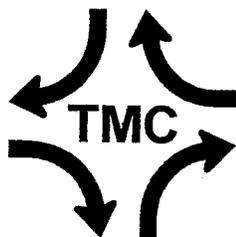


**APPENDIX B – TRAFFIC IMPACT ANALYSIS REPORT**

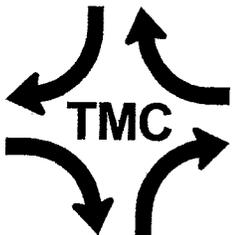
TRAFFIC ACCESS ANALYSIS REPORT  
FOR THE PROPOSED  
**MAKU`U MASTER PLAN - PHASE 1**  
PUNA, HAWAII  
TAX MAP KEY: (3) 1-5-10: 41

PREPARED FOR  
**BRIAN NISHIMURA, PLANNING CONSULTANT**  
NOVEMBER 29, 2010



PREPARED BY  
**THE TRAFFIC MANAGEMENT CONSULTANT**

TRAFFIC ACCESS ANALYSIS REPORT  
FOR THE PROPOSED  
**MAKU`U MASTER PLAN - PHASE 1**  
PUNA, HAWAII  
TAX MAP KEY: (3) 1-5-10: 41



**THE TRAFFIC MANAGEMENT CONSULTANT**  
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**TRAFFIC ACCESS ANALYSIS REPORT  
FOR THE PROPOSED  
MAKU`U MASTER PLAN - PHASE 1  
PUNA, HAWAII  
TAX MAP KEY: (3) 1-5-10: 41**

**I. Introduction**

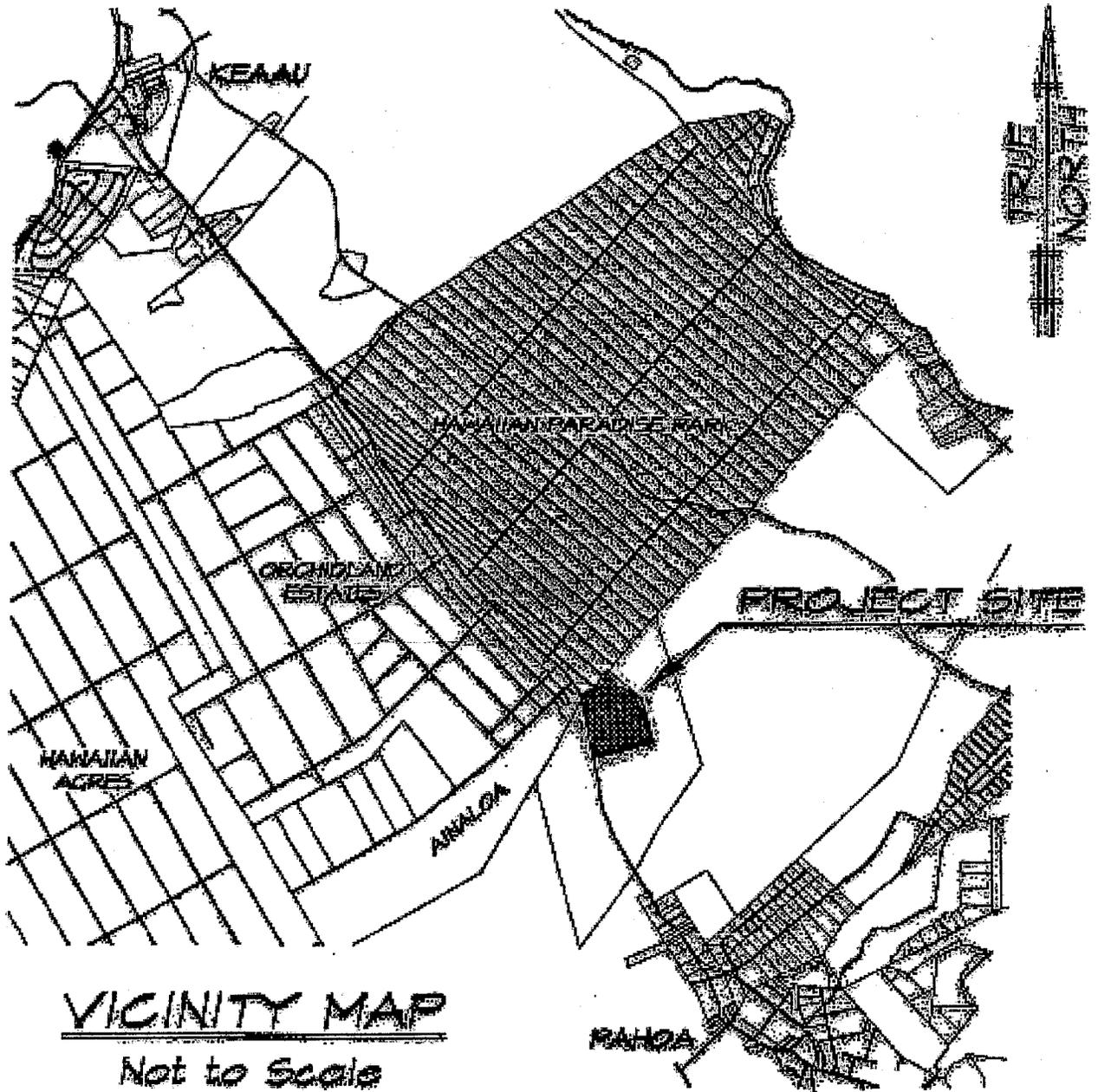
**A. Project Description**

The Maku`u Farmer's Association (MFA) has obtained management control of approximately 38 acres of land to construct and operate a cultural/community learning center, and other related uses, through a license agreement with the Department of Hawaiian Home Lands (DHHL). The License Agreement authorizes the MFA to construct and operate uses to service the Hawaiian homestead communities in East Hawaii. The property is located in Maku`u, Puna, Island of Hawaii and identified as Tax Map Key: (3) 1-5-10: 41. The subject property is situated on the makai (north) side of the Kea`au – Pahoa Road (State Highway 13), approximately three miles north of Pahoa town.

The MFA is currently utilizing approximately 9 acres of the property for a Farmer's market and cultural learning center. Plans for a Maku`u Farmer's Association Community Center were included in the DHHL Maku`u Regional Plan, which was completed in 2008. The initial focus of the MFA is to continue to operate the Farmer's Market and develop a Community Center facility to provide a gathering place, which enhances community identity, reflects and preserves Hawaiian culture and values, while promoting small business enterprises.

The Maku`u Regional Plan includes longer range objectives by expanding the uses to include kūpuna housing, a social agency center, a retail/commercial space, a comprehensive health center, a child care center, a visitor center with overnight quarters and park space. A preliminary site plan has been developed, which lays out the various uses on a conceptual basis.

This Traffic Access Analysis Report analyzes only the first 9 acres, immediately adjacent to the Kea`au-Pahoa Road, which includes the existing Farmer's Market and Māla (garden area), and the proposed community center. The traffic impacts of the long-range objectives will be evaluated in the future when specific plans are developed for implementation. Site access will be provided by an existing channelized intersection on Keaau-Pahoa Road. Figure 1 depicts the vicinity of the project. The proposed site plan is depicted on Figure 2.



VICINITY MAP  
Not to Scale

Figure 1. Vicinity Map

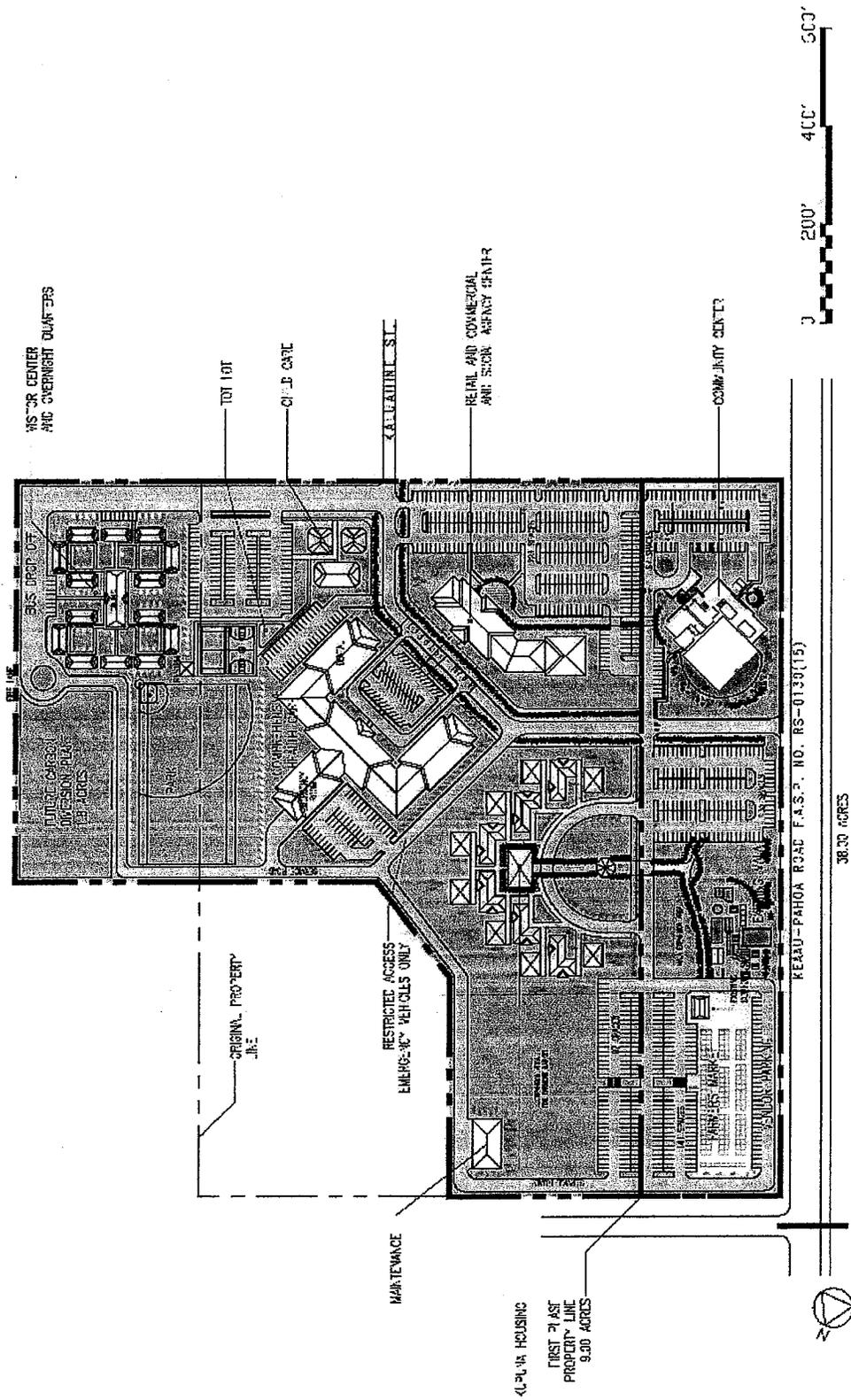
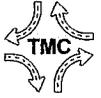


Figure 2. Maku'u Master Plan



## **B. Purpose and Scope of the Study**

The purpose of this study is to analyze the traffic impacts, resulting from the development of the proposed Maku`u Master Plan - Phase 1. This report presents the findings and recommendations of the study. The scope of this study includes:

1. Description of the proposed project.
2. Evaluation of existing roadways and traffic conditions.
3. Development of trip generation characteristics of the proposed project.
4. Analysis of future traffic conditions without the proposed project.
5. Identification and analysis of traffic impacts resulting from the development of the proposed project.
6. Recommendations of improvements, as necessary, that would mitigate the traffic impacts identified in this study.

## **C. 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, 2000. HCM defines Level of Service (LOS) as "a quality measure describing operational conditions within a traffic stream". Several factors may be included in determining LOS, such as: speed, travel time, freedom to maneuver, traffic interruptions, driver comfort, and convenience. LOS's "A", "B", and LOS "C" are considered satisfactory Levels of Service. LOS "D" is generally considered a "minimum acceptable" operating Level of Service. LOS "E" is an undesirable condition, and LOS "F" is an unacceptable condition. The Level of Service for a two-lane highway is based upon the average speed and the "percent time-spent-following" (PTSF). PTSF is a result of vehicle platoons following slow-moving vehicles, combined with limited opportunities for passing vehicles. Intersection LOS is primarily based upon average delay (d), which is expressed in terms of average seconds of delay per vehicle. The capacity analysis worksheets are attached in the Appendix. Table 1 summarizes the LOS criteria.



LOS	Two-Lane Highway		At-Grade Intersections Delay	
	PTSF (%)	Average Speed (mph)	Signalized Control (d)	Unsignalized Control (d)
A	≤ 35	> 55	≤ 10	≤ 10
B	> 35 – 50	> 50 – 55	> 10 – 20	> 10 – 15
C	> 50 – 65	> 45 – 50	> 20 – 35	> 15 – 25
D	> 65 – 80	> 40 – 45	> 35 – 55	> 25 – 35
E	> 80	≤ 40	> 55 – 80	> 35 – 50
F	v/c > 1.00	Varies	> 80	> 50

## 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 recreation community centers, such as the vehicle trips per hour (vph) per 1,000 square feet of gross floor area.

## II. Existing Conditions

### A. Roadways

Keaau-Pahoa Road is the primary arterial highway in the Puna area on the island of Hawaii. Keaau-Pahoa Road is a two-way, two-lane highway, between Keaau and Pahoa. The posted speed on Keaau-Pahoa Road is 45 miles per hour (mph).

The Project Access Driveway is stop-controlled at its Tee-intersection with Keaau-Pahoa Road. Exclusive left-turn and right-turn lanes are provided on Keaau-Pahoa Road at the Project Access Driveway.

Kaohuwalu Street is a two-way, two-lane local roadway. Kaohuwalu Street is stop-controlled at its Tee-intersection with Keaau-Pahoa Road, immediately south of the Project Access Driveway intersection. Exclusive left-turn and right-turn lanes are provided on Keaau-Pahoa Road at Kaohuwalu Street.

### B. Existing Peak Hour Traffic Volumes and Operating Conditions

#### 1. Field Investigation and Data Collection

Manual traffic count surveys were conducted on Keaau-Pahoa Road at Kaohuwalu Street on November 3-4, 2009, during the AM and PM peak periods of weekday traffic – from 6:45 AM to 8:30 AM and from 3:45 PM to 6:00 PM. The



Project Access Driveway was closed during the field investigation. The traffic data are presented in the Appendix.

Weekday (10/19/2010) and Sunday (10/17/2010) traffic data on Keaau-Pahoa Road (Station C2F), south of Waste Station Road, were obtained from DOT. The Sunday peak hour traffic occurred between 12:00 PM and 1:00 PM with Keaau-Pahoa Road carrying 1,588 vehicles per hour (vph) total for both directions. The weekday (AM) peak hour traffic volume was 2,889 vph, i.e. 82 percent higher than the Sunday peak hour of traffic. Therefore, the Sunday peak hour traffic was not included in this analysis.

## **2. Existing AM Peak Hour Traffic**

The AM peak hour of traffic occurred between 7:15 AM and 8:15 AM. Keaau-Pahoa Road carried about 1,270 vehicles per hour (vph), total for both directions. The peak direction of traffic was split between the southbound and northbound directions. Kaohuwalu Street carried a total of about 40 vph at Keaau-Pahoa Road, during the existing AM peak hour of traffic.

Keaau-Pahoa Road operated at LOS "D" with a v/c ratio of 0.44. Kaohuwalu Street operated at LOS "B" at Keaau-Pahoa Road. Figure 3 depicts the existing AM peak hour traffic volumes and the results of the capacity analysis.

## **3. Existing PM Peak Hour Traffic**

The existing PM peak hour of traffic occurred between 4:30 PM and 5:30 PM. Keaau-Pahoa Road carried about 1,220 vph, total for both directions. The peak direction of traffic was southbound with a 60 percent/40 percent split. Kaohuwalu Street carried a total of about 30 vph at Keaau-Pahoa Road, during the existing AM peak hour of traffic.

During the existing PM peak hour of traffic, the intersection of Keaau-Pahoa Road operated at LOS "D" with a v/c ratio of 0.39. Kaohuwalu Street operated at LOS "B" at Keaau-Pahoa Road. The existing PM peak hour traffic volumes and the results of the capacity analysis are depicted on Figure 4.

# **III. Future Traffic Conditions**

## **A. External Traffic**

The ambient growth in traffic was derived from historic traffic data collected by the State Department of Transportation (DOT) on Keaau-Pahoa Road from 1992 through 2007. Linear regression techniques were applied to the DOT data, which indicated that the traffic on Keaau-Pahoa Road grew at an annual rate of about 2.5 percent. A multiplier factor of 1.25 was uniformly applied to the existing peak hour traffic demands to estimate the Year 2019 peak hour traffic demands without the proposed project.

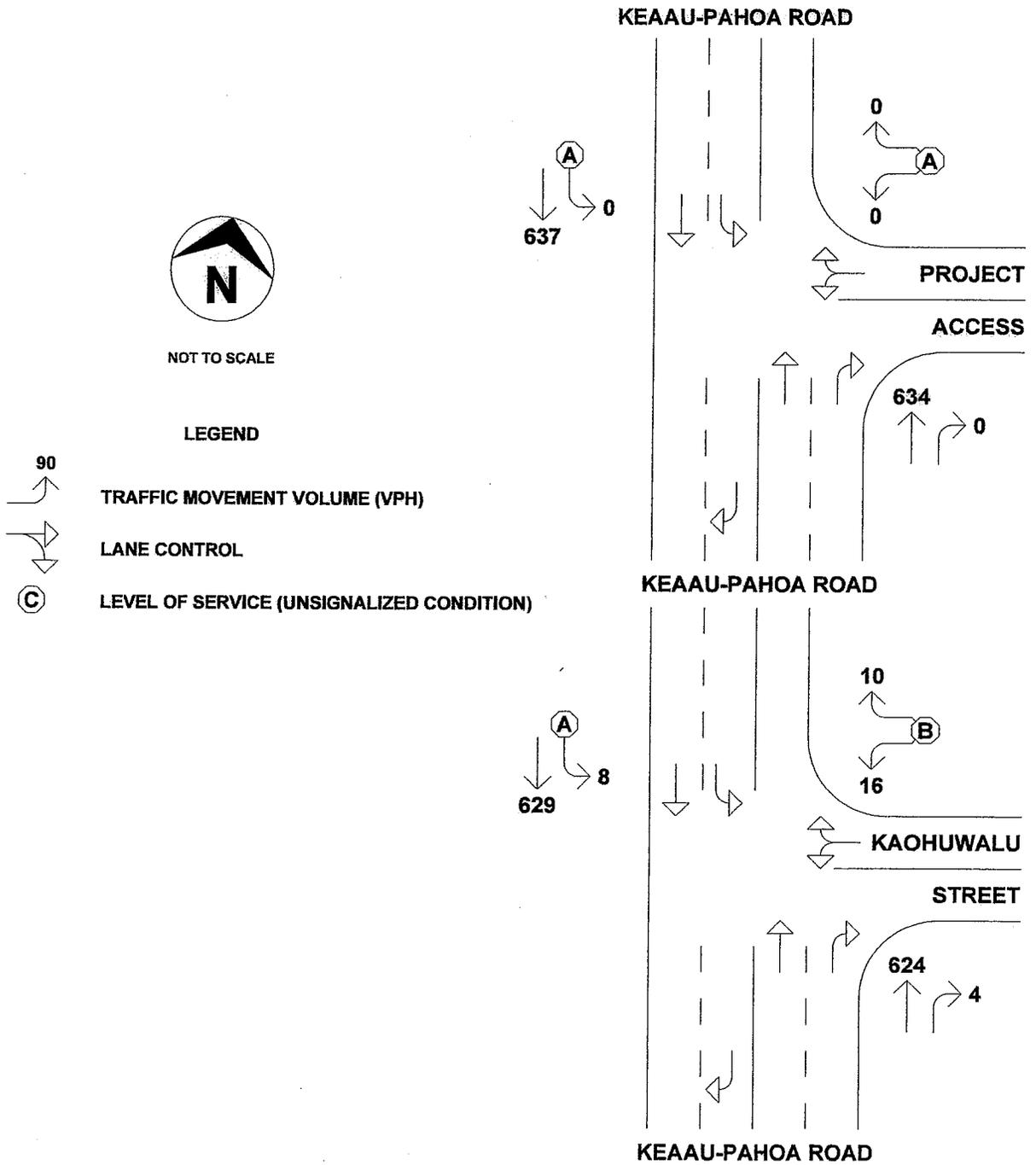
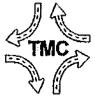


Figure 3. Existing AM Peak Hour Traffic

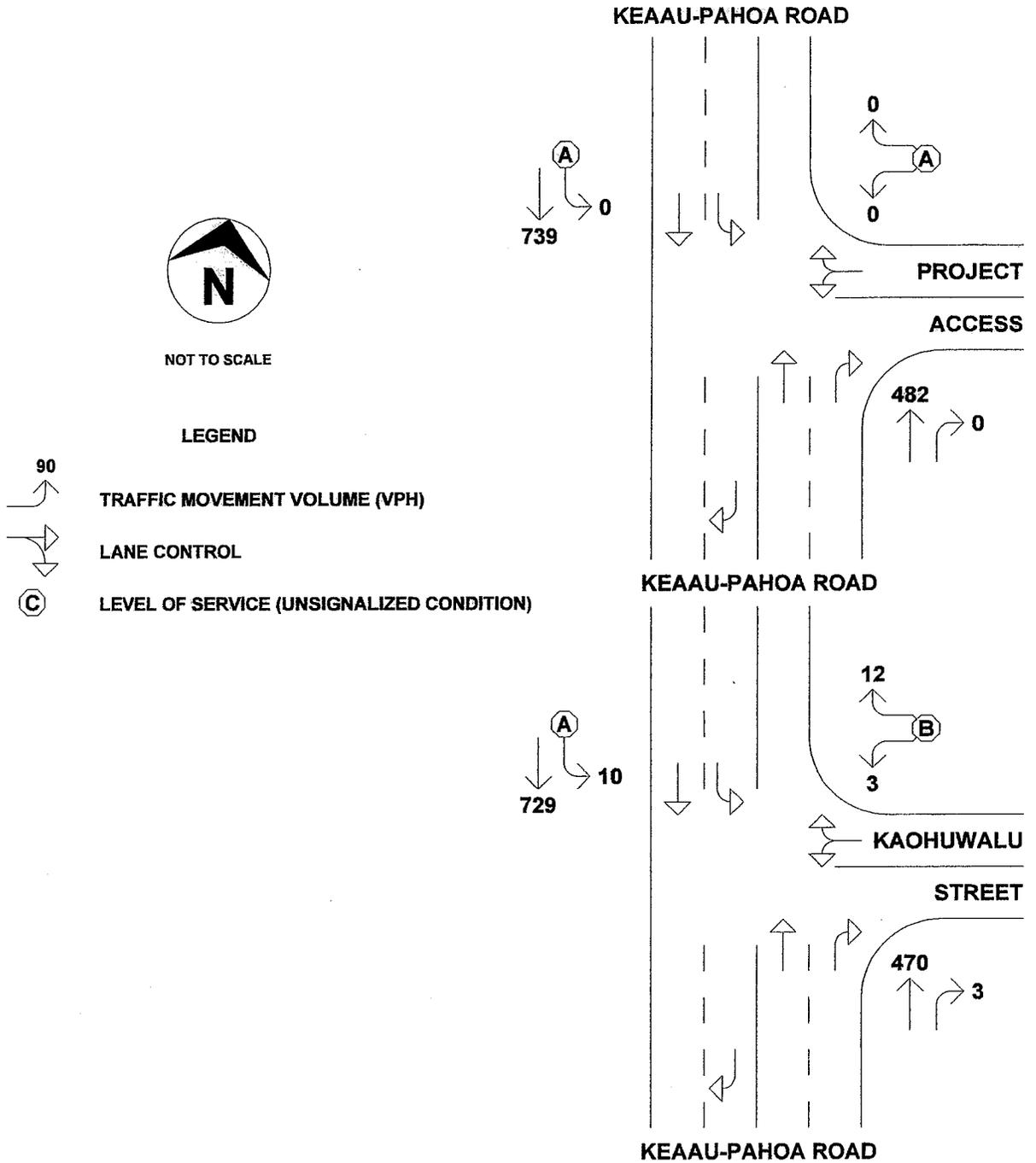


Figure 4. Existing PM Peak Hour Traffic



## **B. AM Peak Hour Traffic Analysis Without Project**

During the AM peak hour of traffic without the proposed project, the Keaau-Pahoa Road is expected to operate at LOS "E" with a v/c ratio of 0.50. Kaohuwalu Street at Keaau-Pahoa Road is expected to operate at LOS "C", during the AM peak hour of traffic without the proposed project. Figure 5 depicts the AM peak hour traffic without the proposed project and the results of the capacity analysis.

## **C. PM Peak Hour Traffic Analysis Without Project**

Keaau-Pahoa Road is expected to operate at LOS "D" with a v/c ratio of 0.48, during the PM peak hour of traffic without the proposed project. During the PM peak hour of traffic without the proposed project, Kaohuwalu Street is expected to operate at LOS "B" at Keaau-Pahoa Road. The PM peak hour traffic without the proposed project and the results of the capacity analysis are depicted on Figure 6.

# **IV. Traffic Access Analysis**

## **A. Site-Generated Traffic**

### **1. Trip Generation Characteristics**

The proposed Maku`u Community Center is expected to generate a total of 25 vph – 15 vph entering the site and 10 vph exiting the site, during the AM peak hour of traffic. During the PM peak hour of traffic, the proposed project is expected to generate 17 vph entering the site and 28 vph exiting the site, for a total of 45 vph. The existing Farmer's Market is not included in this analysis, since it is open only on Sundays, when the peak hour traffic is about one half of the weekday peak hour traffic.

### **2. Trip Distribution**

The trip distribution is based upon existing traffic patterns and the U. S. Census population distribution for the State of Hawaii. The AM and PM peak hour site-generated traffic assignments for the proposed project are depicted on Figures 7 and 8, respectively.

## **B. AM Peak Hour Traffic Access Analysis With Project**

Keaau-Pahoa Road is expected to operate at LOS "E", with a v/c ratio of 0.56, during the AM peak hour of traffic with the proposed project. The Project Access Driveway at Keaau-Pahoa Road is expected to operate at LOS "C". Kaohuwalu Street is expected to operate at LOS "C" at Keaau-Pahoa Road. The AM peak hour traffic with the proposed project and the results of the capacity analysis are depicted on Figure 9.

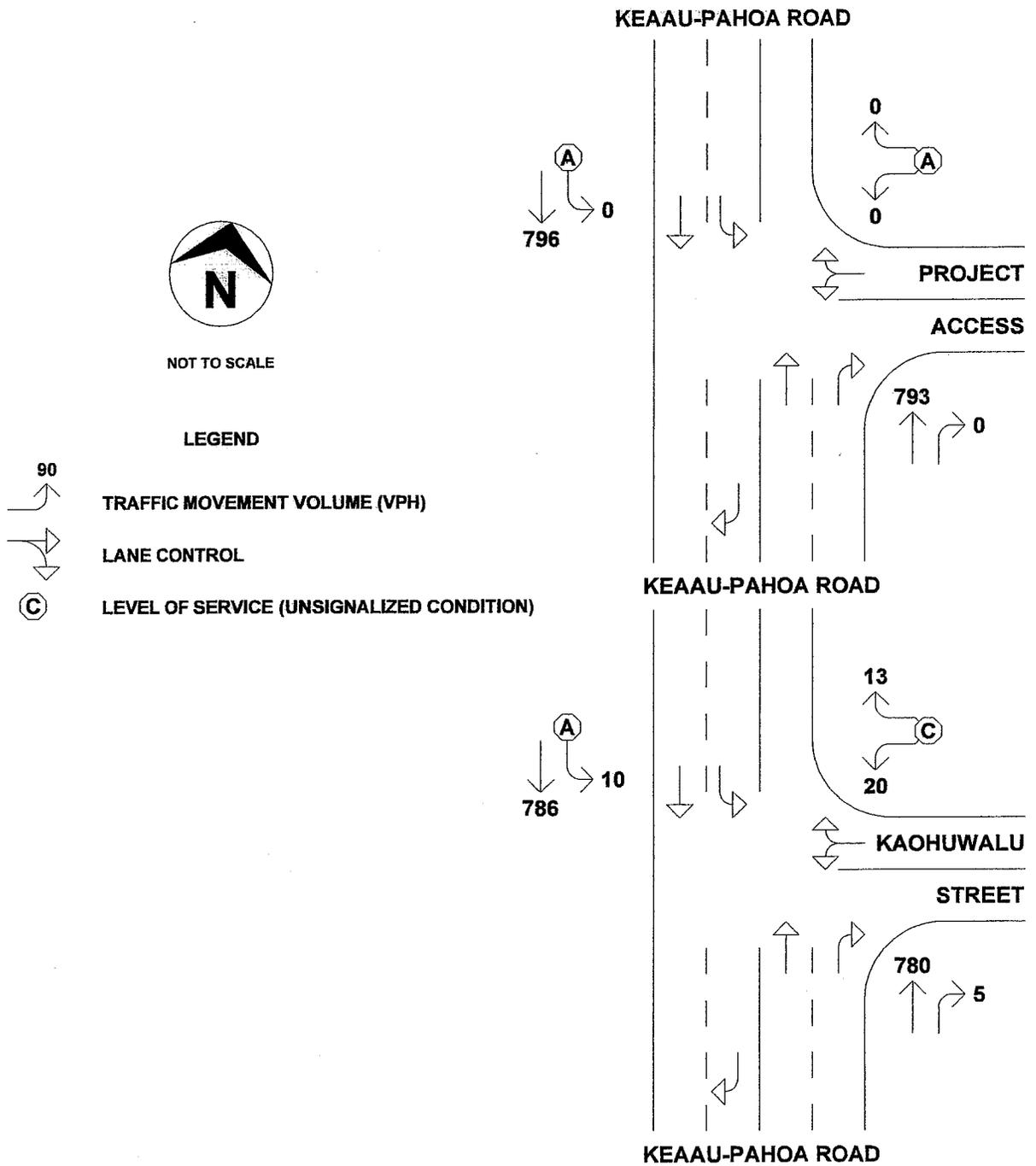


Figure 5. AM Peak Hour Traffic Without Project

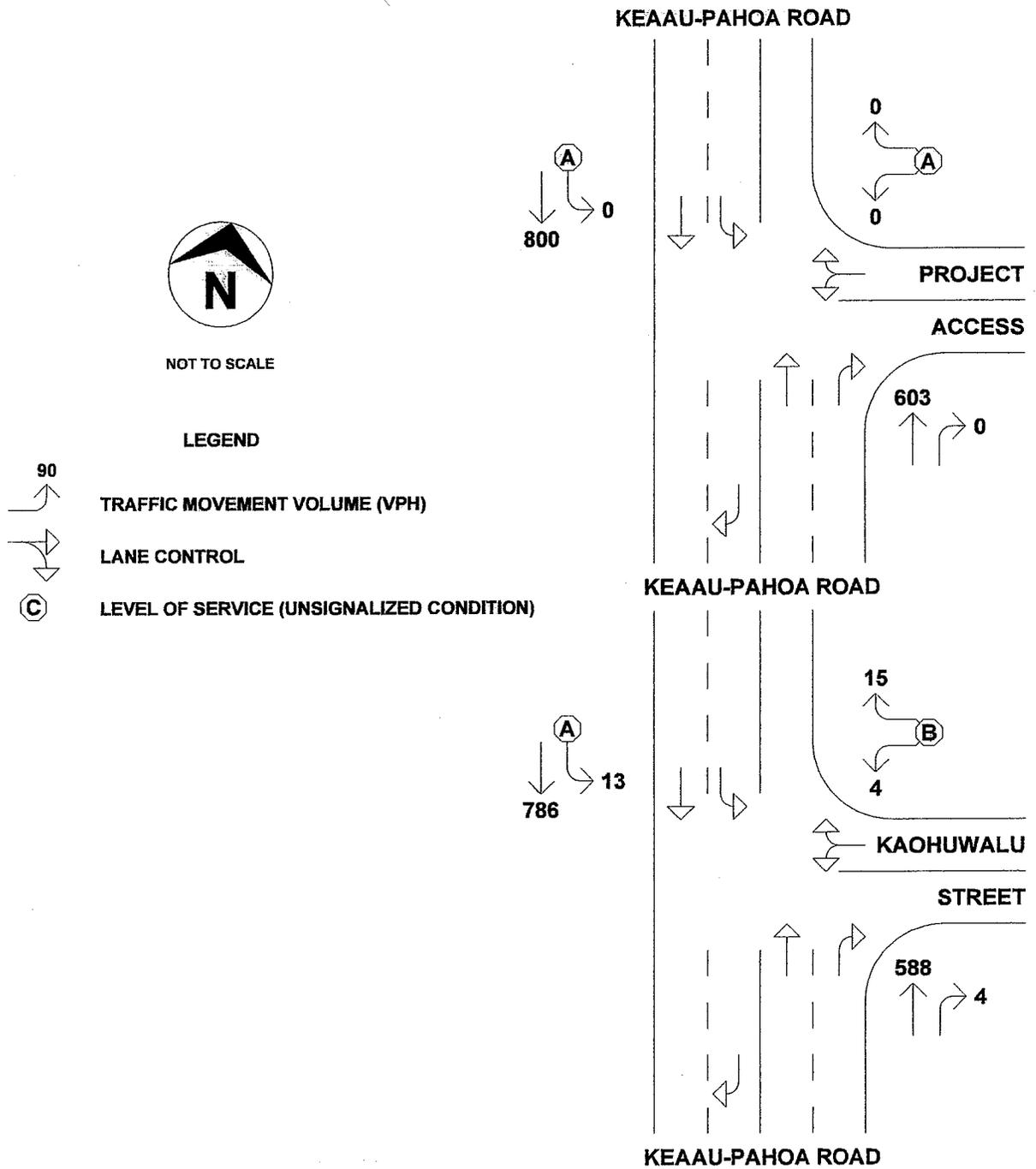


Figure 6. PM Peak Hour Traffic Without Project

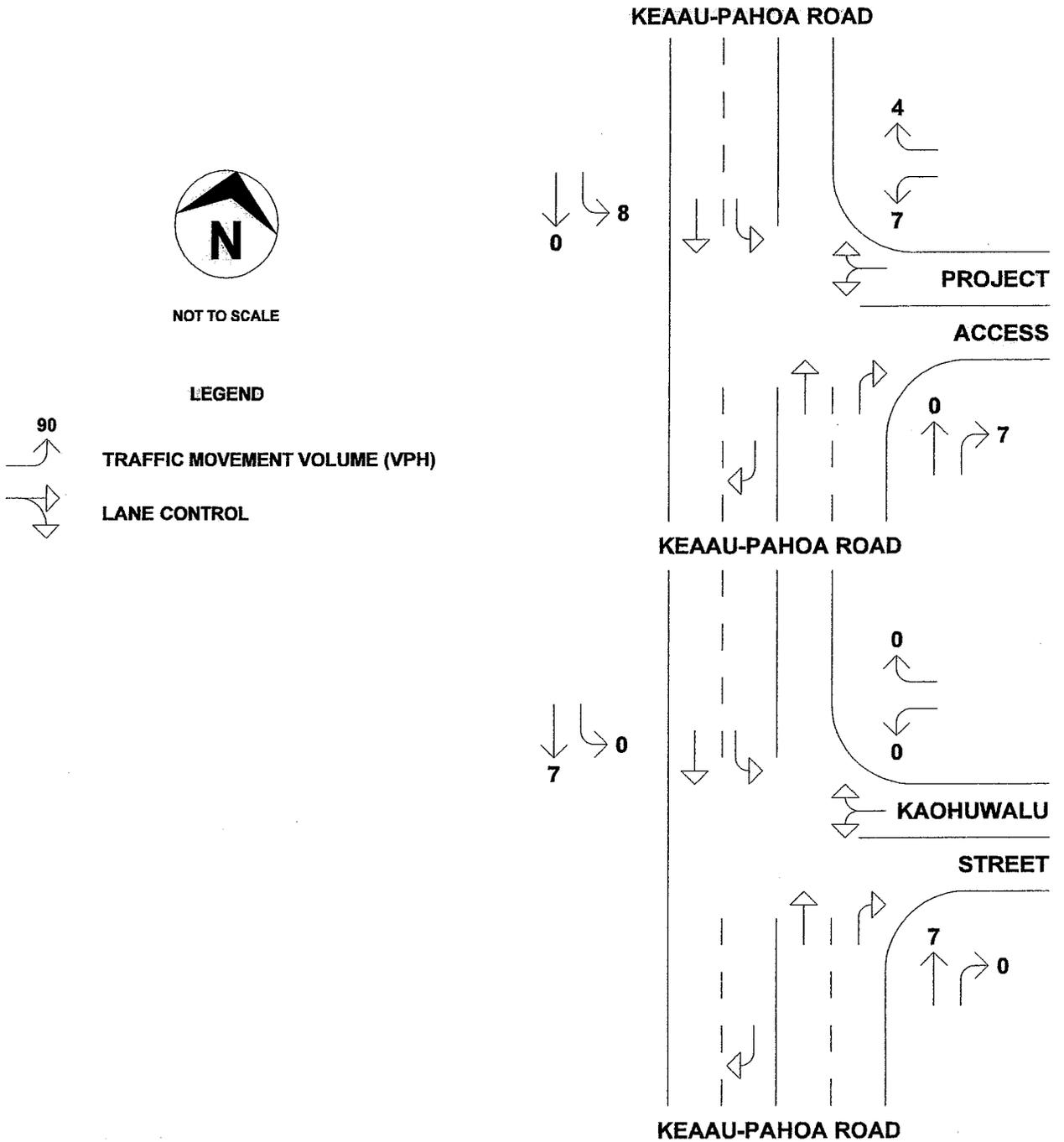


Figure 7. AM Peak Hour Site Traffic Assignment

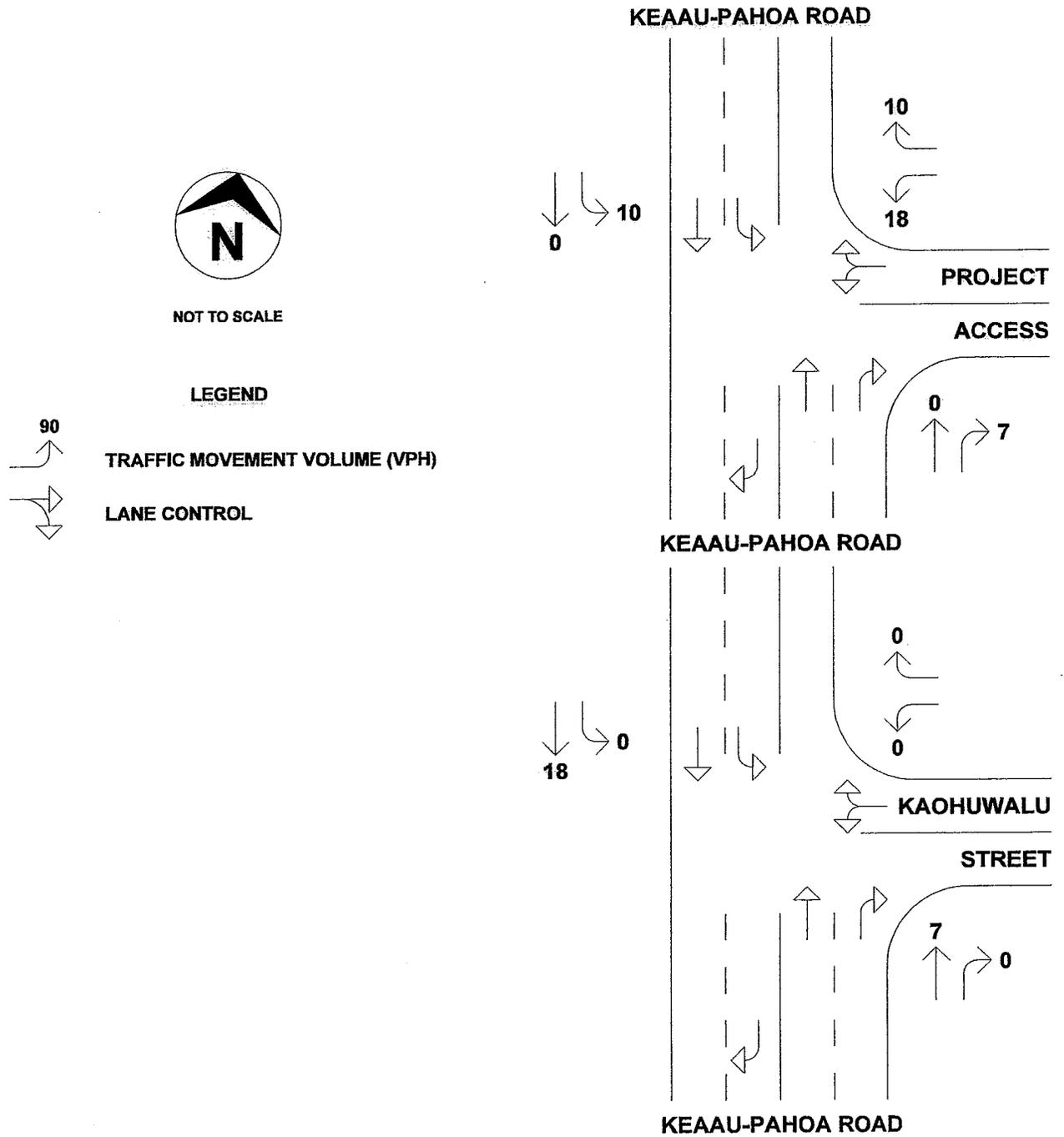


Figure 8. PM Peak Hour Site Traffic Assignment

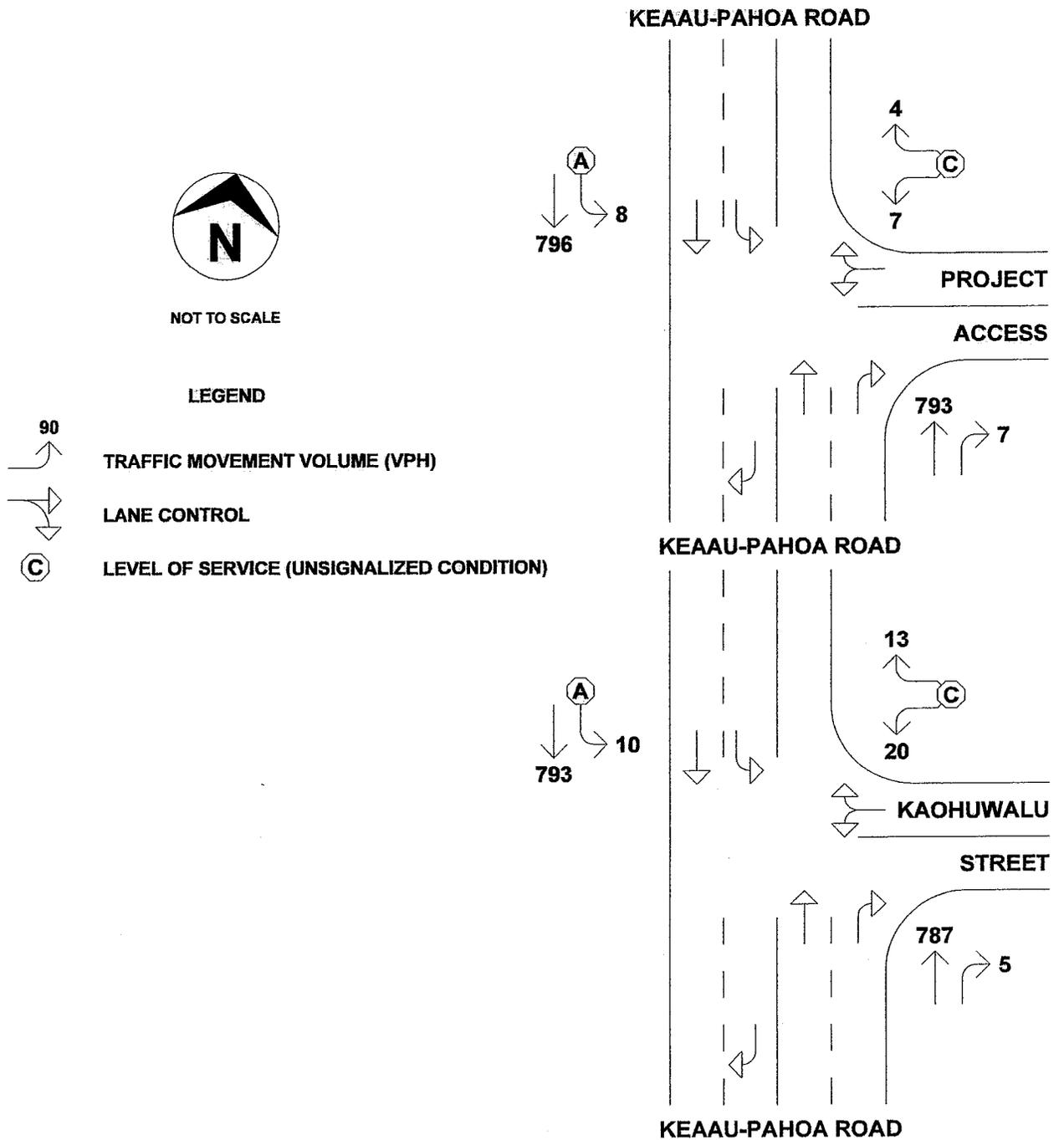


Figure 9. AM Peak Hour Traffic With Project



### **C. PM Peak Hour Traffic Access Analysis With Project**

During the PM peak hour of traffic with the proposed project, Keaau-Pahoa Road is expected to operate at LOS "E" with a v/c ratio of 0.49. The Project Access Driveway is expected to operate at LOS "C" at Keaau-Pahoa Road. Kaohuwalu Street is expected to operate at LOS "C" at Keaau-Pahoa Road, during the PM peak hour with the proposed project. Figure 10 depicts the PM peak hour traffic with the proposed project and the results of the capacity analysis.

## **V. Recommendations and Conclusions**

### **A. Recommendations**

The Project Access Driveway is expected to operate at satisfactory Levels of Service during the AM and PM weekday peak hours of traffic with the proposed project. Traffic improvements at the intersection of Keaau-Pahoa Road and the Project Access Driveway are not recommended at this time.

### **B. Conclusions**

The development of Maku`u Master Plan is expected to begin with the community center. The existing unsignalized access can be expected to support the existing Farmer's Market and the proposed community center. Subsequent development of any other major trip generation components of the Master Plan, such as the health center, retail space, office space, and child care center, will require further analysis on Keaau-Pahoa Road at the Project Access Driveway.

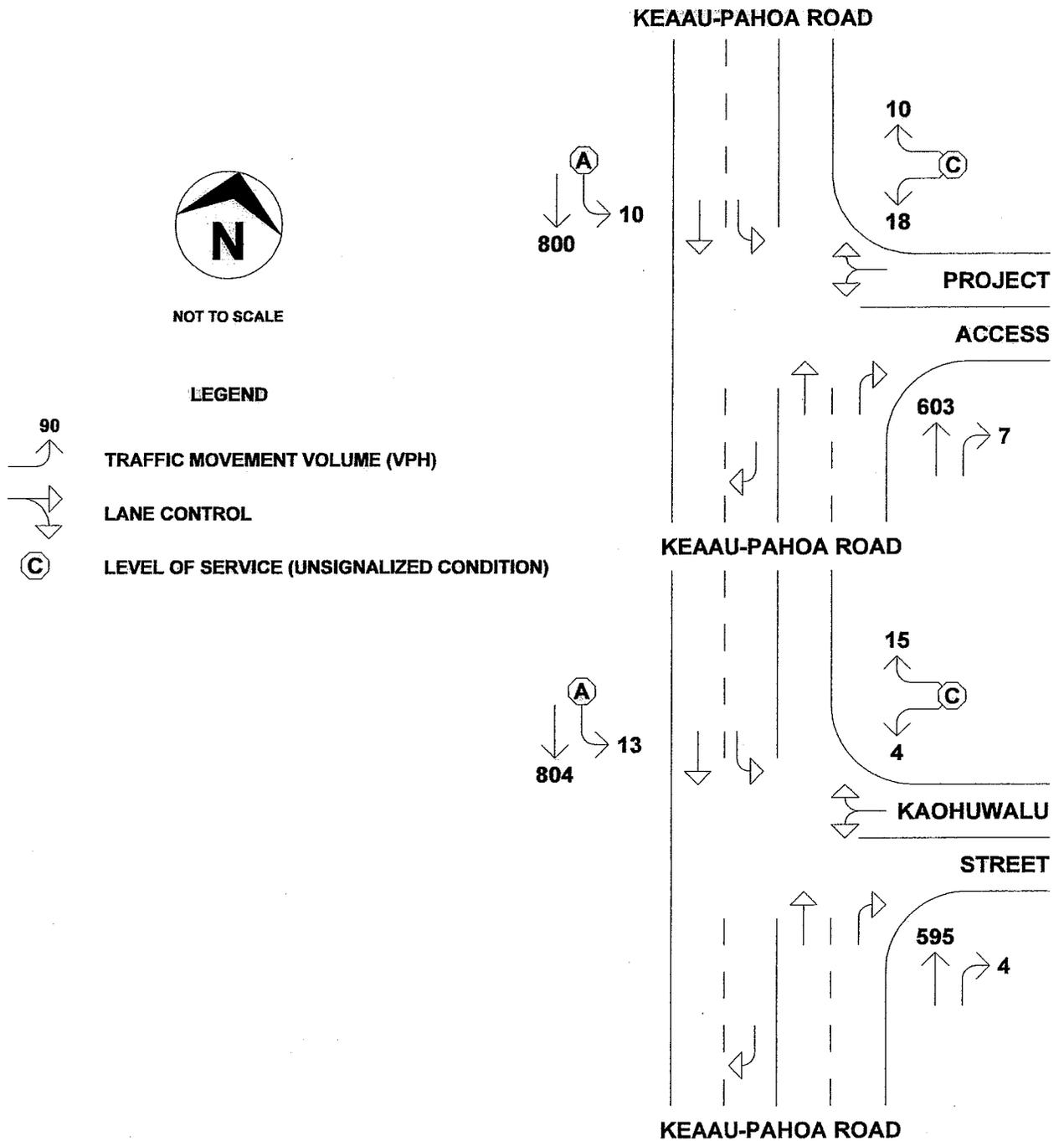


Figure 10. PM Peak Hour Traffic With Project

**TRAFFIC ACCESS ANALYSIS REPORT  
FOR THE PROPOSED  
MAKU`U MASTER PLAN - PHASE 1  
PUNA, HAWAII**

**APPENDIX A  
TRAFFIC COUNT DATA**

**TRAFFIC COUNT DATA**

**FILE NAME: Pahoa Rd**

PROJECT: Aloha Surf Hotel  
 LOCATION: Honolulu, Hawaii  
 E-W STREET: Pahoa Road  
 N-S STREET: Kaohuwalu St

PERIOD: AM Peak  
 NORTH:  
 TECHNICIAN: Video  
 DATE: 11/4/09

TIME	Pahoa Road						Kaohuwalu St						TOTAL	HRLY
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
6:45 7:00	0	88	0	0	124	0	0	0	0	0	0	0	0	212
7:00 7:15	11	92	0	0	176	2	0	0	0	6	0	2	289	
7:15 7:30	6	135	0	0	157	1	0	0	0	9	0	4	312	
7:30 7:45	1	156	0	0	133	1	0	0	0	4	0	3	298 1111	
7:45 8:00	1	178	0	0	173	0	0	0	0	1	0	2	355 1254	
8:00 8:15	0	160	0	0	161	2	0	0	0	2	0	1	326 1291	
8:15 8:30	11	114	0	0	178	3	0	0	0	6	0	0	312 1291	

**AM PEAK HOUR**

7:15 8:15	8	629	0	0	624	4	0	0	0	16	0	10	1291 1291
PHF	2.00	0.88	N/A	N/A	0.90	N/A	N/A	N/A	N/A	4.00	N/A	1.25	0.91 PHF

**TRAFFIC COUNT DATA**

**FILE NAME: Pahoa Rd**

PROJECT: Aloha Surf Hotel  
 LOCATION: Honolulu, Hawaii  
 E-W STREET: Pahoa Road  
 N-S STREET: Kaohuwalu St

PERIOD: PM Peak  
 NORTH:  
 TECHNICIAN: Video  
 DATE: 11/3/09

TIME	Pahoa Road						Kaohuwalu St						TOTAL	HRLY
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR		
15:45 16:00	1	172	0	0	139	2	0	0	0	1	0	2	317	
16:00 16:15	2	170	0	0	142	1	0	0	0	0	0	1	316	
16:15 16:30	4	158	0	0	109	1	0	0	0	0	0	0	272	
16:30 16:45	4	191	0	0	137	1	0	0	0	0	0	3	336 1241	
16:45 17:00	3	171	0	0	115	0	0	0	0	1	0	3	293 1217	
17:00 17:15	2	192	0	0	117	0	0	0	0	1	0	4	316 1217	
17:15 17:30	1	175	0	0	101	2	0	0	0	1	0	2	282 1227	
17:30 17:45	3	167	0	0	116	0	0	0	0	2	0	0	288 1179	
17:45 18:00	0	154	0	0	84	0	0	0	0	4	0	0	242 1128	

**PM PEAK HOUR**

16:30 17:30	10	729	0	0	470	3	0	0	0	3	0	12	1227 1241
PHF	0.63	0.95	N/A	N/A	0.86	0.75	N/A	N/A	N/A	N/A	N/A	1.00	0.91 PHF

**TRAFFIC ACCESS ANALYSIS REPORT  
FOR THE PROPOSED  
MAKU`U MASTER PLAN - PHASE 1  
PUNA, HAWAII**

**APPENDIX B  
CAPACITY ANALYSIS WORKSHEETS  
UNSIGNALIZED INTERSECTION ANALYSIS**



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔	↔	↑	↔	↔	↔
Volume (veh/h)	0	0	634	0	0	637
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.91	0.92	0.92	0.89
Hourly flow rate (vph)	0	0	697	0	0	716

**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	1412	697			697	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1412	697			697	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	100	100			100	
cM capacity (veh/h)	152	441			899	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	0	697	0	0	716
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.41	0.00	0.00	0.42
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS	A				
Approach Delay (s)	0.0	0.0		0.0	
Approach LOS	A				

**Intersection Summary**

Average Delay	0.0
Intersection Capacity Utilization	36.9%
ICU Level of Service	A
Analysis Period (min)	15



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↶	↷	↕	↷	↶	↕
Volume (veh/h)	16	10	624	4	8	629
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	1.00	1.00	0.90	0.92	1.00	0.88
Hourly flow rate (vph)	16	10	693	4	8	715

**Pedestrians**

Lane Width (ft)

Walking Speed (ft/s)

Percent Blockage

Right turn flare (veh)

Median type: TWL/TL None

Median storage (veh): 2

Upstream signal (ft)

pX, platoon unblocked

vC, conflicting volume	1424	693		698
vC1, stage 1 conf vol	693			
vC2, stage 2 conf vol	731			
vCu, unblocked vol	1424	693		698
tC, single (s)	6.4	6.2		4.1
tC, 2 stage (s)	5.4			
tF (s)	3.5	3.3		2.2
p0 queue free %	96	98		99
cM capacity (veh/h)	363	443		899

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	26	693	4	8	715
Volume Left	16	0	0	8	0
Volume Right	10	0	4	0	0
cSH	390	1700	1700	899	1700
Volume to Capacity	0.07	0.41	0.00	0.01	0.42
Queue Length 95th (ft)	5	0	0	1	0
Control Delay (s)	14.9	0.0	0.0	9.0	0.0
Lane LOS	B			A	
Approach Delay (s)	14.9	0.0		0.1	
Approach LOS	B				

**Intersection Summary**

Average Delay	0.3		
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (veh/h)	0	739	482	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.95	0.86	0.92	0.92	0.92
Hourly flow rate (vph)	0	778	560	0	0	0
<b>Pedestrians</b>						
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	560				1338	560
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	560				1338	560
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
CM capacity (veh/h)	1011				169	528
<b>Direction Lane #</b>						
	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	0	778	560	0	0	
Volume Left	0	0	0	0	0	
Volume Right	0	0	0	0	0	
cSF	1700	1700	1700	1700	1700	
Volume to Capacity	0:00	0.46	0.33	0:00	0:00	
Queue Length 95th (ft)	0	0	0	0	0	
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	
Lane LOS						A
Approach Delay (s)	0.0		0.0		0.0	
Approach LOS						A
<b>Intersection Summary</b>						
Average Delay			0.0			
Intersection Capacity Utilization			42.2%	ICU Level of Service	A	
Analysis Period (min)			15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations	↑	↑	↑	↑	↑	↑	
Volume (veh/h)	10	729	470	3	3	12	
Sign Control	Free		Free	Stop			
Grade	0%		0%	0%			
Peak Hour Factor	0.63	0.95	0.86	0.75	1.00	1.00	
Hourly flow rate (vph)	16	767	547	4	3	12	
<b>Pedestrians</b>							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type	None/TW/TL						
Median storage (veh)	2						
Upstream signal (ft)							
pX, platoon unblocked							
VC, conflicting volume	551					1346	547
VC1, stage 1 conf vol	547						
VC2, stage 2 conf vol	799						
vCu, unblocked vol	551					1346	547
tC, single (s)	4.1					6.4	6.2
tC, 2 stage (s)	5.4						
tF (s)	2.2					3.5	3.3
p0 queue free %	98					99	98
cM capacity (veh/h)	1019					371	537
<b>Direction, Lane #</b>							
	EB 1	EB 2	WB 1	WB 2	SB 1		
Volume Total	16	767	547	4	15		
Volume Left	16	0	0	0	3		
Volume Right	0	0	0	4	12		
cSH	1019	1700	1700	1700	493		
Volume to Capacity	0:02	0:45	0:32	0:00	0:08		
Queue Length 95th (ft)	1	0	0	0	2		
Control Delay (s)	8.6	0.0	0.0	0.0	12.5		
Lane LOS	A				B		
Approach Delay (s)	0.2		0.0		12.5		
Approach LOS					B		
<b>Intersection Summary</b>							
Average Delay			0.2				
Intersection Capacity Utilization			48.4%		ICU Level of Service A		
Analysis Period (min)	15						



Movement	EB1	EB2	WB1	WB2	SB1	SB2
Lane Configurations	←	↑	↑	←	↘	↘
Volume (veh/h)	0	796	793	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.89	0.91	0.92	0.92	0.92
Hourly flow rate (vph)	0	894	871	0	0	0
<b>Pedestrians</b>						
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	871			1766	871	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	871			1766	871	
tC, single (s)	4.1			6.4	6.2	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	100			100	100	
cM capacity (veh/h)	774			92	350	
<b>Direction, Lane #</b>						
	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total	0	894	871	0	0	0
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	0
cSFH	1700	1700	1700	1700	1700	
Volume to Capacity	0:00	0.53	0.51	0:00	0:00	
Queue Length 95th (ft)	0	0	0	0	0	
Control Delay (s)	0:0	0:0	0:0	0:0	0:0	
Lane LOS						A
Approach Delay (s)	0:0		0:0		0:0	
Approach LOS						A
<b>Intersection Summary</b>						
Average Delay			0.0			
Intersection Capacity Utilization			45.2%	ICU Level of Service	A	
Analysis Period (min)			15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←	↑	↑	↑	↑	↑
Volume (veh/h)	10	786	780	5	20	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	0.88	0.90	0.92	1.00	1.00
Hourly flow rate (vph)	10	893	867	5	20	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None/TWL/TL					
Median storage (veh)	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	872			1780	867	
vC1, stage 1 conf vol				867		
vC2, stage 2 conf vol				913		
vCu, unblocked vol	872			1780	867	
tC, single (s)	4.1			6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)	2.2			3.5	3.3	
p0 queue free %	99			93	96	
cM capacity (veh/h)	773			288	352	

Direction Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	10	893	867	5	33
Volume Left	10	0	0	0	20
Volume Right	0	0	0	5	13
cSH	773	1700	1700	1700	310
Volume to Capacity	0.01	0.53	0.51	0.00	0.11
Queue Length 95th (ft)	1	0	0	0	9
Control Delay (s)	9.7	0.0	0.0	0.0	18.0
Lane LOS	A				C
Approach Delay (s)	0.1		0.0		18.0
Approach LOS					C

Intersection Summary			
Average Delay		0.4	
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←	↑	↑	↑	←	←
Volume (veh/h)	0	800	603	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.95	0.86	0.92	0.92	0.92
Hourly flow rate (vph)	0	842	701	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	701			1543	701	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	701			1543	701	
tC, single (s)	4.1			6.4	6.2	
tC, 2 stage (s)						
tF (s)	2.2			3.5	3.3	
p0 queue free %	100			100	100	
cM capacity (veh/h)	896			126	439	
Direction Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	0	842	701	0	0	
Volume Left	0	0	0	0	0	
Volume Right	0	0	0	0	0	
cSH	1700	1700	1700	1700	1700	
Volume to Capacity	0.00	0.50	0.41	0.00	0.00	
Queue Length 95th (ft)	0	0	0	0	0	
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	
Lane LOS					A	
Approach Delay (s)	0.0		0.0		0.0	
Approach LOS					A	
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			45.4%		ICU Level of Service	A
Analysis Period (min)			15			



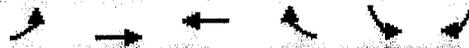
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←	↑	↑	↑	←	←
Volume (veh/h)	13	786	588	4	4	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.63	0.95	0.86	0.75	1.00	1.00
Hourly flow rate (vph)	21	827	684	5	4	15
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type: None/TWL/TL						
Median storage (veh): 2						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	689				1552	684
vC1, stage 1 conf vol					684	
vC2, stage 2 conf vol					869	
vCu, unblocked vol	689				1552	684
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0-queue free %	98				99	97
cM capacity (veh/h)	905				327	449
Direction Lane #						
	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	21	827	684	5	19	
Volume Left	21	0	0	0	4	
Volume Right	0	0	0	5	15	
cSFH	905	1700	1700	1700	416	
Volume to Capacity	0.02	0.49	0.40	0.00	0.05	
Queue Length 95th (ft)	2	0	0	0	4	
Control Delay (s)	9.1	0.0	0.0	0.0	14.1	
Lane LOS	A				B	
Approach Delay (s)	0.2		0.0		14.1	
Approach LOS					B	
Intersection Summary						
Average Delay			0.3			
Intersection Capacity Utilization			51.4%		ICU Level of Service	A
Analysis Period (min)			15			



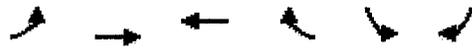
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑	↑	↑	↑	↓	↓
Volume (veh/h)	8	796	793	7	7	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.89	0.91	0.92	0.92	0.92
Hourly flow rate (vph)	9	894	871	8	8	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None/TWL/TL					
Median storage (veh)	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	879			1783	871	
vC1, stage 1 conf vol				871		
vC2, stage 2 conf vol				912		
vCu, unblocked vol	879			1783	871	
tC, single (s)	4.1			6.4	6.2	
tC, 2 stage (s)				5.4		
tF (s)	2.2			3.5	3.3	
p0 queue free %	99			97	99	
cM capacity (veh/h)	769			288	350	
Direction Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	9	894	871	8	12	
Volume Left	9	0	0	0	8	
Volume Right	0	0	0	8	4	
cSH	769	1700	1700	1700	308	
Volume to Capacity	0.01	0.53	0.51	0.00	0.04	
Queue Length 95th (ft)	1	0	0	0	3	
Control Delay (s)	9.7	0.0	0.0	0.0	17.2	
Lane LOS	A				C	
Approach Delay (s)	0.1		0.0		17.2	
Approach LOS					C	
<b>Intersection Summary</b>						
Average Delay	0.2					
Intersection Capacity Utilization	51.9%					
ICU Level of Service	A					
Analysis Period (min)	15					



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←	↑	↑	↑	←	←
Volume (veh/h)	10	793	787	5	20	13
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	0.88	0.90	0.92	1.00	1.00
Hourly flow rate (vph)	10	901	874	5	20	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		TWLT	TL	TWLT	TL	
Median storage (veh)		2	2			
Upstream signal (ft)						
pX, platoon unblocked						
VC conflicting volume	880				1796	874
VC1, stage 1 conf vol					874	
VC2, stage 2 conf vol					921	
vCu, unblocked vol	880				1796	874
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				93	96
cM capacity (veh/h)	768				285	349
Direction Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	10	901	874	5	33	
Volume Left	10	0	0	0	20	
Volume Right	0	0	0	5	13	
cSH	768	1700	1700	1700	307	
Volume to Capacity	0.01	0.53	0.51	0.00	0.11	
Queue Length 95th (ft)	1	0	0	0	9	
Control Delay (s)	9.7	0.0	0.0	0.0	18.1	
Lane LOS	A				C	
Approach Delay (s)	0.1		0.0		18.1	
Approach LOS					C	
<b>Intersection Summary</b>						
Average Delay			0.4			
Intersection Capacity Utilization			51.7%		ICU Level of Service	A
Analysis Period (min)			15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Volume (veh/h)	10	800	603	7	18	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.95	0.86	0.92	0.92	0.92
Hourly flow rate (vph)	11	842	701	8	20	11
<b>Pedestrians</b>						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None/TW/TL					
Median storage (veh)	2					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	701				1565	701
vC1, stage 1 conf vol	701					
vC2, stage 2 conf vol	864					
vCu, unblocked vol	701				1565	701
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)	5.4					
f (s)	2.2				3.5	3.3
p0-queue free %	99				94	98
cM capacity (veh/h)	896				328	439
<b>Direction Lane#</b>						
	EB 1	EB 2	WB 1	WB 2	SB 1	
Volume Total	11	842	701	8	30	
Volume Left	11	0	0	0	20	
Volume Right	0	0	0	8	11	
cSH	896	1700	1700	1700	360	
Volume to Capacity	0.01	0.50	0.41	0.00	0.08	
Queue Length 95th (ft)	1	0	0	0	7	
Control Delay (s)	9.1	0.0	0.0	0.0	15.9	
Lane LOS	A				C	
Approach Delay (s)	0.1		0.0		15.9	
Approach LOS					C	
<b>Intersection Summary</b>						
Average Delay	0.4					
Intersection Capacity Utilization	52.1%					
ICU Level of Service	A					
Analysis Period (min)	15					



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←	↑	↑	↑	↑	↑
Volume (veh/h)	13	804	595	4	4	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.63	0.95	0.86	0.75	1.00	1.00
Hourly flow rate (vph)	21	846	692	5	4	15

**Pedestrians**

Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	TWL TL TWL TL
Median storage (veh)	2 2
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	697 1579 692
vC1, stage 1 conf vol	692
vC2, stage 2 conf vol	888
vCu, unblocked vol	697 1579 692
tC, single (s)	4.1 6.4 6.2
tC, 2 stage (s)	5.4
tF (s)	2.2 3.5 3.3
p0 queue free %	98 99 97
cM capacity (veh/h)	899 321 444

Direction Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	21	846	692	5	19
Volume Left	21	0	0	0	4
Volume Right	0	0	0	5	15
cSH	899	1700	1700	1700	411
Volume to Capacity	0.02	0.50	0.41	0.00	0.05
Queue Length 95th (ft)	2	0	0	0	4
Control Delay (s)	9.1	0.0	0.0	0.0	14.2
Lane LOS	A				B
Approach Delay (s)	0.2		0.0		14.2
Approach LOS					B

**Intersection Summary**

Average Delay	0.3
Intersection Capacity Utilization	52.3%
ICU Level of Service	A
Analysis Period (min)	15

**TRAFFIC ACCESS ANALYSIS REPORT  
FOR THE PROPOSED  
MAKU`U MASTER PLAN - PHASE 1  
PUNA, HAWAII**

**APPENDIX C  
CAPACITY ANALYSIS WORKSHEETS  
TWO-LANE HIGHWAY ANALYSIS**

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 Two-Way Two-Lane Highway Segment Analysis
 

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Analyst	Randall S. Okaneku
Agency/Co.	Traffic Management Consultant
Date Performed	12/30/2009
Analysis Time Period	Existing AM Peak Hour
Highway	Keaau-Pahoa Road
From/To	West of Kaohuwalu Street
Jurisdiction	State of Hawaii
Analysis Year	2009
Description	Maku`u Master Plan

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 Input Data
 

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Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.90	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	4	/mi
Up/down		%			
Two-way hourly volume, V	1271	veh/h			
Directional split	50 / 50	%			

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 Average Travel Speed
 

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Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate, (note-1) vp	1415	pc/h
Highest directional split proportion (note-2)	708	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	60.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	1.0	mi/h
Free-flow speed, FFS	59.0	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h
Average travel speed, ATS	47.0	mi/h

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Percent Time-Spent-Following

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Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate, (note-1) vp	1412	pc/h
Highest directional split proportion (note-2)	706	
Base percent time-spent-following, BPTSF	71.1	%
Adj. for directional distribution and no-passing zones, fd/np	6.0	
Percent time-spent-following, PTSF	77.1	%

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Level of Service and Other Performance Measures

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Level of service, LOS	D	
Volume to capacity ratio, v/c	0.44	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

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Notes:

1. If  $vp \geq 3200$  pc/h, terminate analysis-the LOS is F.
2. If highest directional split  $vp \geq 1700$  pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

Two-Way Two-Lane Highway Segment Analysis

Analyst Randall S. Okaneku  
 Agency/Co. Traffic Management Consultant  
 Date Performed 12/30/2009  
 Analysis Time Period Existing PM Peak Hour  
 Highway Keaau-Pahoa Road  
 From/To West of Kaohuwalu Street  
 Jurisdiction State of Hawaii  
 Analysis Year 2009  
 Description Maku`u Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.91	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	4	/mi
Up/down		%			

Two-way hourly volume, V 1122 veh/h  
 Directional split 57 / 43 %

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate, (note-1) vp	1235	pc/h
Highest directional split proportion (note-2)	704	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	60.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	1.0	mi/h
Free-flow speed, FFS	59.0	mi/h
Adjustment for no-passing zones, fnp	1.3	mi/h
Average travel speed, ATS	48.1	mi/h

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Percent Time-Spent-Following

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Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate, (note-1) vp	1233	pc/h
Highest directional split proportion (note-2)	703	
Base percent time-spent-following, BPTSF	66.2	%
Adj. for directional distribution and no-passing zones, fd/np	7.8	
Percent time-spent-following, PTSF	74.0	%

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Level of Service and Other Performance Measures

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Level of service, LOS	D	
Volume to capacity ratio, v/c	0.39	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

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Notes:

1. If  $vp \geq 3200$  pc/h, terminate analysis-the LOS is F.
2. If highest directional split  $vp \geq 1700$  pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

Two-Way Two-Lane Highway Segment Analysis

Analyst Randall S. Okaneku  
 Agency/Co. Traffic Management Consultant  
 Date Performed 12/30/2009  
 Analysis Time Period AM Peak Hour Without Project  
 Highway Keaau-Pahoa Road  
 From/To West of Kaohuwalu Street  
 Jurisdiction State of Hawaii  
 Analysis Year 2014  
 Description Maku'u Master Plan

Input Data

Highway class Class 1  
 Shoulder width 6.0 ft Peak-hour factor, PHF 0.90  
 Lane width 12.0 ft % Trucks and buses 2 %  
 Segment length 0.0 mi % Recreational vehicles 0 %  
 Terrain type Level % No-passing zones 50 %  
 Grade: Length mi Access points/mi 4 /mi  
 Up/down %  
 Two-way hourly volume, V 1589 veh/h  
 Directional split 50 / 50 %

Average Travel Speed

Grade adjustment factor, fG 1.00  
 PCE for trucks, ET 1.1  
 PCE for RVs, ER 1.0  
 Heavy-vehicle adjustment factor, 0.998  
 Two-way flow rate, (note-1) vp 1769 pc/h  
 Highest directional split proportion (note-2) 885 pc/h  
 Free-Flow Speed from Field Measurement:  
 Field measured speed, SFM - mi/h  
 Observed volume, Vf - veh/h  
 Estimated Free-Flow Speed:  
 Base free-flow speed, BFFS 60.0 mi/h  
 Adj. for lane and shoulder width, fLS 0.0 mi/h  
 Adj. for access points, fA 1.0 mi/h  
 Free-flow speed, FFS 59.0 mi/h  
 Adjustment for no-passing zones, fnp 0.9 mi/h  
 Average travel speed, ATS 44.4 mi/h

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Percent Time-Spent-Following

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Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate, (note-1) vp	1766	pc/h
Highest directional split proportion (note-2)	883	
Base percent time-spent-following, BPTSF	78.8	%
Adj. for directional distribution and no-passing zones, fd/np	4.4	
Percent time-spent-following, PTSF	83.2	%

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Level of Service and Other Performance Measures

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Level of service, LOS	E	
Volume to capacity ratio, v/c	0.55	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

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Notes:

1. If  $vp \geq 3200$  pc/h, terminate analysis-the LOS is F.
2. If highest directional split  $vp \geq 1700$  pc/h, terminate analysis-the LOS is F.

Two-Way Two-Lane Highway Segment Analysis

Analyst Randall S. Okaneku  
 Agency/Co. Traffic Management Consultant  
 Date Performed 12/30/2009  
 Analysis Time Period PM Peak Hour Without Project  
 Highway Keaau-Pahoa Road  
 From/To West of Kaohuwalu Street  
 Jurisdiction State of Hawaii  
 Analysis Year 2019  
 Description Maku`u Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.91	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	4	/mi
Up/down		%			
Two-way hourly volume, V	1403	veh/h			
Directional split	57 / 43	%			

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate, (note-1) vp	1545	pc/h
Highest directional split proportion (note-2)	881	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	60.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	1.0	mi/h
Free-flow speed, FFS	59.0	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h
Average travel speed, ATS	46.0	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate, (note-1) vp	1542	pc/h
Highest directional split proportion (note-2)	879	
Base percent time-spent-following, BPTSF	74.2	%
Adj.for directional distribution and no-passing zones, fd/np	5.6	
Percent time-spent-following, PTSF	79.8	%

Level of Service and Other Performance Measures

Level of service, LOS	D	
Volume to capacity ratio, v/c	0.48	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:

1. If vp  $\geq$  3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp  $\geq$  1700 pc/h, terminate analysis-the LOS is F.

Two-Way Two-Lane Highway Segment Analysis

Analyst Randall S. Okaneku  
 Agency/Co. Traffic Management Consultant  
 Date Performed 12/30/2009  
 Analysis Time Period AM Peak Hour With Project  
 Highway Keaau-Pahoa Road  
 From/To West of Kaohuwalu Street  
 Jurisdiction State of Hawaii  
 Analysis Year 2019  
 Description Maku`u Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.90	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	4	/mi
Up/down		%			
Two-way hourly volume, V	1603	veh/h			
Directional split	50 / 50	%			

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate, (note-1) vp	1785	pc/h
Highest directional split proportion (note-2)	893	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	60.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	1.0	mi/h
Free-flow speed, FFS	59.0	mi/h
Adjustment for no-passing zones, fnp	0.9	mi/h
Average travel speed, ATS	44.3	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate, (note-1) vp	1781	pc/h
Highest directional split proportion (note-2)	891	
Base percent time-spent-following, BPTSF	79.1	%
Adj. for directional distribution and no-passing zones, fd/np	4.3	
Percent time-spent-following, PTSF	83.4	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.56	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:

1. If  $vp \geq 3200$  pc/h, terminate analysis-the LOS is F.
2. If highest directional split  $vp \geq 1700$  pc/h, terminate analysis-the LOS is F.

HCS+: Two-Lane Highways Release 5.4

Two-Way Two-Lane Highway Segment Analysis

Analyst Randall S. Okaneku  
 Agency/Co. Traffic Management Consultant  
 Date Performed 12/30/2009  
 Analysis Time Period PM Peak Hour With Project  
 Highway Keaau-Pahoa Road  
 From/To West of Kaohuwalu Street  
 Jurisdiction State of Hawaii  
 Analysis Year 2019  
 Description Maku`u Master Plan

Input Data

Highway class	Class 1				
Shoulder width	6.0	ft	Peak-hour factor, PHF	0.91	
Lane width	12.0	ft	% Trucks and buses	2	%
Segment length	0.0	mi	% Recreational vehicles	0	%
Terrain type	Level		% No-passing zones	50	%
Grade: Length		mi	Access points/mi	4	/mi
Up/down		%			
Two-way hourly volume, V	1428	veh/h			
Directional split	57 / 43	%			

Average Travel Speed

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.1	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor,	0.998	
Two-way flow rate, (note-1) vp	1572	pc/h
Highest directional split proportion (note-2)	896	pc/h
Free-Flow Speed from Field Measurement:		
Field measured speed, SFM	-	mi/h
Observed volume, Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, BFFS	60.0	mi/h
Adj. for lane and shoulder width, fLS	0.0	mi/h
Adj. for access points, fA	1.0	mi/h
Free-flow speed, FFS	59.0	mi/h
Adjustment for no-passing zones, fnp	1.0	mi/h
Average travel speed, ATS	45.8	mi/h

Percent Time-Spent-Following

Grade adjustment factor, fG	1.00	
PCE for trucks, ET	1.0	
PCE for RVs, ER	1.0	
Heavy-vehicle adjustment factor, fHV	1.000	
Two-way flow rate, (note-1) vp	1569	pc/h
Highest directional split proportion (note-2)	894	
Base percent time-spent-following, BPTSF	74.8	%
Adj. for directional distribution and no-passing zones, fd/np	5.4	
Percent time-spent-following, PTSF	80.2	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.49	
Peak 15-min vehicle-miles of travel, VMT15	0	veh-mi
Peak-hour vehicle-miles of travel, VMT60	0	veh-mi
Peak 15-min total travel time, TT15	0.0	veh-h

Notes:

1. If vp  $\geq$  3200 pc/h, terminate analysis-the LOS is F.
2. If highest directional split vp  $\geq$  1700 pc/h, terminate analysis-the LOS is F.