KAUAI COUNTY OFFICE COMPLEX

TRAFFIC IMPACT ASSESSMENT REPORT

NOVEMBER 1989

PACIFIC PLANNING & ENGINEERING, INC.

TRAFFIC IMPACT ASSESSMENT REPORT

FOR THE

KAUAI COUNTY OFFICE COMPLEX

AT THE LIHUE SHOPPING CENTER

Lihue, Kauai, Hawaii

November 1989

Prepared for:

Kauai County

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EXECUTIVE SUMMARY

This traffic study identifies and evaluates the probable impact of traffic generated by the proposed Kauai County Office Complex at the Lihue Shopping Center.

The County of Kauai is proposing to relocate its offices, presently scattered at locations within the Lihue area, to the existing Lihue Shopping Center. The site is bordered by Rice Street, Eiwa Street, Hardy Street and Kuhio Highway. At the south west corner of the Lihue Shopping Center, Kuhio Highway, Kaumualii Highway and Rice Street form a three-leg intersection.

The existing buildings are proposed sites for the Kauai County offices. A three-story circular building and the street level extension of the circular building will be renovated for the County offices. The buildings were formerly used by private businesses and are presently occupied by five or six tenants in the process of vacating their offices.

The Office of Economic Development, Outreach Program and Department of Finance, Purchasing Division are the only County office presently located at the proposed site. The remaining area in the Lihue Shopping Center is occupied by three major businesses; Big Save Supermarket, Gem Department Store and First Interstate Bank.

The purpose of this Report is to present the results of a traffic impact study of the proposed Kauai County Office Complex within the Lihue Shopping Center. The Report presents a comparison of what traffic would be like *without* and *with* the proposed relocation. The afternoon peak hour was analyzed because it is most representative of the impact caused by the relocation.

This traffic impact report identifies and evaluates the probable impact of the forecasted traffic generated by the relocation of the County offices by mid 1991. The analysis focuses on the traffic impact at the major intersection of Kaumualii and Kuhio Highways with Rice Street, Eiwa Street with Rice Street, Eiwa Street with Hardy Street, Hardy Street with Kuhio Highway and the seven driveway accesses of the shopping center. The study describes the impact on the Level-of-Service (LOS) at the study intersections when the

relocation is completed in mid 1991.

Conclusions and Recommendations

The proposed Lihue Shopping Center/Kauai County Municipal Building Complex will not have a major traffic impact on the twelve study intersections surrounding the project site.

The results of the intersection analysis indicate that even without the project generated traffic, the signalized intersection at Kaumualii Highway/Kuhio Highway/Rice Street will operate at LOS F in 1991, as a result of the increase in ambient traffic. All other study intersections will continue to operate at the same LOS even with the project generated traffic in 1991.

The State DOT Highways Division is planning to improve the intersection of Kaumualii Highway/Kuhio Highway/Rice Street by realigning portions of Kaumualii Highway and Kuhio Highway. The improvement, scheduled for completion in 1994, is also expected to alleviate the congestion at the intersection of Kuhio Highway and Hardy Street.

We recommend the following short-term improvements at the following intersections:

Kaumualii Highway/Kuhio Highway/Rice Street

Adjust the existing signal timing to reduce the maximum green time for Phase IV, Kuhio Highway left-turn movement onto Rice Street by 5 seconds, and correspondingly increase the maximum green time for Phase V, Kaumualii Highway left-turn onto Kuhio Highway by 5 seconds.

Kuhio Highway at Hardy Street

Motorists westbound on Hardy Street who wish to turn left onto Kuhio Highway should be encouraged to use alternative routes to avoid long delays at the intersection during peak hours.

All Other Study Intersections

No improvements are necessary at the other study intersections since they will continue to operate at LOS D or better. The exceptions would be the left-turn movement from the driveways. Drivers who wish to turn left from minor roads will continue to experience long delays (LOS E). However, there are alternative routes that would permit drivers to avoid the long delays during the peak hours, therefore, no mitigating actions are recommended.

PROJECT DESCRIPTION

Kauai County is proposing to relocate it offices into the Lihue Shopping Center. This consolidation of the County offices into one location would create the Lihue Shopping Center/Kauai County Municipal Building Complex. The proposed location for the County offices is in Lihue on the island of Kauai.

The site is bordered by Rice Street, Eiwa Street, Hardy Street and Kuhio Highway. At the south west corner of the Lihue Shopping Center, Kuhio Highway, Kaumualii Highway and Rice Street form a three-leg intersection. The project location map and roadway network in the vicinity are shown in Figure 1.

The existing buildings are proposed sites for the Kauai County offices. A three-story circular building and the street level extension of the circular building will be renovated for the County offices. The buildings were formerly used by private businesses and are presently occupied by five or six tenants in the process of vacating their offices.

The Office of Economic Development, Outreach Program and Department of Finance, Purchasing Division are the only County offices presently located at the proposed site. The remaining area in the Lihue Shopping Center is occupied by three major businesses; Big Save Supermarket, Gem Department Store and First Interstate Bank.

The following Kauai County Agencies and number of employees will be relocating to the new Kauai County Municipal Building complex by mid 1991.

Government Agency	Number of Employees
Elderly Affairs	12
Liquor Control	6
Public Works	60
Planning	18
Parks & Recreation	10
Finance	58
Housing	14

Economic Development		6
Personnel		8
Outreach Program		1
Prosecuting Attorney		18
Police		119
	Total	330

The primary roadways providing vehicular access to the proposed location of the Kauai County offices are Kaumualii Highway, Kuhio Highway, Rice Street and Hardy Street.

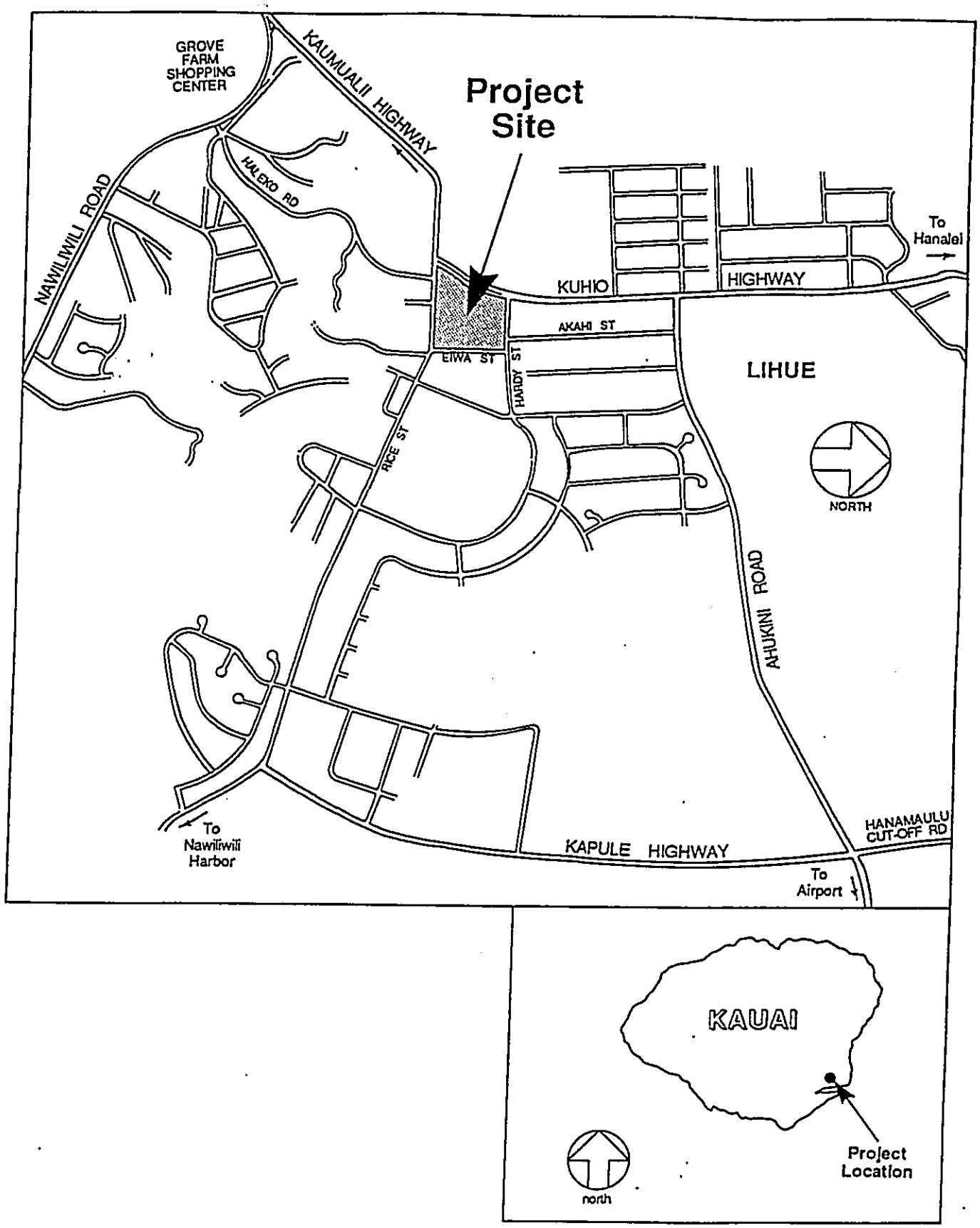

Figure 1. Project Location Map and Roadway Network

EXISTING CONDITIONS

A review of the area was conducted to better understand future traffic conditions surrounding the proposed project. The review included the land uses, roadway facilities, and traffic conditions. Figure 2 shows the site plan for the Lihue Shopping Center/Kauai County Municipal Building Complex.

Area Conditions

The immediately adjacent land uses to the west of the Lihue Shopping Center are generally agricultural. To the north, east and south, there are small business and State and County public facilities. The Kauai Public Museum is located on the southwest corner of the shopping center. Kukui Grove is a major shopping center located south of the Lihue Shopping Center. Lihue Airport and Lihue Town are located Northeast of the shopping center and beyond Lihue are the towns of Hanamaulu, Wailua, Kapaa and Hanalei. To the southwest are the towns of Koloa, Kalaheo, Hanapepe, Waimea, and Kekaha.

Roadway Facilities

The primary vehicular accesses to the Lihue Shopping Center are from Kaumualii Highway (Route 50) and Kuhio Highway (Route 56) which provide through traffic into and out of Lihue.

Kaumualii Highway is a two-lane rural arterial which runs on an east-west orientation along the southern region of Kauai. It is a State maintained facility and has two 12–foot lanes with 4-foot paved and 10-foot unpaved shoulders on each side. The posted speed limit is generally 50 miles per hour (mph), and is 25 to 35 mph in populated areas.

Kuhio Highway is a four-lane arterial which runs along the eastern and northern regions of Kauai on a north-south orientation. The lanes are 12 feet in width with 2-foot shoulders and a 9-foot medial strip in the vicinity of the shopping center.

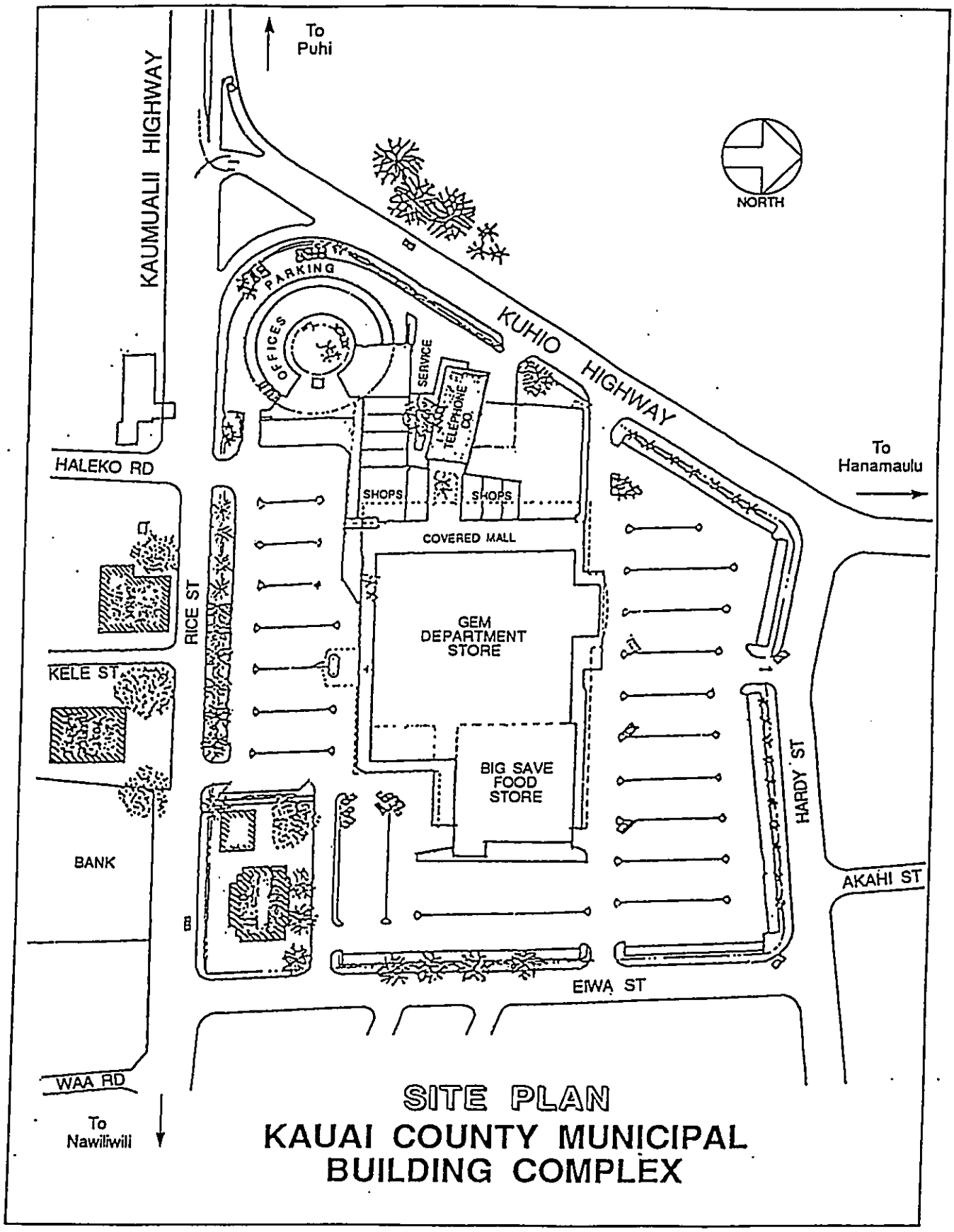

Figure 2. Lihue Shopping Center Complex Site Plan

Seven driveways into the Lihue Shopping Center are accessed through the surrounding roads. Two accesses (one is a loading zone) from Kuhio Highway for vehicles travelling in a northbound direction. One access from Hardy Street in the north, two from Eiwa Street in the east and two from Rice Street in the south.

Future

The State Department of Transportation (DOT) Highways Division is planning to improve the intersection of Kaumualii Highway, Rice Street and Kuhio Highway in 1992. Portions of Kaumualii Highway and Kuhio Highway will be realigned between Lihue Mill Bridge and Hardy Street such that Kaumualii Highway and Kuhio Highway will become a continuous through street and Rice Street will form a "T" intersection with Kaumualii-Kuhio Highway.

Traffic Conditions

A review of 1989 State DOT traffic count data for station 1-B at the intersection of Kaumualii Highway at Rice Street and Kuhio Highway indicated that the peak hour traffic generally occurs between 3:30 and 4:30 pm.

Manual traffic counts were taken for the signalized intersection of Kaumualii Highway at Rice Street and Kuhio Highway. Traffic counts at the intersections of Kuhio Highway and Hardy Street, Hardy Street and Akahi Street, Hardy Street and Eiwa Street, Rice Street and Eiwa Street, Rice Street and Haleko Street and seven (7) access driveways into the project site were also taken on September 7, 1989. Traffic counts for the present condition were used as a baseline upon which future estimated traffic volumes were added. Figure 3 depicts the present volumes and movements of traffic at the study intersections. At the time of the traffic counts, most of the office space at the shopping center was vacant.

The recorded traffic count data is shown in Appendix B. Manual counts were taken of passenger cars, trucks, buses, bicycles, motorcycles and pedestrians by turning movements and approaches. During the field counts, the weather was clear and the pavement was dry.

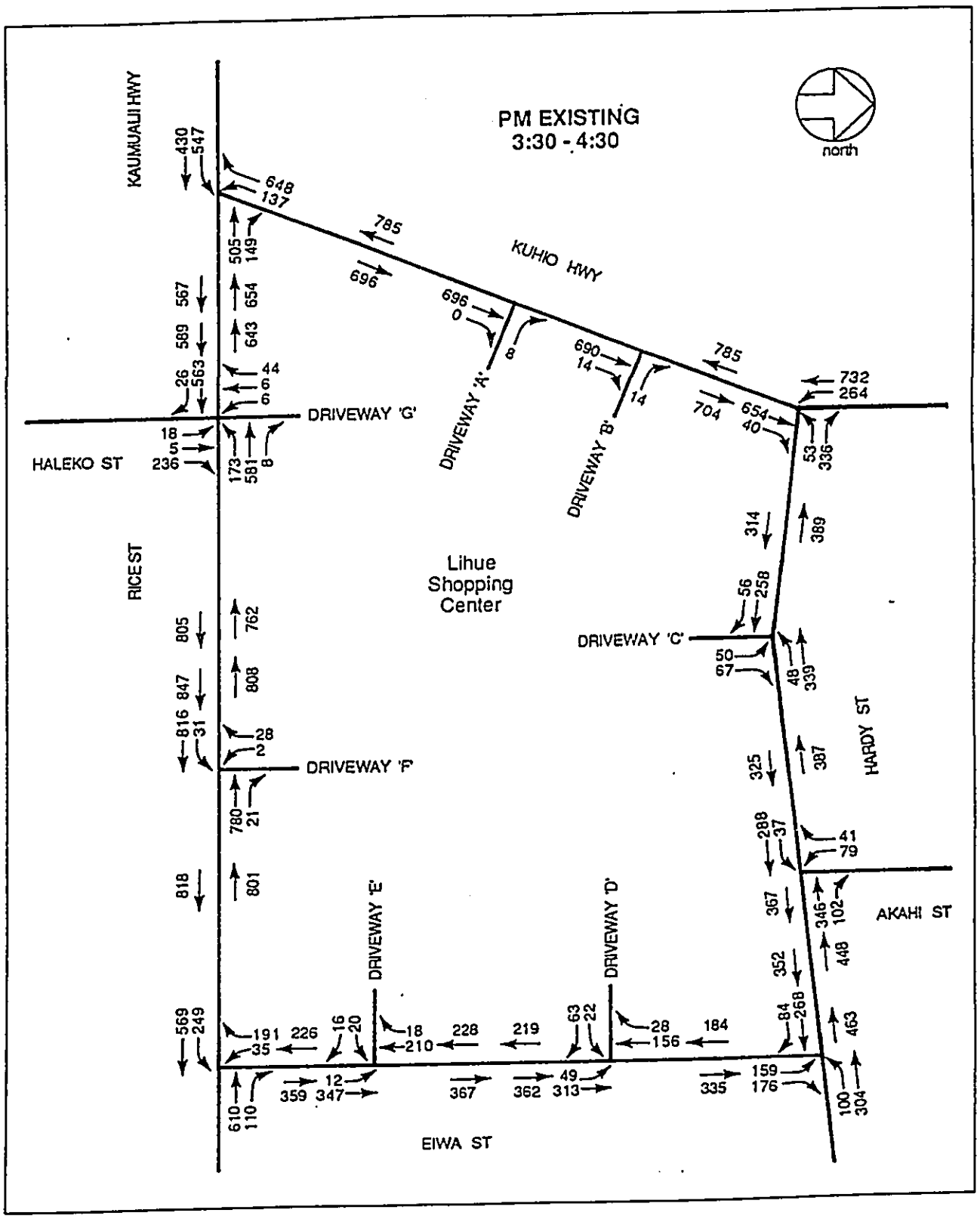

Figure 3. Existing Afternoon Peak Hour Traffic

PROJECTED TRAFFIC CONDITIONS

The focus of the study was to determine the impact of the project generated traffic at the study intersections when the project is completed and fully occupied in 1991. .

The afternoon peak hour was used as a basis for forecasting because it represents the worst case condition. State DOT traffic counts at the intersection of Kaumualii Highway and Kuhio Highway show that the heaviest traffic occur between 3:30 and 4:30 pm. DOT traffic counts at Station 1-B and the manual traffic counts taken by Pacific Planning & Engineering, Inc. were used as the baseline to forecast future traffic.

Future traffic forecasts without and with the project were estimated for 1991. The trend in traffic growth and traffic generated by future developments such as the Grove Farm Development and other known developments were used to forecast traffic without the project. The additional traffic volumes from ambient growth and the proposed project were added to the present traffic counts to arrive at the 1991 forecast volumes.

The study intersections were analyzed for existing traffic conditions, 1991 *without* the project and 1991 *with* the project. The resulting impacts are discussed and final recommendations are presented in the Conclusion and Recommendations Section of this report.

Future Ambient Traffic

Ambient traffic is the traffic which would occur if the proposed project were not built. Ambient traffic was forecasted based on the growth in traffic along the major roadways and additional traffic generated by proposed developments in the area.

Future ambient traffic at the study intersections for the year 1991 was derived from historical traffic count data using linear regression techniques. This methodology implicitly assumes that future development will occur in the same patterns and rates as in the past. The Grove Farm Development is considered significant in terms of traffic impact at the study intersections and is therefore superimposed over the projected conditions.

Based on the Kaku & Associates Transportation Planning Study for Kauai County, traffic increased at an annual rate of 3.6% between September 1988 and June 1989 or approximately 4% per year.

Therefore, by June 1991, the ambient traffic is estimated to increase by 8% over the next two years. Table 4 and Figure 4 show the traffic forecasted for the year 1991 without the project generated traffic.

Project Generated Traffic

The three-step procedure of trip generation, distribution and assignment was used to forecast future peak hour traffic from the proposed project.

Trip Generation

Trip Generation calculates the number of trips which would be generated during the afternoon peak hour by the proposed project. The number of trips were calculated from the ITE Trip Generation Report (Fourth Edition, 1987) for the land uses described below.

Table 1 shows the ITE standard trip generation rates and number of trips generated by the proposed land uses during the morning and afternoon peak hour, while Table 2 shows the actual vehicles counts obtained by PPE, Inc. on Friday, September 22, 1989 for the Big Save Supermarket, Gem Department Store, and First Interstate Bank.

Table 1. Trip Generation -- ITE Standard Rates
Weekday Morning and Afternoon Peak Hour

Tenant/Land Use	Floor Area (1,000 sf)	Morning Peak Hour Trip Rate		Morning Peak Hour No. of Trips		Afternoon Peak Hour Trip Rate		Afternoon Peak Hour No. of Trips	
		Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit
Big Save Supermarket	24.570	0.382	0.165	9	4	4.500	4.321	111	106
Gem Department Store	44.215	0.396	0.396	17	18	3.177	2.932	140	130
First Interstate Bank	3.340	12.000	12.000	40	40	10.501	9.694	35	32
Government Office (Police)	19.217	4.939	0.941	95	18	8.162	2.868	157	55
Other Government Offices	57.825	4.939	0.941	286	54	8.162	2.868	472	166
Total Number of Trip Ends				447	134			915	489

Table 2. PPE Traffic Count -- September 22, 1989
Weekday (Friday) Morning and Afternoon Peak Hour

Tenant/Land Use	Floor Area (1,000 sf)	Morning Peak Hour Enter	Morning Peak Hour Exit	Afternoon Peak Hour Enter	Afternoon Peak Hour Exit
Big Save Supermarket	24.570	51	46	112	114
Gem Department Store	44.215	9	4	65	76
First Interstate Bank	3.340	10	8	8	7

Trip Distribution and Traffic Assignment

Trip distribution and traffic assignment allocate the generated trips to the different directions of travel and specific turning movements on the roadway.

The project generated traffic entering and exiting the project site were assigned to seven (7) existing access driveways based on percentages determined by computing the existing

traffic entering and exiting from the present access driveways. It was assumed that future traffic circulation in and out of the project site will continue to follow the existing pattern.

Total Traffic

Table 3 shows the breakdown in traffic estimated for the various conditions at the two study intersections. Figures 4 and 5 are show the roadway network and resulting turning movement volumes at the study intersections for the conditions *without* and *with* the proposed project.

Table 3. Traffic Volumes @ Study Intersections

Afternoon Peak Hour

Intersection		1989	1991 w/o Project	1991 w/ Project
Kaumualii Highway/Kuhio Highway/Rice Street				
Kaumualii Highway				
Eastbound	LT	547	591	595
	TH	430	431	470
Kuhio Highway				
Southbound	LT	137	148	148
	RT	648	700	701
Rice Street				
Westbound	TH	505	545	584
	RT	149	161	161
Kuhio Highway/Access Driveway "A"				
Kuhio Highway				
Northbound	TH	696	752	754
	RT	0	0	2
Access Driveway "A"				
Westbound	RT	8	9	24
Kuhio Highway/Access Driveway "B"				
Kuhio Highway				
Northbound	RT	690	745	761
	TH	14	15	17
Access Driveway "B"				
Westbound	RT	14	15	17

Table 3. Traffic Volumes @ Study Intersections (Continued)

Afternoon Peak Hour

Intersection		1989	1991 w/o Project	1991 w/ Project
Kuhio Highway/Hardy Street				
Kuhio Highway				
Northbound	TH	654	706	722
	RT	50	54	54
Southbound	LT	264	285	294
	TH	732	791	791
Hardy Street				
Westbound	LT	53	57	58
	RT	336	362	370
Hardy Street/Access Driveway "C"				
Hardy Street				
Eastbound	TH	258	279	279
	RT	56	60	69
Westbound	LT	48	52	59
	TH	339	366	369
Access Driveway "C"				
Northbound	LT	50	54	62
	RT	67	72	83
Hardy Street/Akahi Street				
Hardy Street				
Eastbound	LT	37	40	40
	TH	288	311	322
Westbound	TH	346	374	384
	RT	102	110	110
Akahi Street				
Southbound	LT	79	85	85
	RT	41	44	44

Table 3. Traffic Volumes @ Study Intersections (Continued)
Afternoon Peak Hour

Intersection		1989	1991 w/o Project	1991 w/ Project
Hardy Street/Eiwa Street				
Hardy Street				
Eastbound	TH	268	289	300
	RT	84	91	91
Westbound	LT	100	108	121
	TH	304	328	328
Eiwa Street				
Northbound	LT	159	172	172
	RT	176	190	213
Eiwa Street/Access Driveway "D"				
Eiwa Street				
Northbound	LT	49	53	61
	TH	313	338	358
Southbound	TH	156	168	178
	RT	28	30	34
Access Driveway "D"				
Eastbound	LT	22	24	27
	RT	63	68	78
Eiwa Street/Access Driveway "E"				
Eiwa Street				
Northbound	LT	12	13	19
	TH	347	375	383
Southbound	TH	210	227	228
	RT	18	19	28
Access Driveway "E"				
Eastbound	LT	20	22	36
	RT	16	17	28

Table 3. Traffic Volumes @ Study Intersections (Continued)

Afternoon Peak Hour

Intersection		1989	1991 w/o Project	1991 w/ Project
Rice Street/Eiwa Street				
Rice Street				
Eastbound	LT	249	269	269
	TH	569	615	624
Westbound	TH	610	659	659
	RT	110	119	133
Eiwa Street				
Southbound	LT	35	38	40
	RT	191	206	216
Rice Street/Access Driveway "F"				
Rice Street				
Eastbound	LT	31	33	49
	TH	816	881	891
Westbound	TH	780	842	842
	RT	21	23	33
Access Driveway "F"				
Southbound	LT	2	2	3
	RT	28	30	50

Table 3. Traffic Volumes @ Study Intersections (Continued)
Afternoon Peak Hour

Intersection		1989	1991 w/o Project	1991 w/ Project
Rice Street/Haleko Street/Access Driveway "G"				
Rice Street				
Eastbound	LT	(Restricted)	(Restricted)	(Restricted)
	TH	563	608	614
	RT	26	28	28
Westbound	LT	173	187	187
	TH	851	627	647
	RT	8	9	12
Haleko Street				
Northbound	LT	18	19	19
	TH	5	5	7
	RT	236	255	255
Access Road "G"				
Southbound	LT	6	6	10
	TH	6	6	10
	RT	44	48	79

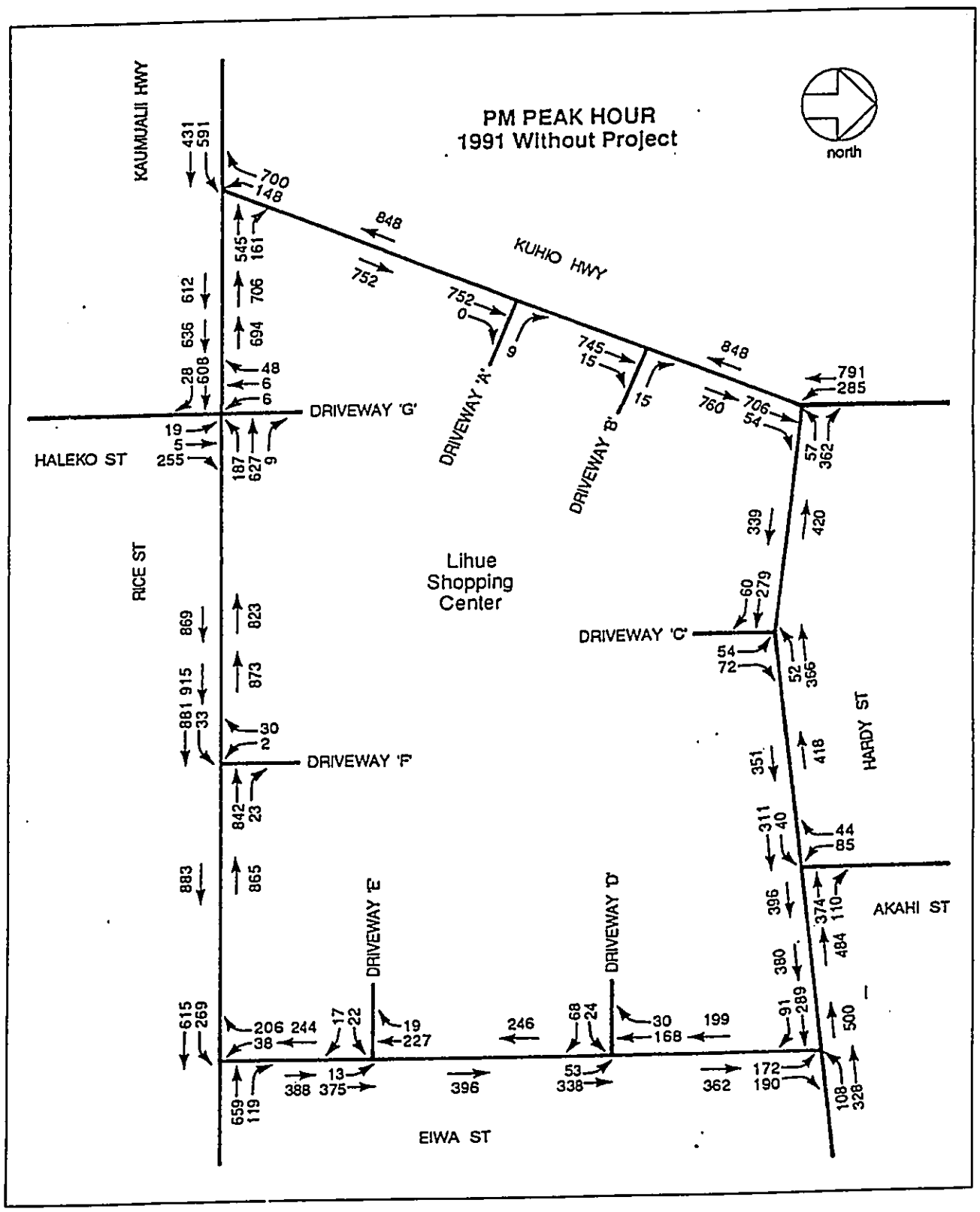

Figure 4. 1991 Afternoon Peak Hour Traffic Forecast
Without Project

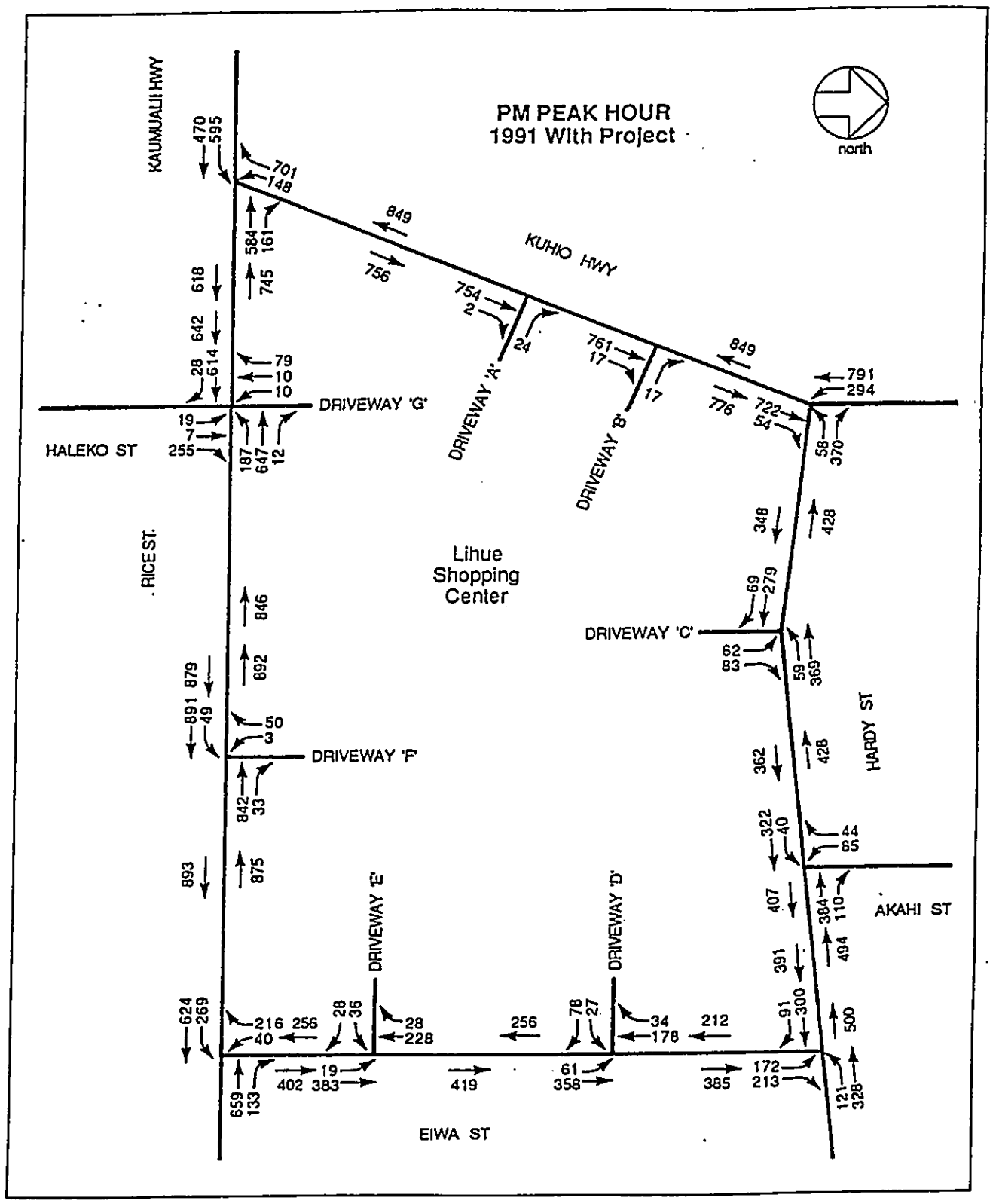

Figure 5. 1991 Afternoon Peak Hour Traffic Forecast
With Project

TRAFFIC IMPACT ANALYSIS

Impacts on traffic resulting from the proposed Lihue Shopping Center/Kauai County Municipal Building Complex were measured by the change in Level-of-Service (LOS) at the study intersections for cases existing traffic, for the year 1991 without and for the year 1991 with the project. The analysis was completed assuming no future improvements to the study intersections.

Impacts from the proposed project were measured by the change in level-of-service (LOS) for specific turning movements in each case. The methodology for analyzing signalized intersections in the TRB Highway Capacity Manual, Special Report 209 (1986) was used. The methodology yields LOS ranging from A to F (summarized in Appendix A). The results of the analysis are summarized on Table 4.

Existing and Future Peak Hour Levels of Service

The existing and future afternoon peak hour intersection level of service is shown on Table 4 for the twelve study intersections impacted by project generated traffic. As indicated, the operational analysis method was used for the signalized intersection of Kaumualii Highway, Kuhio Highway and Rice Street, while T-intersection and Four-Leg intersection analysis was used for the unsignalized intersections.

The results of the intersection analysis indicate that even without the project generated traffic, the signalized intersection of Kaumualii Highway/Kuhio Highway/Rice Street will operate at LOS F in 1991, as a result of increase in ambient traffic. At the intersection of Kuhio Highway and Hardy Street, the left-turn movement from Hardy Street onto Kuhio Highway is already operating at LOS E for the unsignalized intersection. For the remainder of the study intersections, the analysis indicates that the unsignalized intersections will continue to operate at the same LOS even with the project generated traffic in 1991.

Table 4. Level-of-Service Analysis
Afternoon Peak Hour

Intersection		1989	1991 w/o Project	1991 w/ Project
Kaumualii Highway/Kuhio Highway/Rice Street				
(Operational Analysis--Signalized Intersection)				
Kaumualii Highway				
Eastbound	LT	E	F	F
	TH	A	A	A
Kuhio Highway				
Southbound	LT	C	C	C
	RT	B	B	B
Rice Street				
Westbound	TH	C	C	C
	RT	B	B	B
Kuhio Highway/Access Driveway "A"				
(Unsignalized T-Intersection Analysis)				
Access Driveway "A"				
Westbound	RT	A	A	A
Kuhio Highway/Access Driveway "B"				
(Unsignalized T-Intersection Analysis)				
Access Driveway "B"				
Westbound	RT	A	A	A
Kuhio Highway/Hardy Street				
(Unsignalized T-Intersection Analysis)				
Kuhio Highway				
Southbound	LT	C	D	D
Hardy Street				
Westbound	LT	E	E	E
	RT	D	E	E

Table 4. Level-of-Service Analysis (Continued)
Afternoon Peak Hour

Intersection		1989	1991 w/o Project	1991 w/ Project
Hardy Street/Access Driveway "C"				
(Unsignalized T-Intersection Analysis)				
Hardy Street				
Westbound	LT	A	A	A
Access Driveway "C"				
Northbound	LT	B	B	C
	RT	A	A	A
Hardy Street/Akahi Street				
(Unsignalized T-Intersection Analysis)				
Hardy Street				
Eastbound	LT	A	A	A
Akahi Street				
Southbound	LT	C	C	C
	RT	A	A	A
Hardy Street/Eiwa Street				
(Unsignalized T-Intersection Analysis)				
Hardy Street				
Westbound	LT	A	A	A
Eiwa Street				
Northbound	LT	D	D	D
	RT	A	A	A
Eiwa Street/Access Driveway "D"				
(Unsignalized T-Intersection Analysis)				
Eiwa Street				
Northbound	LT	A	A	A
Access Driveway "D"				
Eastbound	LT	A	A	A
	RT	A	A	A

Table 4. Level-of-Service Analysis (Continued)
Afternoon Peak Hour

Intersection		1989	1991 w/o Project	1991 w/ Project
Eiwa Street/Access Driveway "E"				
(Unsignalized T-Intersection Analysis)				
Eiwa Street				
Northbound	LT	A	A	A
Access Driveway "E"				
Eastbound	LT	A	A	B
	RT	A	A	A
Rice Street/Eiwa Street				
(Unsignalized T-Intersection Analysis)				
Rice Street				
Eastbound	LT	C	C	C
Eiwa Street				
Southbound	LT	E	E	E
	RT	B	C	C
Rice Street/Access Driveway "F"				
(Unsignalized T-Intersection Analysis)				
Rice Street				
Eastbound	LT	A	A	A
Access Driveway "F"				
Southbound	LT	E	E	E
	RT	A	B	B

Table 4. Level-of-Service Analysis (Continued)
Afternoon Peak Hour

Intersection		1989	1991 w/o Project	1991 w/ Project
Rice Street/Haleko Street/Access Driveway "G"				
(Unsignalized Four-Leg Intersection Analysis)				
Rice Street				
Eastbound	LT	(Restricted)	(Restricted)	(Restricted)
Westbound	LT	A	A	A
Haleko Street				
Northbound	LT	E	E	E
	TH	D	D	D
	RT	C	C	C
Access Road "G"				
Southbound	LT	E	E	E
	TH	D	D	D
	RT	A	A	A

CONCLUSIONS AND RECOMMENDATIONS

The proposed Lihue Shopping Center/Kauai County Municipal Building Complex will not have a major traffic impact on the twelve study intersections surrounding the project site.

The results of the intersection analysis indicate that even without the project generated traffic, the signalized intersection at Kaumualii Highway/Kuhio Highway/Rice Street will operate at LOS F in 1991, as a result of the increase in ambient traffic. All other study intersections will continue to operate at the same LOS even with the project generated traffic in 1991.

The State DOT Highways Division is planning to improve the intersection of Kaumualii Highway/Kuhio Highway/Rice Street by realigning portions of Kaumualii Highway and Kuhio Highway. The improvement, scheduled for completion in 1994, is also expected to alleviate the congestion at the intersection of Kuhio Highway and Hardy Street.

We recommend the following short-term improvements at the following intersections:

Kaumualii Highway/Kuhio Highway/Rice Street

Adjust the existing signal timing to reduce the maximum green time for Phase IV, Kuhio Highway left-turn movement onto Rice Street by 5 seconds, and correspondingly increase the maximum green time for Phase V, Kaumualii Highway left-turn onto Kuhio Highway by 5 seconds.

Kuhio Highway at Hardy Street

Motorists westbound on Hardy Street who wish to turn left onto Kuhio Highway should be encouraged to use alternative routes to avoid long delays at the intersection during peak hours.

All Other Study Intersections

No improvements are necessary at other study intersections since the intersections will continue to operate at LOS D or better. The exceptions would be the left-turn movement from the driveways. Drivers who wish to turn left from minor roads will continue to experience long delays (LOS E). However, there are alternative routes that would permit drivers to avoid the long delays during the peak hours, therefore, no mitigating actions are recommended.

APPENDIX A

Definition of Level-of-Service
for
Signalized
and
Unsignalized Intersections

APPENDIX A
LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS

Level of service for signalized intersections is defined in terms of *delay*. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. Specifically, level-of-service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period.

Level-of Service A describes operations with very low delay, i.e., less than 5.0 sec per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

Level-of-Service B describes operations with delay in the range of 5.1 to 15.0 sec per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.

Level-of-Service C describes operations with delay in the range of 15.1 to 25.0 sec per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

Level-of-Service D describes operations with delay in the range of 25.1 to 40.0 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or a high *v/c* ratios (volume of cars to capacity of intersection). Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level-of-Service E describes operations with delay in the range of 40.1 to 60.0 sec per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle length, and high *v/c* ratios. Individual cycle failures are frequent occurrences.

Level-of-Service F describes operations with delay in excess of 60.0 sec per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

LEVEL-OF-SERVICE FOR UNSIGNALIZED INTERSECTIONS

For unsignalized intersections, the traffic most impacted will be the minor or cross-street with the stop or yield control. The major roadway will have the right-of-way. The level-of-service is the amount of delay expected for the average vehicle desiring to cross or enter the major road. The following gives a general description of the measure.

The concept of levels of service is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level of service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from A to F, with level-of-service A representing the best operating conditions and level-of-service F the worst.

Level-of-Service definitions--In general, the various levels of service are defined as follows for uninterrupted flow facilities:

Level-of-service A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

Level-of-service B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior.

Level-of-service C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the

presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

Level-of-service D represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

Level-of-service E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuver. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

Level-of-service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go wave, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level-of-service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases operating conditions of the vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow which causes the queue to form, and level-of-service F is an appropriate designation for such points.

These definitions are general and conceptual in nature, and they apply primarily to uninterrupted flow. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them.

REFERENCE: Highway Capacity Manual (Special Report 209, 1985)

APPENDIX B

MANUAL TRAFFIC COUNTS

APPENDIX B
MANUAL TRAFFIC COUNTS

Kauai County Office Complex
September 7, 1989
3:30-5:00 P.M.

Kaumualii Highway/Kuhio Highway/Rice Street

	Kaumualii Highway Eastbound		Kuhio Highway Southbound		Rice Street Westbound	
Afternoon Peak Hour	LT	TH	LT	RT	TH	RT
3:30-3:45	128	100	30	159	117	31
3:45-4:00	151	127	35	160	113	41
4:00-4:15	139	105	37	160	129	37
4:15-4:30	129	98	35	169	146	40
4:30-4:45	148	93	29	162	172	22
4:45-5:00	140	93	21	183	146	25
3:30-4:30 Peak Hour Total	547	430	137	648	505	149

Kuhio Highway/Hardy Street

	Kuhio Highway Northbound		Kuhio Highway Southbound		Hardy Street Westbound	
Afternoon Peak Hour	TH	RT	LT	TH	LT	RT
3:30-3:45	136	15	82	187	9	78
3:45-4:00	188	14	73	188	11	77
4:00-4:15	173	11	58	179	26	101
4:15-4:30	157	10	51	178	16	80
4:30-4:45	170	5	67	176	22	106
4:45-5:00	165	18	62	169	11	86
3:30-4:30 Peak Hour Total	654	50	264	732	53	336

Hardy Street/Akahi Street

	Hardy Street				Akahi Street	
Afternoon	Eastbound		Westbound		Southbound	
Peak Hour	LT	TH	TH	RT	LT	RT
3:30-3:45	8	94	81	25	17	6
3:45-4:00	11	72	88	31	16	9
4:00-4:15	10	72	92	25	22	10
4:15-4:30	8	50	85	21	24	16
4:30-4:45	9	63	123	22	15	13
4:45-5:00	8	56	74	18	11	11
3:30-4:30						
Peak Hour Total	37	288	346	102	79	41

Hardy Street/Eiwa Street

	Hardy Street				Eiwa Street	
Afternoon	Eastbound		Westbound		Northbound	
Peak Hour	TH	RT	LT	TH	LT	RT
3:30-3:45	91	21	25	72	38	43
3:45-4:00	68	14	32	75	48	54
4:00-4:15	54	25	13	82	39	34
4:15-4:30	55	24	30	75	34	45
4:30-4:45	59	14	25	101	44	43
4:45-5:00	51	17	26	62	30	35
3:30-4:30						
Peak Hour Total	268	84	100	304	159	176

Rice Street/Eiwa Street

	Rice Street				Eiwa Street	
Afternoon	Eastbound		Westbound		Southbound	
Peak Hour	LT	TH	TH	RT	LT	RT
3:30-3:45	73	137	142	24	8	49
3:45-4:00	59	150	151	36	5	39
4:00-4:15	59	145	146	25	11	44
4:15-4:30	58	137	171	25	11	59
4:30-4:45	68	115	189	26	5	58
4:45-5:00	47	119	144	25	11	40
3:30-4:30						
Peak Hour Total	249	569	610	110	35	191

Rice Street/Haleko Street/Access Driveway "G"

Afternoon	Rice Street Eastbound			Rice Street Westbound			Haleko Street Northbound			Access Driveway G Southbound		
Peak Hour	LT[1]	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
3:30-3:45	0	143	4	51	122	4	8	0	69	1	0	12
3:45-4:00	0	162	7	33	138	1	4	2	55	2	3	11
4:00-4:15	2	134	10	38	149	1	3	1	58	3	1	7
4:15-4:30	0	124	5	51	172	2	3	2	54	0	2	14
4:30-4:45	1	58	1	32	98	2	1	1	23	0	3	8
3:30-4:30 Pk Hr Total	2	563	26	173	581	8	18	5	236	6	6	44

[1] Left-turn from Rice Street, eastbound, is restricted.