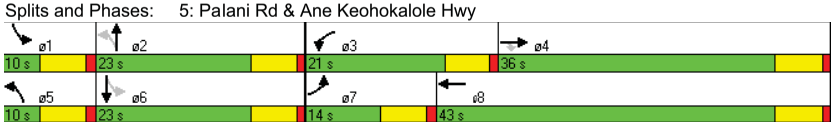
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	563	117	438	487	5	79	77	502	19	48	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	250		0	200		0	311		200
Storage Lanes	1		1	2		0	0		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	1827	1583	2993	1623	0	0	3075	0	1770	3316	0
Flt Permitted	0.950			0.950				0.896		0.190		
Satd. Flow (perm)	1770	1827	1583	2993	1623	0	0	2772	0	354	3316	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			117		1			334			38	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			3376	
Travel Time (s)		22.7			22.7			22.7			76.7	
Peak Hour Factor	0.92	0.96	1.00	0.89	1.00	0.92	0.92	0.92	0.97	0.92	0.92	0.92
Heavy Vehicles (%)	2%	4%	2%	17%	17%	2%	2%	2%	4%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	92	586	117	492	492	0	0	688	0	21	90	0
Turn Type	Prot		Perm	Prot			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4				2			6		
Detector Phase	7	4	4	3	8		5	2		1	6	
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	10.0	10.0	10.0	22.0		10.0	22.0		10.0	22.0	
Total Split (s)	14.0	36.0	36.0	21.0	43.0	0.0	10.0	23.0	0.0	10.0	23.0	0.0
Total Split (%)	15.6%	40.0%	40.0%	23.3%	47.8%	0.0%	11.1%	25.6%	0.0%	11.1%	25.6%	0.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		None	Min		None	Min	
Act Effct Green (s)	7.7	29.0	29.0	15.2	39.5			15.1		18.7	18.7	
Actuated g/C Ratio	0.09	0.36	0.36	0.19	0.49			0.19		0.23	0.23	
v/c Ratio	0.55	0.90	0.18	0.88	0.62			0.92dr		0.14	0.11	
Control Delay	51.1	44.9	5.2	53.1	22.9			30.4		25.1	15.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Total Delay	51.1	44.9	5.2	53.1	22.9			30.4		25.1	15.4	
LOS	D	D	A	D	C			C		C	B	
Approach Delay		39.8			38.0			30.4			17.3	
Approach LOS		D			D			C			B	
Queue Length 50th (ft)	45	264	0	124	181			88		8	11	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#113	#537	36	#242	354			#206		25	28	
Internal Link Dist (ft)		920			920			920			3296	
Turn Bay Length (ft)				250						311		
Base Capacity (vph)	176	683	665	560	790			851		152	878	
Starvation Cap Reductn	0	0	0	0	0			0		0	0	
Spillback Cap Reductn	0	0	0	0	0			0		0	0	
Storage Cap Reductn	0	0	0	0	0			0		0	0	
Reduced v/c Ratio	0.52	0.86	0.18	0.88	0.62			0.81		0.14	0.10	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 81.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 35.6 Intersection LOS: D
Intersection Capacity Utilization 81.2% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
dr Defacto Right Lane. Recode with 1 though lane as a right lane.

Splits and Phases: 5: Palani Rd & Ane Keohokalole Hwy

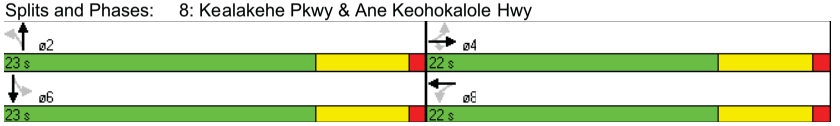


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	54	117	138	86	60	10	175	5	138	23	5	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	340		0	480		0	300		0	430		0
Storage Lanes	1		1	1		0	1		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	1863	1583	1770	1827	0	1770	1593	0	1770	1593	0
Flt Permitted	0.701			0.682			0.669			0.659		
Satd. Flow (perm)	1306	1863	1583	1270	1827	0	1246	1593	0	1228	1593	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			138		11			150			132	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			800			1000	
Travel Time (s)		22.7			22.7			18.2			22.7	
Peak Hour Factor	0.92	1.00	1.00	0.92	0.79	0.92	0.89	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	59	117	138	93	87	0	197	155	0	25	137	0
Turn Type	Perm		Perm	Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4		4	8			2			6		
Detector Phase	4	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	4.0	
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0		22.0	22.0		22.0	22.0	
Total Split (s)	22.0	22.0	22.0	22.0	22.0	0.0	23.0	23.0	0.0	23.0	23.0	0.0
Total Split (%)	48.9%	48.9%	48.9%	48.9%	48.9%	0.0%	51.1%	51.1%	0.0%	51.1%	51.1%	0.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		Min	Min		Min	Min	
Act Effct Green (s)	8.0	8.0	8.0	8.0	8.0		15.2	15.2		15.2	15.2	
Actuated g/C Ratio	0.25	0.25	0.25	0.25	0.25		0.48	0.48		0.48	0.48	
v/c Ratio	0.18	0.25	0.27	0.29	0.18		0.33	0.18		0.04	0.16	
Control Delay	11.4	11.5	4.4	12.8	10.0		9.9	2.7		7.3	2.7	
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	11.4	11.5	4.4	12.8	10.0		9.9	2.7		7.3	2.7	
LOS	B	B	A	B	A		A	A		A	A	
Approach Delay		8.4			11.5			6.7			3.4	
Approach LOS		A			B			A			A	
Queue Length 50th (ft)	7	14	0	11	9		22	1		2	1	
Queue Length 95th (ft)	29	48	26	42	30		66	23		13	21	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			720			920	
Turn Bay Length (ft)	340			480			300			430		
Base Capacity (vph)	684	975	895	665	962		784	1058		773	1051	
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.09	0.12	0.15	0.14	0.09		0.25	0.15		0.03	0.13	

Intersection Summary		
Area Type:	Other	
Cycle Length: 45		
Actuated Cycle Length: 31.4		
Natural Cycle: 45		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.33		
Intersection Signal Delay: 7.5	Intersection LOS: A	
Intersection Capacity Utilization 43.9%	ICU Level of Service A	
Analysis Period (min) 15		

Splits and Phases: 8: Kealakehe Pkwy & Ane Keohokalole Hwy



TRAFFIC IMPACT ANALYSIS REPORT

FOR THE PROPOSED

KAMAKANA VILLAGES

AT KEAHUOLU

APPENDIX D

CAPACITY ANALYSIS WORKSHEETS

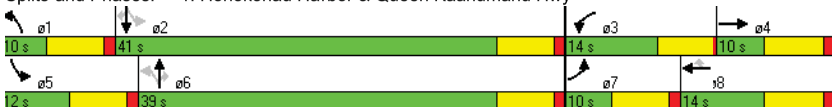
2019 PEAK HOUR TRAFFIC WITHOUT PROJECT

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	14	51	309	24	178	95	1258	593	166	927	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		100	200		200	550		550	300		550
Storage Lanes	1		0	2		1	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1719	1654	0	3433	1863	1538	1770	3438	1583	1719	3438	1538
Flt Permitted	0.950			0.950			0.170			0.107		
Satd. Flow (perm)	1719	1654	0	3433	1863	1538	317	3438	1583	194	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		56				164			634			66
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			900	
Travel Time (s)		22.7			22.7			22.7			20.5	
Peak Hour Factor	1.00	0.75	0.91	0.93	1.00	1.00	1.00	0.96	0.70	0.75	0.81	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	38	75	0	332	24	178	95	1310	847	221	1144	66
Turn Type	Prot			Prot		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8	6		6	2		2
Detector Phase	7	4		3	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	10.0	10.0	0.0	14.0	14.0	14.0	10.0	39.0	39.0	12.0	41.0	41.0
Total Split (%)	13.3%	13.3%	0.0%	18.7%	18.7%	18.7%	13.3%	52.0%	52.0%	16.0%	54.7%	54.7%
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	None	None	None	None	None	None
Act Effct Green (s)	4.0	4.0		8.0	10.0	10.0	37.1	33.1	33.1	42.0	37.4	37.4
Actuated g/C Ratio	0.05	0.05		0.11	0.14	0.14	0.51	0.45	0.45	0.58	0.51	0.51
v/c Ratio	0.40	0.52		0.88	0.09	0.51	0.39	0.84	0.80	0.93	0.65	0.08
Control Delay	47.2	29.0		59.2	31.1	12.8	12.0	24.7	11.4	62.5	16.8	3.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.2	29.0		59.2	31.1	12.8	12.0	24.7	11.4	62.5	16.8	3.6
LOS	D	C		E	C	B	B	C	B	E	B	A
Approach Delay		35.1			42.5			19.2			23.2	
Approach LOS		D			D			B			C	
Queue Length 50th (ft)	18	9		80	10	6	17	278	62	57	213	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#51	35		#154	32	62	34	#388	54	#131	241	19
Internal Link Dist (ft)		920			920			920			820	
Turn Bay Length (ft)	100			200		200	550		550	300		550
Base Capacity (vph)	95	144		377	255	352	241	1559	1065	237	1759	819
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.40	0.52		0.88	0.09	0.51	0.39	0.84	0.80	0.93	0.65	0.08

Intersection Summary	
Area Type:	Other
Cycle Length: 75	
Actuated Cycle Length: 73	
Natural Cycle: 75	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.93	
Intersection Signal Delay: 23.8	Intersection LOS: C
Intersection Capacity Utilization 74.5%	ICU Level of Service D
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 1: Honokohau Harbor & Queen Kaahumanu Hwy



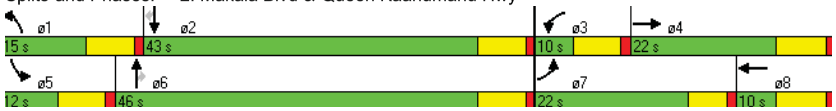
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	530	38	44	18	37	63	161	1313	25	46	865	311
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	2		0	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3335	3260	0	3433	3120	0	3433	3438	1583	1719	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3335	3260	0	3433	3120	0	3433	3438	1583	1719	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		44			84				30			311
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	0.94	1.00	0.39	0.91	0.75	0.91	0.87	0.83	1.00	0.99	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	530	84	0	46	125	0	177	1509	30	46	874	311
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases									6			2
Detector Phase	7	4		3	8		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		10.0	10.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	10.0	10.0	0.0	15.0	46.0	46.0	12.0	43.0	43.0
Total Split (%)	24.4%	24.4%	0.0%	11.1%	11.1%	0.0%	16.7%	51.1%	51.1%	13.3%	47.8%	47.8%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	None	None	None	None	None
Act Effct Green (s)	15.7	20.1		4.0	4.0		8.4	40.4	40.4	5.9	32.7	32.7
Actuated g/C Ratio	0.18	0.24		0.05	0.05		0.10	0.48	0.48	0.07	0.38	0.38
v/c Ratio	0.86	0.10		0.28	0.55		0.52	0.92	0.04	0.38	0.66	0.40
Control Delay	50.3	17.6		45.8	26.6		43.2	33.4	5.5	49.5	24.3	3.8
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.3	17.6		45.8	26.6		43.2	33.4	5.5	49.5	24.3	3.8
LOS	D	B		D	C		D	C	A	D	C	A
Approach Delay		45.8			31.8			33.9			20.0	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)	153	10		13	12		50	432	0	26	201	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#244	30		13	40		82	#566	13	61	264	48
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	631	803		163	228		365	1635	768	122	1504	848
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.84	0.10		0.28	0.55		0.48	0.92	0.04	0.38	0.58	0.37

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 85
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 31.2 Intersection LOS: C
Intersection Capacity Utilization 76.4% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Makala Blvd & Queen Kaahumanu Hwy

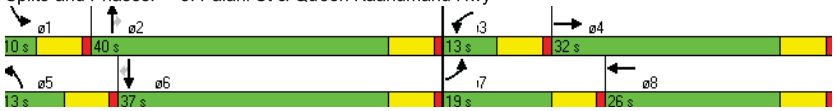


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	390	162	127	32	407	28	128	1114	10	42	657	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3335	3276	0	1543	3075	0	3433	3438	1583	3335	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3335	3276	0	1543	3075	0	3433	3438	1583	3335	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		127			9				15			297
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	0.96	1.00	1.00	0.88	0.67	0.97	0.94	0.67	1.00	0.89	0.70
Heavy Vehicles (%)	5%	4%	2%	17%	17%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	390	296	0	32	504	0	132	1185	15	42	738	371
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	27.0		10.0	26.0		10.0	27.0	27.0	10.0	27.0	27.0
Total Split (s)	19.0	32.0	0.0	13.0	26.0	0.0	13.0	40.0	40.0	10.0	37.0	37.0
Total Split (%)	20.0%	33.7%	0.0%	13.7%	27.4%	0.0%	13.7%	42.1%	42.1%	10.5%	38.9%	38.9%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	12.8	29.6		6.5	18.0		6.9	34.4	34.4	4.0	27.1	27.1
Actuated g/C Ratio	0.14	0.33		0.07	0.20		0.08	0.39	0.39	0.04	0.30	0.30
v/c Ratio	0.81	0.25		0.28	0.80		0.49	0.89	0.02	0.28	0.71	0.55
Control Delay	53.3	14.8		48.1	44.5		48.1	37.1	9.7	48.6	31.7	9.3
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	53.3	14.8		48.1	44.5		48.1	37.1	9.7	48.6	31.7	9.3
LOS	D	B		D	D		D	D	A	D	C	A
Approach Delay		36.7			44.7			37.9			25.1	
Approach LOS		D			D			D			C	
Queue Length 50th (ft)	120	41		19	148		40	363	0	12	198	31

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#197	75		48	202		70	#509	8	30	259	43
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	491	1173		123	704		273	1353	632	151	1208	733
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.79	0.25		0.26	0.72		0.48	0.88	0.02	0.28	0.61	0.51

Intersection Summary			
Area Type:	Other		
Cycle Length: 95			
Actuated Cycle Length: 89			
Natural Cycle: 90			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.89			
Intersection Signal Delay: 34.7		Intersection LOS: C	
Intersection Capacity Utilization 77.4%		ICU Level of Service D	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Palani St & Queen Kaahumanu Hwy

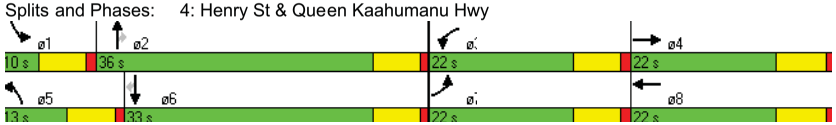


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	311	60	525	431	145	208	1002	542	102	775	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	200		0	330		350	370		400
Storage Lanes	1		0	2		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3451	0	3433	3383	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3451	0	3433	3383	0	3433	3539	1583	3433	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		23			62				506			146
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.70	0.68	0.65	0.95	1.00	0.80	1.00	0.96	0.86	1.00	0.96	0.94
Shared Lane Traffic (%)												
Lane Group Flow (vph)	151	549	0	553	612	0	208	1044	630	102	807	146
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	22.0	22.0	0.0	13.0	36.0	36.0	10.0	33.0	33.0
Total Split (%)	24.4%	24.4%	0.0%	24.4%	24.4%	0.0%	14.4%	40.0%	40.0%	11.1%	36.7%	36.7%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	12.4	15.6		15.8	19.0		7.0	30.5	30.5	4.0	25.3	25.3
Actuated g/C Ratio	0.14	0.18		0.18	0.22		0.08	0.35	0.35	0.05	0.29	0.29
v/c Ratio	0.60	0.87		0.89	0.78		0.76	0.85	0.72	0.65	0.79	0.26
Control Delay	46.0	50.0		54.8	39.0		59.1	35.4	10.7	62.4	35.3	5.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.0	50.0		54.8	39.0		59.1	35.4	10.7	62.4	35.3	5.6
LOS	D	D		D	D		E	D	B	E	D	A
Approach Delay		49.2			46.5			29.7			33.8	
Approach LOS		D			D			C			C	
Queue Length 50th (ft)	82	155		160	157		60	292	51	29	217	0
Queue Length 95th (ft)	104	151		#254	#271		#115	#410	148	#67	287	42

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	150			200			330		350	370		400
Base Capacity (vph)	324	649		627	781		275	1231	881	157	1092	589
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.85		0.88	0.78		0.76	0.85	0.72	0.65	0.74	0.25

Intersection Summary		
Area Type:	Other	
Cycle Length: 90		
Actuated Cycle Length: 87.8		
Natural Cycle: 90		
Control Type: Actuated-Uncoordinated		
Maximum v/c Ratio: 0.89		
Intersection Signal Delay: 37.5		Intersection LOS: D
Intersection Capacity Utilization 76.5%		ICU Level of Service D
Analysis Period (min) 15		
# 95th percentile volume exceeds capacity, queue may be longer.		
Queue shown is maximum after two cycles.		

Splits and Phases: 4: Henry St & Queen Kaahumanu Hwy

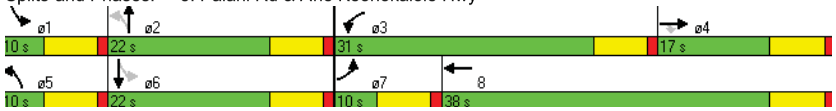


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	202	60	874	539	5	55	39	536	5	83	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	250		0	200		0	311		200
Storage Lanes	1		1	2		0	0		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	1827	1583	2993	1624	0	0	3023	0	1770	3295	0
Flt Permitted	0.950			0.950				0.906		0.252		
Satd. Flow (perm)	1770	1827	1583	2993	1624	0	0	2750	0	469	3295	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			67		1			558			76	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			3500	
Travel Time (s)		22.7			22.7			22.7			79.5	
Peak Hour Factor	0.92	0.98	0.90	0.94	0.81	0.92	1.00	0.92	0.96	0.92	0.92	0.92
Heavy Vehicles (%)	2%	4%	2%	17%	17%	2%	2%	2%	4%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	23	206	67	930	670	0	0	655	0	5	166	0
Turn Type	Prot		Perm	Prot			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4				2			6		
Detector Phase	7	4	4	3	8		5	2		1	6	
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	10.0	10.0	10.0	22.0		10.0	22.0		10.0	22.0	
Total Split (s)	10.0	17.0	17.0	31.0	38.0	0.0	10.0	22.0	0.0	10.0	22.0	0.0
Total Split (%)	12.5%	21.3%	21.3%	38.8%	47.5%	0.0%	12.5%	27.5%	0.0%	12.5%	27.5%	0.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		None	Min		None	Min	
Act Effct Green (s)	4.1	10.7	10.7	25.1	38.3			9.9		11.5	11.5	
Actuated g/C Ratio	0.06	0.16	0.16	0.38	0.58			0.15		0.18	0.18	
v/c Ratio	0.21	0.69	0.21	0.81	0.71			0.74		0.03	0.26	
Control Delay	37.6	42.2	10.3	27.4	20.0			10.6		20.4	13.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0		0.0	0.0	
Total Delay	37.6	42.2	10.3	27.4	20.0			10.6		20.4	13.5	
LOS	D	D	B	C	C			B		C	B	
Approach Delay		34.6			24.3			10.6			13.7	
Approach LOS		C			C			B			B	
Queue Length 50th (ft)	9	76	0	159	127			17		2	16	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	34	#214	34	#365	#477			69		9	37	
Internal Link Dist (ft)		920			920			920			3420	
Turn Bay Length (ft)				250						311		
Base Capacity (vph)	109	310	324	1155	949			1099		163	952	
Starvation Cap Reductn	0	0	0	0	0			0		0	0	
Spillback Cap Reductn	0	0	0	0	0			0		0	0	
Storage Cap Reductn	0	0	0	0	0			0		0	0	
Reduced v/c Ratio	0.21	0.66	0.21	0.81	0.71			0.60		0.03	0.17	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 65.6			
Natural Cycle: 80			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.81			
Intersection Signal Delay: 21.5		Intersection LOS: C	
Intersection Capacity Utilization 80.2%		ICU Level of Service D	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 5: Palani Rd & Ane Keohokalole Hwy

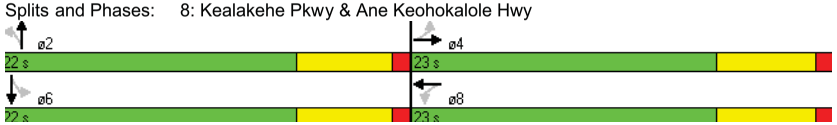


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	121	94	414	153	302	30	241	5	64	8	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	340		0	480		0	300		0	430		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3107	0	1770	1837	0	1770	1602	0	1770	1650	0
Flt Permitted	0.546			0.446			0.744			0.708		
Satd. Flow (perm)	1017	3107	0	831	1837	0	1386	1602	0	1319	1650	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		450			13			70			16	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			800			1000	
Travel Time (s)		22.7			22.7			18.2			22.7	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	132	552	0	166	361	0	262	75	0	9	21	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			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)	22.0	22.0		22.0	22.0		22.0	22.0		22.0	22.0	
Total Split (s)	23.0	23.0	0.0	23.0	23.0	0.0	22.0	22.0	0.0	22.0	22.0	0.0
Total Split (%)	51.1%	51.1%	0.0%	51.1%	51.1%	0.0%	48.9%	48.9%	0.0%	48.9%	48.9%	0.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	12.5	12.5		12.5	12.5		11.7	11.7		11.7	11.7	
Actuated g/C Ratio	0.34	0.34		0.34	0.34		0.32	0.32		0.32	0.32	
v/c Ratio	0.38	0.41		0.59	0.57		0.59	0.13		0.02	0.04	
Control Delay	13.5	3.3		20.4	14.0		17.5	4.4		9.6	6.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	13.5	3.3		20.4	14.0		17.5	4.4		9.6	6.4	
LOS	B	A		C	B		B	A		A	A	
Approach Delay		5.3			16.0			14.6			7.3	
Approach LOS		A			B			B			A	
Queue Length 50th (ft)	19	6		26	54		43	1		1	1	
Queue Length 95th (ft)	56	32		#82	125		107	19		8	11	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			720			920	
Turn Bay Length (ft)	340			480			300			430		
Base Capacity (vph)	493	1738		403	897		632	769		601	761	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.27	0.32		0.41	0.40		0.41	0.10		0.01	0.03	

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 36.7			
Natural Cycle: 45			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.59			
Intersection Signal Delay: 10.9		Intersection LOS: B	
Intersection Capacity Utilization 59.5%		ICU Level of Service B	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 8: Kealakehe Pkwy & Ane Keohokalole Hwy



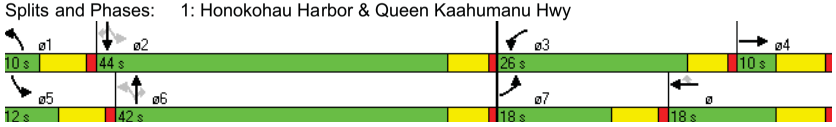
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	15	122	629	35	121	95	1159	244	129	1404	102
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		100	200		200	550		550	300		550
Storage Lanes	1		0	2		1	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1736	1611	0	3433	1863	1553	1770	3471	1583	1719	3438	1538
Flt Permitted	0.950			0.950			0.111			0.105		
Satd. Flow (perm)	1736	1611	0	3433	1863	1553	207	3471	1583	190	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		88				121			244			132
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			900	
Travel Time (s)		22.7			22.7			22.7			20.5	
Peak Hour Factor	0.82	0.92	0.88	0.77	0.43	1.00	0.72	0.93	1.00	0.88	0.92	0.77
Heavy Vehicles (%)	4%	2%	2%	2%	2%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	104	155	0	817	81	121	132	1246	244	147	1526	132
Turn Type	Prot			Prot		Perm	pm+pt		Perm	pm+pt		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8	6		6	2		2
Detector Phase	7	4		3	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	18.0	10.0	0.0	26.0	18.0	18.0	10.0	42.0	42.0	12.0	44.0	44.0
Total Split (%)	20.0%	11.1%	0.0%	28.9%	20.0%	20.0%	11.1%	46.7%	46.7%	13.3%	48.9%	48.9%
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	None	None	None	None	None	None
Act Effct Green (s)	10.0	4.0		20.0	16.5	16.5	40.0	36.0	36.0	44.0	38.0	38.0
Actuated g/C Ratio	0.11	0.04		0.22	0.18	0.18	0.44	0.40	0.40	0.49	0.42	0.42
v/c Ratio	0.54	0.99		1.07	0.24	0.32	0.82	0.90	0.31	0.75	1.05	0.18
Control Delay	47.8	93.9		88.3	36.8	9.6	53.0	35.5	3.6	39.7	65.3	3.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.8	93.9		88.3	36.8	9.6	53.0	35.5	3.6	39.7	65.3	3.7
LOS	D	F		F	D	A	D	D	A	D	E	A
Approach Delay		75.4			74.9			32.1			58.7	
Approach LOS		E			E			C			E	
Queue Length 50th (ft)	56	39		~268	42	0	36	341	0	40	~503	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	96	#164		#293	39	48	#62	#476	44	#122	#637	21
Internal Link Dist (ft)		920			920			920			820	
Turn Bay Length (ft)	100			200		200	550		550	300		550
Base Capacity (vph)	231	156		763	341	383	161	1388	780	195	1452	726
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.99		1.07	0.24	0.32	0.82	0.90	0.31	0.75	1.05	0.18

Intersection Summary	
Area Type:	Other
Cycle Length: 90	
Actuated Cycle Length: 90	
Natural Cycle: 90	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.07	
Intersection Signal Delay: 54.0	Intersection LOS: D
Intersection Capacity Utilization 90.3%	ICU Level of Service E
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Honokohau Harbor & Queen Kaahumanu Hwy



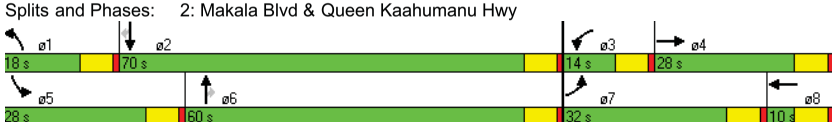
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	637	213	164	164	88	90	326	801	50	179	1397	497
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	2		0	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3367	3327	0	3433	3246	0	3433	3471	1583	1719	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3367	3327	0	3433	3246	0	3433	3471	1583	1719	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		106			90				51			585
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.93	0.78	0.90	1.00	0.96	1.00	1.00	0.99	0.98	1.00	0.81	0.85
Heavy Vehicles (%)	4%	2%	2%	2%	2%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	685	455	0	164	182	0	326	809	51	179	1725	585
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases									6			2
Detector Phase	7	4		3	8		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0		10.0	10.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	32.0	28.0	0.0	14.0	10.0	0.0	18.0	60.0	60.0	28.0	70.0	70.0
Total Split (%)	24.6%	21.5%	0.0%	10.8%	7.7%	0.0%	13.8%	46.2%	46.2%	21.5%	53.8%	53.8%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	None	None	None	None	None
Act Effct Green (s)	26.0	22.0		8.0	4.0		12.0	58.0	58.0	18.0	64.0	64.0
Actuated g/C Ratio	0.20	0.17		0.06	0.03		0.09	0.45	0.45	0.14	0.49	0.49
v/c Ratio	1.02	0.70		0.78	0.97		1.03	0.52	0.07	0.75	1.02	0.56
Control Delay	90.3	45.1		84.2	90.6		115.2	28.2	6.2	72.7	59.7	3.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	90.3	45.1		84.2	90.6		115.2	28.2	6.2	72.7	59.7	3.6
LOS	F	D		F	F		F	C	A	E	E	A
Approach Delay		72.3			87.6			51.1			47.5	
Approach LOS		E			F			D			D	
Queue Length 50th (ft)	~314	148		71	41		~151	257	0	146	~809	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#437	169		#128	#121		#248	334	26	223	727	40
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	673	651		211	187		317	1548	734	291	1693	1054
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.02	0.70		0.78	0.97		1.03	0.52	0.07	0.62	1.02	0.56

Intersection Summary	
Area Type:	Other
Cycle Length: 130	
Actuated Cycle Length: 130	
Natural Cycle: 130	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.03	
Intersection Signal Delay: 56.5	Intersection LOS: E
Intersection Capacity Utilization 91.4%	ICU Level of Service F
Analysis Period (min) 15	

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 2: Makala Blvd & Queen Kaahumanu Hwy



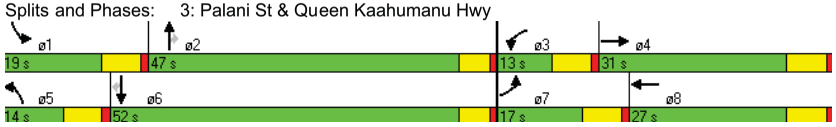
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	364	426	245	66	419	102	262	726	20	241	1281	638
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		200	200		0	400		400	400		400
Storage Lanes	2		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3367	3334	0	1641	3221	0	3433	3471	1583	3335	3438	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3367	3334	0	1641	3221	0	3433	3471	1583	3335	3438	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		117			24				25			237
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	1.00	0.91	1.00	0.89	0.89	1.00	0.91	0.80	1.00	0.85	1.00
Heavy Vehicles (%)	4%	2%	2%	10%	10%	4%	2%	4%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	364	695	0	66	586	0	262	798	25	241	1507	638
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	27.0		10.0	27.0		10.0	27.0	27.0	10.0	27.0	27.0
Total Split (s)	17.0	31.0	0.0	13.0	27.0	0.0	14.0	47.0	47.0	19.0	52.0	52.0
Total Split (%)	15.5%	28.2%	0.0%	11.8%	24.5%	0.0%	12.7%	42.7%	42.7%	17.3%	47.3%	47.3%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	11.0	27.4		6.8	20.8		8.0	42.0	42.0	12.0	46.0	46.0
Actuated g/C Ratio	0.10	0.25		0.06	0.19		0.07	0.38	0.38	0.11	0.42	0.42
v/c Ratio	1.08	0.76		0.65	0.93		1.05	0.60	0.04	0.66	1.05	0.82
Control Delay	118.5	38.4		79.1	65.0		119.3	29.8	8.5	56.0	68.8	27.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	118.5	38.4		79.1	65.0		119.3	29.8	8.5	56.0	68.8	27.2
LOS	F	D		E	E		F	C	A	E	E	C
Approach Delay		65.9			66.4			50.9			56.4	
Approach LOS		E			E			D			E	
Queue Length 50th (ft)	~148	207		46	207		~104	238	0	84	~611	260

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#244	#280		#112	#308		#188	304	15	126	#676	#446
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	338	920		104	635		250	1327	621	395	1441	782
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.08	0.76		0.63	0.92		1.05	0.60	0.04	0.61	1.05	0.82

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 109.8
Natural Cycle: 110
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.08
Intersection Signal Delay: 58.4 Intersection LOS: E
Intersection Capacity Utilization 88.1% ICU Level of Service E
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Palani St & Queen Kaahumanu Hwy

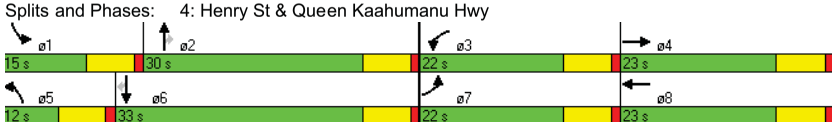


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	87	458	109	564	455	284	170	636	527	299	1081	212
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	200		0	330		350	370		400
Storage Lanes	1		0	2		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3451	0	3433	3348	0	3433	3539	1583	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3451	0	3433	3348	0	3433	3539	1583	3433	3539	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		23			106				460			272
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	0.76	0.84	1.00	0.97	0.90	1.00	0.73	1.00	0.81	1.00	1.00	0.78
Shared Lane Traffic (%)												
Lane Group Flow (vph)	114	654	0	581	790	0	233	636	651	299	1081	272
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	23.0	0.0	22.0	23.0	0.0	12.0	30.0	30.0	15.0	33.0	33.0
Total Split (%)	24.4%	25.6%	0.0%	24.4%	25.6%	0.0%	13.3%	33.3%	33.3%	16.7%	36.7%	36.7%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	11.1	17.0		16.0	24.5		6.0	24.0	24.0	9.0	27.0	27.0
Actuated g/C Ratio	0.12	0.19		0.18	0.27		0.07	0.27	0.27	0.10	0.30	0.30
v/c Ratio	0.52	0.97		0.95	0.80		1.02	0.67	0.86	0.87	1.02	0.41
Control Delay	44.9	65.5		64.5	36.0		107.9	33.7	22.2	66.2	64.7	5.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.9	65.5		64.5	36.0		107.9	33.7	22.2	66.2	64.7	5.2
LOS	D	E		E	D		F	C	C	E	E	A
Approach Delay		62.5			48.1			40.1			55.2	
Approach LOS		E			D			D			E	
Queue Length 50th (ft)	62	190		170	200		~71	170	103	88	~332	0
Queue Length 95th (ft)	90	#270		#273	#354		#105	229	186	#159	#472	31

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	150			200			330		350	370		400
Base Capacity (vph)	315	671		610	988		229	944	759	343	1062	665
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.97		0.95	0.80		1.02	0.67	0.86	0.87	1.02	0.41

Intersection Summary			
Area Type:	Other		
Cycle Length: 90			
Actuated Cycle Length: 90			
Natural Cycle: 90			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.02			
Intersection Signal Delay: 50.1		Intersection LOS: D	
Intersection Capacity Utilization 87.0%		ICU Level of Service E	
Analysis Period (min) 15			
~ Volume exceeds capacity, queue is theoretically infinite.			
Queue shown is maximum after two cycles.			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 4: Henry St & Queen Kaahumanu Hwy



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	628	131	490	548	5	89	97	561	37	57	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	250		0	200		0	311		200
Storage Lanes	1		1	2		0	0		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	1827	1583	2993	1624	0	0	3083	0	1770	3291	0
Flt Permitted	0.950			0.950				0.890		0.177		
Satd. Flow (perm)	1770	1827	1583	2993	1624	0	0	2760	0	330	3291	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			131		1			313			54	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			3376	
Travel Time (s)		22.7			22.7			22.7			76.7	
Peak Hour Factor	0.92	0.96	1.00	0.89	1.00	0.92	0.92	0.92	0.97	0.92	0.92	0.92
Heavy Vehicles (%)	2%	4%	2%	17%	17%	2%	2%	2%	4%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	115	654	131	551	553	0	0	780	0	40	116	0
Turn Type	Prot		Perm	Prot			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4				2			6		
Detector Phase	7	4	4	3	8		5	2		1	6	
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	22.0	22.0	10.0	22.0		10.0	22.0		10.0	22.0	
Total Split (s)	15.0	36.0	36.0	21.0	42.0	0.0	10.0	23.0	0.0	10.0	23.0	0.0
Total Split (%)	16.7%	40.0%	40.0%	23.3%	46.7%	0.0%	11.1%	25.6%	0.0%	11.1%	25.6%	0.0%
Yellow Time (s)	5.0	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None	None	None	None		None	Min		None	Min	
Act Effct Green (s)	8.6	30.1	30.1	15.1	36.6			16.6			22.3	22.3
Actuated g/C Ratio	0.10	0.35	0.35	0.18	0.43			0.19			0.26	0.26
v/c Ratio	0.65	1.02	0.20	1.05	0.80			1.04dr			0.26	0.13
Control Delay	56.3	70.4	5.0	88.6	33.1			52.7			27.2	13.7
Queue Delay	0.0	0.0	0.0	0.0	0.0			0.0			0.0	0.0
Total Delay	56.3	70.4	5.0	88.6	33.1			52.7			27.2	13.7
LOS	E	E	A	F	C			D			C	B
Approach Delay		59.1			60.8			52.7			17.2	
Approach LOS		E			E			D			B	
Queue Length 50th (ft)	64	~418	0	~185	279			~152			16	13

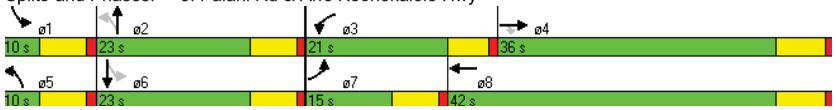
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#138	#626	38	#282	#471			#281		40	33	
Internal Link Dist (ft)		920			920			920			3296	
Turn Bay Length (ft)				250						311		
Base Capacity (vph)	187	643	643	527	695			801		154	916	
Starvation Cap Reductn	0	0	0	0	0			0		0	0	
Spillback Cap Reductn	0	0	0	0	0			0		0	0	
Storage Cap Reductn	0	0	0	0	0			0		0	0	
Reduced v/c Ratio	0.61	1.02	0.20	1.05	0.80			0.97		0.26	0.13	

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 85.5
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 55.8 Intersection LOS: E
Intersection Capacity Utilization 92.8% ICU Level of Service F
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
dr Defacto Right Lane. Recode with 1 though lane as a right lane.

Splits and Phases: 5: Palani Rd & Ane Keohokalole Hwy

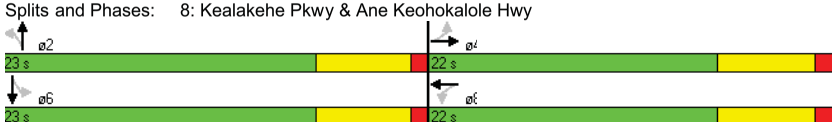


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	54	159	170	111	87	14	193	5	180	28	5	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	340		0	480		0	300		0	430		0
Storage Lanes	1		0	1		0	1		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3263	0	1770	1829	0	1770	1591	0	1770	1593	0
Flt Permitted	0.677			0.553			0.669			0.632		
Satd. Flow (perm)	1261	3263	0	1030	1829	0	1246	1591	0	1177	1593	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		170			15			196			132	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			800			1000	
Travel Time (s)		22.7			22.7			18.2			22.7	
Peak Hour Factor	0.92	1.00	1.00	0.92	0.79	0.92	0.89	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)												
Lane Group Flow (vph)	59	329	0	121	125	0	217	201	0	30	137	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			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)	22.0	22.0		22.0	22.0		22.0	22.0		22.0	22.0	
Total Split (s)	22.0	22.0	0.0	22.0	22.0	0.0	23.0	23.0	0.0	23.0	23.0	0.0
Total Split (%)	48.9%	48.9%	0.0%	48.9%	48.9%	0.0%	51.1%	51.1%	0.0%	51.1%	51.1%	0.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag												
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Act Effct Green (s)	9.6	9.6		9.6	9.6		12.9	12.9		12.9	12.9	
Actuated g/C Ratio	0.28	0.28		0.28	0.28		0.37	0.37		0.37	0.37	
v/c Ratio	0.17	0.32		0.43	0.24		0.47	0.28		0.07	0.20	
Control Delay	10.8	5.9		15.5	10.0		13.4	3.3		8.8	3.4	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	10.8	5.9		15.5	10.0		13.4	3.3		8.8	3.4	
LOS	B	A		B	A		B	A		A	A	
Approach Delay		6.6			12.7			8.5			4.4	
Approach LOS		A			B			A			A	
Queue Length 50th (ft)	7	10		16	13		28	1		3	1	
Queue Length 95th (ft)	28	34		54	39		86	30		17	25	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			720			920	
Turn Bay Length (ft)	340			480			300			430		
Base Capacity (vph)	597	1634		487	874		626	897		592	867	
Starvation Cap Reductn	0	0		0	0		0	0		0	0	
Spillback Cap Reductn	0	0		0	0		0	0		0	0	
Storage Cap Reductn	0	0		0	0		0	0		0	0	
Reduced v/c Ratio	0.10	0.20		0.25	0.14		0.35	0.22		0.05	0.16	

Intersection Summary			
Area Type:	Other		
Cycle Length: 45			
Actuated Cycle Length: 34.8			
Natural Cycle: 45			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.47			
Intersection Signal Delay: 8.2		Intersection LOS: A	
Intersection Capacity Utilization 54.4%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 8: Kealakehe Pkwy & Ane Keohokalole Hwy



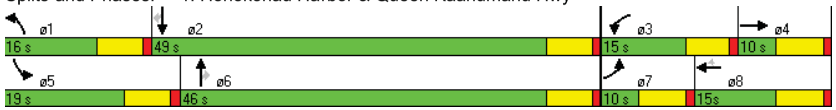
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	38	14	51	309	24	178	95	1258	593	166	927	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		100	200		200	550		550	300		550
Storage Lanes	1		0	2		1	1		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1719	1654	0	3433	1863	1538	1770	4940	1583	1719	4940	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1719	1654	0	3433	1863	1538	1770	4940	1583	1719	4940	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		56				178			464			66
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			900	
Travel Time (s)		22.7			22.7			22.7			20.5	
Peak Hour Factor	1.00	0.75	0.91	0.93	1.00	1.00	1.00	0.96	0.70	0.75	0.81	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	38	75	0	332	24	178	95	1310	847	221	1144	66
Turn Type	Prot			Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases						8			6			2
Detector Phase	7	4		3	8	8	1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total Split (s)	10.0	10.0	0.0	15.0	15.0	15.0	16.0	46.0	46.0	19.0	49.0	49.0
Total Split (%)	11.1%	11.1%	0.0%	16.7%	16.7%	16.7%	17.8%	51.1%	51.1%	21.1%	54.4%	54.4%
Yellow Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0	1.0	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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None	None	None	None	None	None	None	None
Act Effct Green (s)	4.0	4.0		9.1	11.0	11.0	8.9	38.3	38.3	12.9	45.3	45.3
Actuated g/C Ratio	0.05	0.05		0.11	0.13	0.13	0.10	0.44	0.44	0.15	0.53	0.53
v/c Ratio	0.47	0.57		0.92	0.10	0.51	0.52	0.60	0.88	0.86	0.44	0.08
Control Delay	62.1	35.7		71.4	37.7	11.9	48.6	19.7	22.4	68.9	14.9	3.8
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.1	35.7		71.4	37.7	11.9	48.6	19.7	22.4	68.9	14.9	3.8
LOS	E	D		E	D	B	D	B	C	E	B	A
Approach Delay		44.6			50.1			21.9			22.7	
Approach LOS		D			D			C			C	
Queue Length 50th (ft)	22	11		98	13	0	52	199	211	125	155	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#64	39		#184	37	60	100	245	174	#189	167	21
Internal Link Dist (ft)		920			920			920			820	
Turn Bay Length (ft)	100			200		200	550		550	300		550
Base Capacity (vph)	80	131		362	238	352	208	2319	989	262	2596	839
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.47	0.57		0.92	0.10	0.51	0.46	0.56	0.86	0.84	0.44	0.08

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 86.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 26.3 Intersection LOS: C
Intersection Capacity Utilization 64.8% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Honokohau Harbor & Queen Kaahumanu Hwy

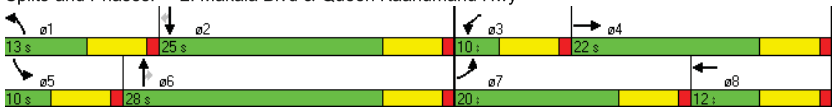


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	530	38	44	18	37	63	161	1313	25	46	865	311
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		0	200		0	400		400	400		400
Storage Lanes	2		0	2		0	2		1	1		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3335	3260	0	3433	3120	0	3433	4940	1583	1719	4940	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3335	3260	0	3433	3120	0	3433	4940	1583	1719	4940	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		44			84				30			311
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	0.94	1.00	0.39	0.91	0.75	0.91	0.87	0.83	1.00	0.99	1.00
Heavy Vehicles (%)	5%	2%	2%	2%	2%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	530	84	0	46	125	0	177	1509	30	46	874	311
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases									6			2
Detector Phase	7	4		3	8		1	6	6	5	2	2
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	22.0		10.0	10.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	20.0	22.0	0.0	10.0	12.0	0.0	13.0	28.0	28.0	10.0	25.0	25.0
Total Split (%)	28.6%	31.4%	0.0%	14.3%	17.1%	0.0%	18.6%	40.0%	40.0%	14.3%	35.7%	35.7%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	None	None	None	None	None
Act Effct Green (s)	13.3	16.6		4.1	5.9		7.0	25.3	25.3	4.1	17.8	17.8
Actuated g/C Ratio	0.20	0.25		0.06	0.09		0.11	0.39	0.39	0.06	0.27	0.27
v/c Ratio	0.78	0.10		0.21	0.35		0.48	0.79	0.05	0.43	0.65	0.48
Control Delay	35.5	12.6		34.1	16.1		34.5	25.0	7.2	45.5	24.4	5.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	35.5	12.6		34.1	16.1		34.5	25.0	7.2	45.5	24.4	5.7
LOS	D	B		C	B		C	C	A	D	C	A
Approach Delay		32.3			21.0			25.7			20.4	
Approach LOS		C			C			C			C	
Queue Length 50th (ft)	112	7		9	8		38	232	0	20	121	0

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#183	23		10	32		67	#314	15	#59	162	54
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	732	938		215	369		376	1910	630	108	1471	676
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.09		0.21	0.34		0.47	0.79	0.05	0.43	0.59	0.46

Intersection Summary	
Area Type:	Other
Cycle Length: 70	
Actuated Cycle Length: 65.4	
Natural Cycle: 70	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.79	
Intersection Signal Delay: 24.8	Intersection LOS: C
Intersection Capacity Utilization 65.5%	ICU Level of Service C
Analysis Period (min) 15	
# 95th percentile volume exceeds capacity, queue may be longer.	
Queue shown is maximum after two cycles.	

Splits and Phases: 2: Makala Blvd & Queen Kaahumanu Hwy

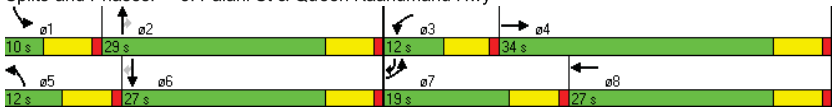


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	390	162	127	32	407	28	128	1114	10	42	657	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	300		200	200		200	400		400	400		400
Storage Lanes	2		0	1		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	3335	3276	0	1543	3075	0	3433	4940	1583	3335	4940	1538
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3335	3276	0	1543	3075	0	3433	4940	1583	3335	4940	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		127			11				15			91
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
Peak Hour Factor	1.00	0.96	1.00	1.00	0.88	0.67	0.97	0.94	0.67	1.00	0.89	0.70
Heavy Vehicles (%)	5%	4%	2%	17%	17%	5%	2%	5%	2%	5%	5%	5%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	390	296	0	32	504	0	132	1185	15	42	738	371
Turn Type	Prot			Prot			Prot		Perm	Prot		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	10.0	27.0		10.0	27.0		10.0	27.0	27.0	10.0	27.0	10.0
Total Split (s)	19.0	34.0	0.0	12.0	27.0	0.0	12.0	29.0	29.0	10.0	27.0	19.0
Total Split (%)	22.4%	40.0%	0.0%	14.1%	31.8%	0.0%	14.1%	34.1%	34.1%	11.8%	31.8%	22.4%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lead
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	None
Act Effct Green (s)	12.4	29.4		6.0	17.5		6.1	23.8	23.8	4.1	20.2	38.8
Actuated g/C Ratio	0.16	0.38		0.08	0.23		0.08	0.31	0.31	0.05	0.26	0.50
v/c Ratio	0.73	0.22		0.27	0.72		0.49	0.78	0.03	0.24	0.57	0.46
Control Delay	41.7	11.5		43.1	34.2		43.5	30.7	11.5	42.0	28.4	12.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.7	11.5		43.1	34.2		43.5	30.7	11.5	42.0	28.4	12.7
LOS	D	B		D	C		D	C	B	D	C	B
Approach Delay		28.6			34.7			31.8			23.8	
Approach LOS		C			C			C			C	
Queue Length 50th (ft)	101	33		16	124		35	214	0	11	124	90

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	#165	62		45	173		64	#301	9	27	165	110
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	300			200			400		400	400		400
Base Capacity (vph)	569	1335		121	855		270	1566	512	175	1361	829
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.69	0.22		0.26	0.59		0.49	0.76	0.03	0.24	0.54	0.45

Intersection Summary			
Area Type:	Other		
Cycle Length: 85			
Actuated Cycle Length: 77.6			
Natural Cycle: 80			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.78			
Intersection Signal Delay: 29.1		Intersection LOS: C	
Intersection Capacity Utilization 68.1%		ICU Level of Service C	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 3: Palani St & Queen Kaahumanu Hwy

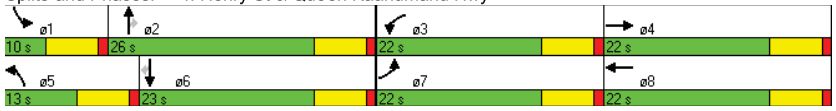


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	311	60	525	431	145	208	1002	542	102	775	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	150		0	200		0	330		350	370		400
Storage Lanes	1		0	2		0	2		1	2		1
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3454	0	3433	3405	0	3433	5085	1583	3433	5085	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3454	0	3433	3405	0	3433	5085	1583	3433	5085	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		25			52				543			149
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			1000	
Travel Time (s)		22.7			22.7			22.7			22.7	
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
Shared Lane Traffic (%)												
Lane Group Flow (vph)	115	403	0	571	626	0	226	1089	589	111	842	149
Turn Type	Prot			Prot			Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			6
Detector Phase	7	4		3	8		5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0		22.0	22.0		10.0	22.0	22.0	10.0	22.0	22.0
Total Split (s)	22.0	22.0	0.0	22.0	22.0	0.0	13.0	26.0	26.0	10.0	23.0	23.0
Total Split (%)	27.5%	27.5%	0.0%	27.5%	27.5%	0.0%	16.3%	32.5%	32.5%	12.5%	28.8%	28.8%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	1.0	1.0		1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min	Min	None	Min	Min
Act Effct Green (s)	10.3	13.4		15.4	21.3		7.0	21.9	21.9	4.0	16.6	16.6
Actuated g/C Ratio	0.13	0.18		0.20	0.28		0.09	0.29	0.29	0.05	0.22	0.22
v/c Ratio	0.49	0.65		0.83	0.64		0.72	0.75	0.70	0.62	0.76	0.32
Control Delay	37.8	32.8		41.4	27.7		49.1	30.4	8.9	52.9	33.8	7.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	37.8	32.8		41.4	27.7		49.1	30.4	8.9	52.9	33.8	7.2
LOS	D	C		D	C		D	C	A	D	C	A
Approach Delay		33.9			34.2			26.0			32.1	
Approach LOS		C			C			C			C	
Queue Length 50th (ft)	52	90		136	133		56	182	17	27	140	0
Queue Length 95th (ft)	99	135		#222	#221		#110	#260	123	#64	191	45

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Internal Link Dist (ft)		920			920			920			920	
Turn Bay Length (ft)	150			200			330		350	370		400
Base Capacity (vph)	372	745		721	984		315	1453	840	180	1134	469
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.54		0.79	0.64		0.72	0.75	0.70	0.62	0.74	0.32

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 76.5			
Natural Cycle: 80			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 0.83			
Intersection Signal Delay: 30.4		Intersection LOS: C	
Intersection Capacity Utilization 68.2%		ICU Level of Service C	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 4: Henry St & Queen Kaahumanu Hwy



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	202	60	874	539	5	55	39	536	5	83	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	250		0	200		0	200		200
Storage Lanes	1		0	2		0	1		0	1		0
Taper Length (ft)	100		100	100		100	100		100	100		100
Satd. Flow (prot)	1770	3359	0	2993	1624	0	1770	2989	0	1770	3295	0
Flt Permitted	0.950			0.950			0.567			0.374		
Satd. Flow (perm)	1770	3359	0	2993	1624	0	1056	2989	0	697	3295	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		43			1			558			76	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1000			1000			3500	
Travel Time (s)		22.7			22.7			22.7			79.5	
Peak Hour Factor	0.92	0.98	0.90	0.94	0.81	0.92	1.00	0.92	0.96	0.92	0.92	0.92
Heavy Vehicles (%)	2%	4%	2%	17%	17%	2%	2%	2%	4%	2%	2%	2%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	23	273	0	930	670	0	55	600	0	5	166	0
Turn Type	Prot			Prot			pm+pt			pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases							2			6		
Detector Phase	7	4		3	8		5	2		1	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)	10.0	10.0		10.0	22.0		10.0	22.0		10.0	22.0	
Total Split (s)	10.0	13.0	0.0	35.0	38.0	0.0	10.0	22.0	0.0	10.0	22.0	0.0
Total Split (%)	12.5%	16.3%	0.0%	43.8%	47.5%	0.0%	12.5%	27.5%	0.0%	12.5%	27.5%	0.0%
Yellow Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
All-Red Time (s)	1.0	1.0		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	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?												
Recall Mode	None	None		None	None		None	Min		None	Min	
Act Effct Green (s)	4.2	8.1		24.3	35.1		12.8	12.2		10.6	8.5	
Actuated g/C Ratio	0.06	0.12		0.38	0.54		0.20	0.19		0.16	0.13	
v/c Ratio	0.20	0.60		0.83	0.76		0.22	0.59		0.03	0.33	
Control Delay	38.8	33.0		27.2	24.1		22.2	6.3		19.8	18.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	38.8	33.0		27.2	24.1		22.2	6.3		19.8	18.0	
LOS	D	C		C	C		C	A		B	B	
Approach Delay		33.4			25.9			7.6			18.0	
Approach LOS		C			C			A			B	
Queue Length 50th (ft)	10	51		175	185		18	7		2	19	