Traffic Impact Analysis Report

Koa Ridge Makai and Waiawa Developments

Prepared For

Castle & Cooke Homes Hawaii

Prepared By

Wilson Okamoto Corporation

November 2008
Revised February 2009
Revised May 2010

Volume 2

TRAFFIC IMPACT ANALYSIS REPORT

FOR

KOA RIDGE MAKAI AND WAIAWA DEVELOPMENTS

Prepared for:

Castle & Cooke Homes Hawaii
100 Kahelu Avenue, 2nd Floor
Mililani, Hawaii 96789

Prepared by:

Wilson Okamoto Corporation
1907 South Beretania Street
Honolulu, Hawaii 96826
WOC Ref: 7101-09

VOLUME 2

November 2008
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VOLUME 2

APPENDIX

LIST OF APPENDICES

APPENDIX A

NEIGHBORHOOD BOARD NO. 25 RESOLUTION

DEC 27 2007

MILILANI/ WAIPIO/ MELEMANU NEIGHBORHOOD BOARD NO. 25

c/o NEIGHBORHOOD COMMISSION • 530 SOUTH KING STREET ROOM 400 • HONOLULU, HAWAII, 96813
PHONE (808) 527-5749 • FAX (808) 527-5760 • INTERNET: http://www.honolulu.gov

RESOLUTION REQUESTING THE INCLUSION OF A REGIONAL TRANSPORTATION SECONDARY AND CUMULATIVE IMPACT ANALYSIS AS PART OF THE FINAL ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR CASTLE & COOKE WAIAWA

WHEREAS, up to 20,000 additional housing units are planned for development by the year 2030 in Central Oahu at Koa Ridge Makai, Mililani Mauka, Royal Kunia, Waiawa Castle & Cooke and, Waiawa Gentry; and

WHEREAS, the proposed Castle & Cooke Waiawa master planned community will include 1,500 single and multi-family housing units as described in the draft EIS for Castle & Cooke Waiawa; and

WHEREAS, the projected population of 189,000 in Central Oahu by 2030 will exceed the forecast of 185,000 for the so-called Secondary Urban Center (Kapolei and its environs) according to the City & County of Honolulu's Central Oahu Sustainable Communities Plan and the Ewa Development Plan; and

WHEREAS, the Oahu Metropolitan Planning Organization 2030 Regional Transportation Plan projects travel time during rush hour from Mililani to Ala Moana to exceed two hours each way by 2030; and

WHEREAS, the City and County of Honolulu's planned rapid transit (rail) system currently excludes an extension to Central Oahu; and

WHEREAS, while the traffic analysis for the draft EIS for Castle & Cooke Waiawa does indeed analyze traffic increases at the study intersections, it does not examine the proposed development's potential connected actions, secondary impacts, significant effects and cumulative impacts relative to Central Oahu transportation infrastructure; and

WHEREAS, in August 2007 the Hawaii State Supreme Court reversed the Sierra Club vs. the State Department of Transportation's (DOT) Circuit Court exemption decision of 2005 and mandated, as a matter of law, the State DOT to conduct an environmental assessment of the Hawaii Super Ferry to include an analysis of the secondary as well as the primary impacts generated by the operations of the Hawaii Super Ferry in Hawaiian waters; now therefore,

BE IT RESOLVED that Mililani/Waipio/MelemanuNeighborhood Board No. 25 requests that the final EIS for Castle & Cooke Waiawa development include an analysis of the primary, secondary, and cumulative impacts of the regional transportation infrastructure in Central Oahu, to include the identification of traffic and transportation needs, deficiencies, and appropriate mitigation measures; and

BE IT FURTHER RESOLVED that the transportation infrastructure analysis include as a minimum the following:

(1) the incremental effect on commuter travel time resulting from the construction of additional housing units in Central Oahu, and a determination as to what point in time proposed developments in Central Oahu will exceed the ability of the regional transportation infrastructure to accommodate such development at the time of occupancy under existing conditions, and

(2) the impact that a fully-developed rapid transit system on Oahu would have on Central Oahu commuter, and

(3) the individual and cumulative impact of the following proposed transportation improvements in Central Oahu on commuter travel times:

- the timing and construction of all new or improved H-2 interchanges identified in the OMPO 2030 Regional Transportation Plan;
- the timing and construction of the Central Mauka Road identified in the OMPO 2030 Regional Transportation Plan;
- the timing and construction of a road connecting Kamehameha Highway and Paiwa Road as identified in the OMPO 2030 Regional Transportation Plan;
- the timing and construction of the widening of Kamehameha Highway to four lanes between Ka Uka Boulevard and Lanikuhana Avenue as identified in the OMPO 2030 Regional Transportation Plan;
- the location of a Regional Park and Ride facility located on the H-2 corridor near Koa Ridge as identified in the Mililani Mauka Park and Ride Feasibility Study;
- the timing and construction of a southern access road connecting the Waiawa and Koa Ridge/Waiawa development to Kamehameha Highway and the H-1 via Pearl City or Seaview as an alternative to or in addition to the northern Ka Uka access road; and
- the timing and construction of adequate access to the rapid transit system assuming either a fixed rail Central Oahu spur or access via busses utilizing dedicated bus lanes connected to Central Oahu park and ride facilities;

BE IT FINALLY RESOLVED that copies of this resolution be transmitted to the Mayor and Councilmembers of the City & County of Honolulu, the City Departments of Planning and Permitting and Transportation Services, the State Land Use Commission, the State Department of Transportation, the State Office of Environmental Quality Control, the State Environmental Council, the State Office of Planning, area legislators, the Oahu Metropolitan Organization, Castle & Cooke Homes, Inc, Wilson Okamoto Corporation, the Hawaii Chapter of the Sierra Club, Attorney Isaac Hall, all members of Neighborhood Boards Nos. 21, 22, 26, and 35, and all neighborhood board chairs.

Adopted by Mililani-Waipio-Melemanu Neighborhood Board No. 25 at its regular meeting of November 28, 2007, by a vote of 22-0-1.

Richard G. Poirier, Chair

APPENDIX B

EXISTING TRAFFIC COUNT DATA

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:T-1841, D4-5676
Counted:ER, LF
Weather:Clear

File Name : Ka Uka - H-1 NB On-Ramp - H-1 NB Off-Ramp AM
Site Code : 00000001
Start Date : 9/9/2008
Page No : 1

Groups Printed- Unshifted

	Southbound	Ka Uka Blvd. Westbound				NB H-1 Off-Ramp Northbound				Ka Uka Blvd. Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	0	0	7	2	9	63	0	3	66	53	2	0	55	130
06:15 AM	0	0	3	3	6	71	0	1	72	64	8	0	72	150
06:30 AM	0	0	0	0	0	89	0	4	93	55	4	0	59	152
06:45 AM	0	0	1	0	1	94	0	3	97	80	3	0	83	181
Total	0	0	11	5	16	317	0	11	328	252	17	0	269	613
07:00 AM	0	0	3	0	3	122	0	4	126	74	1	0	75	204
07:15 AM	0	0	0	0	0	141	0	5	146	81	9	0	90	236
07:30 AM	0	0	1	0	1	135	0	8	143	73	12	0	85	229
07:45 AM	0	0	3	1	4	166	0	8	174	66	9	0	75	253
Total	0	0	7	1	8	564	0	25	589	294	31	0	325	922
08:00 AM	0	0	4	1	5	133	0	7	140	68	9	0	77	222
08:15 AM	0	0	7	0	7	131	0	7	138	62	5	0	67	212
08:30 AM	0	0	4	2	6	138	1	6	145	54	9	0	63	214
08:45 AM	0	0	6	1	7	115	0	14	129	74	13	0	87	223
Total	0	0	21	4	25	517	1	34	552	258	36	0	294	871
Grand Total	0	0	39	10	49	1398	1	70	1469	804	84	0	888	2406
Apprch %		0	79.6	20.4		95.2	0.1	4.8		90.5	9.5	0		
Total %	0	0	1.6	0.4	2	58.1	0	2.9	61.1	33.4	3.5	0	36.9	

	Southbound	Ka Uka Blvd. Westbound				NB H-1 Off-Ramp Northbound				Ka Uka Blvd. Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:15 AM														
07:15 AM	0	0	0	0	0	141	0	5	146	**81**	9	0	**90**	236
07:30 AM	0	0	1	0	1	135	0	**8**	143	73	**12**	0	85	229
07:45 AM	0	0	3	**1**	4	**166**	0	8	**174**	66	9	0	75	**253**
08:00 AM	0	0	**4**	1	**5**	133	0	7	140	68	9	0	77	222
Total Volume	0	0	8	2	10	575	0	28	603	288	39	0	327	940
% App. Total		0	80	20		95.4	0	4.6		88.1	11.9	0		
PHF	.000	.000	.500	.500	.500	.866	.000	.875	.866	.889	.813	.000	.908	.929

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:T-1841, D4-5676
Counted:ER, LF
Weather:Clear

File Name : Ka Uka - H-1 NB On-Ramp - H-1 NB Off-Ramp PM
Site Code : 00000001
Start Date : 9/9/2008
Page No : 1

Groups Printed- Unshifted

	Southbound	Ka Uka Blvd. Westbound				NB H-1 Off-Ramp Northbound				Ka Uka Blvd. Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	0	0	3	5	8	329	1	7	337	112	7	0	119	464
03:15 PM	0	0	10	1	11	349	0	5	354	89	11	0	100	465
03:30 PM	0	0	16	10	26	316	0	3	319	103	4	0	107	452
03:45 PM	0	0	4	3	7	282	0	5	287	120	6	0	126	420
Total	0	0	33	19	52	1276	1	20	1297	424	28	0	452	1801
04:00 PM	0	0	10	11	21	270	0	4	274	107	7	0	114	409
04:15 PM	0	0	7	3	10	295	0	5	300	121	4	0	125	435
04:30 PM	0	0	11	9	20	266	0	1	267	122	8	0	130	417
04:45 PM	0	0	15	5	20	311	1	4	316	116	14	0	130	466
Total	0	0	43	28	71	1142	1	14	1157	466	33	0	499	1727
05:00 PM	0	0	14	6	20	276	0	9	285	127	9	0	136	441
05:15 PM	0	0	10	10	20	297	0	9	306	146	22	0	168	494
05:30 PM	0	0	13	7	20	285	0	6	291	127	25	0	152	463
05:45 PM	0	0	13	8	21	281	0	17	298	88	14	0	102	421
Total	0	0	50	31	81	1139	0	41	1180	488	70	0	558	1819
Grand Total	0	0	126	78	204	3557	2	75	3634	1378	131	0	1509	5347
Apprch %		0	61.8	38.2		97.9	0.1	2.1		91.3	8.7	0		
Total %	0	0	2.4	1.5	3.8	66.5	0	1.4	68	25.8	2.4	0	28.2	

	Southbound	Ka Uka Blvd. Westbound				NB H-1 Off-Ramp Northbound				Ka Uka Blvd. Eastbound				
Start Time	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 04:45 PM														
04:45 PM	0	0	**15**	5	**20**	**311**	**1**	4	**316**	116	14	0	130	466
05:00 PM	0	0	14	6	20	276	0	**9**	285	127	9	0	136	441
05:15 PM	0	0	10	**10**	20	297	0	9	306	**146**	22	0	**168**	**494**
05:30 PM	0	0	13	7	20	285	0	6	291	127	**25**	0	152	463
Total Volume	0	0	52	28	80	1169	1	28	1198	516	70	0	586	1864
% App. Total		0	65	35		97.6	0.1	2.3		88.1	11.9	0		
PHF	.000	.000	.867	.700	1.000	.940	.250	.778	.948	.884	.700	.000	.872	.943

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-3888, D4-5673
Counted:RY, JY
Weather:Clear

File Name : SB H-2 On-Ramp AM
Site Code : 00000001
Start Date : 9/9/2008

Groups Printed- Unshifted

	Construction Site Southbound				Ka Uka Blvd. Westbound				Northbound	Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	0	0	0	0	6	63	1	70	0	1	63	290	354	424
06:15 AM	0	0	0	0	3	73	0	76	0	1	70	276	347	423
06:30 AM	0	0	0	0	0	86	3	89	0	0	55	236	291	380
06:45 AM	0	0	0	0	2	93	1	96	0	0	81	263	344	440
Total	0	0	0	0	11	315	5	331	0	2	269	1065	1336	1667
07:00 AM	0	0	0	0	3	122	0	125	0	0	75	264	339	464
07:15 AM	0	0	0	0	0	143	1	144	0	0	87	230	317	461
07:30 AM	0	0	1	1	1	137	0	138	0	1	84	239	324	463
07:45 AM	0	0	0	0	1	163	2	166	0	0	74	235	309	475
Total	0	0	1	1	5	565	3	573	0	1	320	968	1289	1863
08:00 AM	2	1	1	4	3	139	1	143	0	1	75	207	283	430
08:15 AM	1	0	0	1	5	134	0	139	0	1	62	185	248	388
08:30 AM	0	0	2	2	2	139	0	141	0	1	67	185	253	396
08:45 AM	0	0	0	0	4	119	0	123	0	1	82	207	290	413
Total	3	1	3	7	14	531	1	546	0	4	286	784	1074	1627
Grand Total	3	1	4	8	30	1411	9	1450	0	7	875	2817	3699	5157
Apprch %	37.5	12.5	50		2.1	97.3	0.6			0.2	23.7	76.2		
Total %	0.1	0	0.1	0.2	0.6	27.4	0.2	28.1	0	0.1	17	54.6	71.7	

	Construction Site Southbound				Ka Uka Blvd. Westbound				Northbound	Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:00 AM														
07:00 AM	0	0	0	0	**3**	122	0	125	0	0	**75**	**264**	**339**	464
07:15 AM	0	0	0	0	0	143	1	144	0	0	**87**	230	317	461
07:30 AM	0	0	**1**	**1**	1	137	0	138	0	**1**	84	239	324	463
07:45 AM	0	0	0	0	1	**163**	**2**	**166**	0	0	74	235	309	**475**
Total Volume	0	0	1	1	5	565	3	573	0	1	320	968	1289	1863
% App. Total	0	0	100		0.9	98.6	0.5			0.1	24.8	75.1		
PHF	.000	.000	.250	.250	.417	.867	.375	.863	.000	.250	.920	.917	.951	.981

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-3888, D4-5673
Counted:RY, JY
Weather:Clear

File Name : SB H-2 On-Ramp PM
Site Code : 00000001
Start Date : 9/9/2008
Page No : 1

Groups Printed- Unshifted

	Construction Site Southbound				Ka Uka Blvd. Westbound				Northbound	Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	0	0	1	1	3	324	0	327	0	0	128	207	335	663
03:15 PM	0	0	0	0	5	344	0	349	0	2	94	178	274	623
03:30 PM	0	0	0	0	12	322	0	334	0	1	106	212	319	653
03:45 PM	1	0	0	1	7	286	0	293	0	0	121	173	294	588
Total	1	0	1	2	27	1276	0	1303	0	3	449	770	1222	2527
04:00 PM	0	0	0	0	3	280	0	283	0	0	129	200	329	612
04:15 PM	0	0	0	0	2	297	0	299	0	1	123	180	304	603
04:30 PM	0	2	3	5	5	276	0	281	0	1	128	233	362	648
04:45 PM	0	0	0	0	7	317	0	324	0	0	127	182	309	633
Total	0	2	3	5	17	1170	0	1187	0	2	507	795	1304	2496
05:00 PM	0	1	1	2	11	279	0	290	0	0	142	172	314	606
05:15 PM	0	0	0	0	2	302	0	304	0	2	142	160	304	608
05:30 PM	0	0	0	0	6	304	0	310	0	0	148	171	319	629
05:45 PM	0	1	0	1	7	293	0	300	0	0	116	147	263	564
Total	0	2	1	3	26	1178	0	1204	0	2	548	650	1200	2407
Grand Total	1	4	5	10	70	3624	0	3694	0	7	1504	2215	3726	7430
Apprch %	10	40	50		1.9	98.1	0			0.2	40.4	59.4		
Total %	0	0.1	0.1	0.1	0.9	48.8	0	49.7	0	0.1	20.2	29.8	50.1	

	Construction Site Southbound				Ka Uka Blvd. Westbound				Northbound	Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 03:00 PM														
03:00 PM	0	0	**1**	**1**	3	324	0	327	0	0	**128**	207	**335**	**663**
03:15 PM	0	0	0	0	5	**344**	0	**349**	0	**2**	94	178	274	623
03:30 PM	0	0	0	0	**12**	322	0	334	0	1	106	**212**	319	653
03:45 PM	**1**	0	0	1	7	286	0	293	0	0	121	173	294	588
Total Volume	1	0	1	2	27	1276	0	1303	0	3	449	770	1222	2527
% App. Total	50	0	50		2.1	97.9	0			0.2	36.7	63		
PHF	.250	.000	.250	.500	.563	.927	.000	.933	.000	.375	.877	.908	.912	.953

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-3890, D4-5674
Counted:DY, EK
Weather:Clear

File Name : UkaMoa AM
Site Code : 00000001
Start Date : 9/9/2008
Page No : 1

Groups Printed- Unshifted

	SB H-2 Off-Ramp Southbound				Ka Uka Blvd. Westbound				Moaniani Street Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	1	21	23	45	23	43	0	66	0	0	115	115	0	278	2	280	506
06:15 AM	6	20	41	67	26	42	0	68	0	0	115	115	0	262	6	268	518
06:30 AM	2	25	48	75	29	58	0	87	5	0	130	135	0	199	5	204	501
06:45 AM	2	30	51	83	32	51	0	83	3	0	113	116	0	249	5	254	536
Total	11	96	163	270	110	194	0	304	8	0	473	481	0	988	18	1006	2061
07:00 AM	0	31	44	75	53	80	0	133	9	0	133	142	0	245	12	257	607
07:15 AM	4	47	40	91	50	83	0	133	5	0	127	132	0	229	15	244	600
07:30 AM	3	35	56	94	63	82	0	145	4	0	97	101	0	254	13	267	607
07:45 AM	4	45	55	104	69	89	0	158	10	0	89	99	0	230	16	246	607
Total	11	158	195	364	235	334	0	569	28	0	446	474	0	958	56	1014	2421
08:00 AM	9	51	43	103	72	66	0	138	4	0	137	141	1	158	10	169	551
08:15 AM	5	37	34	76	72	67	0	139	4	0	90	94	0	166	14	180	489
08:30 AM	6	31	32	69	72	77	0	149	11	0	94	105	0	189	10	199	522
08:45 AM	8	30	31	69	38	74	0	112	9	0	117	126	0	197	15	212	519
Total	28	149	140	317	254	284	0	538	28	0	438	466	1	710	49	760	2081
Grand Total	50	403	498	951	599	812	0	1411	64	0	1357	1421	1	2656	123	2780	6563
Apprch %	5.3	42.4	52.4		42.5	57.5	0		4.5	0	95.5		0	95.5	4.4		
Total %	0.8	6.1	7.6	14.5	9.1	12.4	0	21.5	1	0	20.7	21.7	0	40.5	1.9	42.4	

	SB H-2 Off-Ramp Southbound				Ka Uka Blvd. Westbound				Moaniani Street Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	31	44	75	53	80	0	133	9	0	**133**	**142**	0	245	12	257	**607**
07:15 AM	**4**	**47**	40	91	50	83	0	133	5	0	127	132	0	229	15	244	600
07:30 AM	3	35	**56**	94	63	82	0	145	**4**	0	97	101	0	**254**	13	**267**	607
07:45 AM	4	45	55	**104**	**69**	**89**	0	**158**	**10**	0	89	99	0	230	**16**	246	607
Total Volume	11	158	195	364	235	334	0	569	28	0	446	474	0	958	56	1014	2421
% App. Total	3	43.4	53.6		41.3	58.7	0		5.9	0	94.1		0	94.5	5.5		
PHF	.688	.840	.871	.875	.851	.938	.000	.900	.700	.000	.838	.835	.000	.943	.875	.949	.997

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-3890, D4-5674
Counted:EK, DY
Weather:Clear

File Name : UkaMoa PM
Site Code : 00000001
Start Date : 9/9/2008
Page No : 1

Groups Printed- Unshifted

	SB H-2 Off-Ramp Southbound				Ka Uka Blvd. Westbound				Moaniani Sreet Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	0	41	38	79	127	213	0	340	18	0	193	211	0	172	13	185	815
03:15 PM	5	50	36	91	128	238	0	366	24	0	173	197	0	125	22	147	801
03:30 PM	4	36	43	83	106	213	0	319	29	0	181	210	0	150	22	172	784
03:45 PM	0	65	29	94	106	182	0	288	13	0	173	186	0	133	12	145	713
Total	9	192	146	347	467	846	0	1313	84	0	720	804	0	580	69	649	3113
04:00 PM	4	39	29	72	88	181	0	269	25	0	159	184	0	172	17	189	714
04:15 PM	2	43	49	94	116	227	0	343	15	0	210	225	0	130	12	142	804
04:30 PM	1	44	54	99	76	166	0	242	22	0	208	230	0	178	13	191	762
04:45 PM	10	45	37	92	108	233	0	341	12	0	157	169	0	156	27	183	785
Total	17	171	169	357	388	807	0	1195	74	0	734	808	0	636	69	705	3065
05:00 PM	1	66	43	110	86	181	0	267	25	0	173	198	0	160	16	176	751
05:15 PM	6	37	42	85	95	214	0	309	19	0	176	195	0	136	19	155	744
05:30 PM	11	38	42	91	92	229	0	321	18	0	174	192	0	184	16	200	804
05:45 PM	10	58	47	115	92	171	0	263	22	0	132	154	0	145	12	157	689
Total	28	199	174	401	365	795	0	1160	84	0	655	739	0	625	63	688	2988
Grand Total	54	562	489	1105	1220	2448	0	3668	242	0	2109	2351	0	1841	201	2042	9166
Apprch %	4.9	50.9	44.3		33.3	66.7	0		10.3	0	89.7		0	90.2	9.8		
Total %	0.6	6.1	5.3	12.1	13.3	26.7	0	40	2.6	0	23	25.6	0	20.1	2.2	22.3	

	SB H-2 Off-Ramp Southbound				Ka Uka Blvd. Westbound				Moaniani Sreet Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:00 PM																	
03:00 PM	0	41	38	79	127	213	0	340	18	0	**193**	**211**	0	**172**	13	**185**	**815**
03:15 PM	**5**	50	36	91	**128**	**238**	0	**366**	24	0	173	197	0	125	**22**	147	801
03:30 PM	4	36	**43**	83	106	213	0	319	**29**	0	181	210	0	150	22	172	784
03:45 PM	0	**65**	29	**94**	106	182	0	288	13	0	173	186	0	133	12	145	713
Total Volume	9	192	146	347	467	846	0	1313	84	0	720	804	0	580	69	649	3113
% App. Total	2.6	55.3	42.1		35.6	64.4	0		10.4	0	89.6		0	89.4	10.6		
PHF	.450	.738	.849	.923	.912	.889	.000	.897	.724	.000	.933	.953	.000	.843	.784	.877	.955

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5677
Counted:TO
Weather:Clear

File Name : SpineUka AM
Site Code : 00000001
Start Date : 9/9/2008
Page No : 1

Groups Printed- Unshifted

	Spine Road Southbound					Ka Uka Blvd. Westbound					Shopping Center Northbound					Ka Uka Blvd. Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
06:00 AM	1	0	0	0	1	9	0	0	0	9	2	0	7	0	9	0	0	15	0	15	34
06:15 AM	0	0	2	2	4	11	0	0	0	11	1	0	6	1	8	2	0	9	0	11	34
06:30 AM	1	0	1	0	2	11	0	0	0	11	1	0	2	4	7	4	0	9	0	13	33
06:45 AM	0	0	0	1	1	17	0	1	0	18	1	0	7	0	8	2	0	14	0	16	43
Total	2	0	3	3	8	48	0	1	0	49	5	0	22	5	32	8	0	47	0	55	144
07:00 AM	0	0	0	0	0	18	0	2	0	20	1	0	6	0	7	2	0	22	0	24	51
07:15 AM	0	0	0	0	0	25	0	0	0	25	2	0	10	3	15	3	0	26	0	29	69
07:30 AM	0	0	1	0	1	21	0	1	0	22	3	0	10	1	14	3	0	13	0	16	53
07:45 AM	0	0	0	0	0	25	0	0	0	25	2	0	4	2	8	4	0	24	0	28	61
Total	0	0	1	0	1	89	0	3	0	92	8	0	30	6	44	12	0	85	0	97	234
08:00 AM	0	1	0	0	1	20	0	0	0	20	1	1	9	1	12	4	0	24	0	28	61
08:15 AM	0	0	0	0	0	22	0	1	0	23	0	0	15	1	16	2	0	16	0	18	57
08:30 AM	0	1	0	0	1	24	0	1	0	25	1	0	18	2	21	0	0	16	0	16	63
08:45 AM	1	0	0	0	1	20	0	0	0	20	0	0	12	0	12	2	0	9	0	11	44
Total	1	2	0	0	3	86	0	2	0	88	2	1	54	4	61	8	0	65	0	73	225
Grand Total	3	2	4	3	12	223	0	6	0	229	15	1	106	15	137	28	0	197	0	225	603
Apprch %	25	16.7	33.3	25		97.4	0	2.6	0		10.9	0.7	77.4	10.9		12.4	0	87.6	0		
Total %	0.5	0.3	0.7	0.5	2	37	0	1	0	38	2.5	0.2	17.6	2.5	22.7	4.6	0	32.7	0	37.3	

	Spine Road Southbound				Ka Uka Blvd. Westbound				Shopping Center Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	0	0	0	0	**25**	0	0	**25**	2	0	**10**	12	3	0	**26**	**29**	**66**
07:30 AM	0	0	1	1	21	0	1	22	**3**	0	10	**13**	3	0	13	16	52
07:45 AM	0	0	0	0	25	0	0	25	2	0	4	6	**4**	0	24	28	59
08:00 AM	0	**1**	0	1	20	0	0	20	1	**1**	9	11	4	0	24	28	60
Total Volume	0	1	1	2	91	0	1	92	8	1	33	42	14	0	87	101	237
% App. Total	0	50	50		98.9	0	1.1		19	2.4	78.6		13.9	0	86.1		
PHF	.000	.250	.250	.500	.910	.000	.250	.920	.667	.250	.825	.808	.875	.000	.837	.871	.898

WILSON OKAMOTO CORPORATION
1907 S. Beretani[illegible]eet Suite 400
Honolulu, HI 96826

Counter:D4-5677
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Weather:Clear

File Name : SpineUka PM
Site Code : 00000001
Start Date : 9/9/2008
Page No : 1

Groups Printed- Unshifted

	Spine Road Southbound				Ka Uka Blvd. Westbound				Shopping Center Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	0	0	1	1	33	0	0	33	2	0	30	32	5	0	20	25	91
03:15 PM	1	0	0	1	37	0	1	38	2	0	18	20	2	0	29	31	90
03:30 PM	0	0	0	0	26	0	1	27	2	0	22	24	3	0	19	22	73
03:45 PM	1	0	1	2	15	0	0	15	5	0	29	34	1	0	26	27	78
Total	2	0	2	4	111	0	2	113	11	0	99	110	11	0	94	105	332
04:00 PM	3	0	1	4	29	0	0	29	3	0	23	26	1	0	27	28	87
04:15 PM	0	0	1	1	33	0	0	33	1	0	31	32	2	0	27	29	95
04:30 PM	0	0	0	0	23	0	1	24	1	0	40	41	1	0	32	33	98
04:45 PM	1	2	0	3	31	0	1	32	2	0	48	50	1	0	41	42	127
Total	4	2	2	8	116	0	2	118	7	0	142	149	5	0	127	132	407
05:00 PM	0	0	1	1	31	0	0	31	0	1	39	40	3	0	32	35	107
05:15 PM	0	0	1	1	23	0	0	23	1	0	42	43	0	0	42	42	109
05:30 PM	0	0	2	2	28	0	1	29	0	0	33	33	2	0	42	44	108
05:45 PM	2	0	1	3	31	0	0	31	1	0	39	40	2	0	29	31	105
Total	2	0	5	7	113	0	1	114	2	1	153	156	7	0	145	152	429
Grand Total	8	2	9	19	340	0	5	345	20	1	394	415	23	0	366	389	1168
Apprch %	42.1	10.5	47.4		98.6	0	1.4		4.8	0.2	94.9		5.9	0	94.1		
Total %	0.7	0.2	0.8	1.6	29.1	0	0.4	29.5	1.7	0.1	33.7	35.5	2	0	31.3	33.3	

	Spine Road Southbound				Ka Uka Blvd. Westbound				Shopping Center Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:45 PM																	
04:45 PM	1	**2**	0	**3**	**31**	0	1	**32**	**2**	0	**48**	**50**	1	0	41	42	**127**
05:00 PM	0	0	1	1	31	0	0	31	0	**1**	39	40	**3**	0	32	35	107
05:15 PM	0	0	1	1	23	0	0	23	1	0	42	43	0	0	**42**	42	109
05:30 PM	0	0	**2**	2	28	0	1	29	0	0	33	33	2	0	42	**44**	108
Total Volume	1	2	4	7	113	0	2	115	3	1	162	166	6	0	157	163	451
% App. Total	14.3	28.6	57.1		98.3	0	1.7		1.8	0.6	97.6		3.7	0	96.3		
PHF	.250	.250	.500	.583	.911	.000	.500	.898	.375	.250	.844	.830	.500	.000	.935	.926	.888

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5673, D4-3888
Counted:RY, JY
Weather:Clear

File Name : UkaUkee(East) AM
Site Code : 00000001
Start Date : 9/11/2008
Page No : 1

Groups Printed- Unshifted

	Ukee Street (East) Southbound				Ka Uka Blvd. Westbound				Ukee Street (East) Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	5	0	1	6	9	36	11	56	6	1	6	13	3	190	12	205	280
06:15 AM	0	2	0	2	20	54	16	90	8	3	7	18	3	205	17	225	335
06:30 AM	2	0	2	4	14	37	18	69	7	2	4	13	1	224	17	242	328
06:45 AM	3	0	1	4	21	65	17	103	12	2	5	19	1	189	18	208	334
Total	10	2	4	16	64	192	62	318	33	8	22	63	8	808	64	880	1277
07:00 AM	2	1	0	3	25	51	18	94	8	2	2	12	1	233	13	247	356
07:15 AM	2	1	0	3	20	73	25	118	11	5	8	24	1	219	22	242	387
07:30 AM	7	0	1	8	21	83	14	118	7	2	4	13	3	210	24	237	376
07:45 AM	2	1	1	4	14	80	16	110	15	6	4	25	3	176	23	202	341
Total	13	3	2	18	80	287	73	440	41	15	18	74	8	838	82	928	1460
08:00 AM	5	2	1	8	15	82	19	116	8	3	9	20	3	176	22	201	345
08:15 AM	2	0	3	5	14	61	11	86	12	4	5	21	2	145	16	163	275
08:30 AM	5	2	0	7	19	52	10	81	13	2	11	26	2	139	16	157	271
08:45 AM	2	4	0	6	16	66	7	89	9	4	11	24	0	144	12	156	275
Total	14	8	4	26	64	261	47	372	42	13	36	91	7	604	66	677	1166
Grand Total	37	13	10	60	208	740	182	1130	116	36	76	228	23	2250	212	2485	3903
Apprch %	61.7	21.7	16.7		18.4	65.5	16.1		50.9	15.8	33.3		0.9	90.5	8.5		
Total %	0.9	0.3	0.3	1.5	5.3	19	4.7	29	3	0.9	1.9	5.8	0.6	57.6	5.4	63.7	

	Ukee Street (East) Southbound				Ka Uka Blvd. Westbound				Ukee Street (East) Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	2	**1**	0	3	**25**	51	18	94	8	2	2	12	1	**233**	13	**247**	356
07:15 AM	2	1	0	3	20	73	**25**	**118**	11	5	**8**	24	1	219	22	242	**387**
07:30 AM	**7**	0	**1**	**8**	21	**83**	14	118	7	2	4	13	**3**	210	**24**	237	376
07:45 AM	2	1	1	4	14	80	16	110	**15**	**6**	4	**25**	3	176	23	202	341
Total Volume	13	3	2	18	80	287	73	440	41	15	18	74	8	838	82	928	1460
% App. Total	72.2	16.7	11.1		18.2	65.2	16.6		55.4	20.3	24.3		0.9	90.3	8.8		
PHF	.464	.750	.500	.563	.800	.864	.730	.932	.683	.625	.563	.740	.667	.899	.854	.939	.943

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5673, D4-3888
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Weather:Clear

File Name : UkaUkee(East) PM
Site Code : 00000001
Start Date : 9/11/2008
Page No : 1

Groups Printed- Unshifted

	Ukee Street (East) Southbound				Ka Uka Blvd. Westbound				Ukee Street (East) Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	17	3	5	25	27	194	14	235	38	3	15	56	4	128	15	147	463
03:15 PM	18	0	10	28	38	198	23	259	35	6	19	60	2	105	16	123	470
03:30 PM	15	1	7	23	32	223	17	272	29	6	11	46	2	118	16	136	477
03:45 PM	12	4	3	19	20	199	24	243	29	5	19	53	3	113	19	135	450
Total	62	8	25	95	117	814	78	1009	131	20	64	215	11	464	66	541	1860
04:00 PM	10	2	3	15	30	202	19	251	33	4	24	61	6	108	17	131	458
04:15 PM	7	2	2	11	18	191	12	221	34	4	15	53	1	112	24	137	422
04:30 PM	12	4	1	17	16	218	11	245	29	4	22	55	3	124	13	140	457
04:45 PM	10	3	4	17	20	224	23	267	24	3	10	37	2	127	14	143	464
Total	39	11	10	60	84	835	65	984	120	15	71	206	12	471	68	551	1801
05:00 PM	12	3	3	18	15	210	22	247	27	3	14	44	1	144	21	166	475
05:15 PM	9	1	6	16	11	181	15	207	35	3	12	50	1	126	6	133	406
05:30 PM	11	0	1	12	13	205	14	232	38	4	20	62	0	112	16	128	434
05:45 PM	1	0	0	1	23	230	14	267	27	0	15	42	5	128	11	144	454
Total	33	4	10	47	62	826	65	953	127	10	61	198	7	510	54	571	1769
Grand Total	134	23	45	202	263	2475	208	2946	378	45	196	619	30	1445	188	1663	5430
Apprch %	66.3	11.4	22.3		8.9	84	7.1		61.1	7.3	31.7		1.8	86.9	11.3		
Total %	2.5	0.4	0.8	3.7	4.8	45.6	3.8	54.3	7	0.8	3.6	11.4	0.6	26.6	3.5	30.6	

	Ukee Street (East) Southbound				Ka Uka Blvd. Westbound				Ukee Street (East) Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 03:00 PM																	
03:00 PM	17	3	5	25	27	194	14	235	**38**	3	15	56	4	**128**	15	**147**	463
03:15 PM	**18**	0	**10**	**28**	**38**	198	23	259	35	**6**	**19**	**60**	2	105	16	123	470
03:30 PM	15	1	7	23	32	**223**	17	**272**	29	6	11	46	2	118	16	136	477
03:45 PM	12	4	3	19	20	199	**24**	243	29	5	19	53	3	113	**19**	135	450
Total Volume	62	8	25	95	117	814	78	1009	131	20	64	215	11	464	66	541	1860
% App. Total	65.3	8.4	26.3		11.6	80.7	7.7		60.9	9.3	29.8		2	85.8	12.2		
PHF	.861	.500	.625	.848	.770	.913	.813	.927	.862	.833	.842	.896	.688	.906	.868	.920	.975

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676, D4-5675
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Weather:Clear

File Name : KaUkaWai AM
Site Code : 00000203
Start Date : 5/7/2008
Page No : 1

Groups Printed- Unshifted

	Waipio Uka Street Southbound					Ka Uka Blvd. Westbound					Waipio Uka Street Northbound					Ka Uka Blvd. Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
06:00 AM	3	10	12	0	25	12	60	2	1	75	27	4	15	2	48	6	227	13	3	249	397
06:15 AM	5	1	6	3	15	7	62	6	0	75	20	9	9	0	38	9	168	7	0	184	312
06:30 AM	3	1	6	0	10	6	150	9	0	165	22	2	16	0	40	16	212	10	2	240	455
06:45 AM	3	1	11	0	15	6	167	21	0	194	16	6	20	1	43	13	218	15	2	248	500
Total	14	13	35	3	65	31	439	38	1	509	85	21	60	3	169	44	825	45	7	921	1664
07:00 AM	5	4	7	0	16	5	164	17	0	186	17	4	22	0	43	18	253	18	2	291	536
07:15 AM	7	4	7	1	19	14	146	15	0	175	18	8	25	3	54	17	245	11	3	276	524
07:30 AM	4	1	12	1	18	2	129	15	3	149	19	3	28	3	53	33	217	10	2	262	482
07:45 AM	7	3	8	0	18	7	74	15	0	96	25	4	14	2	45	41	181	23	5	250	409
Total	23	12	34	2	71	28	513	62	3	606	79	19	89	8	195	109	896	62	12	1079	1951
08:00 AM	0	2	8	0	10	13	70	12	0	95	28	10	15	1	54	21	204	13	1	239	398
08:15 AM	8	7	12	0	27	12	68	12	0	92	28	3	11	0	42	8	154	5	1	168	329
08:30 AM	2	4	11	0	17	17	48	9	0	74	16	3	4	0	23	4	134	11	2	151	265
08:45 AM	3	4	12	0	19	15	60	7	1	83	26	3	13	0	42	7	141	4	0	152	296
Total	13	17	43	0	73	57	246	40	1	344	98	19	43	1	161	40	633	33	4	710	1288
Grand Total	50	42	112	5	209	116	1198	140	5	1459	262	59	192	12	525	193	2354	140	23	2710	4903
Apprch %	23.9	20.1	53.6	2.4		8	82.1	9.6	0.3		49.9	11.2	36.6	2.3		7.1	86.9	5.2	0.8		
Total %	1	0.9	2.3	0.1	4.3	2.4	24.4	2.9	0.1	29.8	5.3	1.2	3.9	0.2	10.7	3.9	48	2.9	0.5	55.3	

	Waipio Uka Street Southbound					Ka Uka Blvd. Westbound					Waipio Uka Street Northbound					Ka Uka Blvd. Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 06:45 AM																					
06:45 AM	3	1	**11**	0	15	6	**167**	**21**	0	**194**	16	6	20	1	43	13	218	15	2	248	500
07:00 AM	5	4	7	0	16	5	164	17	**0**	186	17	4	22	0	43	18	**253**	**18**	2	**291**	**536**
07:15 AM	**7**	4	7	1	**19**	**14**	146	15	0	175	18	**8**	25	**3**	**54**	17	245	11	**3**	276	524
07:30 AM	4	1	**12**	1	18	2	129	15	**3**	149	**19**	3	**28**	3	53	**33**	217	10	2	262	482
Total Volume	19	10	37	2	68	27	606	68	3	704	70	21	95	7	193	81	933	54	9	1077	2042
% App. Total	27.9	14.7	54.4	2.9		3.8	86.1	9.7	0.4		36.3	10.9	49.2	3.6		7.5	86.6	5	0.8		
PHF	.679	.625	.771	.500	.895	.482	.907	.810	.250	.907	.921	.656	.848	.583	.894	.614	.922	.750	.750	.925	.952

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-5676, D4-5675
Counted:JY, JM
Weather:Clear

File Name : KaUkaWai PM
Site Code : 00000203
Start Date : 5/7/2008
Page No : 1

Groups Printed- Unshifted

	Waipio Uka Street Southbound					Ka Uka Blvd. Westbound					Waipio Uka Street Northbound					Ka Uka Blvd. Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
03:00 PM	8	3	8	0	19	10	199	17	0	226	19	6	19	0	44	17	104	8	0	129	418
03:15 PM	8	6	10	0	24	6	210	20	0	236	11	5	18	1	35	17	108	10	1	136	431
03:30 PM	12	4	24	0	40	8	186	18	0	212	10	9	34	0	53	26	126	5	0	157	462
03:45 PM	11	11	20	0	42	13	183	23	1	220	15	4	19	0	38	18	98	11	1	128	428
Total	39	24	62	0	125	37	778	78	1	894	55	24	90	1	170	78	436	34	2	550	1739
04:00 PM	4	7	17	1	29	4	219	19	0	242	13	8	16	0	37	30	126	7	4	167	475
04:15 PM	5	5	13	0	23	14	205	28	0	247	12	3	25	0	40	29	115	12	0	156	466
04:30 PM	6	15	34	0	55	3	180	19	0	202	9	5	34	10	58	16	131	9	3	159	474
04:45 PM	5	5	19	0	29	14	206	26	0	246	7	11	30	1	49	25	104	12	1	142	466
Total	20	32	83	1	136	35	810	92	0	937	41	27	105	11	184	100	476	40	8	624	1881
05:00 PM	15	10	23	0	48	9	224	36	2	271	12	3	28	0	43	23	119	10	0	152	514
05:15 PM	7	8	13	0	28	14	208	38	0	260	13	7	37	6	63	25	116	10	6	157	508
05:30 PM	3	2	24	1	30	9	215	32	0	256	11	1	28	0	40	22	110	9	0	141	467
05:45 PM	7	1	10	0	18	11	166	32	1	230	11	6	22	0	39	15	117	18	0	150	437
Total	32	21	70	1	124	43	833	138	3	1017	47	17	115	6	185	85	462	47	6	600	1926
Grand Total	91	77	215	2	385	115	2421	308	4	2848	143	68	310	18	539	263	1374	121	16	1774	5546
Apprch %	23.6	20	55.8	0.5		4	85	10.8	0.1		26.5	12.6	57.5	3.3		14.8	77.5	6.8	0.9		
Total %	1.6	1.4	3.9	0	6.9	2.1	43.7	5.6	0.1	51.4	2.6	1.2	5.6	0.3	9.7	4.7	24.8	2.2	0.3	32	

	Waipio Uka Street Southbound					Ka Uka Blvd. Westbound					Waipio Uka Street Northbound					Ka Uka Blvd. Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:30 PM																					
04:30 PM	6	**15**	**34**	0	**55**	3	180	19	0	202	9	5	34	**10**	58	16	**131**	9	3	**159**	474
04:45 PM	**5**	5	19	0	29	**14**	206	26	0	246	7	**11**	30	1	49	**25**	104	**12**	1	142	466
05:00 PM	**15**	10	23	0	48	9	**224**	36	**2**	**271**	12	3	28	0	43	23	119	10	0	152	**514**
05:15 PM	7	8	13	0	28	14	208	**38**	0	260	**13**	7	**37**	6	**63**	25	116	10	**6**	157	508
Total Volume	33	38	89	0	160	40	818	119	2	979	41	26	129	17	213	89	470	41	10	610	1962
% App. Total	20.6	23.8	55.6	0		4.1	83.6	12.2	0.2		19.2	12.2	60.6	8		14.6	77	6.7	1.6		
PHF	.550	.633	.654	.000	.727	.714	.913	.783	.250	.903	.788	.591	.872	.425	.845	.890	.897	.854	.417	.959	.954

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5677, D4-5674
Counted:DY, TO
Weather:Clear

File Name : UkaUkee(West) AM
Site Code : 00000001
Start Date : 9/11/2008
Page No : 1

Groups Printed- Unshifted

	Ukee Street (West) Southbound				Ka Uka Blvd. Westbound				Ukee Street (West) Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	1	0	1	2	20	34	0	54	12	2	58	72	10	140	14	164	292
06:15 AM	0	0	1	1	12	44	0	56	18	6	55	79	6	150	14	170	306
06:30 AM	0	3	1	4	24	41	1	66	13	5	61	79	13	172	8	193	342
06:45 AM	0	5	4	9	31	47	0	78	22	2	48	72	11	142	9	162	321
Total	1	8	7	16	87	166	1	254	65	15	222	302	40	604	45	689	1261
07:00 AM	0	1	2	3	25	44	1	70	14	3	53	70	12	177	21	210	353
07:15 AM	0	4	3	7	36	68	1	105	16	4	62	82	12	167	14	193	387
07:30 AM	0	1	2	3	38	52	3	93	20	2	96	118	13	155	23	191	405
07:45 AM	3	1	0	4	39	44	3	86	27	3	76	106	23	147	30	200	396
Total	3	7	7	17	138	208	8	354	77	12	287	376	60	646	88	794	1541
08:00 AM	2	4	2	8	29	64	4	97	12	9	39	60	14	147	10	171	336
08:15 AM	1	5	2	8	13	58	1	72	20	4	31	55	9	126	10	145	280
08:30 AM	2	3	3	8	12	49	1	62	15	4	28	47	8	107	12	127	244
08:45 AM	0	4	2	6	28	62	5	95	15	2	27	44	16	110	10	136	281
Total	5	16	9	30	82	233	11	326	62	19	125	206	47	490	42	579	1141
Grand Total	9	31	23	63	307	607	20	934	204	46	634	884	147	1740	175	2062	3943
Apprch %	14.3	49.2	36.5		32.9	65	2.1		23.1	5.2	71.7		7.1	84.4	8.5		
Total %	0.2	0.8	0.6	1.6	7.8	15.4	0.5	23.7	5.2	1.2	16.1	22.4	3.7	44.1	4.4	52.3	

	Ukee Street (West) Southbound				Ka Uka Blvd. Westbound				Ukee Street (West) Northbound				Ka Uka Blvd. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	1	2	3	25	44	1	70	14	3	53	70	12	**177**	21	**210**	353
07:15 AM	0	**4**	**3**	**7**	36	**68**	**1**	**105**	16	4	62	82	12	167	14	193	387
07:30 AM	0	1	2	3	38	52	**3**	93	20	2	**96**	**118**	13	155	23	191	**405**
07:45 AM	**3**	1	0	4	**39**	44	3	86	**27**	3	76	106	**23**	147	**30**	200	396
Total Volume	3	7	7	17	138	208	8	354	77	12	287	376	60	646	88	794	1541
% App. Total	17.6	41.2	41.2		39	58.8	2.3		20.5	3.2	76.3		7.6	81.4	11.1		
PHF	.250	.438	.583	.607	.885	.765	.667	.843	.713	.750	.747	.797	.652	.912	.733	.945	.951

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5677, D4-5674
Counted:DY, TO
Weather:Clear

File Name : UkaUkee (West) PM
Site Code : 00000001
Start Date : 9/11/2008
Page No : 1

Groups Printed- Unshifted

	Ukee Street (West) Southbound					Ka Uka Blvd. Westbound					Ukee Street (West) Northbound					Ka Uka Blvd. Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
03:00 PM	5	0	12	1	18	41	199	1	8	249	26	5	39	2	72	12	102	17	0	131	470
03:15 PM	3	6	15	0	24	37	186	3	1	227	49	3	33	1	86	13	98	16	0	127	464
03:30 PM	1	4	19	0	24	47	232	2	2	283	29	2	41	2	74	13	94	15	0	122	503
03:45 PM	3	7	24	0	34	50	186	2	0	238	32	9	49	1	91	26	89	14	0	129	492
Total	12	17	70	1	100	175	803	8	11	997	136	19	162	6	323	64	383	62	0	509	1929
04:00 PM	2	1	17	0	20	39	199	2	4	244	44	7	57	0	108	5	84	26	0	115	487
04:15 PM	4	5	20	0	29	44	199	1	4	248	32	3	46	1	82	10	105	14	0	129	488
04:30 PM	4	4	36	0	44	53	233	2	3	291	36	1	35	2	74	8	124	22	0	154	563
04:45 PM	2	6	15	0	23	44	182	2	7	235	41	8	48	1	98	16	103	23	0	142	498
Total	12	16	88	0	116	180	813	7	18	1018	153	19	186	4	362	39	416	85	0	540	2036
05:00 PM	3	10	35	0	48	52	202	1	7	262	31	7	52	0	90	16	106	24	0	146	546
05:15 PM	2	2	19	0	23	45	199	2	1	247	35	3	45	3	86	11	93	24	0	128	484
05:30 PM	1	8	15	0	24	58	189	2	0	249	31	3	55	2	91	17	85	16	0	118	482
05:45 PM	2	3	10	0	15	49	194	1	0	244	38	3	53	1	95	15	99	29	0	143	497
Total	8	23	79	0	110	204	784	6	8	1002	135	16	205	6	362	59	383	93	0	535	2009
Grand Total	32	56	237	1	326	559	2400	21	37	3017	424	54	553	16	1047	162	1182	240	0	1584	5974
Apprch %	9.8	17.2	72.7	0.3		18.5	79.5	0.7	1.2		40.5	5.2	52.8	1.5		10.2	74.6	15.2	0		
Total %	0.5	0.9	4	0	5.5	9.4	40.2	0.4	0.6	50.5	7.1	0.9	9.3	0.3	17.5	2.7	19.8	4	0	26.5	

	Ukee Street (West) Southbound					Ka Uka Blvd. Westbound					Ukee Street (West) Northbound					Ka Uka Blvd. Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:15 PM																					
04:15 PM	**4**	5	20	0	29	44	199	1	4	248	32	3	46	1	82	10	105	14	0	129	488
04:30 PM	4	4	**36**	0	44	**53**	**233**	**2**	3	**291**	36	1	35	**2**	74	8	**124**	22	0	**154**	**563**
04:45 PM	2	6	15	0	23	44	182	2	7	235	**41**	**8**	48	1	**98**	**16**	103	23	0	142	498
05:00 PM	3	**10**	35	0	**48**	52	202	1	7	262	31	7	**52**	0	90	16	106	**24**	0	146	546
Total Volume	13	25	106	0	144	193	816	6	21	1036	140	19	181	4	344	50	438	83	0	571	2095
% App. Total	9	17.4	73.6	0		18.6	78.8	0.6	2		40.7	5.5	52.6	1.2		8.8	76.7	14.5	0		
PHF	.813	.625	.736	.000	.750	.910	.876	.750	.750	.890	.854	.594	.870	.500	.878	.781	.883	.865	.000	.927	.930

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5676, T-1841
Counted:ER, LF
Weather:Clear

File Name : KamUka AM
Site Code : 00000001
Start Date : 9/11/2008
Page No : 1

Groups Printed- Unshifted

	Kamehameha Highway Southbound				Ka Uka Blvd. Westbound				Kamehameha Highway Northbound				Oahu Regional Park Dwy. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	142	227	3	372	25	6	17	48	3	34	32	69	0	1	2	3	492
06:15 AM	117	205	6	328	29	3	30	62	2	60	37	99	2	1	0	3	492
06:30 AM	138	209	1	348	20	5	29	54	3	76	53	132	1	1	0	2	536
06:45 AM	121	176	1	298	23	3	49	75	0	95	54	149	1	1	0	2	524
Total	518	817	11	1346	97	17	125	239	8	265	176	449	4	4	2	10	2044
07:00 AM	165	223	1	389	21	4	40	65	1	97	48	146	0	1	1	2	602
07:15 AM	160	184	2	346	25	7	60	92	5	93	37	135	11	6	1	18	591
07:30 AM	139	236	4	379	17	4	65	86	1	142	45	188	3	7	0	10	663
07:45 AM	152	219	10	381	20	2	62	84	1	82	30	113	2	6	2	10	588
Total	616	862	17	1495	83	17	227	327	8	414	160	582	16	20	4	40	2444
08:00 AM	120	192	5	317	32	5	52	89	2	93	34	129	1	2	6	9	544
08:15 AM	103	175	8	286	28	10	42	80	4	80	36	120	1	3	1	5	491
08:30 AM	101	181	6	288	28	5	45	78	3	57	27	87	1	5	1	7	460
08:45 AM	99	167	2	268	27	6	48	81	3	71	37	111	1	0	3	4	464
Total	423	715	21	1159	115	26	187	328	12	301	134	447	4	10	11	25	1959
Grand Total	1557	2394	49	4000	295	60	539	894	28	980	470	1478	24	34	17	75	6447
Apprch %	38.9	59.8	1.2		33	6.7	60.3		1.9	66.3	31.8		32	45.3	22.7		
Total %	24.2	37.1	0.8	62	4.6	0.9	8.4	13.9	0.4	15.2	7.3	22.9	0.4	0.5	0.3	1.2	

	Kamehameha Highway Southbound				Ka Uka Blvd. Westbound				Kamehameha Highway Northbound				Oahu Regional Park Dwy. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	**165**	223	1	**389**	21	4	40	65	1	97	**48**	146	0	1	1	2	602
07:15 AM	160	184	2	346	**25**	7	60	**92**	**5**	93	37	135	**11**	6	1	**18**	591
07:30 AM	139	**236**	4	379	17	4	**65**	86	1	**142**	45	**188**	3	7	0	10	**663**
07:45 AM	152	219	**10**	381	20	2	62	84	1	82	30	113	2	6	**2**	10	588
Total Volume	616	862	17	1495	83	17	227	327	8	414	160	582	16	20	4	40	2444
% App. Total	41.2	57.7	1.1		25.4	5.2	69.4		1.4	71.1	27.5		40	50	10		
PHF	.933	.913	.425	.961	.830	.607	.873	.889	.400	.729	.833	.774	.364	.714	.500	.556	.922

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5676, T-1841
Counted:ER, LF
Weather:Clear

File Name : KamUka PM
Site Code : 00000001
Start Date : 9/11/2008
Page No : 1

Groups Printed- Unshifted

	Kamehameha Highway Southbound				Ka Uka Blvd. Westbound				Kamehameha Highway Northbound				Oahu Regional Park Dwy. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	62	140	1	203	38	17	169	224	12	157	62	231	4	5	2	11	669
03:15 PM	59	125	8	192	46	30	174	250	17	201	66	284	3	7	5	15	741
03:30 PM	62	162	5	229	64	31	209	304	14	213	60	287	2	6	2	10	830
03:45 PM	65	148	14	227	64	24	164	252	7	188	55	250	7	10	7	24	753
Total	248	575	28	851	212	102	716	1030	50	759	243	1052	16	28	16	60	2993
04:00 PM	65	129	16	210	48	35	172	255	13	191	49	253	3	12	4	19	737
04:15 PM	79	141	22	242	42	25	153	220	21	196	44	261	8	11	3	22	745
04:30 PM	80	165	20	265	63	22	206	291	11	208	65	284	16	20	10	46	886
04:45 PM	88	133	14	235	47	18	212	277	8	175	61	244	6	7	8	21	777
Total	312	568	72	952	200	100	743	1043	53	770	219	1042	33	50	25	108	3145
05:00 PM	89	135	7	231	61	24	170	255	9	152	53	214	8	7	9	24	724
05:15 PM	84	118	10	212	51	17	206	274	5	190	38	233	2	9	8	19	738
05:30 PM	61	162	8	231	43	19	173	235	11	144	45	200	5	5	5	15	681
05:45 PM	91	119	13	223	0	0	0	0	0	0	0	0	8	15	21	44	267
Total	325	534	38	897	155	60	549	764	25	486	136	647	23	36	43	102	2410
Grand Total	885	1677	138	2700	567	262	2008	2837	128	2015	598	2741	72	114	84	270	8548
Apprch %	32.8	62.1	5.1		20	9.2	70.8		4.7	73.5	21.8		26.7	42.2	31.1		
Total %	10.4	19.6	1.6	31.6	6.6	3.1	23.5	33.2	1.5	23.6	7	32.1	0.8	1.3	1	3.2	

	Kamehameha Highway Southbound				Ka Uka Blvd. Westbound				Kamehameha Highway Northbound				Oahu Regional Park Dwy. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:30 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	65	129	16	210	48	**35**	172	255	13	191	49	253	3	12	4	19	737
04:15 PM	79	141	**22**	242	42	25	153	220	**21**	196	44	261	8	11	3	22	745
04:30 PM	80	**165**	20	**265**	**63**	22	206	**291**	11	**208**	**65**	**284**	**16**	**20**	**10**	**46**	**886**
04:45 PM	**88**	133	14	235	47	18	**212**	277	8	175	61	244	6	7	8	21	777
Total Volume	312	568	72	952	200	100	743	1043	53	770	219	1042	33	50	25	108	3145
% App. Total	32.8	59.7	7.6		19.2	9.6	71.2		5.1	73.9	21		30.6	46.3	23.1		
PHF	.886	.861	.818	.898	.794	.714	.876	.896	.631	.925	.842	.917	.516	.625	.625	.587	.887

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-3891, D4-5671
Counted:JY, RY
Weather:Clear

File Name : KamWaipioUka AM
Site Code : 00000001
Start Date : 9/10/2008
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Groups Printed- Unshifted

	Kamehameha Highway Southbound				Waipio Uka Westbound				Kamehameha Highway Northbound				Central Oahu Regional Park Dwy. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	5	256	0	261	132	2	1	135	1	68	77	146	0	2	0	2	544
06:15 AM	4	256	0	260	136	1	4	141	4	100	71	175	0	0	0	0	576
06:30 AM	5	235	0	240	144	2	4	150	8	138	72	218	0	0	0	0	608
06:45 AM	3	246	0	249	123	0	5	128	2	152	89	243	1	0	2	3	623
Total	17	993	0	1010	535	5	14	554	15	458	309	782	1	2	2	5	2351
07:00 AM	8	217	0	223	146	0	6	152	4	111	114	229	1	2	2	5	609
07:15 AM	4	244	0	248	137	0	15	152	5	169	132	306	0	2	2	4	710
07:30 AM	10	266	0	276	124	1	9	134	5	181	166	352	0	0	2	2	764
07:45 AM	10	212	1	223	169	1	10	180	2	124	138	264	0	0	3	3	670
Total	30	939	1	970	576	2	40	618	16	585	550	1151	1	4	9	14	2753
08:00 AM	4	237	1	242	125	3	10	138	3	126	121	250	0	0	7	7	637
08:15 AM	7	205	0	212	131	2	7	140	2	81	71	154	0	1	2	3	509
08:30 AM	4	210	1	215	111	1	4	116	9	98	80	187	1	1	1	3	521
08:45 AM	4	193	0	197	100	2	11	113	5	124	82	211	0	1	3	4	525
Total	19	845	2	866	467	8	32	507	19	429	354	802	1	3	13	17	2192
Grand Total	66	2777	3	2846	1578	15	86	1679	50	1472	1213	2735	3	9	24	36	7296
Apprch %	2.3	97.6	0.1		94	0.9	5.1		1.8	53.8	44.4		8.3	25	66.7		
Total %	0.9	38.1	0	39	21.6	0.2	1.2	23	0.7	20.2	16.6	37.5	0	0.1	0.3	0.5	

	Kamehameha Highway Southbound				Waipio Uka Westbound				Kamehameha Highway Northbound				Central Oahu Regional Park Dwy. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15 AM																	
07:15 AM	4	244	0	248	137	0	**15**	152	**5**	169	132	306	0	**2**	2	4	710
07:30 AM	**10**	**266**	0	**276**	124	1	9	134	5	**181**	**166**	**352**	0	0	2	2	**764**
07:45 AM	10	212	**1**	223	**169**	1	10	**180**	2	124	138	264	0	0	3	3	670
08:00 AM	4	237	1	242	125	**3**	10	138	3	126	121	250	0	0	**7**	**7**	637
Total Volume	28	959	2	989	555	5	44	604	15	600	557	1172	0	2	14	16	2781
% App. Total	2.8	97	0.2		91.9	0.8	7.3		1.3	51.2	47.5		0	12.5	87.5		
PHF	.700	.901	.500	.896	.821	.417	.733	.839	.750	.829	.839	.832	.000	.250	.500	.571	.910

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:
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Weather:

File Name : KamWaipioUka PM
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Groups Printed- Unshifted

	Kamehameha Highway Southbound				Waipio Uka Westbound				Kamehameha Highway Northbound				Central Oahu Regional Park Dwy. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	4	188	0	192	104	2	18	124	9	251	205	465	0	1	4	5	786
03:15 PM	2	175	0	177	136	2	10	148	4	278	195	477	0	0	2	2	804
03:30 PM	8	216	1	225	141	2	17	160	6	273	193	472	0	1	8	9	866
03:45 PM	9	170	4	183	131	2	7	140	8	246	184	438	1	3	4	8	769
Total	23	749	5	777	512	8	52	572	27	1048	777	1852	1	5	18	24	3225
04:00 PM	7	206	2	215	135	8	15	158	13	262	205	480	0	2	10	12	865
04:15 PM	13	174	2	189	138	9	9	156	23	253	216	492	2	6	12	20	857
04:30 PM	13	208	6	227	150	5	9	164	32	281	214	527	4	3	15	22	940
04:45 PM	11	179	2	192	156	6	10	172	20	234	201	455	2	3	8	13	832
Total	44	767	12	823	579	28	43	650	88	1030	836	1954	8	14	45	67	3494
05:00 PM	7	185	1	193	138	2	15	155	15	267	195	477	0	5	9	14	839
05:15 PM	13	183	3	199	141	4	18	163	16	250	203	469	0	5	7	12	843
05:30 PM	16	189	0	205	132	7	7	146	18	224	213	455	0	3	10	13	819
05:45 PM	6	159	2	167	150	3	6	159	18	236	194	448	2	1	9	12	786
Total	42	716	6	764	561	16	46	623	67	977	805	1849	2	14	35	51	3287
Grand Total	109	2232	23	2364	1652	52	141	1845	182	3055	2418	5655	11	33	98	142	10006
Apprch %	4.6	94.4	1		89.5	2.8	7.6		3.2	54	42.8		7.7	23.2	69		
Total %	1.1	22.3	0.2	23.6	16.5	0.5	1.4	18.4	1.8	30.5	24.2	56.5	0.1	0.3	1	1.4	

Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 04:00 PM

	Kamehameha Highway Southbound				Waipio Uka Westbound				Kamehameha Highway Northbound				Central Oahu Regional Park Dwy. Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	7	206	2	215	135	8	**15**	158	13	262	205	480	0	2	10	12	865
04:15 PM	**13**	174	2	189	138	**9**	9	156	23	253	**216**	492	2	**6**	12	20	857
04:30 PM	13	**208**	**6**	**227**	150	5	9	164	**32**	**281**	214	**527**	**4**	3	**15**	**22**	**940**
04:45 PM	11	179	2	192	**156**	6	10	**172**	20	234	201	455	2	3	8	13	832
Total Volume	44	767	12	823	579	28	43	650	88	1030	836	1954	8	14	45	67	3494
% App. Total	5.3	93.2	1.5		89.1	4.3	6.6		4.5	52.7	42.8		11.9	20.9	67.2		
PHF	.846	.922	.500	.906	.928	.778	.717	.945	.688	.916	.968	.927	.500	.583	.750	.761	.929

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D54-5672, D4-0525
Counted:EK, JM
Weather:Clear

File Name : KamLumiaina AM
Site Code : 00000002
Start Date : 9/10/2008
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Groups Printed- Unshifted

	Kam Highway Southbound				Lumiaina Street Westbound				Kam Highway Northbound				Lumiaina Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	2	295	109	406	23	9	3	35	6	53	2	61	94	5	43	142	644
06:15 AM	0	274	105	379	12	16	9	37	2	63	5	70	85	9	34	128	614
06:30 AM	2	226	132	360	15	14	6	35	7	93	6	106	114	3	31	148	649
06:45 AM	1	267	129	397	14	14	7	35	5	97	6	108	121	2	35	158	698
Total	5	1062	475	1542	64	53	25	142	20	306	19	345	414	19	143	576	2605
07:00 AM	6	240	119	365	17	14	13	44	11	83	7	101	147	4	28	179	689
07:15 AM	2	231	135	368	13	27	11	51	6	180	8	194	110	5	22	137	750
07:30 AM	4	247	148	399	21	15	11	47	12	203	8	223	142	5	15	162	831
07:45 AM	4	259	153	416	14	17	3	34	16	188	15	219	83	3	31	117	786
Total	16	977	555	1548	65	73	38	176	45	654	38	737	482	17	96	595	3056
08:00 AM	6	219	131	356	16	6	5	27	14	164	7	185	78	5	28	111	679
08:15 AM	3	236	110	349	9	6	4	19	11	100	6	117	57	6	27	90	575
08:30 AM	3	197	93	293	15	6	3	24	13	126	16	155	48	1	27	76	548
08:45 AM	5	204	87	296	15	1	2	18	14	150	6	170	67	6	30	103	587
Total	17	856	421	1294	55	19	14	88	52	540	35	627	250	18	112	380	2389
Grand Total	38	2895	1451	4384	184	145	77	406	117	1500	92	1709	1146	54	351	1551	8050
Apprch %	0.9	66	33.1		45.3	35.7	19		6.8	87.8	5.4		73.9	3.5	22.6		
Total %	0.5	36	18	54.5	2.3	1.8	1	5	1.5	18.6	1.1	21.2	14.2	0.7	4.4	19.3	

	Kam Highway Southbound				Lumiaina Street Westbound				Kam Highway Northbound				Lumiaina Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	**6**	240	119	365	17	14	**13**	44	11	83	7	101	**147**	4	28	179	689
07:15 AM	2	231	135	368	13	**27**	11	**51**	6	180	8	194	110	**5**	22	137	750
07:30 AM	4	247	148	399	**21**	15	11	47	12	**203**	8	**223**	142	5	15	162	**831**
07:45 AM	4	**259**	**153**	**416**	14	17	3	34	**16**	188	**15**	219	83	3	**31**	117	786
Total Volume	16	977	555	1548	65	73	38	176	45	654	38	737	482	17	96	595	3056
% App. Total	1	63.1	35.9		36.9	41.5	21.6		6.1	88.7	5.2		81	2.9	16.1		
PHF	.667	.943	.907	.930	.774	.676	.731	.863	.703	.805	.633	.826	.820	.850	.774	.831	.919

1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5672, D1-0525
Counted:EK, JM
Weather:Clear

File Name : KamLumiaina PM
Site Code : 00000002
Start Date : 9/10/2008
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Groups Printed- Unshifted

	Kamehameha Highway Southbound				Lumiaina Street Westbound				Kamehameha Highway Northbound				Lumiaina Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	3	163	133	299	9	10	6	25	53	324	36	413	108	7	26	141	878
03:15 PM	0	125	109	234	11	9	4	24	49	367	26	442	128	4	30	162	862
03:30 PM	2	152	175	329	12	9	5	26	40	319	30	389	154	7	35	196	940
03:45 PM	4	146	172	322	7	11	4	22	50	349	36	435	112	10	42	164	943
Total	9	586	589	1184	39	39	19	97	192	1359	128	1679	502	28	133	663	3623
04:00 PM	2	191	197	390	12	13	21	46	53	316	18	387	162	4	45	211	1034
04:15 PM	1	176	153	330	12	6	23	41	49	393	36	478	126	3	40	169	1018
04:30 PM	6	198	215	419	3	7	13	23	48	346	22	416	146	4	33	183	1041
04:45 PM	9	213	159	381	5	4	20	29	42	346	24	412	96	8	24	128	950
Total	18	778	724	1520	32	30	77	139	192	1401	100	1693	530	19	142	691	4043
05:00 PM	3	210	135	348	8	13	6	27	32	314	26	372	132	10	29	171	918
05:15 PM	8	193	168	369	9	7	9	25	46	316	28	390	124	9	52	185	969
05:30 PM	4	204	128	336	19	12	27	58	38	295	22	355	133	1	51	185	934
05:45 PM	2	212	161	375	5	2	1	8	48	296	22	366	134	3	42	179	928
Total	17	819	592	1428	41	34	43	118	164	1221	98	1483	523	23	174	720	3749
Grand Total	44	2183	1905	4132	112	103	139	354	548	3981	326	4855	1555	70	449	2074	11415
Apprch %	1.1	52.8	46.1		31.6	29.1	39.3		11.3	82	6.7		75	3.4	21.6		
Total %	0.4	19.1	16.7	36.2	1	0.9	1.2	3.1	4.8	34.9	2.9	42.5	13.6	0.6	3.9	18.2	

	Kamehameha Highway Southbound				Lumiaina Street Westbound				Kamehameha Highway Northbound				Lumiaina Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	2	191	197	390	**12**	**13**	21	**46**	**53**	316	18	387	**162**	4	**45**	**211**	1034
04:15 PM	1	176	153	330	12	6	**23**	41	49	**393**	**36**	**478**	126	3	40	169	1018
04:30 PM	6	198	**215**	**419**	3	7	13	23	48	346	22	416	146	4	33	183	**1041**
04:45 PM	**9**	**213**	159	381	5	4	20	29	42	346	24	412	96	**8**	24	128	950
Total Volume	18	778	724	1520	32	30	77	139	192	1401	100	1693	530	19	142	691	4043
% App. Total	1.2	51.2	47.6		23	21.6	55.4		11.3	82.8	5.9		76.7	2.7	20.5		
PHF	.500	.913	.842	.907	.667	.577	.837	.755	.906	.891	.694	.885	.818	.594	.789	.819	.971

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-3889, D1-0769
Counted:DY, TO
Weather:Clear

File Name : KamLumiauau AM
Site Code : 00000001
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Groups Printed- Unshifted

	Kamehameha Highway Southbound				Lumiauau Street Westbound				Kamehameha Highway Northbound				Lumiauau Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	1	339	2	342	58	2	5	65	5	63	3	71	3	1	97	101	579
06:15 AM	1	369	3	373	50	1	1	52	7	72	5	84	1	1	87	89	598
06:30 AM	0	277	7	284	60	1	2	63	9	98	3	110	12	1	101	114	571
06:45 AM	2	293	2	297	64	1	0	65	6	88	9	103	15	1	82	98	563
Total	4	1278	14	1296	232	5	8	245	27	321	20	368	31	4	367	402	2311
07:00 AM	1	263	3	267	54	1	3	58	7	91	9	107	13	2	123	138	570
07:15 AM	1	269	1	271	49	6	6	61	2	137	10	149	42	2	76	120	601
07:30 AM	0	279	2	281	36	4	3	43	11	191	11	213	55	5	80	140	677
07:45 AM	1	279	4	284	37	1	1	39	10	221	24	255	5	3	48	56	634
Total	3	1090	10	1103	176	12	13	201	30	640	54	724	115	12	327	454	2482
08:00 AM	5	270	3	278	28	2	2	32	12	175	21	208	0	1	30	31	549
08:15 AM	1	279	3	283	25	3	0	28	11	136	23	170	2	0	34	36	517
08:30 AM	0	263	6	269	22	0	1	23	9	152	14	175	1	0	25	26	493
08:45 AM	0	230	1	231	26	1	2	29	5	173	14	192	3	0	38	41	493
Total	6	1042	13	1061	101	6	5	112	37	636	72	745	6	1	127	134	2052
Grand Total	13	3410	37	3460	509	23	26	558	94	1597	146	1837	152	17	821	990	6845
Apprch %	0.4	98.6	1.1		91.2	4.1	4.7		5.1	86.9	7.9		15.4	1.7	82.9		
Total %	0.2	49.8	0.5	50.5	7.4	0.3	0.4	8.2	1.4	23.3	2.1	26.8	2.2	0.2	12	14.5	

	Kamehameha Highway Southbound				Lumiauau Street Westbound				Kamehameha Highway Northbound				Lumiauau Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	**1**	263	3	267	**54**	1	3	58	7	91	9	107	13	2	**123**	138	570
07:15 AM	1	269	1	271	49	**6**	**6**	**61**	2	137	10	149	42	2	76	120	601
07:30 AM	0	**279**	2	281	36	4	3	43	**11**	191	11	213	**55**	**5**	80	**140**	**677**
07:45 AM	1	279	**4**	**284**	37	1	1	39	10	**221**	**24**	**255**	5	3	48	56	634
Total Volume	3	1090	10	1103	176	12	13	201	30	640	54	724	115	12	327	454	2482
% App. Total	0.3	98.8	0.9		87.6	6	6.5		4.1	88.4	7.5		25.3	2.6	72		
PHF	.750	.977	.625	.971	.815	.500	.542	.824	.682	.724	.563	.710	.523	.600	.665	.811	.917

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, Hi 96826

Counter:D4-3889, D1-0769
Counted:DY, TO
Weather:Clear

File Name : KamLumiauau PM
Site Code : 00000001
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Groups Printed- Unshifted

	Kamehameha Highway Southbound				Lumiauau Street Westbound				Kamehameha Highway Northbound				Lumiauau Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	2	213	11	226	23	4	3	30	26	402	49	477	3	1	22	26	759
03:15 PM	3	200	5	208	18	3	1	22	44	396	44	484	6	1	25	32	746
03:30 PM	1	219	7	227	12	3	3	18	39	389	52	480	4	1	24	29	754
03:45 PM	3	207	1	211	29	2	1	32	24	390	46	460	2	1	20	23	726
Total	9	839	24	872	82	12	8	102	133	1577	191	1901	15	4	91	110	2985
04:00 PM	1	221	8	230	20	3	6	29	33	382	36	451	4	2	21	27	737
04:15 PM	6	230	6	242	12	2	5	19	43	434	44	521	5	3	28	36	818
04:30 PM	0	224	5	229	22	2	4	28	34	437	42	513	6	5	18	29	799
04:45 PM	5	218	4	227	15	4	3	22	41	404	39	484	3	0	22	25	758
Total	12	893	23	928	69	11	18	98	151	1657	161	1969	18	10	89	117	3112
05:00 PM	1	217	10	228	14	1	1	16	39	424	41	504	6	1	14	21	769
05:15 PM	4	223	7	234	13	1	1	15	42	396	45	483	7	0	16	23	755
05:30 PM	3	219	9	231	25	2	1	28	42	365	40	447	10	3	27	40	746
05:45 PM	1	252	6	259	24	4	3	31	45	388	42	475	3	4	21	28	793
Total	9	911	32	952	76	8	6	90	168	1573	168	1909	26	8	78	112	3063
Grand Total	30	2643	79	2752	227	31	32	290	452	4807	520	5779	59	22	258	339	9160
Apprch %	1.1	96	2.9		78.3	10.7	11		7.8	83.2	9		17.4	6.5	76.1		
Total %	0.3	28.9	0.9	30	2.5	0.3	0.3	3.2	4.9	52.5	5.7	63.1	0.6	0.2	2.8	3.7	

	Kamehameha Highway Southbound				Lumiauau Street Westbound				Kamehameha Highway Northbound				Lumiauau Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:15 PM																	
04:15 PM	**6**	**230**	6	**242**	12	2	**5**	19	**43**	434	44	**521**	5	3	**28**	**36**	818
04:30 PM	0	224	5	229	**22**	2	4	**28**	34	**437**	42	513	**6**	**5**	18	29	799
04:45 PM	5	218	4	227	15	**4**	3	22	41	404	39	484	3	0	22	25	758
05:00 PM	1	217	**10**	228	14	1	1	16	39	424	41	504	6	1	14	21	769
Total Volume	12	889	25	926	63	9	13	85	157	1699	166	2022	20	9	82	111	3144
% App. Total	1.3	96	2.7		74.1	10.6	15.3		7.8	84	8.2		18	8.1	73.9		
PHF	.500	.966	.625	.957	.716	.563	.650	.759	.913	.972	.943	.970	.833	.450	.732	.771	.961

1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5675, T-1839
Counted:ER, LF
Weather:Clear

File Name : KamWaipahu AM
Site Code : 00000001
Start Date : 9/10/2008
Page No : 1

Groups Printed- Unshifted

	Kamehameha Highway Southbound				Westbound	Kamehameha Highway Northbound				Waipahu Street Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
06:00 AM	0	439	5	444	0	19	50	0	69	18	0	98	116	629
06:15 AM	0	478	8	486	0	22	74	0	96	17	0	125	142	724
06:30 AM	0	427	14	441	0	12	90	0	102	14	0	145	159	702
06:45 AM	0	349	9	358	0	25	75	0	100	29	0	134	163	621
Total	0	1693	36	1729	0	78	289	0	367	78	0	502	580	2676
07:00 AM	0	456	15	471	0	26	90	0	116	15	0	103	118	705
07:15 AM	0	337	22	359	0	28	115	0	143	28	0	184	212	714
07:30 AM	0	356	21	377	0	39	185	0	224	21	0	158	179	780
07:45 AM	0	325	27	352	0	46	213	0	259	51	0	173	224	835
Total	0	1474	85	1559	0	139	603	0	742	115	0	618	733	3034
08:00 AM	0	321	34	355	0	40	184	0	224	27	0	148	175	754
08:15 AM	0	300	26	326	0	31	141	0	172	21	0	127	148	646
08:30 AM	0	271	16	287	0	26	157	0	183	26	0	155	181	651
08:45 AM	0	282	20	302	0	32	167	0	199	23	0	126	149	650
Total	0	1174	96	1270	0	129	649	0	778	97	0	556	653	2701
Grand Total	0	4341	217	4558	0	346	1541	0	1887	290	0	1676	1966	8411
Apprch %	0	95.2	4.8			18.3	81.7	0		14.8	0	85.2		
Total %	0	51.6	2.6	54.2	0	4.1	18.3	0	22.4	3.4	0	19.9	23.4	

	Kamehameha Highway Southbound				Westbound	Kamehameha Highway Northbound				Waipahu Street Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 06:00 AM to 08:45 AM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 07:15 AM														
07:15 AM	0	337	22	359	0	28	115	0	143	28	0	**184**	212	714
07:30 AM	0	**356**	21	**377**	0	39	185	0	224	21	0	158	179	780
07:45 AM	0	325	27	352	0	**46**	**213**	0	**259**	**51**	0	173	**224**	**835**
08:00 AM	0	321	**34**	355	0	40	184	0	224	27	0	148	175	754
Total Volume	0	1339	104	1443	0	153	697	0	850	127	0	663	790	3083
% App. Total	0	92.8	7.2			18	82	0		16.1	0	83.9		
PHF	.000	.940	.765	.957	.000	.832	.818	.000	.820	.623	.000	.901	.882	.923

WILSON OKAMOTO CORPORATION
1907 S. Beretania Street Suite 400
Honolulu, HI 96826

Counter:D4-5675, T-1839
Counted:ER, LF
Weather:Clear

File Name : KamWaipahu PM
Site Code : 00000001
Start Date : 9/10/2008
Page No : 1

Groups Printed- Unshifted

	Kamehameha Highway Southbound				Westbound	Kamehameha Highway Northbound				Waipahu Street Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
03:00 PM	0	209	41	250	0	61	451	0	512	41	0	114	155	917
03:15 PM	0	198	43	241	0	49	339	109	497	54	0	94	148	886
03:30 PM	0	198	50	248	0	73	362	74	509	51	0	122	173	930
03:45 PM	0	204	50	254	0	76	413	0	489	53	0	117	170	913
Total	0	809	184	993	0	259	1565	183	2007	199	0	447	646	3646
04:00 PM	0	195	50	245	0	72	427	0	499	58	0	125	183	927
04:15 PM	0	225	49	274	0	69	487	0	556	62	0	139	201	1031
04:30 PM	0	211	42	253	0	58	448	0	506	78	0	132	210	969
04:45 PM	0	198	61	259	0	99	456	0	555	45	0	114	159	973
Total	0	829	202	1031	0	298	1818	0	2116	243	0	510	753	3900
05:00 PM	0	185	39	224	0	69	437	0	506	55	0	96	151	881
05:15 PM	0	241	24	265	0	66	411	0	477	69	0	114	183	925
05:30 PM	0	222	50	272	0	51	413	0	464	44	0	125	169	905
05:45 PM	0	231	59	290	0	54	438	0	492	59	0	128	187	969
Total	0	879	172	1051	0	240	1699	0	1939	227	0	463	690	3680
Grand Total	0	2517	558	3075	0	797	5082	183	6062	669	0	1420	2089	11226
Apprch %	0	81.9	18.1			13.1	83.8	3		32	0	68		
Total %	0	22.4	5	27.4	0	7.1	45.3	1.6	54	6	0	12.6	18.6	

	Kamehameha Highway Southbound				Westbound	Kamehameha Highway Northbound				Waipahu Street Eastbound				
Start Time	Left	Thru	Right	App. Total	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 03:00 PM to 05:45 PM - Peak 1 of 1														
Peak Hour for Entire Intersection Begins at 04:00 PM														
04:00 PM	0	195	50	245	0	72	427	0	499	58	0	125	183	927
04:15 PM	0	**225**	49	**274**	0	69	**487**	0	**556**	62	0	**139**	201	**1031**
04:30 PM	0	211	42	253	0	58	448	0	506	**78**	0	132	**210**	969
04:45 PM	0	198	**61**	259	0	**99**	456	0	555	45	0	114	159	973
Total Volume	0	829	202	1031	0	298	1818	0	2116	243	0	510	753	3900
% App. Total	0	80.4	19.6			14.1	85.9	0		32.3	0	67.7		
PHF	.000	.921	.828	.941	.000	.753	.933	.000	.951	.779	.000	.917	.896	.946

APPENDIX C

LEVEL OF SERVICE DEFINITIONS

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR SIGNALIZED INTERSECTIONS

Level of Service (LOS) for signalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption, and increased travel time. Specifically, level-of-service (LOS) criteria are stated in terms of the average control delay per vehicle, typically a 15-min analysis period. The criteria are given in the following table.

Table 1: Level-of-Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec/veh)
A	≤10.0
B	>10.0 and ≤20.0
C	>20.0 and ≤35.0
D	>35.0 and ≤55.0
E	>55.0 and ≤80.0
F	>80.0

Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group.

Level of Service A describes operations with low control delay, up to 10 sec per vehicle. This level of service occurs when progression is extremely favorable and most vehicles arrive during the green phase. Many vehicles do not stop at all. Short cycle lengths may tend to contribute to low delay values.

Level of Service B describes operations with control delay greater than 10 and up to 20 sec per vehicle. This level generally occurs with good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.

Level of Service C describes operations with control delay greater than 20 and up to 35 sec per vehicle. These higher delays may result from only fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level. Cycle failure occurs when a given green phase does not serve queued vehicles and overflows occur. The number of vehicles stopping is significant at this level, though many still pass through the intersection without stopping.

Level of Service D describes operations with control delay greater than 35 and up to 55 sec per vehicle. At level of service D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

"Highway Capacity Manual," Transportation Research Board, 2000.

Level of Service E describes operation with control delay greater than 55 and up to 80 sec per vehicle. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent.

Level of Service F describes operations with control delay in excess of 80 sec per vehicle. This level, considered to be unacceptable to most drivers, often occurs with oversaturation, that is, when arrival flow rates exceed the capacity lane groups. It may also occur at high v/c ratios with many individual cycle failures. Poor progression and long cycle lengths may also contribute significantly to high delay levels.

"Highway Capacity Manual," Transportation Research Board, 2000.

LEVEL OF SERVICE DEFINITIONS

LEVEL-OF-SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level of Service (LOS) criteria are given in Table 1. As used here, control delay is defined as the total elapsed time from the time a vehicle stops at the end of the queue to the time required for the vehicle to travel from the last-in-queue position to the first-in-queue position, including deceleration of vehicles from free-flow speed to the speed of vehicles in the queue.

The average total delay for any particular minor movement is a function of the service rate or capacity of the approach and the degree of saturation. If the degree of saturation is greater than about 0.9, average control delay is significantly affected by the length of the analysis period.

Table 1: Level-of-Service Criteria for Unsignalized Intersections

Level of Service	Average Control Delay (Sec/Veh)
A	≤10.0
B	>10.0 and ≤15.0
C	>15.0 and ≤25.0
D	>25.0 and ≤35.0
E	>35.0 and ≤50.0
F	>50.0

"Highway Capacity Manual," Transportation Research Board, 2000.

APPENDIX D

CAPACITY ANALYSIS CALCULATIONS
EXISTING PEAK HOUR TRAFFIC ANALYSIS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↑↱		↰	✣				
Volume (vph)	293	31	0	0	7	1	563	0	25	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0				
Lane Util. Factor	1.00	1.00			0.95		0.95	0.95				
Frt	1.00	1.00			0.98		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	0.96				
Satd. Flow (prot)	1863	1961			3663		1770	1759				
Flt Permitted	0.75	1.00			1.00		0.95	0.96				
Satd. Flow (perm)	1473	1961			3663		1770	1759				
Peak-hour factor, PHF	0.50	0.50	0.50	0.90	0.90	0.90	0.85	0.85	0.85	0.92	0.92	0.92
Adj. Flow (vph)	586	62	0	0	8	1	662	0	29	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	3	0	0	0	0
Lane Group Flow (vph)	586	62	0	0	9	0	344	344	0	0	0	0
Turn Type	Perm						Perm					
Protected Phases		4			8			2				
Permitted Phases	4						2					
Actuated Green, G (s)	29.8	29.8			29.8		18.0	18.0				
Effective Green, g (s)	29.8	29.8			29.8		18.0	18.0				
Actuated g/C Ratio	0.52	0.52			0.52		0.31	0.31				
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	759	1011			1889		551	548				
v/s Ratio Prot		0.03			0.00							
v/s Ratio Perm	c0.40						0.19	0.20				
v/c Ratio	0.77	0.06			0.00		0.62	0.63				
Uniform Delay, d1	11.3	7.0			6.8		17.0	17.0				
Progression Factor	1.00	1.00			1.00		1.00	1.00				
Incremental Delay, d2	4.9	0.0			0.0		2.2	2.2				
Delay (s)	16.2	7.0			6.8		19.2	19.3				
Level of Service	B	A			A		B	B				
Approach Delay (s)		15.3			6.8			19.2			0.0	
Approach LOS		B			A			B			A	

Intersection Summary			
HCM Average Control Delay	17.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	57.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑			↑↑↱		↰	✥				
Volume (vph)	508	53	0	0	50	30	1162	0	23	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0				
Lane Util. Factor	1.00	1.00			0.95		0.95	0.95				
Frt	1.00	1.00			0.94		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	0.95				
Satd. Flow (prot)	1863	1961			3516		1770	1767				
Flt Permitted	0.70	1.00			1.00		0.95	0.95				
Satd. Flow (perm)	1377	1961			3516		1770	1767				
Peak-hour factor, PHF	0.84	0.84	0.84	1.00	1.00	1.00	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	605	63	0	0	50	30	1249	0	25	0	0	0
RTOR Reduction (vph)	0	0	0	0	16	0	0	2	0	0	0	0
Lane Group Flow (vph)	605	63	0	0	64	0	637	635	0	0	0	0
Turn Type	Perm						Perm					
Protected Phases		4			8			2				
Permitted Phases	4						2					
Actuated Green, G (s)	39.7	39.7			39.7		34.1	34.1				
Effective Green, g (s)	39.7	39.7			39.7		34.1	34.1				
Actuated g/C Ratio	0.47	0.47			0.47		0.41	0.41				
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	652	929			1666		720	719				
v/s Ratio Prot		0.03			0.02							
v/s Ratio Perm	c0.44						c0.36	0.36				
v/c Ratio	0.93	0.07			0.04		0.88	0.88				
Uniform Delay, d1	20.7	12.0			11.8		23.0	23.0				
Progression Factor	1.00	1.00			1.00		1.00	1.00				
Incremental Delay, d2	19.4	0.0			0.0		12.5	12.4				
Delay (s)	40.1	12.0			11.8		35.5	35.4				
Level of Service	D	B			B		D	D				
Approach Delay (s)		37.5			11.8			35.5			0.0	
Approach LOS		D			B			D			A	

Intersection Summary			
HCM Average Control Delay	35.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	83.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	103.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	[illegible]	[illegible]	[illegible]	[illegible]		
Volume (veh/h)	324	968	5	565	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.86	0.86	0.92	0.92
Hourly flow rate (vph)	341	1019	6	657	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)	516			638		
pX, platoon unblocked			0.75		0.75	0.75
vC, conflicting volume			341		681	341
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		405	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1213		427	811
Direction, Lane #	**EB 1**	**EB 2**	**WB 1**	**WB 2**	**WB 3**	
Volume Total	681	679	6	328	328	
Volume Left	0	0	6	0	0	
Volume Right	340	679	0	0	0	
cSH	1700	1700	1213	1700	1700	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.19	
Queue Length 95th (ft)	0	0	0	0	0	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
Lane LOS			A			
Approach Delay (s)	0.0		0.1			
Approach LOS						
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			49.6%	ICU Level of Service		A
Analysis Period (min)			15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↱	↱	↰	↑↑		
Volume (veh/h)	561	767	25	1187	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.93	0.93	0.92	0.92
Hourly flow rate (vph)	630	862	27	1276	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)	516			638		
pX, platoon unblocked			0.81		0.81	0.81
vC, conflicting volume			630		1322	630
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			426		1281	426
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		100	100
cM capacity (veh/h)			915		124	467

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	918	575	27	638	638
Volume Left	0	0	27	0	0
Volume Right	287	575	0	0	0
cSH	1700	1700	915	1700	1700
Volume to Capacity	0.54	0.34	0.03	0.38	0.38
Queue Length 95th (ft)	0	0	2	0	0
Control Delay (s)	0.0	0.0	9.1	0.0	0.0
Lane LOS			A		
Approach Delay (s)	0.0		0.2		
Approach LOS					

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	89.9%	ICU Level of Service	E
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↱		↰	↑↑		↰		↱		✢	
Volume (vph)	0	844	52	236	329	0	28	0	437	11	158	191
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0		5.0	5.0		5.0		6.0		5.0	
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00		1.00	
Frt		0.99		1.00	1.00		1.00		0.85		0.93	
Flt Protected		1.00		0.95	1.00		0.95		1.00		1.00	
Satd. Flow (prot)		3693		1863	3725		1863		1667		1818	
Flt Permitted		1.00		0.95	1.00		0.95		1.00		1.00	
Satd. Flow (perm)		3693		1863	3725		1863		1667		1818	
Peak-hour factor, PHF	0.88	0.88	0.88	0.90	0.90	0.90	0.83	0.83	0.83	0.95	0.95	0.95
Adj. Flow (vph)	0	959	59	262	366	0	34	0	527	12	166	201
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	482	0	34	0
Lane Group Flow (vph)	0	1015	0	262	366	0	34	0	45	0	345	0
Turn Type				Prot			Prot		custom	Split		
Protected Phases		4		3	8		5			6	6	
Permitted Phases									5			
Actuated Green, G (s)		33.3		18.2	56.5		9.9		9.9		23.9	
Effective Green, g (s)		33.3		18.2	56.5		9.9		8.9		23.9	
Actuated g/C Ratio		0.32		0.17	0.54		0.09		0.08		0.23	
Clearance Time (s)		5.0		5.0	5.0		5.0		5.0		5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)		1168		322	1999		175		141		413	
v/s Ratio Prot		c0.27		c0.14	0.10		0.02				c0.19	
v/s Ratio Perm									c0.03			
v/c Ratio		0.87		0.81	0.18		0.19		0.32		0.84	
Uniform Delay, d1		33.9		41.9	12.5		44.0		45.3		38.8	
Progression Factor		1.00		1.00	1.00		1.00		1.00		1.00	
Incremental Delay, d2		7.1		14.5	0.0		0.5		1.3		13.6	
Delay (s)		41.0		56.4	12.6		44.6		46.6		52.4	
Level of Service		D		E	B		D		D		D	
Approach Delay (s)		41.0			30.9			46.5			52.4	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM Average Control Delay	41.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	105.3	Sum of lost time (s)	21.0
Intersection Capacity Utilization	82.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↱		↰	↑↑		↰		↱		✥	
Volume (vph)	0	614	75	368	819	0	78	0	696	18	192	178
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0		5.0	5.0		5.0		6.0		5.0	
Lane Util. Factor		0.95		1.00	0.95		1.00		1.00		1.00	
Frt		0.98		1.00	1.00		1.00		0.85		0.94	
Flt Protected		1.00		0.95	1.00		0.95		1.00		1.00	
Satd. Flow (prot)		3664		1863	3725		1863		1667		1835	
Flt Permitted		1.00		0.95	1.00		0.95		1.00		1.00	
Satd. Flow (perm)		3664		1863	3725		1863		1667		1835	
Peak-hour factor, PHF	0.92	0.92	0.92	0.85	0.85	0.85	0.86	0.86	0.86	0.88	0.88	0.88
Adj. Flow (vph)	0	667	82	433	964	0	91	0	809	20	218	202
RTOR Reduction (vph)	0	8	0	0	0	0	0	0	628	0	25	0
Lane Group Flow (vph)	0	741	0	433	964	0	91	0	181	0	415	0
Turn Type				Prot			Prot		custom	Split		
Protected Phases		4		3	8		5			6	6	
Permitted Phases									5			
Actuated Green, G (s)		24.1		28.0	57.1		17.0		17.0		27.8	
Effective Green, g (s)		24.1		28.0	57.1		17.0		16.0		27.8	
Actuated g/C Ratio		0.21		0.24	0.49		0.15		0.14		0.24	
Clearance Time (s)		5.0		5.0	5.0		5.0		5.0		5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0		3.0	
Lane Grp Cap (vph)		755		446	1819		271		228		436	
v/s Ratio Prot		c0.20		c0.23	0.26		0.05				c0.23	
v/s Ratio Perm									c0.11			
v/c Ratio		0.98		0.97	0.53		0.34		0.79		0.95	
Uniform Delay, d1		46.2		44.0	20.6		44.9		48.8		43.9	
Progression Factor		1.00		1.00	1.00		1.00		1.00		1.00	
Incremental Delay, d2		28.0		34.9	0.3		0.7		17.0		30.9	
Delay (s)		74.2		79.0	20.9		45.6		65.8		74.7	
Level of Service		E		E	C		D		E		E	
Approach Delay (s)		74.2			38.9			63.8			74.7	
Approach LOS		E			D			E			E	

Intersection Summary			
HCM Average Control Delay	57.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	116.9	Sum of lost time (s)	21.0
Intersection Capacity Utilization	93.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↱			↑↑		↱
Volume (veh/h)	864	73	90	458	0	32
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.90	0.90	0.75	0.75
Hourly flow rate (vph)	939	79	100	509	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				648		
pX, platoon unblocked					0.99	
vC, conflicting volume			1018		1433	509
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1018		1421	509
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			85		100	92
cM capacity (veh/h)			677		108	509

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	626	392	270	339	43
Volume Left	0	0	100	0	0
Volume Right	0	79	0	0	43
cSH	1700	1700	677	1700	509
Volume to Capacity	0.37	0.23	0.15	0.20	0.08
Queue Length 95th (ft)	0	0	13	0	7
Control Delay (s)	0.0	0.0	5.3	0.0	12.7
Lane LOS			A		B
Approach Delay (s)	0.0		2.4		12.7
Approach LOS					B

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↱			↑↑		↱
Volume (veh/h)	519	140	107	968	0	170
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.91	0.91	0.88	0.88
Hourly flow rate (vph)	583	157	118	1064	0	193
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				648		
pX, platoon unblocked					0.82	
vC, conflicting volume			740		1429	370
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			740		1092	370
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			86		100	69
cM capacity (veh/h)			862		149	627

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Volume Left	0	0	118	0	0
Volume Right	0	157	0	0	193
cSH	1700	1700	862	1700	627
Volume to Capacity	0.23	0.21	0.14	0.42	0.31
Queue Length 95th (ft)	0	0	12	0	33
Control Delay (s)	0.0	0.0	3.7	0.0	13.3
Lane LOS			A		B
Approach Delay (s)	0.0		1.5		13.3
Approach LOS					B

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Volume (veh/h)	15	3	2	41	15	21	8	901	69	84	299	75
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.56	0.56	0.56	0.74	0.74	0.74	0.94	0.94	0.94	0.93	0.93	0.93
Hourly flow rate (vph)	27	5	4	55	20	28	9	959	73	90	322	81
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								871				
pX, platoon unblocked												
vC, conflicting volume	1077	1591	201	1360	1595	516	402			1032		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1077	1591	201	1360	1595	516	402			1032		
tC, single (s)	*5.5	*4.5	*4.9	*5.5	*4.5	*4.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	*2.5	*3.0	*2.3	*2.5	*3.0	*2.3	2.2			2.2		
p0 queue free %	92	98	100	77	92	97	99			86		
cM capacity (veh/h)	320	254	1269	244	254	910	1153			669		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	36	104	9	639	393	90	214	188
Volume Left	27	55	9	0	0	90	0	0
Volume Right	4	28	0	0	73	0	0	81
cSH	332	308	1153	1700	1700	669	1700	1700
Volume to Capacity	0.11	0.34	0.01	0.38	0.23	0.14	0.13	0.11
Queue Length 95th (ft)	9	36	1	0	0	12	0	0
Control Delay (s)	17.1	22.6	8.1	0.0	0.0	11.2	0.0	0.0
Lane LOS	C	C	A			B		
Approach Delay (s)	17.1	22.6	0.1			2.1		
Approach LOS	C	C						

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	44.6%	ICU Level of Service	A
Analysis Period (min)	15		

* User Entered Value

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Volume (veh/h)	45	11	14	121	13	61	7	553	54	61	839	68
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.94	0.94	0.94	0.85	0.85	0.85	0.88	0.88	0.88	0.90	0.90	0.90
Hourly flow rate (vph)	48	12	15	142	15	72	8	628	61	68	932	76
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								871				
pX, platoon unblocked												
vC, conflicting volume	1515	1811	504	1297	1818	345	1008			690		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1515	1811	504	1297	1818	345	1008			690		
tC, single (s)	*5.5	*4.5	*4.9	*5.5	*4.5	*4.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	*2.5	*3.0	*2.3	*2.5	*3.0	*2.3	2.2			2.2		
p0 queue free %	75	95	98	46	93	93	99			92		
cM capacity (veh/h)	190	221	922	266	219	1091	683			901		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	74	229	8	419	271	68	621	386
Volume Left	48	142	8	0	0	68	0	0
Volume Right	15	72	0	0	61	0	0	76
cSH	232	342	683	1700	1700	901	1700	1700
Volume to Capacity	0.32	0.67	0.01	0.25	0.16	0.08	0.37	0.23
Queue Length 95th (ft)	33	115	1	0	0	6	0	0
Control Delay (s)	27.7	34.6	10.3	0.0	0.0	9.3	0.0	0.0
Lane LOS	D	D	B			A		
Approach Delay (s)	27.7	34.6	0.1			0.6		
Approach LOS	D	D						

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	50.4%	ICU Level of Service	A
Analysis Period (min)	15		

* User Entered Value

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Volume (vph)	39	12	23	91	19	94	58	845	101	62	252	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.96			0.94		1.00	0.98		1.00	0.98	
Flt Protected		0.97			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1738			1709		1863	3666		1863	3669	
Flt Permitted		0.80			0.82		0.54	1.00		0.22	1.00	
Satd. Flow (perm)		1427			1432		1067	3666		434	3669	
Peak-hour factor, PHF	0.96	0.96	0.96	0.92	0.92	0.92	0.92	0.92	0.92	0.81	0.81	0.81
Adj. Flow (vph)	41	12	24	99	21	102	63	918	110	77	311	35
RTOR Reduction (vph)	0	17	0	0	36	0	0	12	0	0	11	0
Lane Group Flow (vph)	0	60	0	0	186	0	63	1016	0	77	335	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		11.1			11.1		19.7	19.7		19.7	19.7	
Effective Green, g (s)		11.1			11.1		19.7	19.7		19.7	19.7	
Actuated g/C Ratio		0.27			0.27		0.48	0.48		0.48	0.48	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		388			390		515	1770		210	1772	
v/s Ratio Prot								c0.28			0.09	
v/s Ratio Perm		0.04			c0.13		0.06			0.18		
v/c Ratio		0.15			0.48		0.12	0.57		0.37	0.19	
Uniform Delay, d1		11.3			12.4		5.8	7.5		6.6	6.0	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			0.9		0.1	0.5		1.1	0.1	
Delay (s)		11.5			13.3		5.9	8.0		7.7	6.1	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		11.5			13.3			7.9			6.4	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	8.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	40.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Volume (vph)	90	38	34	138	26	41	41	483	92	111	823	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.97			0.97		1.00	0.98		1.00	0.99	
Flt Protected		0.97			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1761			1753		1863	3636		1863	3700	
Flt Permitted		0.74			0.71		0.23	1.00		0.42	1.00	
Satd. Flow (perm)		1344			1295		458	3636		825	3700	
Peak-hour factor, PHF	0.73	0.73	0.73	0.86	0.86	0.86	0.96	0.96	0.96	0.91	0.91	0.91
Adj. Flow (vph)	123	52	47	160	30	48	43	503	96	122	904	44
RTOR Reduction (vph)	0	12	0	0	11	0	0	19	0	0	4	0
Lane Group Flow (vph)	0	210	0	0	227	0	43	580	0	122	944	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		14.6			14.6		19.6	19.6		19.6	19.6	
Effective Green, g (s)		14.6			14.6		19.6	19.6		19.6	19.6	
Actuated g/C Ratio		0.33			0.33		0.44	0.44		0.44	0.44	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		444			428		203	1612		366	1641	
v/s Ratio Prot								0.16			c0.26	
v/s Ratio Perm		0.16			c0.18		0.09			0.15		
v/c Ratio		0.47			0.53		0.21	0.36		0.33	0.58	
Uniform Delay, d1		11.7			12.0		7.6	8.1		8.0	9.2	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.8			1.2		0.5	0.1		0.5	0.5	
Delay (s)		12.5			13.2		8.1	8.3		8.6	9.7	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		12.5			13.2			8.3			9.6	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	9.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	44.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✥			✥	
Volume (vph)	58	687	85	135	223	8	83	12	314	3	7	7
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	0.98		1.00	0.99			0.90			0.94	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1863	3664		1863	3705			1653			1744	
Flt Permitted	0.95	1.00		0.95	1.00			0.92			0.94	
Satd. Flow (perm)	1863	3664		1863	3705			1542			1648	
Peak-hour factor, PHF	0.95	0.95	0.95	0.84	0.84	0.84	0.80	0.80	0.80	0.61	0.61	0.61
Adj. Flow (vph)	61	723	89	161	265	10	104	15	392	5	11	11
RTOR Reduction (vph)	0	9	0	0	2	0	0	161	0	0	8	0
Lane Group Flow (vph)	61	803	0	161	273	0	0	350	0	0	19	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	4.1	23.7		10.8	30.4			20.8			20.8	
Effective Green, g (s)	4.1	23.7		10.8	30.4			20.8			20.8	
Actuated g/C Ratio	0.06	0.34		0.15	0.43			0.30			0.30	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	109	1235		286	1602			456			488	
v/s Ratio Prot	0.03	c0.22		c0.09	0.07							
v/s Ratio Perm								c0.23			0.01	
v/c Ratio	0.56	0.65		0.56	0.17			0.77			0.04	
Uniform Delay, d1	32.2	19.8		27.6	12.2			22.6			17.6	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	6.1	1.2		2.5	0.1			7.6			0.0	
Delay (s)	38.3	21.0		30.1	12.3			30.2			17.7	
Level of Service	D	C		C	B			C			B	
Approach Delay (s)		22.2			18.9			30.2			17.7	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	23.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	70.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✥			✥	
Volume (vph)	53	432	99	185	803	7	149	19	173	11	22	108
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	0.97		1.00	1.00			0.93			0.90	
Flt Protected	0.95	1.00		0.95	1.00			0.98			1.00	
Satd. Flow (prot)	1863	3622		1863	3721			1698			1664	
Flt Permitted	0.95	1.00		0.95	1.00			0.76			0.96	
Satd. Flow (perm)	1863	3622		1863	3721			1315			1603	
Peak-hour factor, PHF	0.93	0.93	0.93	0.89	0.89	0.89	0.89	0.89	0.89	0.72	0.72	0.72
Adj. Flow (vph)	57	465	106	208	902	8	167	21	194	15	31	150
RTOR Reduction (vph)	0	20	0	0	1	0	0	47	0	0	101	0
Lane Group Flow (vph)	57	551	0	208	909	0	0	335	0	0	95	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	3.1	19.2		13.0	29.1			22.8			22.8	
Effective Green, g (s)	3.1	19.2		13.0	29.1			22.8			22.8	
Actuated g/C Ratio	0.04	0.27		0.19	0.42			0.33			0.33	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	83	993		346	1547			428			522	
v/s Ratio Prot	0.03	0.15		c0.11	c0.24							
v/s Ratio Perm								c0.25			0.06	
v/c Ratio	0.69	0.55		0.60	0.59			0.78			0.18	
Uniform Delay, d1	33.0	21.7		26.1	15.8			21.4			16.9	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	21.0	0.7		2.9	0.6			9.0			0.2	
Delay (s)	54.0	22.4		29.1	16.4			30.4			17.1	
Level of Service	D	C		C	B			C			B	
Approach Delay (s)		25.3			18.7			30.4			17.1	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	22.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	69.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱	↰	↑↑	↱	↰↰	↑↑	↱
Volume (vph)	16	20	4	78	16	219	8	438	172	638	878	17
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0		5.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	6.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3453		1863	1961	1667	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3453		1863	1961	1667	1863	3725	1667	3614	3725	1667
Peak-hour factor, PHF	0.56	0.56	0.56	0.89	0.89	0.89	0.77	0.77	0.77	0.96	0.96	0.96
Adj. Flow (vph)	29	36	7	88	18	246	10	569	223	665	915	18
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	152	0	0	8
Lane Group Flow (vph)	29	36	0	88	18	246	10	569	71	665	915	10
Turn Type	Split			Split		Free	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			6
Actuated Green, G (s)	5.2	5.2		7.3	7.3	77.8	1.0	24.6	24.6	20.7	44.3	44.3
Effective Green, g (s)	5.2	5.2		7.3	7.3	77.8	1.0	24.6	24.6	20.7	44.3	43.3
Actuated g/C Ratio	0.07	0.07		0.09	0.09	1.00	0.01	0.32	0.32	0.27	0.57	0.56
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	118	231		175	184	1667	24	1178	527	962	2121	928
v/s Ratio Prot	0.02	0.01		c0.05	0.01		0.01	c0.15		c0.18	0.25	
v/s Ratio Perm						c0.15			0.04			0.01
v/c Ratio	0.25	0.16		0.50	0.10	0.15	0.42	0.48	0.13	0.69	0.43	0.01
Uniform Delay, d1	34.4	34.2		33.5	32.2	0.0	38.1	21.5	19.0	25.7	9.6	7.7
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.3		2.3	0.2	0.2	11.3	0.3	0.1	2.2	0.1	0.0
Delay (s)	35.5	34.6		35.8	32.5	0.2	49.4	21.8	19.1	27.8	9.7	7.7
Level of Service	D	C		D	C	A	D	C	B	C	A	A
Approach Delay (s)		34.9			10.7			21.4			17.2	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	77.8	Sum of lost time (s)	15.0
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	41	36	220	78	762	35	783	220	323	569	51
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0		5.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	6.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3290		1863	1961	1667	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3290		1863	1961	1667	1863	3725	1667	3614	3725	1667
Peak-hour factor, PHF	0.60	0.60	0.60	0.94	0.94	0.94	0.86	0.86	0.86	0.89	0.89	0.89
Adj. Flow (vph)	53	68	60	234	83	811	41	910	256	363	639	57
RTOR Reduction (vph)	0	54	0	0	0	0	0	0	166	0	0	31
Lane Group Flow (vph)	53	74	0	234	83	811	41	910	90	363	639	26
Turn Type	Split			Split		Free	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			6
Actuated Green, G (s)	8.5	8.5		17.0	17.0	92.7	3.7	32.6	32.6	14.6	43.5	43.5
Effective Green, g (s)	8.5	8.5		17.0	17.0	92.7	3.7	32.6	32.6	14.6	43.5	42.5
Actuated g/C Ratio	0.09	0.09		0.18	0.18	1.00	0.04	0.35	0.35	0.16	0.47	0.46
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	162	302		342	360	1667	74	1310	586	569	1748	764
v/s Ratio Prot	0.03	0.02		c0.13	0.04		0.02	c0.24		c0.10	0.17	
v/s Ratio Perm						c0.49			0.05			0.02
v/c Ratio	0.33	0.24		0.68	0.23	0.49	0.55	0.69	0.15	0.64	0.37	0.03
Uniform Delay, d1	39.4	39.1		35.3	32.3	0.0	43.7	25.8	20.6	36.6	15.8	13.8
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.4		5.6	0.3	1.0	8.7	1.6	0.1	2.4	0.1	0.0
Delay (s)	40.6	39.5		40.9	32.6	1.0	52.4	27.4	20.7	38.9	15.9	13.8
Level of Service	D	D		D	C	A	D	C	C	D	B	B
Approach Delay (s)		39.8			11.6			26.8			23.7	
Approach LOS		D			B			C			C	

Intersection Summary			
HCM Average Control Delay	21.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	92.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	1	4	9	578	2	38	16	579	567	30	929	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1595		1863	3725	1667	1863	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1595		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.70	0.70	0.70	0.86	0.86	0.86	0.82	0.82	0.82	0.88	0.88	0.88
Adj. Flow (vph)	1	6	13	672	2	44	20	706	691	34	1056	1
RTOR Reduction (vph)	0	0	0	0	31	0	0	0	429	0	0	1
Lane Group Flow (vph)	1	6	13	672	15	0	20	706	262	34	1056	0
Turn Type	Split		Free	Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	0.8	0.8	73.5	21.3	21.3		1.5	27.9	27.9	3.5	29.9	29.9
Effective Green, g (s)	0.8	0.8	73.5	21.3	21.3		1.5	27.9	27.9	3.5	29.9	29.9
Actuated g/C Ratio	0.01	0.01	1.00	0.29	0.29		0.02	0.38	0.38	0.05	0.41	0.41
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	19	20	1583	995	462		38	1414	633	89	1515	678
v/s Ratio Prot	0.00	c0.00		c0.20	0.01		0.01	0.19		c0.02	c0.28	
v/s Ratio Perm			c0.01						0.16			0.00
v/c Ratio	0.05	0.30	0.01	0.68	0.03		0.53	0.50	0.41	0.38	0.70	0.00
Uniform Delay, d1	36.0	36.1	0.0	23.0	18.7		35.6	17.5	16.8	34.0	18.0	12.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	8.3	0.0	1.8	0.0		12.5	0.3	0.4	2.7	1.4	0.0
Delay (s)	37.1	44.3	0.0	24.9	18.7		48.2	17.7	17.2	36.7	19.5	12.9
Level of Service	D	D	A	C	B		D	B	B	D	B	B
Approach Delay (s)		15.2			24.5			17.9			20.0	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	73.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	55.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	16	41	618	17	49	84	983	833	43	770	12
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3614	1742		1863	3725	1667	1863	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3614	1742		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.69	0.69	0.69	0.94	0.94	0.94	0.91	0.91	0.91	0.89	0.89	0.89
Adj. Flow (vph)	9	23	59	657	18	52	92	1080	915	48	865	13
RTOR Reduction (vph)	0	0	0	0	39	0	0	0	494	0	0	8
Lane Group Flow (vph)	9	23	59	657	31	0	92	1080	421	48	865	5
Turn Type	Split		Free	Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	3.7	3.7	90.6	23.3	23.3		7.8	39.4	39.4	4.2	35.8	35.8
Effective Green, g (s)	3.7	3.7	90.6	23.3	23.3		7.8	39.4	39.4	4.2	35.8	35.8
Actuated g/C Ratio	0.04	0.04	1.00	0.26	0.26		0.09	0.43	0.43	0.05	0.40	0.40
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	72	76	1583	929	448		160	1620	725	86	1472	659
v/s Ratio Prot	0.01	c0.01		c0.18	0.02		c0.05	c0.29		0.03	0.23	
v/s Ratio Perm			0.04						0.25			0.00
v/c Ratio	0.12	0.30	0.04	0.71	0.07		0.57	0.67	0.58	0.56	0.59	0.01
Uniform Delay, d1	41.9	42.2	0.0	30.6	25.5		39.8	20.4	19.4	42.3	21.6	16.6
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.8	2.2	0.0	2.5	0.1		4.9	1.1	1.2	7.6	0.6	0.0
Delay (s)	42.7	44.4	0.0	33.0	25.5		44.7	21.4	20.5	49.9	22.2	16.6
Level of Service	D	D	A	C	C		D	C	C	D	C	B
Approach Delay (s)		15.5			32.3			22.1			23.5	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	90.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑	↱	↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	466	17	93	64	73	37	46	659	39	16	948	552
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.95	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1777	1583	1770	1769		1770	3539	1583	1770	3539	1583
Flt Permitted		0.64	1.00	0.27	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1197	1583	511	1769		1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	0.83	0.83	0.83	0.86	0.86	0.86	0.83	0.83	0.83	0.93	0.93	0.93
Adj. Flow (vph)	561	20	112	74	85	43	55	794	47	17	1019	594
RTOR Reduction (vph)	0	0	0	0	15	0	0	0	31	0	0	0
Lane Group Flow (vph)	0	581	112	74	113	0	55	794	16	17	1019	594
Turn Type	Perm		Free	Perm			Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		Free	8					2			Free
Actuated Green, G (s)		57.5	114.3	57.5	57.5		5.2	39.2	39.2	2.6	36.6	114.3
Effective Green, g (s)		57.5	114.3	57.5	57.5		5.2	39.2	39.2	2.6	36.6	114.3
Actuated g/C Ratio		0.50	1.00	0.50	0.50		0.05	0.34	0.34	0.02	0.32	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		602	1583	257	890		81	1214	543	40	1133	1583
v/s Ratio Prot					0.06		c0.03	0.22		0.01	c0.29	
v/s Ratio Perm		c0.49	0.07	0.14					0.01			c0.38
v/c Ratio		0.97	0.07	0.29	0.13		0.68	0.65	0.03	0.42	0.90	0.38
Uniform Delay, d1		27.4	0.0	16.5	15.1		53.7	31.8	24.9	55.1	37.1	0.0
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		27.9	0.1	0.6	0.1		20.3	1.3	0.0	7.1	9.6	0.7
Delay (s)		55.3	0.1	17.1	15.1		74.0	33.1	24.9	62.2	46.7	0.7
Level of Service		E	A	B	B		E	C	C	E	D	A
Approach Delay (s)		46.4			15.9			35.2			30.1	
Approach LOS		D			B			D			C	

Intersection Summary			
HCM Average Control Delay	33.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	114.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑	↱	↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	488	31	134	24	31	47	176	1365	105	25	759	645
Ideal Flow (vphpl)	2000	2000	2000	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	0.91		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1873	1667	1770	1694		1863	3725	1667	1863	3725	1667
Flt Permitted		0.68	1.00	0.23	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1327	1667	429	1694		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.96	0.96	0.96	0.91	0.91	0.91
Adj. Flow (vph)	542	34	149	27	34	52	183	1422	109	27	834	709
RTOR Reduction (vph)	0	0	0	0	29	0	0	0	56	0	0	0
Lane Group Flow (vph)	0	576	149	27	57	0	183	1422	53	27	834	709
Turn Type	Perm		Free	Perm			Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		Free	8					2			Free
Actuated Green, G (s)		52.2	116.7	52.2	52.2		14.1	46.6	46.6	2.9	35.4	116.7
Effective Green, g (s)		52.2	116.7	52.2	52.2		14.1	46.6	46.6	2.9	35.4	116.7
Actuated g/C Ratio		0.45	1.00	0.45	0.45		0.12	0.40	0.40	0.02	0.30	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		594	1667	192	758		225	1487	666	46	1130	1667
v/s Ratio Prot					0.03		c0.10	c0.38		0.01	0.22	
v/s Ratio Perm		c0.43	0.09	0.06					0.03			0.43
v/c Ratio		0.97	0.09	0.14	0.08		0.81	0.96	0.08	0.59	0.74	0.43
Uniform Delay, d1		31.5	0.0	19.0	18.4		50.0	34.1	21.7	56.3	36.5	0.0
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		29.0	0.1	0.3	0.0		19.7	14.2	0.1	17.7	2.6	0.8
Delay (s)		60.5	0.1	19.4	18.5		69.7	48.2	21.8	74.0	39.0	0.8
Level of Service		E	A	B	B		E	D	C	E	D	A
Approach Delay (s)		48.1			18.7			48.8			22.4	
Approach LOS		D			B			D			C	

Intersection Summary			
HCM Average Control Delay	37.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	116.7	Sum of lost time (s)	15.0
Intersection Capacity Utilization	85.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑	↱	↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	111	12	321	173	12	13	30	620	55	3	1092	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1782	1583	1770	1719		1863	3725	1667	1863	3725	1667
Flt Permitted		0.72	1.00	0.66	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1350	1583	1230	1719		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.81	0.81	0.81	0.82	0.82	0.82	0.71	0.71	0.71	0.97	0.97	0.97
Adj. Flow (vph)	137	15	396	211	15	16	42	873	77	3	1126	10
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	38	0	0	0
Lane Group Flow (vph)	0	152	396	211	19	0	42	873	39	3	1126	10
Turn Type	Perm		Free	Perm			Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		Free	8					2			Free
Actuated Green, G (s)		20.1	72.5	20.1	20.1		3.4	36.9	36.9	0.5	34.0	72.5
Effective Green, g (s)		20.1	72.5	20.1	20.1		3.4	36.9	36.9	0.5	34.0	72.5
Actuated g/C Ratio		0.28	1.00	0.28	0.28		0.05	0.51	0.51	0.01	0.47	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		374	1583	341	477		87	1896	848	13	1747	1667
v/s Ratio Prot					0.01		c0.02	0.23		0.00	c0.30	
v/s Ratio Perm		0.11	c0.25	c0.17					0.02			0.01
v/c Ratio		0.41	0.25	0.62	0.04		0.48	0.46	0.05	0.23	0.64	0.01
Uniform Delay, d1		21.3	0.0	22.9	19.2		33.7	11.4	9.0	35.8	14.7	0.0
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.7	0.4	3.3	0.0		4.2	0.2	0.0	8.9	0.8	0.0
Delay (s)		22.1	0.4	26.2	19.2		37.9	11.6	9.0	44.7	15.5	0.0
Level of Service		C	A	C	B		D	B	A	D	B	A
Approach Delay (s)		6.4			25.3			12.5			15.4	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	72.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	53.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	21	6	69	63	8	9	158	1616	171	10	881	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1793	1583	1770	1717		1863	3725	1667	1863	3725	1667
Flt Permitted		0.76	1.00	0.74	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1413	1583	1372	1717		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.84	0.84	0.84	0.72	0.72	0.72	0.97	0.97	0.97	0.98	0.98	0.98
Adj. Flow (vph)	25	7	82	88	11	12	163	1666	176	10	899	27
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	60	0	0	0
Lane Group Flow (vph)	0	32	82	88	12	0	163	1666	116	10	899	27
Turn Type	Perm		Free	Perm			Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		Free	8					2			Free
Actuated Green, G (s)		8.8	72.2	8.8	8.8		13.4	47.6	47.6	0.8	35.0	72.2
Effective Green, g (s)		8.8	72.2	8.8	8.8		13.4	47.6	47.6	0.8	35.0	72.2
Actuated g/C Ratio		0.12	1.00	0.12	0.12		0.19	0.66	0.66	0.01	0.48	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		172	1583	167	209		346	2456	1099	21	1806	1667
v/s Ratio Prot					0.01		c0.09	c0.45		0.01	0.24	
v/s Ratio Perm		0.02	0.05	c0.06					0.07			0.02
v/c Ratio		0.19	0.05	0.53	0.06		0.47	0.68	0.11	0.48	0.50	0.02
Uniform Delay, d1		28.5	0.0	29.7	28.0		26.2	7.6	4.5	35.5	12.6	0.0
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.5	0.1	3.0	0.1		1.0	0.8	0.0	16.0	0.2	0.0
Delay (s)		29.0	0.1	32.7	28.2		27.3	8.3	4.5	51.5	12.8	0.0
Level of Service		C	A	C	C		C	A	A	D	B	A
Approach Delay (s)		8.2			31.8			9.5			12.9	
Approach LOS		A			C			A			B	

Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	72.2	Sum of lost time (s)	15.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	Y		↰	↑↑	↑↑	↱
Volume (vph)	114	618	139	591	1500	86
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.89		1.00	1.00	1.00	0.85
Flt Protected	0.99		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1724		1863	3725	3725	1667
Flt Permitted	0.99		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1724		1863	3725	3725	1667
Peak-hour factor, PHF	0.82	0.82	0.72	0.72	0.83	0.83
Adj. Flow (vph)	139	754	193	821	1807	104
RTOR Reduction (vph)	115	0	0	0	0	43
Lane Group Flow (vph)	778	0	193	821	1807	62
Turn Type			Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	43.0		10.0	67.0	52.0	52.0
Effective Green, g (s)	43.0		10.0	67.0	52.0	52.0
Actuated g/C Ratio	0.36		0.08	0.56	0.43	0.43
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	618		155	2080	1614	722
v/s Ratio Prot	c0.45		c0.10	0.22	c0.49	
v/s Ratio Perm						0.04
v/c Ratio	1.26		1.25	0.39	1.12	0.09
Uniform Delay, d1	38.5		55.0	15.0	34.0	20.0
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	129.4		152.9	0.1	62.8	0.1
Delay (s)	167.9		207.9	15.1	96.8	20.1
Level of Service	F		F	B	F	C
Approach Delay (s)	167.9			51.8	92.6	
Approach LOS	F			D	F	

Intersection Summary			
HCM Average Control Delay	99.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	101.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	241	456	292	1704	844	169
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0		5.0	5.0	5.0	5.0
Lane Util. Factor	1.00		1.00	0.95	0.95	1.00
Frt	0.91		1.00	1.00	1.00	0.85
Flt Protected	0.98		0.95	1.00	1.00	1.00
Satd. Flow (prot)	1757		1863	3725	3725	1667
Flt Permitted	0.98		0.95	1.00	1.00	1.00
Satd. Flow (perm)	1757		1863	3725	3725	1667
Peak-hour factor, PHF	0.84	0.84	0.92	0.92	0.94	0.94
Adj. Flow (vph)	287	543	317	1852	898	180
RTOR Reduction (vph)	57	0	0	0	0	129
Lane Group Flow (vph)	773	0	317	1852	898	51
Turn Type			Prot			Perm
Protected Phases	4		5	2	6	
Permitted Phases						6
Actuated Green, G (s)	50.0		21.0	60.0	34.0	34.0
Effective Green, g (s)	50.0		21.0	60.0	34.0	34.0
Actuated g/C Ratio	0.42		0.18	0.50	0.28	0.28
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	732		326	1863	1055	472
v/s Ratio Prot	c0.44		0.17	c0.50	0.24	
v/s Ratio Perm						0.03
v/c Ratio	1.06		0.97	0.99	0.85	0.11
Uniform Delay, d1	35.0		49.2	29.8	40.6	31.8
Progression Factor	1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2	49.2		42.1	19.3	6.7	0.1
Delay (s)	84.2		91.4	49.2	47.3	31.9
Level of Service	F		F	D	D	C
Approach Delay (s)	84.2			55.3	44.8	
Approach LOS	F			E	D	

Intersection Summary			
HCM Average Control Delay	58.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	92.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCS+: Ramps and Ramp Junctions Release 5.3

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	
Agency/Co.:	
Date performed:	2/24/2009
Analysis time period:	AM Peak
Freeway/Dir of Travel:	H-2 Fwy NB Off-Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Existing
Description:	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2768	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	588	vph
Length of first accel/decel lane	230	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	294	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2768		588		294	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	769		163		82	v
Trucks and buses	2		2		2	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3168	660	330	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1753 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3168	9400	No
$v_{FO} = v_F - v_R$	2508	9400	No
v_R	660	2000	No
v_3 or v_{av34}	707 pc/h	(Equation 25-15 or 25-16)	

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 No

If yes, v_{12A} = 1753 (Equation 25-18)

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1753	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 17.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.487

Space mean speed in ramp influence area, S_R = 53.8 mph

Space mean speed in outer lanes, S_0 = 71.3 mph

Space mean speed for all vehicles, S = 60.4 mph

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Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	
Agency/Co.:	
Date performed:	2/24/2009
Analysis time period:	PM Peak
Freeway/Dir of Travel:	H-2 Fwy NB Off-Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Existing
Description:	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4412	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1185	vph
Length of first accel/decel lane	230	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	538	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	4412		1185		538	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1226		329		149	v
Trucks and buses	2		2		2	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	5049	1330	604	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2951 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5049	9400	No
$v_{FO} = v_F - v_R$	3719	9400	No
v_R	1330	2000	No
v_3 or v_{av34}	1049 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12} /2		No	
If yes, v_{12A} = 2951		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2951	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 27.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.548	
Space mean speed in ramp influence area,	S_R = 52.4	mph
Space mean speed in outer lanes,	S_0 = 71.1	mph
Space mean speed for all vehicles,	S = 58.8	mph

HCS+: Ramps and Ramp Junctions Release 5.3

Phone: Fax:
E-mail:

Merge Analysis

Analyst:
Agency/Co.:
Date performed: 2/24/2009
Analysis time period: AM Peak
Freeway/Dir of Travel: H-2 Fwy NB On Ramp
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Existing
Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2180	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	294	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	588	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2180	294	588	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	606	82	163	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2495	330	660	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.400 Using Equation 4

$v_{12} = v_F \, (P_{FM})$ = 997 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2825	9400	No

v_3 or v_{av34} 749 pc/h (Equation 25-4 or 25-5)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12}/2 Yes

If yes, v_{12A} = 998 (Equation 25-8)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	998	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 11.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.287

Space mean speed in ramp influence area, S_R = 58.4 mph

Space mean speed in outer lanes, S_0 = 64.1 mph

Space mean speed for all vehicles, S = 61.3 mph

HCS+: Ramps and Ramp Junctions Release 5.3

Phone: Fax:
E-mail:

Merge Analysis

Analyst:
Agency/Co.:
Date performed: 2/24/2009
Analysis time period: PM Peak
Freeway/Dir of Travel: H-2 Fwy NB On Ramp
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Existing
Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3227	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	538	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1185	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3227		538		1185	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	896		149		329	v
Trucks and buses	2		2		2	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3693	604	1330	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.142 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 526 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4297	9400	No
v_3 or v_{av34}	1583 pc/h	(Equation 25-4 or 25-5)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 1477		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1477	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.303

Space mean speed in ramp influence area, S_R = 58.0 mph

Space mean speed in outer lanes, S_0 = 62.8 mph

Space mean speed for all vehicles, S = 60.4 mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:
Agency/Co.:
Date performed: 2/24/2009
Analysis time period: AM Peak
Freeway/Dir of Travel: H-2 Fwy SB Off-Ramp
Junction: H-2 Fwy/Ka Uka Blvd.
Jurisdiction:
Analysis Year: Existing
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3760	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	360	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	973	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3760		360		973	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	1044		100		270	v
Trucks and buses	2		2		2	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4303	404	1092	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2104 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4303	9400	No
$v_{FO} = v_F - v_R$	3899	9400	No
v_R	404	2000	No
v_{3} or v_{av34}	1099 pc/h	(Equation 25-15 or 25-16)	
Is v_{3} or v_{av34} > 2700 pc/h?		No	
Is v_{3} or v_{av34} > 1.5 v_{12}/2		No	
If yes, v_{12A} = 2104		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2104	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 21.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.464	
Space mean speed in ramp influence area,	S_R = 54.3	mph
Space mean speed in outer lanes,	S_0 = 70.9	mph
Space mean speed for all vehicles,	S = 61.7	mph

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	
Agency/Co.:	
Date performed:	2/24/2009
Analysis time period:	PM Peak
Freeway/Dir of Travel:	H-2 Fwy SB Off-Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Existing
Description:	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2695	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	388	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	792	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2695		388		792	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	749		108		220	v
Trucks and buses	2		2		2	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3084	435	889	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1590 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3084	9400	No
$v_{FO} = v_F - v_R$	2649	9400	No
v_R	435	2000	No
v_3 or v_{av34}	747 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	
If yes, v_{12A} = 1590		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1590	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 16.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.467

Space mean speed in ramp influence area, S_R = 54.3 mph

Space mean speed in outer lanes, S_0 = 71.3 mph

Space mean speed for all vehicles, S = 61.4 mph

HCS+: Ramps and Ramp Junctions Release 5.3

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	
Agency/Co.:	
Date performed:	2/24/2009
Analysis time period:	AM Peak
Freeway/Dir of Travel:	H-2 Fwy SB On Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Existing
Description:	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3400	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	973	vph
Length of first accel/decel lane	820	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	360	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3400		973		360	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	944		270		100	v
Trucks and buses	2		2		2	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3891	1092	404	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.081 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 316 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4983	9400	No
v_3 or v_{av34}	1787 pc/h	(Equation 25-4 or 25-5)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 1556		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1556	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 20.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.319

Space mean speed in ramp influence area, S_R = 57.7 mph

Space mean speed in outer lanes, S_0 = 62.6 mph

Space mean speed for all vehicles, S = 59.9 mph

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	
Agency/Co.:	
Date performed:	2/24/2009
Analysis time period:	PM Peak
Freeway/Dir of Travel:	H-2 Fwy SB On Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Existing
Description:	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2307	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	792	vph
Length of first accel/decel lane	820	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	388	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2307		792		388	vph
Peak-hour factor, PHF	0.90		0.90		0.90	
Peak 15-min volume, v15	641		220		108	v
Trucks and buses	2		2		2	%
Recreational vehicles	0		0		0	%
Terrain type:	Rolling		Level		Level	
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	

Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2640	889	435	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.107 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 282 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3529	9400	No
v_3 or v_{av34}	1179 pc/h	(Equation 25-4 or 25-5)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 1056		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1056	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 15.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.291

Space mean speed in ramp influence area, S_R = 58.3 mph

Space mean speed in outer lanes, S_0 = 63.9 mph

Space mean speed for all vehicles, S = 60.7 mph

HCS+: Basic Freeway Segments Release 5.3

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	
Agency or Company:	
Date Performed:	2/26/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	H-2 Fwy NB
From/To:	
Jurisdiction:	
Analysis Year:	Existing
Description:	South of Ka Uka Blvd

Flow Inputs and Adjustments

Volume, V	2768	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	769	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	792	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	792	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	11.6	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.3

Phone: Fax:
E-mail:

Operational Analysis

Analyst:
Agency or Company:
Date Performed: 2/26/2009
Analysis Time Period: PM Peak
Freeway/Direction: H-2 Fwy NB
From/To:
Jurisdiction:
Analysis Year: Existing
Description: South of Ka Uka Blvd

Flow Inputs and Adjustments

Volume, V	4412	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1226	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1262	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1262	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	18.4	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.3

Phone: Fax:
E-mail:

Operational Analysis

Analyst:
Agency or Company:
Date Performed: 2/26/2009
Analysis Time Period: AM Peak
Freeway/Direction: H-2 Fwy NB
From/To:
Jurisdiction:
Analysis Year: Existing
Description: North of Ka Uka Blvd

Flow Inputs and Adjustments

Volume, V	2474	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	687	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	708	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	708	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	10.3	pc/mi/ln
Level of service, LOS	A	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.3

Phone: Fax:
E-mail:

Operational Analysis

Analyst:
Agency or Company:
Date Performed: 2/26/2009
Analysis Time Period: PM Peak
Freeway/Direction: H-2 Fwy NB
From/To:
Jurisdiction:
Analysis Year: Existing
Description: North of Ka Uka Blvd

Flow Inputs and Adjustments

Volume, V	3765	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1046	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1077	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1077	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	15.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.3

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	
Agency or Company:	
Date Performed:	2/26/2009
Analysis Time Period:	AM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Existing
Description:	North of Ka Uka Blvd

Flow Inputs and Adjustments

Volume, V	3760	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1044	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1076	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1076	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	15.7	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.3

Phone: Fax:
E-mail:

Operational Analysis

Analyst:
Agency or Company:
Date Performed: 2/26/2009
Analysis Time Period: PM Peak
Freeway/Direction: H-2 Fwy SB
From/To:
Jurisdiction:
Analysis Year: Existing
Description: North of Ka Uka Blvd

Flow Inputs and Adjustments

Volume, V	2695	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	749	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	771	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	771	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	11.3	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.3

Phone: Fax:
E-mail:

Operational Analysis

Analyst:
Agency or Company:
Date Performed: 2/26/2009
Analysis Time Period: AM Peak
Freeway/Direction: H-2 Fwy SB
From/To:
Jurisdiction:
Analysis Year: Existing
Description: South of Ka Uka Blvd

Flow Inputs and Adjustments

Volume, V	4373	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1215	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1251	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1251	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	18.3	pc/mi/ln
Level of service, LOS	C	

Overall results are not computed when free-flow speed is less than 55 mph.

HCS+: Basic Freeway Segments Release 5.3

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	
Agency or Company:	
Date Performed:	2/26/2009
Analysis Time Period:	PM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Existing
Description:	South of Ka Uka Blvd

Flow Inputs and Adjustments

Volume, V	3099	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	861	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	887	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	887	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	12.9	pc/mi/ln
Level of service, LOS	B	

Overall results are not computed when free-flow speed is less than 55 mph.

APPENDIX E

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2016 PEAK HOUR TRAFFIC
ANALYSIS WITHOUT PROJECT

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	305	31	0	0	7	1	586	0	25	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0				
Lane Util. Factor	0.95	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			0.98		1.00	0.99				
Flt Protected	0.95	0.96			1.00		0.95	0.96				
Satd. Flow (prot)	1770	1790			3663		1770	1759				
Flt Permitted	0.95	0.96			1.00		0.95	0.96				
Satd. Flow (perm)	1770	1790			3663		1770	1759				
Peak-hour factor, PHF	0.50	0.50	0.50	0.90	0.90	0.90	0.85	0.85	0.85	0.92	0.92	0.92
Adj. Flow (vph)	610	62	0	0	8	1	689	0	29	0	0	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	3	0	0	0	0
Lane Group Flow (vph)	335	337	0	0	8	0	358	357	0	0	0	0
Turn Type	Split						Perm					
Protected Phases	4	4			8			2				
Permitted Phases							2					
Actuated Green, G (s)	15.8	15.8			0.7		16.5	16.5				
Effective Green, g (s)	15.8	15.8			0.7		16.5	16.5				
Actuated g/C Ratio	0.33	0.33			0.01		0.34	0.34				
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	583	589			53		608	605				
v/s Ratio Prot	c0.19	0.19			c0.00							
v/s Ratio Perm							0.20	0.20				
v/c Ratio	0.57	0.57			0.15		0.59	0.59				
Uniform Delay, d1	13.3	13.3			23.4		13.0	13.0				
Progression Factor	1.00	1.00			1.00		1.00	1.00				
Incremental Delay, d2	1.4	1.3			1.3		1.5	1.5				
Delay (s)	14.7	14.7			24.7		14.4	14.4				
Level of Service	B	B			C		B	B				
Approach Delay (s)		14.7			24.7			14.4			0.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM Average Control Delay	14.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	48.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
25: Ka Uka Blvd & H-2 On (NB)

9/29/2009

[illegible]												
Lane Configurations												
[illegible]												
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
[illegible]												
Lane Util. Factor	0.95	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			0.94		1.00	0.99				
Flt Protected	0.95	0.96			1.00		0.95	0.95				
Satd. Flow (prot)	1770	1790			3516		1770	1767				
Flt Permitted	0.95	0.96			1.00		0.95	0.95				
Satd. Flow (perm)	1770	1790			3516		1770	1767				
Peak-hour factor, PHF	0.84	0.84	0.84	1.00	1.00	1.00	0.93	0.93	0.93	0.92	0.92	0.92
Adj. Flow (vph)	629	63	0	0	50	30	1299	0	25	0	0	0
RTOR Reduction (vph)	0	0	0	0	28	0	0	2	0	0	0	0
Lane Group Flow (vph)	346	346	0	0	52	0	662	660	0	0	0	0
Turn Type	Split						Perm					
Protected Phases	4	4			8			2				
Permitted Phases							2					
Actuated Green, G (s)	19.2	19.2			5.0		33.5	33.5				
Effective Green, g (s)	19.2	19.2			5.0		33.5	33.5				
Actuated g/C Ratio	0.26	0.26			0.07		0.46	0.46				
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	467	473			242		816	814				
v/s Ratio Prot	c0.20	0.19			c0.01							
v/s Ratio Perm							c0.37	0.37				
v/c Ratio	0.74	0.73			0.22		0.81	0.81				
Uniform Delay, d1	24.5	24.4			32.0		16.9	16.9				
Progression Factor	1.00	1.00			1.00		1.00	1.00				
Incremental Delay, d2	6.2	5.8			0.4		6.2	6.2				
Delay (s)	30.7	30.2			32.4		23.0	23.0				
Level of Service	C	C			C		C	C				
Approach Delay (s)		30.4			32.4			23.0			0.0	
Approach LOS		C			C			C			A	

[illegible]			
HCM Average Control Delay	25.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	72.7	Sum of lost time (s)	15.0
Intersection Capacity Utilization	106.8%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↱	↱	↰	↑↑		
Volume (veh/h)	337	1007	5	588	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.86	0.86	0.92	0.92
Hourly flow rate (vph)	355	1060	6	684	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)	516			638		
pX, platoon unblocked			0.73		0.73	0.73
vC, conflicting volume			355		708	355
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			0		415	0
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		100	100
cM capacity (veh/h)			1184		411	791

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3
Volume Total	708	707	6	342	342
Volume Left	0	0	6	0	0
Volume Right	353	707	0	0	0
cSH	1700	1700	1184	1700	1700
Volume to Capacity	0.42	0.42	0.00	0.20	0.20
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	8.1	0.0	0.0
Lane LOS			A		
Approach Delay (s)	0.0		0.1		
Approach LOS					

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	583	798	25	1234	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.93	0.93	0.92	0.92
Hourly flow rate (vph)	655	897	27	1327	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)	516			638		
pX, platoon unblocked			0.80		0.80	0.80
vC, conflicting volume			655		1372	655
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			449		1341	449
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		100	100
cM capacity (veh/h)			891		112	448

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3
Volume Total	954	598	27	663	663
Volume Left	0	0	27	0	0
Volume Right	299	598	0	0	0
cSH	1700	1700	891	1700	1700
Volume to Capacity	0.56	0.35	0.03	0.39	0.39
Queue Length 95th (ft)	0	0	2	0	0
Control Delay (s)	0.0	0.0	9.2	0.0	0.0
Lane LOS			A		
Approach Delay (s)	0.0		0.2		
Approach LOS					

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	92.8%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱		↰↰	↑↑		↰		↱		↰	↱
Volume (vph)	0	878	52	236	342	0	28	0	437	11	158	199
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0		5.0	5.0		5.0		6.0		5.0	6.0
Lane Util. Factor		0.95		0.97	0.95		1.00		1.00		1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85		1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00		1.00	1.00
Satd. Flow (prot)		3694		3614	3725		1863		1667		1954	1667
Flt Permitted		1.00		0.95	1.00		0.95		1.00		1.00	1.00
Satd. Flow (perm)		3694		3614	3725		1863		1667		1954	1667
Peak-hour factor, PHF	0.88	0.88	0.88	0.90	0.90	0.90	0.83	0.83	0.83	0.95	0.95	0.95
Adj. Flow (vph)	0	998	59	262	380	0	34	0	527	12	166	209
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	401	0	0	179
Lane Group Flow (vph)	0	1054	0	262	380	0	34	0	126	0	178	30
Turn Type				Prot			Prot		custom	Split		Perm
Protected Phases		4		3	8		5			6	6	
Permitted Phases									5			6
Actuated Green, G (s)		32.9		11.3	49.2		12.6		12.6		13.8	13.8
Effective Green, g (s)		32.9		11.3	49.2		12.6		11.6		13.8	12.8
Actuated g/C Ratio		0.36		0.12	0.54		0.14		0.13		0.15	0.14
Clearance Time (s)		5.0		5.0	5.0		5.0		5.0		5.0	5.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0		3.0	3.0
Lane Grp Cap (vph)		1341		451	2023		259		213		298	236
v/s Ratio Prot		c0.29		c0.07	0.10		0.02				c0.09	
v/s Ratio Perm									c0.08			0.02
v/c Ratio		0.79		0.58	0.19		0.13		0.59		0.60	0.13
Uniform Delay, d1		25.7		37.4	10.5		34.2		37.3		35.8	34.0
Progression Factor		1.00		1.00	1.00		1.00		1.00		1.00	1.00
Incremental Delay, d2		3.1		1.9	0.0		0.2		4.3		3.2	0.2
Delay (s)		28.8		39.3	10.6		34.4		41.6		39.0	34.2
Level of Service		C		D	B		C		D		D	C
Approach Delay (s)		28.8			22.3			41.2			36.4	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	31.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	90.6	Sum of lost time (s)	21.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	639	75	368	852	0	78	0	696	19	192	185
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0		5.0	5.0		5.0		6.0		5.0	6.0
Lane Util. Factor		0.95		0.97	0.95		1.00		1.00		1.00	1.00
Frt		0.98		1.00	1.00		1.00		0.85		1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00		1.00	1.00
Satd. Flow (prot)		3667		3614	3725		1863		1667		1952	1667
Flt Permitted		1.00		0.95	1.00		0.95		1.00		1.00	1.00
Satd. Flow (perm)		3667		3614	3725		1863		1667		1952	1667
Peak-hour factor, PHF	0.92	0.92	0.92	0.85	0.85	0.85	0.86	0.86	0.86	0.88	0.88	0.88
Adj. Flow (vph)	0	695	82	433	1002	0	91	0	809	22	218	210
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	455	0	0	178
Lane Group Flow (vph)	0	770	0	433	1002	0	91	0	354	0	240	32
Turn Type				Prot			Prot		custom	Split		Perm
Protected Phases		4		3	8		5			6	6	
Permitted Phases									5			6
Actuated Green, G (s)		23.9		15.5	44.4		26.0		26.0		16.5	16.5
Effective Green, g (s)		23.9		15.5	44.4		26.0		25.0		16.5	15.5
Actuated g/C Ratio		0.23		0.15	0.44		0.26		0.25		0.16	0.15
Clearance Time (s)		5.0		5.0	5.0		5.0		5.0		5.0	5.0
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0		3.0	3.0
Lane Grp Cap (vph)		860		550	1623		475		409		316	254
v/s Ratio Prot		c0.21		c0.12	0.27		0.05				c0.12	
v/s Ratio Perm									c0.21			0.02
v/c Ratio		0.90		0.79	0.62		0.19		0.87		0.76	0.13
Uniform Delay, d1		37.8		41.6	22.2		29.7		36.8		40.8	37.3
Progression Factor		1.00		1.00	1.00		1.00		1.00		1.00	1.00
Incremental Delay, d2		11.8		7.3	0.7		0.2		17.1		10.0	0.2
Delay (s)		49.6		48.9	22.9		29.9		54.0		50.8	37.6
Level of Service		D		D	C		C		D		D	D
Approach Delay (s)		49.6			30.8			51.5			44.6	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM Average Control Delay	41.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	101.9	Sum of lost time (s)	21.0
Intersection Capacity Utilization	83.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↱			↑↑		↱
Volume (veh/h)	899	73	90	476	0	32
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.90	0.90	0.75	0.75
Hourly flow rate (vph)	977	79	100	529	0	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				648		
pX, platoon unblocked					0.99	
vC, conflicting volume			1057		1481	528
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1057		1463	528
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			85		100	91
cM capacity (veh/h)			655		100	495

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	651	405	276	353	43
Volume Left	0	0	100	0	0
Volume Right	0	79	0	0	43
cSH	1700	1700	655	1700	495
Volume to Capacity	0.38	0.24	0.15	0.21	0.09
Queue Length 95th (ft)	0	0	13	0	7
Control Delay (s)	0.0	0.0	5.4	0.0	13.0
Lane LOS			A		B
Approach Delay (s)	0.0		2.4		13.0
Approach LOS					B

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		

	→	↘	↙	←	↖	↗
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑↱			↑↑		↱
Volume (veh/h)	540	140	107	1007	0	170
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.89	0.89	0.91	0.91	0.88	0.88
Hourly flow rate (vph)	607	157	118	1107	0	193
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (ft)				648		
pX, platoon unblocked					0.81	
vC, conflicting volume			764		1474	382
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			764		1115	382
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			86		100	69
cM capacity (veh/h)			845		141	616

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	404	360	486	738	193
Volume Left	0	0	118	0	0
Volume Right	0	157	0	0	193
cSH	1700	1700	845	1700	616
Volume to Capacity	0.24	0.21	0.14	0.43	0.31
Queue Length 95th (ft)	0	0	12	0	33
Control Delay (s)	0.0	0.0	3.7	0.0	13.5
Lane LOS			A		B
Approach Delay (s)	0.0		1.5		13.5
Approach LOS					B

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣		↰	↑↱		↰	↑↱	
Volume (vph)	15	3	2	41	15	21	8	937	69	84	311	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.98			0.96		1.00	0.99		1.00	0.97	
Flt Protected		0.96			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1768			1748		1863	3687		1863	3616	
Flt Permitted		0.77			0.81		0.51	1.00		0.24	1.00	
Satd. Flow (perm)		1413			1460		998	3687		478	3616	
Peak-hour factor, PHF	0.56	0.56	0.56	0.74	0.74	0.74	0.94	0.94	0.94	0.93	0.93	0.93
Adj. Flow (vph)	27	5	4	55	20	28	9	997	73	90	334	81
RTOR Reduction (vph)	0	3	0	0	16	0	0	6	0	0	25	0
Lane Group Flow (vph)	0	33	0	0	87	0	9	1064	0	90	390	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		6.7			6.7		29.4	29.4		29.4	29.4	
Effective Green, g (s)		6.7			6.7		29.4	29.4		29.4	29.4	
Actuated g/C Ratio		0.15			0.15		0.64	0.64		0.64	0.64	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		205			212		636	2351		305	2306	
v/s Ratio Prot								c0.29			0.11	
v/s Ratio Perm		0.02			c0.06		0.01			0.19		
v/c Ratio		0.16			0.41		0.01	0.45		0.30	0.17	
Uniform Delay, d1		17.2			17.9		3.1	4.3		3.7	3.4	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.4			1.3		0.0	0.1		0.5	0.0	
Delay (s)		17.6			19.2		3.1	4.4		4.3	3.4	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		17.6			19.2			4.4			3.6	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	5.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	46.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Volume (vph)	45	11	14	121	13	61	7	575	54	61	873	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.97			0.96		1.00	0.99		1.00	0.99	
Flt Protected		0.97			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1756			1730		1863	3678		1863	3685	
Flt Permitted		0.80			0.77		0.22	1.00		0.36	1.00	
Satd. Flow (perm)		1446			1368		427	3678		700	3685	
Peak-hour factor, PHF	0.94	0.94	0.94	0.85	0.85	0.85	0.88	0.88	0.88	0.90	0.90	0.90
Adj. Flow (vph)	48	12	15	142	15	72	8	653	61	68	970	76
RTOR Reduction (vph)	0	11	0	0	21	0	0	8	0	0	6	0
Lane Group Flow (vph)	0	64	0	0	208	0	8	706	0	68	1040	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		13.3			13.3		26.4	26.4		26.4	26.4	
Effective Green, g (s)		13.3			13.3		26.4	26.4		26.4	26.4	
Actuated g/C Ratio		0.28			0.28		0.55	0.55		0.55	0.55	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		403			381		236	2036		387	2039	
v/s Ratio Prot								0.19			c0.28	
v/s Ratio Perm		0.04			c0.15		0.02			0.10		
v/c Ratio		0.16			0.55		0.03	0.35		0.18	0.51	
Uniform Delay, d1		13.0			14.6		4.8	5.9		5.3	6.6	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			1.6		0.1	0.1		0.2	0.2	
Delay (s)		13.2			16.2		4.9	6.0		5.5	6.8	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		13.2			16.2			6.0			6.7	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	47.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑↱			↰↑↱		↰	↑↑↱		↰	↑↑↱	
Volume (vph)	39	12	23	91	19	94	58	879	101	62	262	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.96			0.94		1.00	0.98		1.00	0.99	
Flt Protected		0.97			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1738			1709		1863	3668		1863	3671	
Flt Permitted		0.81			0.82		0.54	1.00		0.22	1.00	
Satd. Flow (perm)		1441			1432		1055	3668		429	3671	
Peak-hour factor, PHF	0.96	0.96	0.96	0.92	0.92	0.92	0.92	0.92	0.92	0.81	0.81	0.81
Adj. Flow (vph)	41	12	24	99	21	102	63	955	110	77	323	35
RTOR Reduction (vph)	0	18	0	0	37	0	0	11	0	0	10	0
Lane Group Flow (vph)	0	59	0	0	185	0	63	1054	0	77	348	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		11.5			11.5		23.9	23.9		23.9	23.9	
Effective Green, g (s)		11.5			11.5		23.9	23.9		23.9	23.9	
Actuated g/C Ratio		0.25			0.25		0.53	0.53		0.53	0.53	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		365			363		555	1931		223	1933	
v/s Ratio Prot								c0.29			0.09	
v/s Ratio Perm		0.04			c0.13		0.06			0.18		
v/c Ratio		0.16			0.51		0.11	0.55		0.35	0.18	
Uniform Delay, d1		13.2			14.5		5.4	7.1		6.2	5.6	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			1.2		0.1	0.3		0.9	0.0	
Delay (s)		13.4			15.8		5.5	7.5		7.2	5.7	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		13.4			15.8			7.4			5.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	8.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	45.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	55.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Volume (vph)	97	38	34	138	26	44	41	759	92	118	1072	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.97			0.97		1.00	0.98		1.00	0.99	
Flt Protected		0.97			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1762			1751		1863	3665		1863	3704	
Flt Permitted		0.75			0.75		0.19	1.00		0.30	1.00	
Satd. Flow (perm)		1362			1355		373	3665		579	3704	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	97	38	34	138	26	44	41	759	92	118	1072	43
RTOR Reduction (vph)	0	11	0	0	12	0	0	11	0	0	3	0
Lane Group Flow (vph)	0	158	0	0	196	0	41	840	0	118	1112	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		13.4			13.4		24.8	24.8		24.8	24.8	
Effective Green, g (s)		13.4			13.4		24.8	24.8		24.8	24.8	
Actuated g/C Ratio		0.28			0.28		0.51	0.51		0.51	0.51	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		379			377		192	1886		298	1906	
v/s Ratio Prot								0.23			c0.30	
v/s Ratio Perm		0.12			c0.14		0.11			0.20		
v/c Ratio		0.42			0.52		0.21	0.45		0.40	0.58	
Uniform Delay, d1		14.2			14.7		6.4	7.4		7.1	8.1	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.7			1.3		0.6	0.2		0.9	0.5	
Delay (s)		15.0			16.0		6.9	7.5		8.0	8.6	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		15.0			16.0			7.5			8.5	
Approach LOS		B			B			A			A	

HCM Average Control Delay	9.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	48.2	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✥			✥	
Volume (vph)	58	714	85	135	232	8	83	12	314	3	7	7
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	0.98		1.00	0.99			0.90			0.94	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1863	3666		1863	3706			1653			1744	
Flt Permitted	0.95	1.00		0.95	1.00			0.92			0.94	
Satd. Flow (perm)	1863	3666		1863	3706			1543			1648	
Peak-hour factor, PHF	0.95	0.95	0.95	0.84	0.84	0.84	0.80	0.80	0.80	0.61	0.61	0.61
Adj. Flow (vph)	61	752	89	161	276	10	104	15	392	5	11	11
RTOR Reduction (vph)	0	10	0	0	3	0	0	155	0	0	8	0
Lane Group Flow (vph)	61	831	0	161	283	0	0	356	0	0	19	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	7.3	22.1		10.8	25.6			21.2			21.2	
Effective Green, g (s)	7.3	22.1		10.8	25.6			21.2			21.2	
Actuated g/C Ratio	0.11	0.32		0.16	0.37			0.31			0.31	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	197	1172		291	1373			473			506	
v/s Ratio Prot	0.03	c0.23		c0.09	c0.08							
v/s Ratio Perm								c0.23			0.01	
v/c Ratio	0.31	0.71		0.55	0.21			0.75			0.04	
Uniform Delay, d1	28.6	20.7		26.9	14.8			21.6			16.8	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.9	2.0		2.3	0.1			6.6			0.0	
Delay (s)	29.5	22.7		29.2	14.9			28.2			16.8	
Level of Service	C	C		C	B			C			B	
Approach Delay (s)		23.1			20.0			28.2			16.8	
Approach LOS		C			C			C			B	

HCM Average Control Delay	23.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	69.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
37: Ka Uka Blvd & Ukee (W)

9/17/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑↱			✣			✣	
Volume (vph)	53	690	99	196	1040	7	149	19	187	12	22	108
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	0.98		1.00	1.00			0.93			0.90	
Flt Protected	0.95	1.00		0.95	1.00			0.98			1.00	
Satd. Flow (prot)	1863	3655		1863	3722			1695			1664	
Flt Permitted	0.95	1.00		0.95	1.00			0.81			0.96	
Satd. Flow (perm)	1863	3655		1863	3722			1406			1607	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	53	690	99	196	1040	7	149	19	187	12	22	108
RTOR Reduction (vph)	0	12	0	0	1	0	0	49	0	0	76	0
Lane Group Flow (vph)	53	777	0	196	1046	0	0	306	0	0	66	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	6.2	22.4		12.7	28.9			20.8			20.8	
Effective Green, g (s)	6.2	22.4		12.7	28.9			20.8			20.8	
Actuated g/C Ratio	0.09	0.32		0.18	0.41			0.29			0.29	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	163	1155		334	1517			412			471	
v/s Ratio Prot	0.03	0.21		c0.11	c0.28							
v/s Ratio Perm								c0.22			0.04	
v/c Ratio	0.33	0.67		0.59	0.69			0.74			0.14	
Uniform Delay, d1	30.4	21.1		26.7	17.3			22.6			18.5	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.2	1.6		2.6	1.3			7.1			0.1	
Delay (s)	31.6	22.6		29.3	18.6			29.7			18.6	
Level of Service	C	C		C	B			C			B	
Approach Delay (s)		23.2			20.3			29.7			18.6	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	70.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱	↰	↑↑	↱	↰↰	↑↑	↱
Volume (vph)	16	20	4	81	16	228	8	456	179	664	913	17
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0		5.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	6.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.98		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3453		1863	1961	1667	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3453		1863	1961	1667	1863	3725	1667	3614	3725	1667
Peak-hour factor, PHF	0.56	0.56	0.56	0.89	0.89	0.89	0.77	0.77	0.77	0.96	0.96	0.96
Adj. Flow (vph)	29	36	7	91	18	256	10	592	232	692	951	18
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	169	0	0	9
Lane Group Flow (vph)	29	36	0	91	18	256	10	592	63	692	951	9
Turn Type	Split			Split		Free	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			6
Actuated Green, G (s)	5.3	5.3		7.6	7.6	75.7	4.7	20.4	20.4	22.4	38.1	38.1
Effective Green, g (s)	5.3	5.3		7.6	7.6	75.7	4.7	20.4	20.4	22.4	38.1	37.1
Actuated g/C Ratio	0.07	0.07		0.10	0.10	1.00	0.06	0.27	0.27	0.30	0.50	0.49
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	124	242		187	197	1667	116	1004	449	1069	1875	817
v/s Ratio Prot	0.02	0.01		c0.05	0.01		0.01	c0.16		c0.19	0.26	
v/s Ratio Perm						c0.15			0.04			0.01
v/c Ratio	0.23	0.15		0.49	0.09	0.15	0.09	0.59	0.14	0.65	0.51	0.01
Uniform Delay, d1	33.3	33.1		32.2	30.9	0.0	33.5	24.0	21.0	23.2	12.5	9.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.3		2.0	0.2	0.2	0.3	0.9	0.1	1.4	0.2	0.0
Delay (s)	34.3	33.4		34.2	31.1	0.2	33.8	24.9	21.1	24.6	12.8	9.9
Level of Service	C	C		C	C	A	C	C	C	C	B	A
Approach Delay (s)		33.7			10.2			24.0			17.6	
Approach LOS		C			B			C			B	

Intersection Summary			
HCM Average Control Delay	18.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	75.7	Sum of lost time (s)	15.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	32	41	36	229	78	792	35	814	229	336	592	51
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0		5.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	6.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3290		1863	1961	1667	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3290		1863	1961	1667	1863	3725	1667	3614	3725	1667
Peak-hour factor, PHF	0.60	0.60	0.60	0.94	0.94	0.94	0.86	0.86	0.86	0.89	0.89	0.89
Adj. Flow (vph)	53	68	60	244	83	843	41	947	266	378	665	57
RTOR Reduction (vph)	0	55	0	0	0	0	0	0	175	0	0	33
Lane Group Flow (vph)	53	73	0	244	83	843	41	947	91	378	665	24
Turn Type	Split			Split		Free	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			6
Actuated Green, G (s)	8.5	8.5		17.9	17.9	93.1	6.1	31.4	31.4	15.3	40.6	40.6
Effective Green, g (s)	8.5	8.5		17.9	17.9	93.1	6.1	31.4	31.4	15.3	40.6	39.6
Actuated g/C Ratio	0.09	0.09		0.19	0.19	1.00	0.07	0.34	0.34	0.16	0.44	0.43
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	162	300		358	377	1667	122	1256	562	594	1624	709
v/s Ratio Prot	0.03	0.02		c0.13	0.04		0.02	c0.25		0.10	0.18	
v/s Ratio Perm						c0.51			0.05			0.01
v/c Ratio	0.33	0.24		0.68	0.22	0.51	0.34	0.75	0.16	0.64	0.41	0.03
Uniform Delay, d1	39.6	39.3		35.0	31.7	0.0	41.6	27.4	21.6	36.3	18.0	15.6
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.4		5.3	0.3	1.1	1.6	2.6	0.1	2.2	0.2	0.0
Delay (s)	40.8	39.7		40.2	32.0	1.1	43.2	30.0	21.8	38.5	18.2	15.6
Level of Service	D	D		D	C	A	D	C	C	D	B	B
Approach Delay (s)		40.1			11.5			28.7			25.1	
Approach LOS		D			B			C			C	

Intersection Summary			
HCM Average Control Delay	22.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	93.1	Sum of lost time (s)	10.0
Intersection Capacity Utilization	61.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	1	4	9	578	2	38	16	602	567	30	966	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1595		1863	3725	1667	1863	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1595		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.70	0.70	0.70	0.86	0.86	0.86	0.82	0.82	0.82	0.88	0.88	0.88
Adj. Flow (vph)	1	6	13	672	2	44	20	734	691	34	1098	1
RTOR Reduction (vph)	0	0	0	0	32	0	0	0	430	0	0	1
Lane Group Flow (vph)	1	6	13	672	14	0	20	734	261	34	1098	0
Turn Type	Split		Free	Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	0.9	0.9	79.4	22.3	22.3		5.3	30.0	30.0	6.2	30.9	30.9
Effective Green, g (s)	0.9	0.9	79.4	22.3	22.3		5.3	30.0	30.0	6.2	30.9	30.9
Actuated g/C Ratio	0.01	0.01	1.00	0.28	0.28		0.07	0.38	0.38	0.08	0.39	0.39
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	20	21	1583	964	448		124	1407	630	145	1450	649
v/s Ratio Prot	0.00	c0.00		c0.20	0.01		0.01	0.20		c0.02	c0.29	
v/s Ratio Perm			c0.01						0.16			0.00
v/c Ratio	0.05	0.29	0.01	0.70	0.03		0.16	0.52	0.41	0.23	0.76	0.00
Uniform Delay, d1	38.8	38.9	0.0	25.5	20.7		35.0	19.1	18.2	34.4	21.0	14.8
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	7.4	0.0	2.2	0.0		0.6	0.4	0.4	0.8	2.3	0.0
Delay (s)	39.9	46.3	0.0	27.7	20.7		35.6	19.5	18.7	35.2	23.3	14.8
Level of Service	D	D	A	C	C		D	B	B	D	C	B
Approach Delay (s)		15.9			27.3			19.3			23.7	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	79.4	Sum of lost time (s)	15.0
Intersection Capacity Utilization	56.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	6	16	41	618	17	49	84	1022	833	43	801	12
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.89		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3614	1742		1863	3725	1667	1863	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3614	1742		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.69	0.69	0.69	0.94	0.94	0.94	0.91	0.91	0.91	0.89	0.89	0.89
Adj. Flow (vph)	9	23	59	657	18	52	92	1123	915	48	900	13
RTOR Reduction (vph)	0	0	0	0	39	0	0	0	496	0	0	8
Lane Group Flow (vph)	9	23	59	657	31	0	92	1123	419	48	900	5
Turn Type	Split		Free	Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	3.9	3.9	93.5	22.8	22.8		9.9	40.6	40.6	6.2	36.9	36.9
Effective Green, g (s)	3.9	3.9	93.5	22.8	22.8		9.9	40.6	40.6	6.2	36.9	36.9
Actuated g/C Ratio	0.04	0.04	1.00	0.24	0.24		0.11	0.43	0.43	0.07	0.39	0.39
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	74	78	1583	881	425		197	1617	724	124	1470	658
v/s Ratio Prot	0.01	c0.01		c0.18	0.02		c0.05	c0.30		0.03	0.24	
v/s Ratio Perm			0.04						0.25			0.00
v/c Ratio	0.12	0.29	0.04	0.75	0.07		0.47	0.69	0.58	0.39	0.61	0.01
Uniform Delay, d1	43.2	43.5	0.0	32.7	27.2		39.3	21.4	20.0	41.8	22.6	17.2
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	2.1	0.0	3.5	0.1		1.7	1.3	1.1	2.0	0.8	0.0
Delay (s)	43.9	45.6	0.0	36.1	27.3		41.1	22.7	21.1	43.8	23.4	17.2
Level of Service	D	D	A	D	C		D	C	C	D	C	B
Approach Delay (s)		15.9			35.3			22.8			24.3	
Approach LOS		B			D			C			C	

Intersection Summary			
HCM Average Control Delay	25.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	93.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	68.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: Lumiaina St & Kam Hwy

9/17/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	494	17	93	64	73	39	46	739	39	18	1087	600
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1681	1691	1583	1770	1765		1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1681	1691	1583	1770	1765		1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	494	17	93	64	73	39	46	739	39	18	1087	600
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	23	0	0	0
Lane Group Flow (vph)	257	254	93	64	96	0	46	739	16	18	1087	600
Turn Type	Split		Free	Split			Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			Free
Actuated Green, G (s)	20.3	20.3	94.4	10.8	10.8		7.4	38.1	38.1	5.2	35.9	94.4
Effective Green, g (s)	20.3	20.3	94.4	10.8	10.8		7.4	38.1	38.1	5.2	35.9	94.4
Actuated g/C Ratio	0.22	0.22	1.00	0.11	0.11		0.08	0.40	0.40	0.06	0.38	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	361	364	1583	203	202		139	1428	639	98	1346	1583
v/s Ratio Prot	c0.15	0.15		0.04	0.05		0.03	0.21		0.01	c0.31	
v/s Ratio Perm			0.06						0.01			c0.38
v/c Ratio	0.71	0.70	0.06	0.32	0.48		0.33	0.52	0.02	0.18	0.81	0.38
Uniform Delay, d1	34.3	34.2	0.0	38.4	39.1		41.2	21.2	17.0	42.6	26.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.5	5.7	0.1	0.9	1.8		1.4	0.3	0.0	0.9	3.7	0.7
Delay (s)	40.8	40.0	0.1	39.3	40.9		42.6	21.5	17.0	43.5	29.8	0.7
Level of Service	D	D	A	D	D		D	C	B	D	C	A
Approach Delay (s)		34.2			40.3			22.5			19.7	
Approach LOS		C			D			C			B	

Intersection Summary			
HCM Average Control Delay	24.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	94.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	488	31	134	24	31	47	176	1420	105	25	789	645
Ideal Flow (vphpl)	2000	2000	2000	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1784	1667	1770	1694		1863	3725	1667	1863	3725	1667
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1784	1667	1770	1694		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.96	0.96	0.96	0.91	0.91	0.91
Adj. Flow (vph)	542	34	149	27	34	52	183	1479	109	27	867	709
RTOR Reduction (vph)	0	0	0	0	49	0	0	0	53	0	0	0
Lane Group Flow (vph)	287	289	149	27	37	0	183	1479	56	27	867	709
Turn Type	Split		Free	Split			Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			Free
Actuated Green, G (s)	21.2	21.2	98.1	6.4	6.4		15.2	46.3	46.3	4.2	35.3	98.1
Effective Green, g (s)	21.2	21.2	98.1	6.4	6.4		15.2	46.3	46.3	4.2	35.3	98.1
Actuated g/C Ratio	0.22	0.22	1.00	0.07	0.07		0.15	0.47	0.47	0.04	0.36	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	383	386	1667	115	111		289	1758	787	80	1340	1667
v/s Ratio Prot	c0.16	0.16		0.02	0.02		c0.10	c0.40		0.01	0.23	
v/s Ratio Perm			0.09						0.03			c0.43
v/c Ratio	0.75	0.75	0.09	0.23	0.34		0.63	0.84	0.07	0.34	0.65	0.43
Uniform Delay, d1	36.0	36.0	0.0	43.5	43.8		38.8	22.7	14.1	45.6	26.2	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.8	7.7	0.1	1.1	1.8		4.5	3.8	0.0	2.5	1.1	0.8
Delay (s)	43.8	43.7	0.1	44.6	45.6		43.3	26.5	14.2	48.1	27.3	0.8
Level of Service	D	D	A	D	D		D	C	B	D	C	A
Approach Delay (s)		34.8			45.4			27.5			15.9	
Approach LOS		C			D			C			B	

HCM Average Control Delay	24.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	98.1	Sum of lost time (s)	15.0
Intersection Capacity Utilization	73.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	111	12	321	173	12	13	30	645	55	3	1136	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1782	1583	1770	1719		1863	3725	1667	1863	3725	1667
Flt Permitted		0.72	1.00	0.66	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1350	1583	1224	1719		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.81	0.81	0.81	0.82	0.82	0.82	0.71	0.71	0.71	0.97	0.97	0.97
Adj. Flow (vph)	137	15	396	211	15	16	42	908	77	3	1171	10
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	40	0	0	0
Lane Group Flow (vph)	0	152	396	211	19	0	42	908	37	3	1171	10
Turn Type	Perm		Free	Perm			Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		Free	8					2			Free
Actuated Green, G (s)		20.4	75.7	20.4	20.4		6.8	36.1	36.1	4.2	33.5	75.7
Effective Green, g (s)		20.4	75.7	20.4	20.4		6.8	36.1	36.1	4.2	33.5	75.7
Actuated g/C Ratio		0.27	1.00	0.27	0.27		0.09	0.48	0.48	0.06	0.44	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		364	1583	330	463		167	1776	795	103	1648	1667
v/s Ratio Prot					0.01		0.02	0.24		0.00	c0.31	
v/s Ratio Perm		0.11	c0.25	c0.17					0.02			0.01
v/c Ratio		0.42	0.25	0.64	0.04		0.25	0.51	0.05	0.03	0.71	0.01
Uniform Delay, d1		22.8	0.0	24.4	20.4		32.1	13.7	10.6	33.8	17.2	0.0
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.8	0.4	4.0	0.0		0.8	0.2	0.0	0.1	1.5	0.0
Delay (s)		23.5	0.4	28.4	20.5		32.9	13.9	10.6	33.9	18.6	0.0
Level of Service		C	A	C	C		C	B	B	C	B	A
Approach Delay (s)		6.8			27.4			14.5			18.5	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	75.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑	↱	↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	21	6	69	63	8	9	158	1681	171	10	916	26
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1793	1583	1770	1717		1863	3725	1667	1863	3725	1667
Flt Permitted		0.76	1.00	0.74	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1411	1583	1372	1717		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	0.84	0.84	0.84	0.72	0.72	0.72	0.97	0.97	0.97	0.98	0.98	0.98
Adj. Flow (vph)	25	7	82	88	11	12	163	1733	176	10	935	27
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	61	0	0	0
Lane Group Flow (vph)	0	32	82	88	12	0	163	1733	115	10	935	27
Turn Type	Perm		Free	Perm			Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		Free	8					2			Free
Actuated Green, G (s)		9.0	82.7	9.0	9.0		13.7	54.1	54.1	4.6	45.0	82.7
Effective Green, g (s)		9.0	82.7	9.0	9.0		13.7	54.1	54.1	4.6	45.0	82.7
Actuated g/C Ratio		0.11	1.00	0.11	0.11		0.17	0.65	0.65	0.06	0.54	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		154	1583	149	187		309	2437	1091	104	2027	1667
v/s Ratio Prot					0.01		c0.09	c0.47		0.01	0.25	
v/s Ratio Perm		0.02	0.05	c0.06					0.07			0.02
v/c Ratio		0.21	0.05	0.59	0.07		0.53	0.71	0.11	0.10	0.46	0.02
Uniform Delay, d1		33.6	0.0	35.1	33.1		31.5	9.2	5.3	37.1	11.5	0.0
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.7	0.1	6.1	0.1		1.6	1.0	0.0	0.4	0.2	0.0
Delay (s)		34.3	0.1	41.2	33.2		33.2	10.2	5.4	37.5	11.6	0.0
Level of Service		C	A	D	C		C	B	A	D	B	A
Approach Delay (s)		9.7			39.6			11.6			11.6	
Approach LOS		A			D			B			B	

Intersection Summary			
HCM Average Control Delay	12.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	82.7	Sum of lost time (s)	15.0
Intersection Capacity Utilization	70.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	114	618	139	615	1560	86
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1863	1667	1863	3725	3725	1667
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1863	1667	1863	3725	3725	1667
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	120	651	146	647	1642	91
RTOR Reduction (vph)	0	6	0	0	0	41
Lane Group Flow (vph)	120	645	146	647	1642	50
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	12.2	42.7	30.5	90.2	54.7	54.7
Effective Green, g (s)	12.2	42.7	30.5	90.2	54.7	54.7
Actuated g/C Ratio	0.11	0.38	0.27	0.80	0.49	0.49
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	202	707	506	2989	1813	811
v/s Ratio Prot	0.06	c0.25	0.08	0.17	c0.44	
v/s Ratio Perm		0.14				0.03
v/c Ratio	0.59	0.91	0.29	0.22	0.91	0.06
Uniform Delay, d1	47.7	33.1	32.4	2.7	26.5	15.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	16.1	0.3	0.0	6.9	0.0
Delay (s)	52.4	49.1	32.7	2.7	33.4	15.3
Level of Service	D	D	C	A	C	B
Approach Delay (s)	49.6			8.2	32.4	
Approach LOS	D			A	C	

Intersection Summary			
HCM Average Control Delay	30.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	112.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	241	456	292	1772	878	169
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1863	1667	1863	3725	3725	1667
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1863	1667	1863	3725	3725	1667
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	254	480	307	1865	924	178
RTOR Reduction (vph)	0	22	0	0	0	112
Lane Group Flow (vph)	254	458	307	1865	924	66
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	18.1	38.9	20.8	57.3	31.5	31.5
Effective Green, g (s)	18.1	38.9	20.8	57.3	31.5	31.5
Actuated g/C Ratio	0.21	0.46	0.24	0.67	0.37	0.37
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	395	857	454	2499	1374	615
v/s Ratio Prot	c0.14	0.13	0.16	c0.50	0.25	
v/s Ratio Perm		0.14				0.04
v/c Ratio	0.64	0.53	0.68	0.75	0.67	0.11
Uniform Delay, d1	30.7	16.7	29.3	9.3	22.6	17.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.6	0.6	4.0	1.2	1.3	0.1
Delay (s)	34.3	17.4	33.2	10.5	23.9	17.8
Level of Service	C	B	C	B	C	B
Approach Delay (s)	23.2			13.7	22.9	
Approach LOS	C			B	C	

Intersection Summary			
HCM Average Control Delay	18.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	85.4	Sum of lost time (s)	10.0
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	AM Peak
Freeway/Dir of Travel:	H-2 Fwy NB Off-Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description: 15/15/15	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2878	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	611	vph
Length of first accel/decel lane	230	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	306	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2878	611	306	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	799	170	85	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	
Heavy vehicle adjustment, fHV	0.971		0.990		0.990	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	3294		686		343	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1823 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3294	9400	No
$v_{FO} = v_F - v_R$	2608	9400	No
v_R	686	2000	No
v_3 or v_{av34}	735 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	
If yes, v_{12A} = 1823		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1823	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 17.9 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.490

Space mean speed in ramp influence area, S_R = 53.7 mph

Space mean speed in outer lanes, S_0 = 71.3 mph

Space mean speed for all vehicles, S = 60.4 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	PM Peak
Freeway/Dir of Travel:	H-2 Fwy NB Off-Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description: 15/15/15	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4588	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	1231	vph
Length of first accel/decel lane	230	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	558	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4588	1231	558	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1274	342	155	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	0.00	%	0.00	%	0.00	%	
Length	0.00	mi	0.00	mi	0.00	mi	
Trucks and buses PCE, ET	2.5		1.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		0.990		
Driver population factor, fP	1.00		1.00		1.00		
Flow rate, vp	5251		1381		626		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3068 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	5251	9400	No
$v_{FO} = v_F - v_R$	3870	9400	No
v_R	1381	2000	No
v_3 or v_{av34}	1091 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12} /2		No	
If yes, v_{12A} = 3068		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3068	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 28.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable, D_S = 0.552

Space mean speed in ramp influence area, S_R = 52.3 mph

Space mean speed in outer lanes, S_0 = 71.0 mph

Space mean speed for all vehicles, S = 58.7 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	AM Peak
Freeway/Dir of Travel:	H-2 Fwy NB On Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description:	15/15/15

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2267	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	306	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	611	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2267	306	611	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	630	85	170	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2594	343	686	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.175 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 454 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2937	9400	No
v_3 or v_{av34}	1070 pc/h	(Equation 25-4 or 25-5)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12} /2		Yes	
If yes, v_{12A} = 1037		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1037	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 11.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.288

Space mean speed in ramp influence area, S_R = 58.4 mph

Space mean speed in outer lanes, S_0 = 64.0 mph

Space mean speed for all vehicles, S = 61.2 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: JW
Agency/Co.:
Date performed: 9/11/09
Analysis time period: PM Peak
Freeway/Dir of Travel: H-2 Fwy NB On Ramp (WB)
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2016 Without Project
Description: 15/15/15

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3356	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	558	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1231	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3356	558	1231	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	932	155	342	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	%	%	%
Length	mi	mi	mi
Trucks and buses PCE, ET	2.5	1.5	1.5
Recreational vehicle PCE, ER	2.0	1.2	1.2
Heavy vehicle adjustment, fHV	0.971	0.990	0.990
Driver population factor, fP	1.00	1.00	1.00
Flow rate, vp	3841	626	1381 pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.140 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 536 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4467	9400	No
v_3 or v_{av34}	1652 pc/h	(Equation 25-4 or 25-5)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 1536		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1536	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 17.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.306

Space mean speed in ramp influence area, S_R = 58.0 mph

Space mean speed in outer lanes, S_0 = 62.7 mph

Space mean speed for all vehicles, S = 60.3 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: JW
Agency/Co.:
Date performed: 9/11/09
Analysis time period: AM Peak
Freeway/Dir of Travel: H-2 Fwy SB Off-Ramp
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2016 Without Project
Description: 15/15/15

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3904	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	368	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1012	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3904	368	1012	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1084	102	281	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	0.00	%	0.00	%	0.00	%	
Length	0.00	mi	0.00	mi	0.00	mi	
Trucks and buses PCE, ET	2.5		1.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		0.990		
Driver population factor, fP	1.00		1.00		1.00		
Flow rate, vp	4468		413		1136		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 2181 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4468	9400	No
$v_{FO} = v_F - v_R$	4055	9400	No
v_R	413	2000	No
v_3 or v_{av34}	1143 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12} /2		No	
If yes, v_{12A} = 2181		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2181	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 21.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D_S = 0.465	
Space mean speed in ramp influence area,	S_R = 54.3	mph
Space mean speed in outer lanes,	S_0 = 70.7	mph
Space mean speed for all vehicles,	S = 61.6	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	PM Peak
Freeway/Dir of Travel:	H-2 Fwy SB Off-Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description: 15/15/15	

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2795	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	396	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	823	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2795	396	823	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	776	110	229	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	0.00	%	0.00	%	0.00	%	
Length	0.00	mi	0.00	mi	0.00	mi	
Trucks and buses PCE, ET	2.5		1.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		0.990		
Driver population factor, fP	1.00		1.00		1.00		
Flow rate, vp	3199		444		924		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1645 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3199	9400	No
$v_{FO} = v_F - v_R$	2755	9400	No
v_R	444	2000	No
v_3 or v_{av34}	777 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12} /2		No	
If yes, v_{12A} = 1645		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1645	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 17.0 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.468

Space mean speed in ramp influence area, S_R = 54.2 mph

Space mean speed in outer lanes, S_0 = 71.3 mph

Space mean speed for all vehicles, S = 61.4 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	AM Peak
Freeway/Dir of Travel:	H-2 Fwy SB On.Ramp (EB)
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description: 15/15/15	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3536	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1012	vph
Length of first accel/decel lane	820	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	368	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3536	1012	368	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	982	281	102	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

```
    Grade                                          %            %            %
    Length                                         mi           mi           mi
Trucks and buses PCE, ET                  2.5          1.5          1.5
Recreational vehicle PCE, ER              2.0          1.2          1.2
Heavy vehicle adjustment, fHV             0.971        0.990        0.990
Driver population factor, fP              1.00         1.00         1.00
Flow rate, vp                             4047         1136         413         pcph

_____________________Estimation of V12 Merge Areas___________________________

                     L   =             (Equation 25-2 or 25-3)
                      EQ
                     P   =    0.076   Using Equation  4
                      FM
                     v   = v  (P  ) =   307     pc/h
                      12    F   FM

_________________________Capacity Checks_________________________________

                             Actual          Maximum         LOS F?
     v                       5183            9400            No
      FO
     v    v                  1870 pc/h       (Equation 25-4 or 25-5)
      3 or  av34
Is   v    v       > 2700 pc/h?               No
      3 or  av34
Is   v    v       > 1.5 v  /2                Yes
      3 or  av34         12
If yes, v     = 1618                          (Equation 25-8)
         12A

_____________________Flow Entering Merge Influence Area_____________________
                         Actual        Max Desirable         Violation?
     v                   1618          4600                  No
      12A
_______________Level of Service Determination (if not F)____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   21.3   pc/mi/ln
                              R                R          12             A
Level of service for ramp-freeway junction areas of influence  C

________________________Speed Estimation_____________________________________

Intermediate speed variable,                   M  = 0.325
                                                S
Space mean speed in ramp influence area,       S  = 57.5    mph
                                                R
Space mean speed in outer lanes,               S  = 62.4    mph
                                                0
Space mean speed for all vehicles,             S  = 59.7    mph
_____________________________________________________________________________
```

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	PM Peak
Freeway/Dir of Travel:	H-2 Fwy SB On Ramp (EB)
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description: 15/15/15	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2399	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	823	vph
Length of first accel/decel lane	820	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	396	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2399	823	396	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	666	229	110	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2746	924	444	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.102 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 281 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3670	9400	No
v_3 or v_{av34}	1232 pc/h	(Equation 25-4 or 25-5)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12} /2		Yes	
If yes, v_{12A} = 1098		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1098	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\ v_R + 0.0078\ v_{12} - 0.00627\ L_A$ = 15.7 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.293

Space mean speed in ramp influence area, S_R = 58.3 mph

Space mean speed in outer lanes, S_0 = 63.8 mph

Space mean speed for all vehicles, S = 60.6 mph

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst: JW
Agency or Company:
Date Performed: 9/11/09
Analysis Time Period: AM Peak
Freeway/Direction: H-2 Fwy NB
From/To:
Jurisdiction:
Analysis Year: Year 2016 Without Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	2878	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	799	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	823	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	823	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	12.0	pc/mi/ln
Level of service, LOS	B	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	PM Peak
Freeway/Direction:	H-2 Fwy NB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description:	South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	4588	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1274	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1313	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1313	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	19.2	pc/mi/ln
Level of service, LOS	C	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	AM Peak
Freeway/Direction:	H-2 Fwy NB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description:	North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	2573	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	715	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	736	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	736	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	10.7	pc/mi/ln
Level of service, LOS	A	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	PM Peak
Freeway/Direction:	H-2 Fwy NB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description:	North of Ka Uka Blvd. - 15/15/15

Flow Inputs and Adjustments

Volume, V	3914	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1087	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1120	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1120	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	16.4	pc/mi/ln
Level of service, LOS	B	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	AM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description:	South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	4548	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1263	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1301	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1301	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	19.0	pc/mi/ln
Level of service, LOS	C	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	PM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description:	South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	3222	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	895	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	922	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	922	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	13.5	pc/mi/ln
Level of service, LOS	B	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	AM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 Without Project

Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	3904	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1084	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1117	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1117	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	16.3	pc/mi/ln
Level of service, LOS	B	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	PM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 Without Project
Description:	North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	2795	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	776	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	800	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	800	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	11.7	pc/mi/ln
Level of service, LOS	B	

APPENDIX F

ALTERNATIVE TRANSPORTATION COMPONENTS

Castle & Cooke Koa Ridge Makai and Waiawa Project

Alternative Transportation Components

Prepared For

Castle & Cooke Homes Hawaii, Inc.

Prepared By

Weslin Consulting Services, Inc.

TABLE OF CONTENTS

I. Introduction

This Waiawa and Koa Ridge Makai Alternative Transportation Components Report is being prepared in support of the master plan process for the Koa Ridge community and in support of identifying possible transportation projects and programs designed to reduce the impacts that might otherwise be caused by additional vehicle trips affiliated with the project.

The master plan for the Koa Ridge community consists of separate development areas known as Koa Ridge Makai and Waiawa. The combined project is a master planned, mixed-use residential community in Central Oahu with commercial, light industrial and health care components.

Plans to move forward with the current development were initiated in the late 1990s to meet anticipated future demand for a wide range of housing opportunities in a new master planned community in Central Oahu. A petition was submitted to the State Land Use Commission together with a preparation notice for a combined EIS for the Koa Ridge Makai and Waiawa developments. The forthcoming EIS is being prepared in support of a State Land Use District Boundary Amendment petition and a subsequent zone change application for the Koa Ridge Makai and Waiawa areas.

This report is prepared with the insight gained from previous technical analyses of potential transportation impacts, consideration of possible mitigation measures and extensive community outreach. It is intended that the types of alternative transportation projects and programs normally offered as mitigations to vehicle trip demands at the end of the master planning and environmental impact assessment process be given rigorous consideration at the beginning of the planning process such that their effectiveness is optimized to the maximum extent possible.

II. Project Description

The proposed site of the master-planned community is located in Waipio and Waiawa, Oahu. It consists of approximately 766 acres of land in two separate areas: Waiawa and Koa Ridge Makai. The Waiawa area is located east of the H-2 Freeway, east of the Waipio Interchange, and adjacent to and northwest of the proposed Waiawa Ridge development. The Koa Ridge Makai area is located north of the Waipio Business Park and west of the H-2 Freeway.

The proposed master planned community will include a mix of approximately 5,000 single-family homes and multi-family units, school sites, neighborhood and community commercial sites, light industrial uses, church/day care centers, recreational centers, community parks, park and ride facilities, and a health care component. The development will feature generous landscaping and open space. The new community will be one that is safe and walkable, where residents can live, work and recreate in a vibrant and healthy master-planned, sustainable community encompassing principles consistent with "smart growth".

Koa Ridge Makai

Koa Ridge Makai provides a master-planned mixed use community that features a health care component providing comprehensive health care and wellness services and facilities. The development encompasses approximately 575 acres and will include approximately 3,500 homes balanced by the employment-generating health care, commercial, light industrial, and educational facilities. A mix of multi-family and single-family homes is planned. Multi-family housing is planned near the village center, employment centers, schools and services and in close proximity to the entry points at the makai and mauka ends of the site.

A key element of the community is the mixed-use "Village Center" area that is planned as the social and community focus. The commercial and health care components will be integrated with the village center, which in turn will be linked by pedestrian pathways to the residential areas. This will provide for easy, pleasant walking to retail establishments and public spaces. A mix of uses and higher densities around the village center encourage walking and bicycling rather than the use of the private automobile. Senior housing is an integral part of the village center to facilitate convenient access to retail services and health care. Neighborhoods designed around planned schools, community centers and churches also increase the opportunity to walk rather than drive for short trips.

Koa Ridge Makai features substantial open space and recreation. Open space and pedestrian access will be provided along the edge of Kipapa Gulch and within utility easements and link to neighborhood parks. A well-landscaped spine road with pedestrian and bike trails alongside will link the makai end of Koa Ridge Makai to the mauka end of the property. Portions of the spine road will travel through adjacent open space and parks.

The health care component will encompass approximately 28 acres for medical and health care facilities, which may include a hospital, skilled nursing, physicians' office building, diagnostic and testing center, and other medical and wellness facilities.

Waiawa

Waiawa encompasses approximately 191 acres adjacent to the proposed Waiawa Ridge development. Primary access to the community is provided along a spine road that has dramatic views at the entry towards the Waianae Mountains. The central portion of the site will feature a community center with neighborhood retail, a neighborhood park, and an elementary school site to provide a concentration of pedestrian-oriented activities. Some 1,200 multi-family homes are located within convenient walking distance of these activities. Lower density homes consisting of approximately 300 single-family residences are located along the spine road extending to the mauka end of the site. The development of Waiawa is dependent on the progress of infrastructure development at the adjacent Waiawa Ridge community that will serve both projects.

III. Existing Transportation Infrastructure and Services

This section of the report presents the existing transportation infrastructure and services relevant to the project.

Freeways, Arterials and Roadways

Freeways, arterials, and roadways are the basic street transportation network elements responsible for the movement of people and goods on O'ahu. All types of vehicles, public and private transit services, bicycles, and pedestrians use this network. O'ahu's roadway system is maintained by HDOT and the City and County of Honolulu Department of Facility Maintenance (DFM).

The State's existing highway system includes all freeways and major highways connecting various parts of the island. It consists of approximately 280 route miles and 940 lane miles.

O'ahu's interstate freeways are dedicated transportation facilities. They are fully grade separated and access controlled. Access to the interstate system is restricted to dedicated ramps, which minimizes disruptions to the flow of traffic. The two freeways serving the project area are H-1 and H-2:

- The H-1 Freeway is the major east-west highway that connects the Central Oahu Area to Honolulu to the east and to the Ewa and Waianae districts to the west. East of the Waiawa Interchange, the H-1 Freeway provides five travel lanes in each direction with one lane in each direction designated as a HOV lane during the peak commute periods. West of the Waiawa Interchange, the H-1

Freeway has four travel lanes in each direction. In the morning peak period, the shoulder lane of the H-1 Freeway provides a sixth eastbound lane from east of the Waiawa Interchange. Also during the morning peak period, an additional eastbound HOV lane is provided from west of the Paiwa Interchange to the Pearl Harbor Interchange by provision of a contra-flow (zipper) lane.

- The H-2 Freeway traverses in a north-south direction through Central Oahu and connects to the H-1 Freeway to the south at the Waiawa Interchange. The northern terminus of the H-2 Freeway is just south of Wahiawa at the junction with Kamehameha Highway and Wilikina Drive. The H-2 Freeway provides four lanes in each direction from the Waiawa Interchange to Mililani, where it transitions to two lanes in each direction. Through the project area, one lane in each direction is designated as a high-occupancy vehicle (HOV) lane during the peak commute traffic periods.

The major arterial serving the Central Oahu region is Kamehameha Highway.

- Kamehameha Highway is a major roadway serving north-south traffic between the north and south shores of Oahu. It is generally parallel to and one-half to one mile west of the H-2 Freeway. Kamehameha Highway is a four-lane divided highway, with separate left- and right-turn lanes at intersections from the H-1 Freeway to north of Ka Uka Boulevard.

Major roadways providing access to the commercial and residential areas in the nearby vicinity of the proposed project include Ka Uka Boulevard, Paiwa Street, and Lumiaina Street.

- Ka Uka Boulevard is an east-west roadway connecting the H-2 Freeway with Kamehameha Highway. It provides access to the Waipio Gentry Business Park and residential areas. It is a four-lane roadway with a median divider and left-turn lanes at cross streets.

- Paiwa Street connects the Waipahu community to Waikele and provides both communities with access to the H-1 Freeway. It is a four-lane divided roadway from the H-1 Freeway Interchange to the northern boundary of the Waikele community where it presently dead-ends.

- Lumiaina Street is an east-west street servicing the Waikele community and the Waikele Center retail complex. Lumiaina Street is a four-lane divided roadway between Paiwa Street and

Kamehameha Highway.

Interconnecting these major freeways, arterials and roadways are several interchanges:

- The Waipio (Ka Uka Boulevard) and Paiwa Interchanges are conventional diamond-type interchanges, except the southbound off-ramp of the Waipio Interchange has been aligned to permit future construction of a loop on-ramp for the movement from westbound Ka Uka Boulevard to southbound H-2 Freeway.

- The Waiawa Interchange provides ramp connections for all movements between the H-1 and H2 Freeways, as well as most movements to and from Kamehameha Highway and Farrington Highway. No ramp connection is provided from makai-bound Kamehameha Highway onto the Ewa-bound H-1 Freeway.

There is a large directional imbalance in traffic volumes on the roadways in the morning peak hour. Honolulu-bound volumes on most roadways generally double or more the volumes in the opposing direction. The highest traffic volumes on major streets are on Kamehameha Highway along the sections across Kipapa Gulch and makai of Waipio Uka Street. Congested conditions and extensive vehicle queues occur in the vicinity of the Waiawa Interchange due to the large volumes of vehicles merging Honolulu-bound in the morning.

The traffic volumes in the afternoon peak hour are higher than those in the morning peak hour at most locations. Peak travel direction is reversed from the morning period.

Public Transportation

Public transportation on O'ahu is the responsibility of the City and County of Honolulu, Department of Transportation Services (DTS). The service is popularly known as TheBus for fixed route operations, TheHandi-Van for demand-responsive curb-to-curb service for Americans with Disabilities Act of 1990 (ADA) paratransit-eligible individuals and TheBoat, a recently inaugurated ferry service connecting West O'ahu with downtown Honolulu.

DTS plans, designs, operates and maintains transportation systems; locates, selects, installs and maintains traffic control facilities, devices and street lighting systems; approves plans and designs for construction, reconstruction and widening of public streets and roads; administers rules and regulations for the use of streets and roadways; and, manages the City's contract for bus and paratransit operations. Within DTS, the Public

Transit Division (PTD) is the division responsible for managing the City's contract for bus and paratransit operations. The current contractor is O'ahu Transit Services (OTS), a private, non-profit corporation that operates and maintains TheBus and TheHandi-Van services.

TheBus consists of 98 fixed routes, two (2) deviation routes (operated by the paratransit division) and five (5) feeder routes for TheBoat for a total of 105 routes. Of these, four (4) are limited stop routes (CityExpress! A, CityExpress! B, CountryExpress! C and CountryExpress! E) and 32 are peak-period, peak-direction-only express routes. The 105 routes serve about 3,800 bus stops. Passenger amenities include approximately 980 passenger shelters and 2,400 benches.

Bus routes fall within seven route classifications. These classifications and their function are described below.

- Rapid Bus – Rapid bus includes CityExpress! and CountryExpress! designated routes. These routes provide limited stop express service in both directions. Service is provided all day on weekdays, Saturdays and Sundays on heavily traveled corridors. The CityExpress! Routes A and B offer 15-minute service; CountyExpress! Routes typically provide 30-minute service.

- Urban Trunk – Urban trunk routes provide frequent, direct service connecting neighborhoods within the Primary Urban Center operating along the major Ewa/Diamond Head corridors. Urban trunk routes typically have 15-minute or less service frequencies (headways).

- Urban Feeder – Urban feeder routes connect the mauka/makai neighborhoods within the Urban Center. These routes serving the hills and valleys of Honolulu connect residents to the urban trunk and limited-stop express routes as well as providing service to major destinations such as downtown Honolulu, the University of Hawaii at Manoa and Waikiki.

- Suburban Trunk – Suburban trunk routes provide all day service from outlying communities to the urban center. These routes also provide connections between the suburban communities connecting with community circulators at transit centers. Routes stop at all local bus stops and operate all day, every day. Suburban trunk routes typically provide 30-minute service. Many of the suburban trunk routes operate along the same major corridors such as Kamehameha Highway, Nimitz Highway and Dillingham Boulevard. Service levels along these corridors are much higher due to the combined number of trips provided by the routes.

- Community Circulators – These routes provide circulation within their established community. They connect at a neighborhood hub or transit center after completing their single cycle trip. Community circulators provide timed connections to other circulators and suburban trunk routes. These routes stop at all local bus stops and frequently operate with loops and branches. Community circulator routes currently fall into three general categories of service provision. Higher demand routes offer 30-minute service; lower demand routes provide 60-minute service and some routes offer intermittent or peak-period-only service such as those operating in Pearl City Aiea today.

- Community Access – These routes operate on a standard schedule serving regular bus stops utilizing the Handi-Van vehicles. Handi-Van type service is provided for registered Handi-Van customers with a 24-hour advance notice within ½ mile of the service route. These routes provide 60-minute service. Time is needed in the schedule to allow for route deviations.

- Peak Express – Peak period expresses routes serve predominantly home-to-work trips by connecting specific neighborhoods to employment centers. These trips are provided in the peak period, peak direction only with minimal scheduled departures. A subset of the Peak Express classification is the feeder services designed for TheBoat. These routes operate as peak expresses connecting passengers to TheBoat service during the peak period. Routes predominantly serving TheBoat are designated with an "F" preceding the route number.

Table III.1 lists those current routes operating in the vicinity of the project area. These routes include the following types of routes: Suburban Trunk, Peak Express and Community Circulator. The characteristics of these routes are included in the Transit Rider Database compiled by the Public Transit Division of the Department of Transportation Services. Routes 52 and 62 are examples of suburban trunk routes operating near Koa Ridge. They serve a mix of trip purposes. Routes 83, 83a, 84, 84a, 96 and 98 are examples of peak express services. Typically, over 80% of the riders on these routes are on work trips. Some of the express routes also serve many school or college trips. Seventeen percent of the riders on Route 84a, service between Mililani and University of Hawaii at Manoa, are on a school or college trip.

Table III.1: TheBus Existing Bus Service Characteristics
For Those Routes Operating In The AM Peak Period (5:00 AM to 8:00 AM)
In The Vicinity Of Koa Ridge

Route	Service	Frequency	Inbound Trips Through Area	Inbound Trips Serving Area	Inbound Trips Bypassing Area	Description
52	ST	30 min	-	-	5	H-2 (3 outbound trips)
62 [1]	ST	15 min	-	10	-	Kamehameha (9 outbound trips)
83	PE	-	-	-	7	H-2
83A	PE	-	-	-	2	H-2 (1 trip); Kamehameha (1 trip)
84/84A	PE	-	-	-	8	H-2
96	PE	-	-	-	2	H-2 & Ka Uka
98	PE	-	-	-	3	H-2
98A	PE	-	-	-	2	H-2
433 [2]	CC	30 min	-	0	-	Ka Uka (first trip at 8:00 am)

Legend: ST = Suburban Trunk local route
PE = Peak Express route with weekday peak period only service
CC = Community Circulator

Notes: [1] Route 62 is planned to be renamed Route 51; characteristics are basically the same.
[2] Route 433 provides service to Waipio starting at 8:00 AM.

Alternative Transportation

Alterative transportation involves a wide range of projects and programs designed to manage both the demand for our overall transportation system and the capacity offered by the system. Two major categories of alternative transportation are Transportation Demand Management (TDM) and Transportation Systems Management (TSM).

Transportation Demand Management

TDM is the application of strategies and policies to influence traveler behavior with the aim of reducing automobile travel demand, or redistributing this demand. Current TDM programs include carpools and vanpools, as well as incentive programs to encourage ridesharing. One goal of the 2030 O'ahu Regional Transportation Plan (ORTP) is to maintain and further develop aggressive TDM programs such as real-time online carpool matching, outreach promotion and marketing of altemative transportation, emergency rideshare home program, employer based commuter programs, and emerging and innovative strategies like car sharing.

Examples of successful TDM are the programs provided by the Leeward O'ahu Transportation Management Association (LOTMA), a non-profit organization consisting of public and private landowners and developers serving 'Ewa and Central O'ahu. LOTMA is a transportation resource center that provides the following services: carpool matching, a commuter express service and an emergency ride home program.

Residents of Leeward, Central, and North Shore O'ahu are eligible to participate in LOTMA's carpool matching program. This program is provided free of charge to participants and matches potential carpoolers by residence and work locations. Registered participants are provided a list of potential carpoolers residing and working in the general same locations. Participants are able to contact and set up carpools that work to their best advantage.

LOTMA contracts with Polynesian Adventure Tours Gray Line Hawai'i to provide commuter service for Central O'ahu to Downtown Honolulu and Waikiki using a tour bus. This service is provided weekdays only offering the round trip schedule and stops listed in Table III-2.

Table III.2: LOTMA Commuter Express Bus Schedule

Outbound Time	Location	Inbound Time
6:05 AM	Waipi'o Gentry Shopping Center	5:50 PM
6:15	Mililani Mauka Park-and-Ride	6:05
7:05	Nimitz - Pier 35	5:20
7:10	Dole Cannery	5:15
7:15	King and Bishop	
7:17	King and Richards	
7:19	Punchbowl and King	
7:21	Federal Building	5:00
7:26*	Ala Moana Hotel	4:40
7:31*	Hale Koa Hotel	
7:35	Sheraton Waikiki	4:30

* Stops made upon request

Current fares for this commuter service include unlimited monthly passes ($95.00), 20-trip monthly passes ($55.00) and one-way fares ($3.50). Free transfers to TheBus are available from LOTMA for Commuter Express passengers.

LOTMA provides an emergency ride home program free of charge to registered commuters living or working in Leeward, Central, or North Shore O'ahu. This program is available to commuters who carpool or ride LOTMA's Commuter Express at least once a week.

HDOT supports a statewide vanpool program and a carpool matching service. HDOT contracts with Vanpool Hawai'i to provide a statewide vanpool program. A monthly fee of $55.00 plus sharing gas and parking expenses is available to participants on O'ahu. Both 7 -passenger and 15-passenger vehicles are available. Vanpool Hawai'i offers a "Cool Pool" program for $70.00 a month, using a sport utility vehicle. The monthly fee covers insurance, maintenance, and road assistance. There are about 240 vanpools on O'ahu. The State provides a matching service for potential carpoolers, similar to LOTMA's program. It uses residence and work locations to provide potential matches for residents islandwide.

Transportation System Management

TSM creates more efficient use of transportation facilities by improving the operation and management of vehicles and roads. Examples of TSM measures specific to the island of O'ahu include contraflow operations, special traffic and high-occupancy vehicle (HOV) lanes, and Intelligent Transportation Systems (ITS).

Contraflow lanes are a TSM strategy where a lane that typically provides vehicle travel in one direction is reversed during peak traffic periods. Contraflow facilities operated by the State are restricted to buses, vanpools, and vehicles with three or more occupants. HDOT provides the following contraflow operations: the H-1 Zipper Lane operating as a contraflow lane in the Koko Head-direction from Managers Drive in Waipahu to the Ke'ehi interchange; and, the Nimitz Highway (Route 92) contraflow lane operating in the Koko Head-direction contraflow beginning in the vicinity of the Ke'ehi Interchange. Both of these are open to High Occupancy Vehicles (HOVs) only and operate in the morning peak period only.

The City and County of Honolulu operates contraflow lanes along a few congested corridors during specific peak periods. These do not have HOV restrictions. The City's contraflow lanes operate during both the morning and afternoon peak periods. City locations with reversible lane operations include: Kapi'olani Boulevard from the H-1 Freeway near South King Street to 'Ewa of Ward Avenue in the a.m. peak period, and from Pensacola Street to McCully Street during the p.m. peak period; Ward Avenue from Lunalilo Street to makai of South King Street during the a.m. peak period; Atkinson Drive from Kona Street to Kapi'olani during the a.m. peak period; and, Wai'alae Avenue from Kapahulu Avenue to 8th Avenue during the p.m. peak period.

ITS applications are another form of TDM. Centralized traffic signal control systems are a widely used ITS application. This group of technologies and communication protocols allows multiple agencies to manage O'ahu's transportation network through a centralized control center. By tailoring traffic controls to operating conditions, a roadway's efficiency can be improved by networking signalized intersections, traffic surveillance, and centralized traffic signal control.

DTS currently operates a centralized signal control system, referred to as the Traffic Control Center (TCC). The TCC offers signal coordination and preemption through live video surveillance provided by a closed-circuit television system. Live surveillance is available along most major arterial corridors.

The DTS ITS program is being broadened to include signal pre-emption for transit vehicles, known as Transit Signal Priority (TSP). DTS has investigated TSP installations in Seattle, Bremerton, Tacoma, Portland and Los Angeles and concluded that such applications are appropriate for immediate deployment on O'ahu. The intent is to offer transit vehicle operations an ability to modify traffic signal cycles so that general purpose traffic can be bypassed. This becomes very effective in maintaining schedule reliability when used at multiple locations along the same bus route; especially, in conjunction with dedicated traffic lane treatments such as exist on Hotel Street and Kalakaua Avenue.

HDOT operates a Traffic Management Center (TMC) that provides live surveillance much like DTS's TCC. The TMC monitors H-1 and H-3 and TCC monitors everything else. The following ITS infrastructure is currently available on O'ahu: 750 signalized intersections on O'ahu and 400 signalized intersections controlled by the City's TCC and 202 closed-circuit cameras on O'ahu: 141 controlled by the City's TCC and 61 controlled by the State's TMC.

IV. Baseline Future Transportation Infrastructure and Services

The City plans to improve bus system service within area neighborhoods as part of its Bus Service Improvement Program. These intended improvements are used as a future baseline for planning purposes. The Bus Service Improvement Plan for Central Oahu is anticipated to serve Mililani, Waipio and Mililani Mauka as outlined in correspondence from DTS to the City Council dated October 25, 2005 and provided in the appendix to this report.

The City's transit plans are based upon fulfilling the expectations and guidelines established in the Central Oahu Sustainable Communities Plan.

The Central Oahu Sustainable Communities Plan

The Central Oahu Sustainable Communities Plan was adopted by City and County of Honolulu Ordinance 02-62 on December 20, 2002. This section highlights the most pertinent excerpts from the plan that relate to the development of bus transit services in the project area.

Chapter 3 of the Central Oahu Sustainable Communities Plan includes land use policies, principles and guidelines to be used in the review and approval of public and private projects to help implement the vision for Central Oahu's development.

Some of the policies address particular locations and make specific reference to transit. These include the following:

> "A transit linkage should be established between Waikele Center and Waipahu Town."[1]

The above explicit policy statement is very helpful in delineating transit routes, but no such statement exists that would pertain to Koa Ridge Other general policies are less explicit such as the following:

> "Street patterns and rights-of-way should be designed to accommodate mass transit (bus) service and make it convenient to access for as many households as possible."[2]

[1] Central Oahu Sustainable Communities Plan as adopted by City and County of Honolulu Ordinance 02-62 on December 20, 2002; Chapter 3, Land Use Policies, Principles, and Guidelines, Section 3.4.3.2 Waipahu Sugar Mill Environs Methods of Preservation; page 3-28.

[2] Ibid, Section 3.8.1.5 Transit-Oriented Streets; page 3-56.

The above policy is too vague to be of adequate value when developing specific routes and schedules. Fortunately, the Central Oahu Sustainable Communities Plan provides some specificity in Section 3.8.2. Guidelines. Under Subsection 3.8.2.4. Circulation System, sufficiently specific guidelines are listed including the following statements:

> "Potential transit routes should be identified by the developer such that at least 85% of all proposed residential housing units are within 1/4 mile of a proposed transit stop, unless localized topographic conditions make such a requirement impractical.
>
> "All development should be within 1/2 mile of a transit stop, unless localized topographic conditions make such a requirement impractical.
>
> "All commercial development with more than 1,000 square feet, and all employment sites with more than ten employees, should be within 1/8th mile of a transit stop.
>
> "The developer should construct all necessary transit stops in accordance with DTS design standards.
>
> "Proposed transit routes should have two different access points into the proposed development. The route alignment should seek to achieve optimal operational efficiency between the two access points."[3]

These guidelines were used for designing new bus routes to serve Central Oahu. The guideline "The route alignment should seek to achieve optimal operational efficiency between the two access points." was further refined to define the word "optimal" to be quantifiably specific. The guideline used was to delineate transit routes that have two different access points into the proposed development with a bus route alignment that measures no more than 1.2 times the airline distance between the two access points. This approach avoids circuitous bus routing which becomes expensive, operationally inefficient and unattractive to intending riders.

The standard rule of the transit industry is that areas within a "five-minute walk" of a transit bus stop, or approximately one quarter mile, are considered "served by transit." Beyond the five-minute walk radius, the experience in the United States has been that the percent of persons desiring transit drops due to their unwillingness or inability to walk greater distances. It is intended that the bus route design for Koa Ridge exceed the guidelines in the Central Oahu Sustainable Plan by having more of the development within one quarter mile of proposed bus stops.

[3] Ibid, Section 3.8.1.5 Transit-Oriented Streets; page 3-56.

The intent for Koa Ridge is to avoid circuitous streets, cul-de-sacs, walls around neighborhoods and other barriers that can serve as obstacles to providing efficient transit service. The design of the roadways and location of land uses will be planned to emphasize a safe, pedestrian-oriented environment and direct access to bus stops.

The Central Oahu Bus Service Plan

DTS has prepared and routinely updates a Bus Service Improvement Plan. Oahu's future bus services are addressed geographically including Central Oahu. Service reliability and productivity are Issues addressed by the Central Oahu Bus Service Plan.

Service reliability issues are a growing challenge. Many un-served and under-served areas make using current routes difficult. Current peak express routes emphasize peak-period, peak-direction service making travel at other times and in other directions impossible. Long routes serving local needs are delayed in traffic at other parts of the island.

Service productivity issues need to be resolved. The development pattern in Central Oahu creates challenges to offer properly structured services. Transit routes have been planned to provide better efficiency using a combination of restructured and new routes. The Central Oahu Bus Service Plan is constantly being revised and refined to reflect current infrastructure, conditions and opportunities.

The Central Oahu Bus Service Plan has been awaiting the completion of transit centers. The completion of those facilities allows for the introduction of new, three-tiered routes that have been the subject of advanced planning discussions for over five years. Routes representing each tier have been planned such that they can serve Koa Ridge effectively and timely under the right circumstances.

Routes operating with the greatest spacing between stops to achieve the highest reasonable and safe operating speed are known as Tier I routes. Their primary function is to connect transit hubs. They are designed to connect transit centers as directly as possible with frequent service and no route deviations from the most expedient alignment possible. Intermediate stops are served only when expedient to do so: the stop has the potential of high boarding utilization and the riders using the route are not significantly delayed or inconvenienced. These routes provide all-day, two-directional, high-capacity service seven days a week. Examples include CityExpress!, CountryExpress! and limited-stop local routes.

The Tier I route that could serve Koa Ridge is a CountryExpress! Route D. This route has not been implemented due to funding constraints, but it has consistently been viewed by transit planners as a reasonable and necessary service improvement for Central Oahu. The possible alignment of this proposed route has varied slightly during the past five years, but it has always connected transit centers in Wahiawa and Mililani with downtown Honolulu using H-2 and H-1 for the middle part of the trip.

CountryExpress! Route D would operate along the H-2 HOV lanes. This tier I route could serve Koa Ridge via a flyer stop accessed via the H-2 HOV lanes using direct access ramps serving the isolated H-2 island mauka of Ka Uka Boulevard. Transit riders could access the flyer stop via an H-2 pedestrian overpass connected directly into Koa Ridge. Examples of such flyer stops can be found in Seattle and Los Angeles.

Tier II routes operate with an average to greater than the average distance between stops to achieve a higher reasonable and safe operating speed. Their primary function is to connect transit hubs while also providing direct service along major development corridors. They are designed to connect hubs with frequent service and only deviate from the most expedient alignment possible when the majority of passengers on board are served by the destinations requiring the deviation. These routes provide all-day, two-directional, regular-capacity service seven days a week.

The Tier II service that could best serve Koa Ridge is the proposed Route 50. Route 50's primary function is to connect the Mililani, Waipahu and Kapolei transit centers. Proposed alignments have most often included Ka Uka Boulevard and H-2, but not direct service into Koa Ridge.

Routes operating with the average to less than average distance between stops to achieve the highest degree of access to neighborhoods and community destinations are Tier III services. Their primary function is to serve one transit hub within one major geographic area. They deviate from the most expedient alignment possible when neighborhood access is required. These routes provide service designed to meet the needs of the community provided that certain levels of productivity are maintained. Examples include shuttles, community circulators, community access routes and feeders. These routes often do not provide frequent service, but operate such that they make timed connections at their assigned transit hub to minimize wait times either between tier III routes or with other higher frequency tier I and II routes.

Existing Tier III Route 433 currently is anchored at the Waipahu transit center. It serves Waipio and has been extended to operate along Ka Uka Boulevard. Route 433 has been viewed as a route that would possibly be extended into Koa Ridge Mauka to serve future development as it evolves. Other Tier III routes have been envisioned to serve Waiawa and connect to a future Pearl Highlands station.

Routes operating to serve the particular needs of a single target market group are considered as special services. Routes are often designed without particular regard to stop spacing or directness of service to meet the needs of a single trip purpose without significant consideration to other possible travel markets. The primary function is to satisfy the needs of a premium travel demand. These routes tend to be the most expensive to operate on a per person trip basis. Examples include commuter express routes and special event services such as the football express. Ferry bus feeder routes designed solely to accommodate commuters connecting to the ferry are classified as special services.

Routes 83, 83a, 84, 84a, 96, 98 and 98a are peak express operations falling into the special services tier. All of these routes except for the 96 operate along H-2 HOV lanes. There has been no consideration to use any of the H-2 peak express routes, or to create any new peak express operations, to serve Koa Ridge with the exception of the allowing these routes to stop at a H-2 freeway flyer transit station should one ever be created.

V. Potential TheBus Transit Service Options

A traffic impact study is being conducted for the Draft EIS which will update the October 2007 traffic study for Waiawa prepared by Wilson Okamoto Corporation, as supplemented in March 2008 in response to a Mililani Neighborhood Board resolution. The traffic impact study analyzes potential traffic impacts on the roadway system within the project vicinity including regional impacts resulting from the proposed development and identifies appropriate mitigation measures that may be required. Additional comments provided by the Mililani Neighborhood Board regarding the March 2008 Supplement are also addressed.

The forthcoming traffic impact study responds to neighborhood board comments by using a wide array of mobility alternatives to reduce vehicle trips generated by the project. Alternative transportation programs include transit, pedestrian, bicycle and Transportation Demand Management (TDM) options. The transit, pedestrian and bicycle transportation investment options involve the infrastructure necessary to provide an attractive environment wherein vehicle trips can be reduced because people choose not drive their vehicle. The TDM options offer the incentives necessary to provide an additional motivation to residents and employees to not drive their vehicle.

Transit service is likely the most promising transportation option with the ability to significantly reduce vehicle trips. Table V.1 identifies the characteristics of six potential transit service options developed to serve the Koa Ridge area. Characteristics are identified for those routes operating in the morning peak period (5:00 AM to 8:00 AM). Three types of morning peak period inbound trips are listed:

1) Through Area -- inbound bus trips that go through Koa Ridge and serve future bus stops located in close proximity to future development.

Table V.1: Potential TheBus Transit Service Option Characteristics
For Those Routes Operating In The AM Peak Period (5:00 AM to 8:00 AM)
In The Vicinity Of Koa Ridge In 2025

OPTIONS		AM PEAK PERIOD INBOUND BUS TRIPS				DESCRIPTION
No.	Name	Through Area	Serving Area	Bypassing Area	Total	
1	Existing Transit Services	0	10	29	39	Maintains 2008 bus services.
2	Transit Services With Bus Improvements	16	19	33	68	Routine bus improvements only, no rail, no new interchange.
3	Transit Services With Bus & Rail Improvements	18	22	71	111	Bus improvements consistent with a rail system investment, no new interchange.
4	Transit Services With TDM, Bus & Rail Improvements	36	10	65	111	Assumes TDM and bus improvements consistent with rail system and new interchange used by buses.
5	Transit Services With H-2 Station, TDM, Bus & Rail Improvements	18	93	0	111	Assumes H-2 freeway flyer station served by either ped/bike bridge or direct access ramps to H-2 HOV ramps, TDM & bus improvements consistent with rail, no new general purpose traffic interchange.
6	Transit Services With H-2 Station, TDM, Bus & No Rail	16	52	0	68	Assumes H-2 freeway flyer station, TDM & routine bus improvements with no rail, no new general purpose traffic interchange.

2) Serving Area – inbound bus trips that do not go through Koa Ridge, but serve the area by traveling along either Ka Uka Boulevard or Kamehameha Avenue and serve existing bus stops.
3) Bypassing Area – inbound bus trips that neither go through Koa Ridge nor serve the area because no existing bus stop exists even though the routes operate along H-2 and other urban areas have introduced freeway flyer stops in such situations.

Each of the six potential transit service options developed to serve the Koa Ridge area summarized in Table V.1 is derived from more detailed descriptions of the transit service characteristics of each route as part of the options in Tables V.2 through V.7. The detailed characteristics of existing services described in the previous section are shown in Table V.2 below. These are presented as Option #1. This option assumes no rail service is implemented and no bus transit services are changed by the year 2025.

Table V.2: OPTION #1
Potential TheBus Transit Service Option Characteristics
For Those Routes Operating In The AM Peak Period (5:00 AM to 8:00 AM)
In The Vicinity Of Koa Ridge
Assuming No Rail Service In 2025

Route	Service	Frequency	Inbound Trips Through Area	Inbound Trips Serving Area	Inbound Trips Bypassing Area	Description
52	ST	30 min	-	-	5	H-2 (3 outbound trips)
62 [1]	ST	15 min	-	10	-	Kamehameha (9 outbound trips)
83	PE	-	-	-	7	H-2
83A	PE	-	-	-	2	H-2 (1 trip); Kamehameha (1 trip)
84/84A	PE	-	-	-	8	H-2
96	PE	-	-	-	2	H-2 & Ka Uka
98	PE	-	-	-	3	H-2
98A	PE	-	-	-	2	H-2
433 [2]	CC	30 min	-	0	-	Ka Uka (first trip at 8:00 am)

Legend: ST = Suburban Trunk local route
PE = Peak Express route with weekday peak period only service
CC = Community Circulator

Notes: [1] Route 62 is planned to be renamed Route 51; characteristics are basically the same.
[2] Route 433 provides service to Waipio starting at 8:00 AM.

Table V.3 depicts Option #2. This table includes the potential bus transit service characteristics for those routes operating in the AM peak period in the vicinity of Koa Ridge assuming previously planned bus service are in place in 2025.

Table V.3: OPTION #2
Potential TheBus Transit Service Option Characteristics
For Those Routes Operating In The AM Peak Period (5:00 AM to 8:00 AM)
In The Vicinity Of Koa Ridge
Assuming Added Bus Service In 2025

Route	Service	Frequency	Inbound Trips Through Area	Inbound Trips Serving Area	Inbound Trips Bypassing Area	Description
CE [1]	RB	30 min	-	-	6	H-2 (6 outbound trips)
50 [2]	ST	30 min	-	6	-	H-2 & Ka Uka (6 outbound trips)
51 [3]	ST	15 min	-	10	-	Kamehameha (9 outbound trips)
52	ST	30 min	-	-	6	H-2 (3 outbound trips)
83	PE	-	-	-	7	H-2
83A	PE	-	-	1	1	H-2 (1 trip); Kamehameha (1 trip)
84/84A	PE	-	-	-	8	H-2
96	PE	-	-	2	-	H-2 & Ka Uka
98	PE	-	-	-	3	H-2
98A	PE	-	-	-	2	H-2
433 [4]	CC	30 min	6	-	-	Serves KR (6 outbound trips)
441	CC	30 min	6	-	-	Serves KR TC (6 outbound trips)
441X	PE	-	4	-	-	Serves KR TC

Legend: RB = Rapid Bus limited stop service on Country Express route
ST = Suburban Trunk local route
PE = Peak Express route with weekday peak period only service
CC = Community Circulator

Notes: [1] Country Express is a high quality service with limited stops.
[2] Planned new route with potential to pass through KR after new H-2 interchange is constructed.
[3] Existing Route 62 is planned to be renamed Route 51; characteristics are basically the same.
[4] Route 433 provides service to Waipio starting at 8:00 AM.

Option #2 includes the following bus routes added to those in Option #1:

CountryExpress (CE) – This Tier I route Rapid Bus (RB) service connects Wahiawa and Mililani with the Pearl Highlands transit center and rail station via H-2 with 6 inbound trips bypassing Koa Ridge because no freeway flyer stop exists for passengers to access this premium service.

Route 50 – This Tier II route, suburban trunk service, connects the existing Mililani transit center with the Waipahu transit center and rail station via H-2 with 6 trips serving Koa Ridge via Ka Uka Boulevard.

Route 441 – This Tier III route, community circulator service, connects Koa Ridge Makai and Waiawa with Pearl Highlands with 6 trips through the areas.

Route 441X – This Tier IV route, peak express service, connects Koa Ridge Makai and Waiawa with downtown Honolulu with 4 trips through the areas.

Option #2 introduces 16 inbound bus trips going through Koa Ridge serving future bus stops located in close proximity to future development. The 10 bus trips serving Koa Ridge Makai are increased to 19 inbound bus trips. These 19 routes do not go through Koa Ridge, but serve the area by traveling along either Ka Uka Boulevard or Kamehameha Avenue and serve existing bus stops. The 29 inbound bus trips that neither go through Koa Ridge nor serve the area because no bus station exists along H-2 increases to 33. Option #2 is consistent with ongoing bus planning.

Option #3 is defined by the bus routes and service characteristics presented in Table V.4. Rail service is introduced with bus connections from Koa Ridge Makai and Waiawa to rail stations at Waipahu and Pearl Highlands. Routes CE, 50 and 441 all have peak period frequency improved from 30 to 15 minute service intervals. Routes 51, 52 and 433 continue to offer the same level of service included in Option #2. Peak express routes are reconfigured to connect with rail stations with inbound trips doubling, but all would be bypassing the area under Option #3.

Option #3 inbound bus trips going through Koa Ridge Makai increase from 16 to 18. Inbound bus trips serving Koa Ridge Makai are increased from 19 to 22. The number of inbound bus trips that neither go through Koa Ridge nor serve the area because no bus station exists along H-2 increases from 33 to 71. Option #3 is consistent with planning assumptions made during the Alternatives Analysis study. This will be confirmed upon the release of the HHCTCP DEIS in October 2008.

Table V.4: OPTION #3
Potential TheBus Transit Service Option Characteristics
For Those Routes Operating In The AM Peak Period (5:00 AM to 8:00 AM)
In The Vicinity Of Koa Ridge
Assuming Bus and Rail Investments In 2025

Route	Service	Frequency	Inbound Trips Through Area	Inbound Trips Serving Area	Inbound Trips Bypassing Area	Description
CE [1]	RB	15 min	-	-	12	H-2 (12 outbound trips)
50 [2]	ST	15 min	-	12	-	H-2 & Ka Uka (12 outbound trips)
51 [3]	ST	15 min	-	10	-	Kamehameha (9 outbound trips)
52	ST	30 min	-	-	6	H-2 (3 outbound trips)
83/83A	PE	-	-	-	30	H-2
84/84A	PE	-	-	-	17	H-2
98	PE	-	-	-	6	H-2
433	CC	30 min	6	-	-	Serves KR (6 outbound trips)
441	CC	15 min	12	-	-	Serves KR TC (12 outbound trips)

Legend: RB = Rapid Bus limited stop service on Country Express route
ST = Suburban Trunk local route
PE = Peak Express route with weekday peak period only service
CC = Community Circulator

Notes: [1] Country Express is a high quality service with limited stops.
[2] Planned new route with potential to pass through KR after new H-2 interchange is constructed.
[3] Existing Route 62 is planned to be renamed Route 51; characteristics are basically the same.

Option #4 is defined by the bus routes and service characteristics presented in Table V.5. Option #3 and #4 both have 111 total morning peak period inbound trips, but bus service through Koa Ridge Makai is doubled with Option #4. This is achieved based upon the creation of a new H-2 interchange located between the Mililani and Waipio interchanges.

Table V.5: OPTION #4
Potential TheBus Transit Service Option Characteristics
For Those Routes Operating In The AM Peak Period (5:00 AM to 8:00 AM)
In The Vicinity Of Koa Ridge
Assuming TDM In 2025 With Bus and Rail Investments

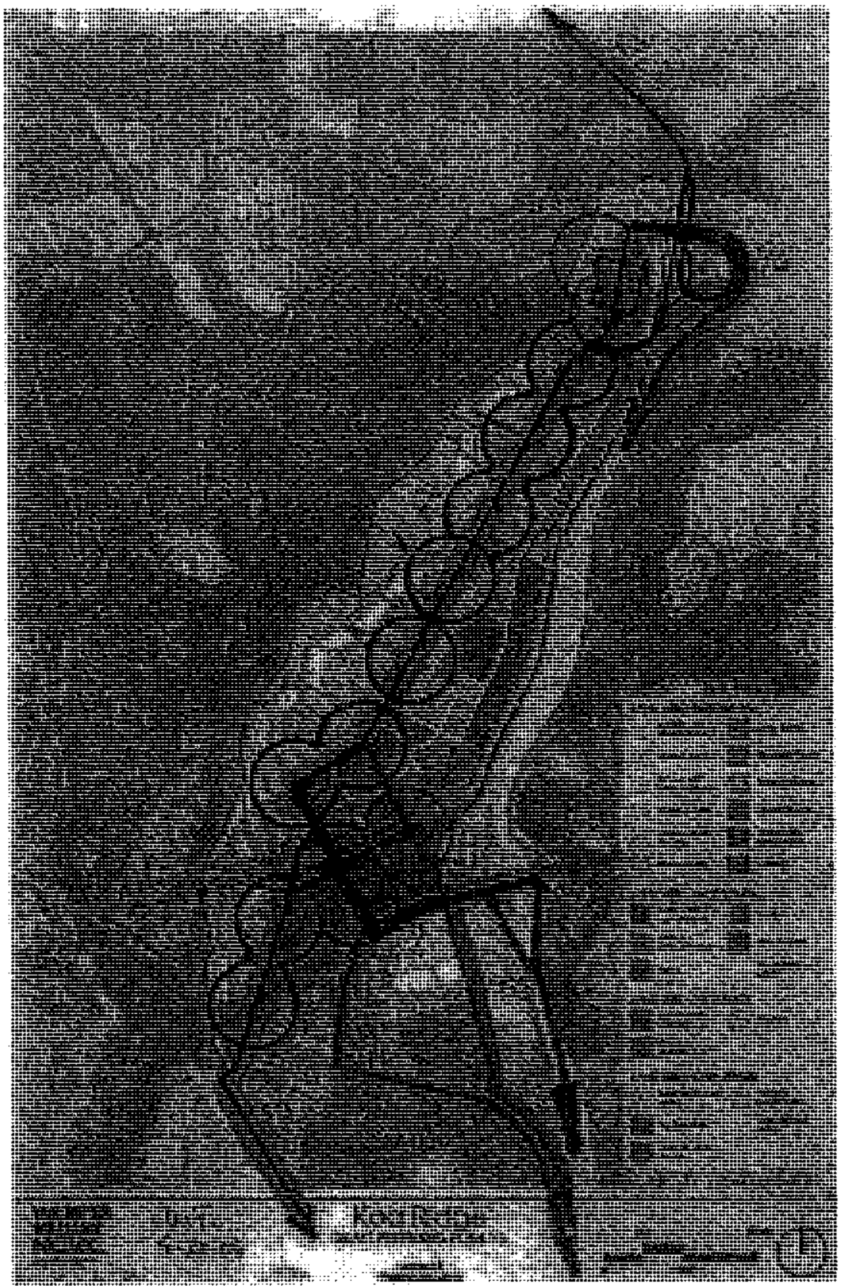
Route	Service	Frequency	Inbound Trips Through Area	Inbound Trips Serving Area	Inbound Trips Bypassing Area	Description
CE [1]	RB	15 min	-	-	12	H-2 (12 outbound trips)
50 [2]	ST	15 min	12	-	-	H-2 & Ka Uka (12 outbound trips)
51 [3]	ST	15 min	-	10	-	Kamehameha (9 outbound trips)
52	ST	30 min	6	-	-	H-2 (3 outbound trips)
83/83A	PE	-	-	-	30	H-2
84/84A	PE	-	-	-	17	H-2
98	PE	-	-	-	6	H-2
433	CC	30 min	6	-	-	Serves KR TC (6 outbound trips)
441	CC	15 min	12	-	-	Serves KR (12 outbound trips)

Legend: RB = Rapid Bus limited stop service on Country Express route
ST = Suburban Trunk local route
PE = Peak Express route with weekday peak period only service
CC = Community Circulator

Notes: [1] Country Express is a high quality service with limited stops.
[2] Planned new route with potential to pass through KR after new H-2 interchange is constructed.
[3] Existing Route 62 is planned to be renamed Route 51; characteristics are basically the same.

Routes 50 and 52 are realigned to take advantage of the new interchange to serve through Koa Ridge Makai as depicted in Figure V.1. Route 50's 12 inbound trips that previously served Koa Ridge only along Ka Uka Boulevard now traverse main roadways through Koa Ridge. Route 52's 6 inbound trips that previously bypassed the area now also traverse main roadways through Koa Ridge. The TDM agreement proposed in the next section of this report is intended to assure the provision of these bus route services.

Figure V.1: Potential TheBus Route Alignments
Through Koa Ridge



Option #5 is defined by the bus routes and service characteristics presented in Table V.6. Like Options #3 and #4, Option #5 offers a total of 111 total morning peak period inbound trips. However, 71 inbound trips in Option #3 and 65 in Option #4 bypassed the area. All 111 inbound bus trips in Option #5 either go through or serve Koa Ridge.

Table V.6: OPTION #5
Potential TheBus Transit Service Option Characteristics
For Those Routes Operating In The AM Peak Period (5:00 AM to 8:00 AM)
In The Vicinity Of Koa Ridge
Assuming TDM In 2025 With Bus and Rail Investments
And An H-2 Freeway Flyer Transit Station

Route	Service	Frequency	Inbound Trips Through Area	Inbound Trips Serving Area	Inbound Trips Bypassing Area	Description
CE [1]	RB	15 min	-	12	-	H-2 (12 outbound trips)
50 [2]	ST	15 min	12	-	-	H-2 & Ka Uka (12 outbound trips)
51 [3]	ST	15 min	-	10	-	Kamehameha (9 outbound trips)
52	ST	30 min	6	-	-	H-2 (3 outbound trips)
83/83A	PE	-	-	30	-	H-2
84/84A	PE	-	-	17	-	H-2
98	PE	-	-	6	-	H-2
433	CC	30 min	6	-	-	Serves KR TC (6 outbound trips)
441	CC	15 min	12	-	-	Serves KR (12 outbound trips)

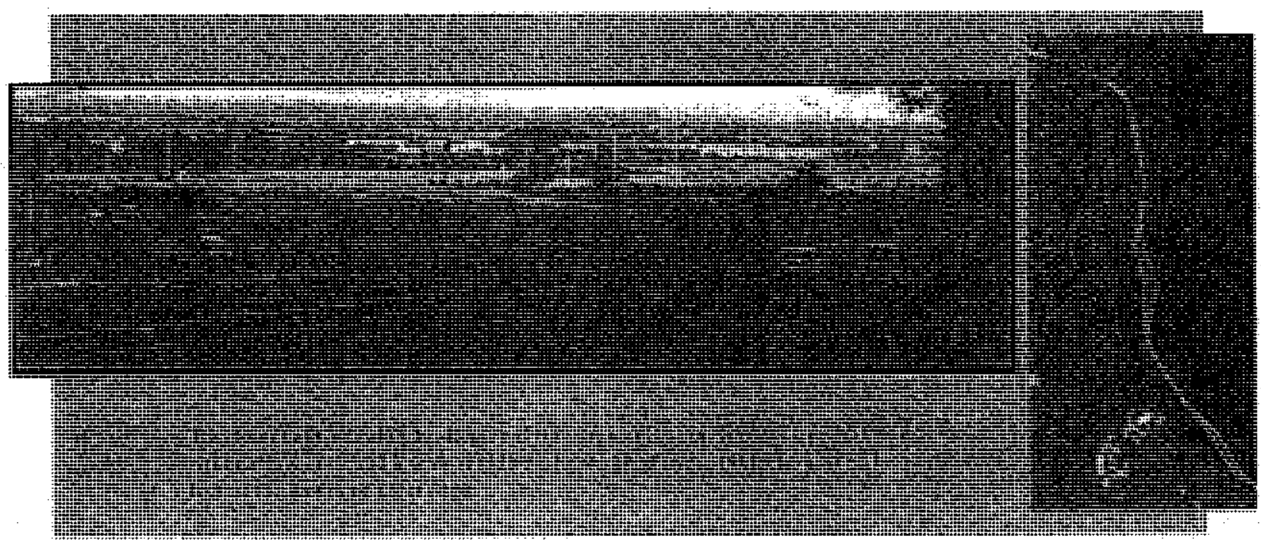
Legend: RB = Rapid Bus limited stop service on Country Express route
ST = Suburban Trunk local route
PE = Peak Express route with weekday peak period only service
CC = Community Circulator

Notes: [1] Country Express is a high quality service with limited stops.
[2] Planned new route with potential to pass through KR after new H-2 interchange is constructed.
[3] Existing Route 62 is planned to be renamed Route 51; characteristics are basically the same.

Options #5 and #6 capture the very high level of service that would otherwise bypass Koa Ridge by creating a Central Oahu Regional Bus Transit Station in the H-2 center median between the Plantation Road bridge over H-2 and the Ka Uka Boulevard bridge over H-2. This median island is up to 250 feet wide and 2000 feet long providing an ample footprint for such a facility consistent with comparable projects in Seattle and Los Angeles without interference with other interchange traffic movements.

Figure V.2 depicts a relatively flat site. It is shaped like an 'S' with narrow ends and a wide middle. The width is over 200 feet for over 1,000 feet of the length of the median. HDOT researched the history of the site and could find no documented reasons for its existence. The speculation is that the roadway simply followed the contour of the land in this location since the cost of even minor cut and fill grading would be greater than the cost of the land at the time of construction. In previous investigations HDOT could find no evidence of any environmental or other reasons for avoiding the site.

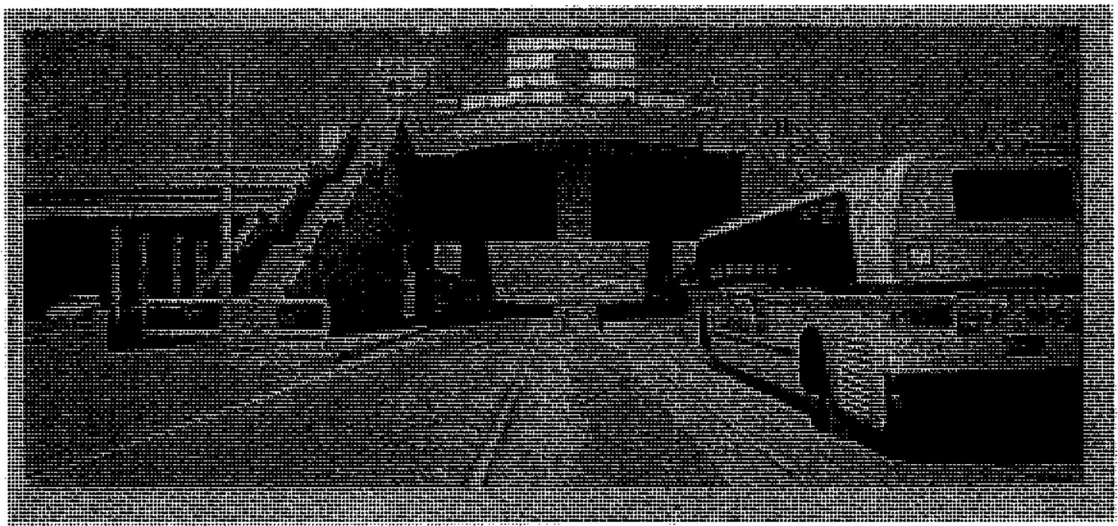
Figure V.2: Potential Central Oahu Regional Bus Transit Station Site



The site is immediately adjacent to HOV lanes in each direction allowing direct access from and to the HOV lanes. An additional three general purpose traffic lanes are on the outside cross-section of the freeway.

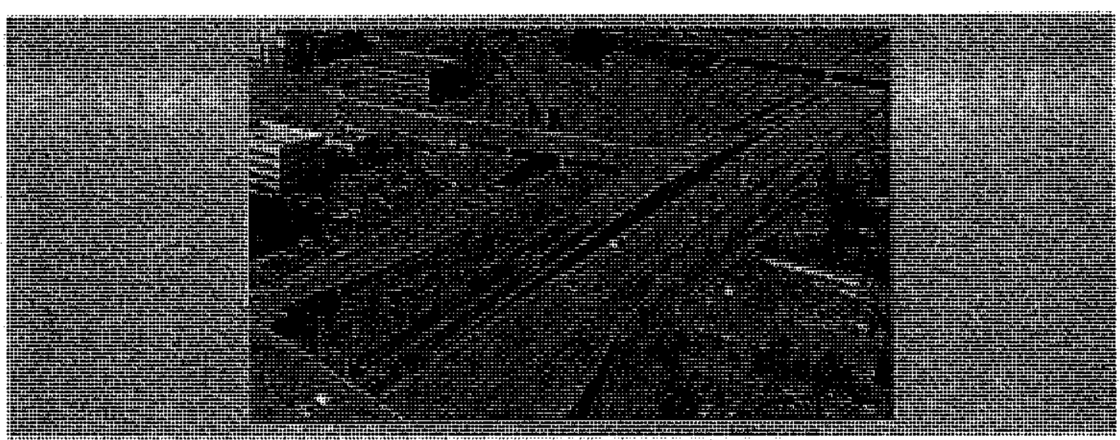
The proposed Central Oahu Regional Bus Transit Station is located in the heart of the Waiawa Koa Ridge Makai developments and is situated to serve most of the housing units and employment planned for the area within reasonable walk and bicycle distances. Figure V.3. illustrates how the Rosecrans Bus Station is configured to serve bus routes on I-110 in Los Angeles. Sidewalks on the Rosecrans overpass provide pedestrian access. Such an overpass on H-2 need only be designed to serve pedestrians and bicyclists.

Figure V.3: Example Of Regional Bus Transit Station On I-110 In Los Angeles



The proposed Central Oahu Regional Bus Transit Station would use direct access ramps from the existing H-2 HOV lanes. Figure V.4. illustrates how the Seattle area has designed these facilities in close proximity to other freeway ramp connections to I-405

Figure V.4: Example Of Direct Access Ramps On I-405 In Bellevue



Bridges for pedestrians are being used throughout the developed world as depicted in Figures V.5, V.6 and V.7. The most recent major bridges in London (the Millennium Bridge across the Thames River opened in 2000) and Paris (across the Seine River opened in 1999) are pedestrian only bridges.

The Millennium Bridge shown in Figure V.5. is London's first pedestrian only crossing of the Thames. The bridge connects St. Paul's Cathedral with the regenerating London Borough of Southwark.

The Passerelle Leopold-Sedar Senghor across the Seine is pictured in Figure V.5. This is one of three pedestrian only bridges in central Paris. It connects the Tuileries Gardens with the d'Orsay museum.

Figure V.6. shows some of the pedestrian and bicycle only bridges in Dublin. Four of the last five bridges built in Dublin (across the River Liffey) are pedestrian and bicycle only bridges. The massive Docklands redevelopment area in Dublin is divided by River Liffey. The primary transportation connection between the predominately mixed use residential construction projects is a pedestrian bridge.

The most recent bridge across the Missouri River is a pedestrian and bicycle only bridge. The bridge in Omaha is shown in Figure V.7 under construction in 2008. The bridge is funded by a special Federal program for such projects. The access created by the bridge will be used by major mixed use development projects being constructed on both sides of the river.

The potential Central Oahu Regional Bus Transit Station site might be best served by the types of pedestrian and bicycle only bridges being increasingly used worldwide to connect major mixed used developments across both natural and manmade barriers. Such bridges are functional, iconic and significantly less expensive than a crossing designed for private vehicular traffic. Options #5 and #6 are predicated on application of these types of approaches that place a priority on coordinated pedestrian, bicycle and transit solutions over accommodation of vehicular movements.

Option #6 is defined by the bus routes and service characteristics presented in Table V.7. Like Option #5, Option #6 is based upon capturing the very high level of transit service that would otherwise bypass Koa Ridge by creating a Central Oahu Regional Bus Transit Station in the H-2 center median between the Plantation Road bridge over H-2 and the Ka Uka Boulevard bridge over H-2. Access to the Central Oahu Regional Bus Transit Station would be by a pedestrian and bicycle only bridge over H-2 with direct, curb-separated, safely-designed and highly-functional alternative transportation pathway connections fully integrated into the Koa Ridge site plan.

Figure V.5: Example Of Pedestrian Only Bridges In London and Paris

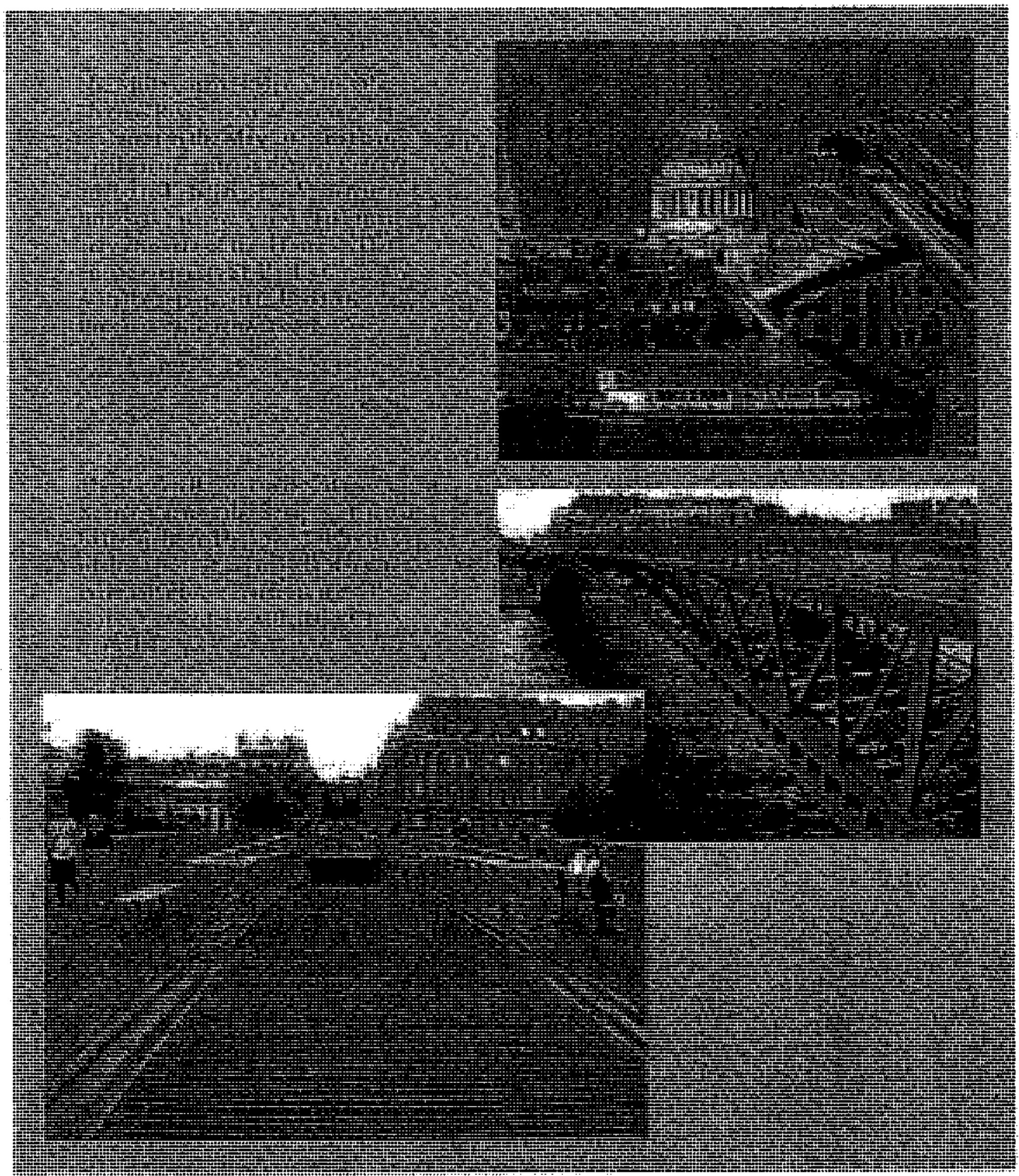


Figure V.6: Example Of Pedestrian And Bicycle Only Bridges In Dublin

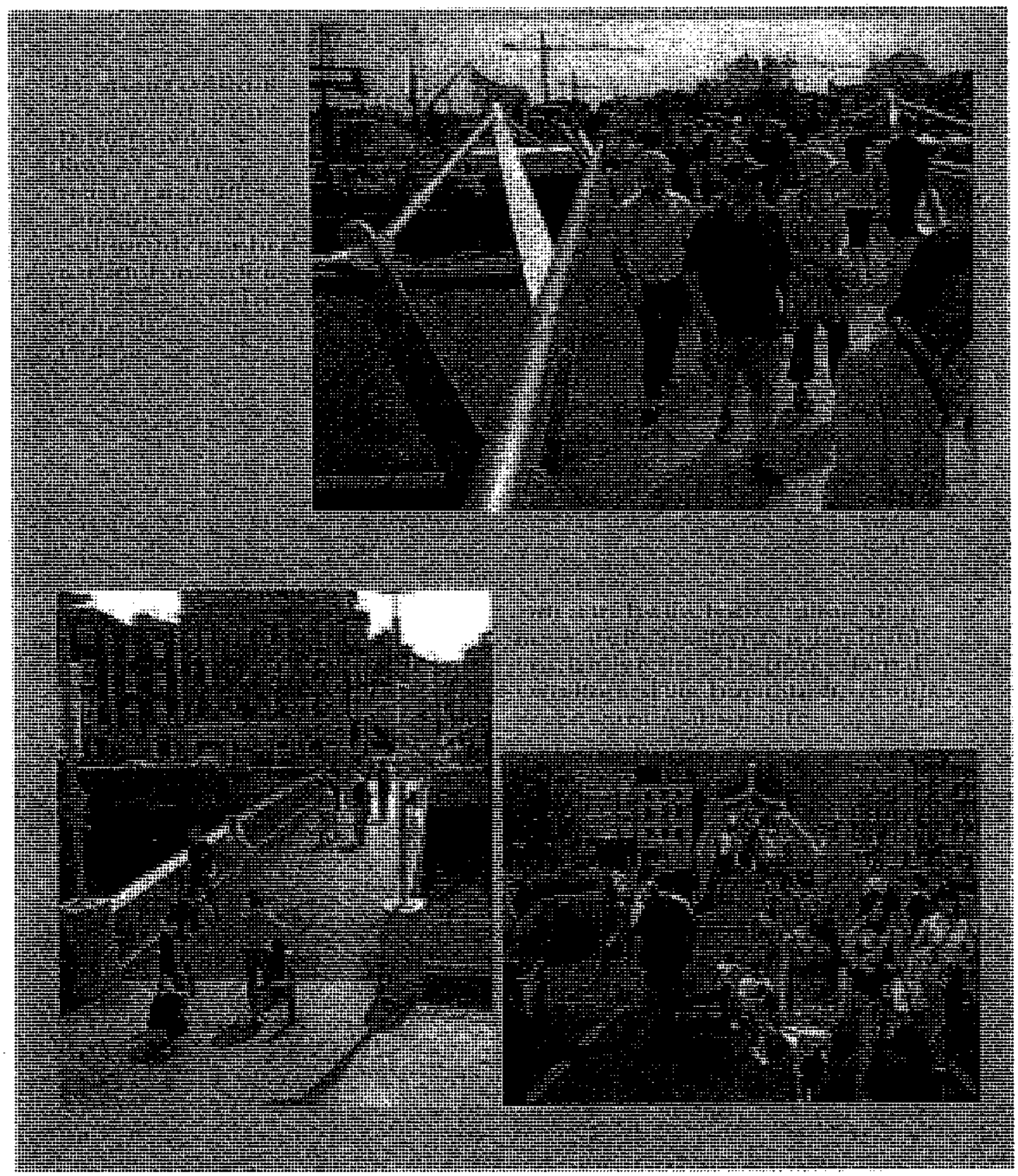


Figure V.7: Example Of Pedestrian and Bicycle Only Bridges In Omaha

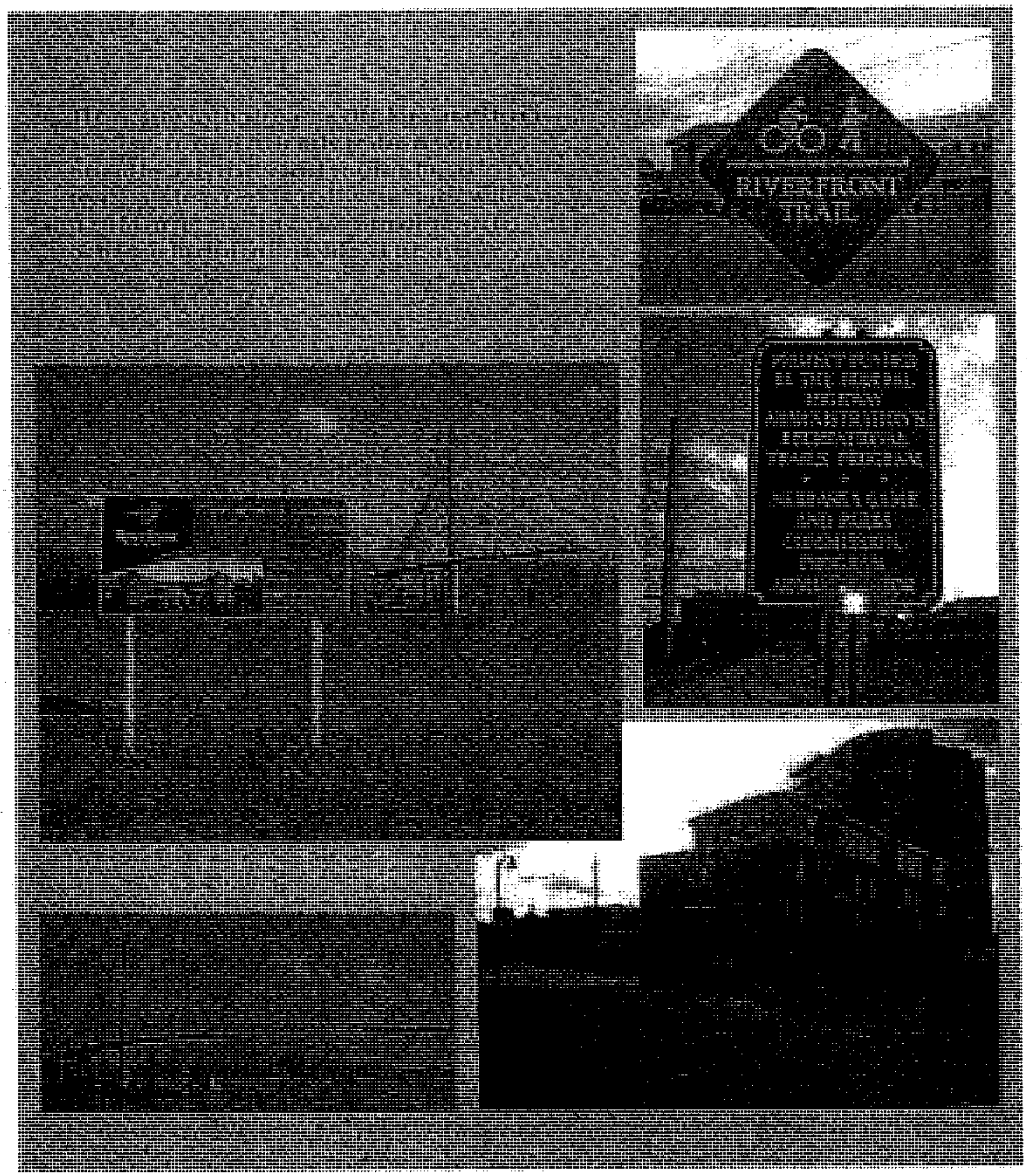


Table V.7: OPTION #6
Potential TheBus Transit Service Option Characteristics
For Those Routes Operating In The AM Peak Period (5:00 AM to 8:00 AM)
In The Vicinity Of Koa Ridge
Assuming TDM In 2025 With Bus Investments
And An H-2 Freeway Flyer Transit Station

Route	Service	Frequency	Inbound Trips Through Area	Inbound Trips Serving Area	Inbound Trips Bypassing Area	Description
CE [1]	RB	30 min	-	6	-	H-2 (6 outbound trips)
50 [2]	ST	30 min	6	-	-	H-2 & Ka Uka (6 outbound trips)
51 [3]	ST	15 min	-	10	-	Kamehameha (9 outbound trips)
52	ST	30 min	-	6	-	H-2 (3 outbound trips)
83	PE	-	-	7	-	H-2
83A	PE	-	-	2	-	H-2 (1 trip); Kamehameha (1 trip)
84/84A	PE	-	-	8	-	H-2
96	PE	-	-	2	-	H-2 & Ka Uka
98	PE	-	-	3	-	H-2
98A	PE	-	-	2	-	H-2
433	CC	30 min	6	-	-	Serves KR TC (6 outbound trips)
441	CC	30 min	6	-	-	Serves KR (6 outbound trips)
441X	PE	-	4	-	-	Serves KR

Legend: RB = Rapid Bus limited stop service on Country Express route
ST = Suburban Trunk local route
PE = Peak Express route with weekday peak period only service
CC = Community Circulator

Notes: [1] Country Express is a high quality service with limited stops.
[2] Planned new route with potential to pass through KR after new H-2 interchange is constructed.
[3] Existing Route 62 is planned to be renamed Route 51; characteristics are basically the same.

Option #6 is designed to illustrate what might happen if the anticipated rail system included in Options #3, 4 and 5 does not occur. Option #6 uses the transit services assumed in Option #2. Therefore, a total of 68 morning inbound bus trips are projected. However, instead of 33 of these bus trips bypassing Koa Ridge, the number of inbound morning bus trips serving Koa Ridge is increased from the 19 in Option #2 to 52. This is almost a bus trip every three minutes during the three hour peak period – comparable to, or even better than, the level of service offered on most new U.S. rail systems.

VI. Vehicle Trip Generation Reductions

The standard approach for determining the transportation implications of a proposed development is to conduct a traffic impact analysis. Such studies have been used consistently for decades to make decisions about maximum land use holding capacity and minimum street network design requirements. The emphasis has been on analyzing the number of vehicle trips generated by the new development and the consequential impact on the level of service of critical roadways and intersections. The traffic impact study has evolved as the single tool used to determine roadway widths, street and intersection design and the financial contributions that are reasonable for those sponsoring the development requiring changes to the transportation system.

Traffic impact studies vary in their range of detail and complexity. Many states are becoming more regulatory in how traffic impact studies are to be conducted. Some jurisdictions have incorporated technical procedures, vehicle trip generation rates and allowable adjustments and reductions to those rates into ordinances and permit regulations. The Institute of Transportation Engineers (ITE) Trip Generation Handbook and User's Guide (7th Edition, 3 volumes) have been the definitive technical references for estimating vehicle traffic for a development project. However, development projects have changed. ITE's procedures are useful for vehicle-oriented, single-land use projects. The vast majority of ITE vehicle trip data was collected for these types of sites.

ITE has found that vehicle trip generation estimates should be reduced for multi-land use projects. This is referred to as an adjustment for "internal capture" vehicle trips. These are vehicle trips that have both vehicle trip ends within a multi- or mixed- land use project, they are captured within the proposed project.

ITE has found that not all vehicle trips are new vehicle trips caused by the development being surveyed. Typical vehicle trip generation rates are derived from driveway counts. For many land uses, vehicle trips being counted are already on the road for other trip purposes and would "pass-by" the land use for other reasons even if it did not exist.

ITE advises areas with good public transportation to adjust the vehicle rates to account for reduced vehicle use. Adjustments and reductions are also made for pedestrian, bicycle and TDM programs. Care must be used to be sure the vehicle trip rate adjustments for all of these factors are not double counted.

The state of the art in traffic impact studies is evolving. Now, they are becoming referred to as "transportation" rather than "traffic" impact analyses, transcending the past emphasis on vehicle traffic toward more consideration given to accessibility and mobility for people.

Koa Ridge embodies the factors that are bringing about this change in how major multi-use projects are evaluated. Environmental movements toward sustainable development have placed emphasis on the use of alternative transportation programs. These alternative transportation programs include fully integrating public transportation, bicycle and pedestrian modes using a wide variety of cost-effective and practical approaches. Some of these approaches may be found on Oahu, more are being used in mainland cities and many more have been time-tested and extensively vetted in European cities where transportation system design excellence is commonplace.

Future development projects such as Koa Ridge Makai and Waiawa must reflect an awareness of where best transportation system design practices are to be found. Continuing European research reveals that Oahu, and developments such as Koa Ridge Makai and Waiawa, are ideal locations to plan to do what most European and other world-class international cities have already achieved. The Koa Ridge projects already reflect the fundamentals of what needs to be done. Such things as a neighborhood center no further than one-half mile from any home has tremendous implication upon creating an alternative transportation culture. The development layout will be designed to facilitate transit, walking and bicycling.

Oddly enough, European cities do not use the term Transit-Oriented Design (TOD). That is because virtually all existing urban transportation function and form in Europe is already configured and composed in a manner we attempt to emulate at a few TOD locations. The Koa Ridge Makai and Waiawa projects already reflect the required basic elements of TOD. Koa Ridge highlights neighborhood clusters connected via landscaped sidewalks and bicycle paths that, together with public transportation, will create mobility options that mean residents can leave their car at home making the Koa Ridge Makai and Waiawa projects highly competitive with any future TOD project on Oahu. Such TOD projects have been found to result in vehicle trip reduction rates that are 44% to 49% less that would otherwise be observed using unadjusted ITE vehicle trip generation rates.[4]

The success of TOD projects is rooted in fundamentals that apply to Koa Ridge Makai and Waiawa. The right kind of transportation facilities and programs, using the right kind of cross-sectional design in the right locations, will result in significant reductions on the reliance in the private vehicle. These transportation facilities and programs will be a magnet for the type of utilization these transportation features routinely obtain in Europe, but not as often in the U.S., even at our heralded TOD projects. The guiding principles for Koa Ridge Makai and Waiawa are the same most critical ones used to attain the European success: creating a walkable community with parks linked by pedestrian and bicycle paths and assuring connectivity in roadways but discouraging through traffic.

[4] TCRP Report 128; Effects of TOD on Housing, Parking, and Travel; 2008; page 4.

This section of the Koa Ridge Makai and Waiawa Project Alternative Transportation Component Report applies the guiding principles for Koa Ridge Makai and Waiawa to alternative transportation components of the projects within the context of the traditional traffic impact study methodology.

Vehicle trip generation rate calculations and adjustment factors were applied to each land use type. The most applicable unit of measurement was used for each land use – square feet of floor area, number of dwelling units or number of students. Two sets of five page tables are included in the Appendix with detailed calculations for the years 2016 and 2025. The results of these calculations is presented in Table VI.1 for 2025.

Table VI.1: SUMMARY TABLE
Koa Ridge Vehicle Trip Generation Adjustments And Reductions
By Type and Time Of Day In 2025

	VEHICLE TRIPS BY TIME PERIOD					
	Daily		AM Peak Hour		PM Peak Hour	
VEHICLE TRIP ADJUSTMENT CATEGORY	No.	%	No.	%	No.	%
Maximum External Vehicle Trips	67,247	100.00	5,125	100.00	6,557	100.00
Vehicle Trip Adjustments and Reductions:						
Internal Capture	14,331	0.21	1,416	0.28	1,563	0.24
Pass-By	3,113	0.05	75	0.01	272	0.04
Transit	5,664	0.08	398	0.08	532	0.08
Pedestrian and Bicycle	1,853	0.03	190	0.04	195	0.03
TDM	11,365	0.17	798	0.16	1,071	0.16
Total Vehicle Trip Adjustments	36,336	0.54	2,886	0.56	3,643	0.56
Estimated Vehicle Trips	30,911	0.46	2,239	0.44	2,913	0.44
Note: See Appendix of this report for detailed notes regarding sources, assumptions and calculations.						

Maximum External Vehicle Trips

The first row in Table VI.1 presents the maximum external vehicle trip calculation based upon the average ITE vehicle trip generation rates included in the ITE Trip Generation Manual, 7th edition. ITE vehicle trip generation rates are used for every land use category to be consistent with the methodologies used in the source documents for the actual vehicle trip adjustments and reductions as specified. Alternative trip generation rates are now being used in Hawaii for other projects showing much lower vehicle trips. These may be appropriate when not placing emphasis on alternative transportation modes, but this analysis gave preference to ITE sanctioned methods.

Vehicle Trip Adjustments: Internal Capture

The second row in Table VI.1 contains the vehicle trip adjustment for those trips that have both their origin and destination within the project. The larger the development project and the more balanced the mix of land uses, the more trips will be internally captured regardless of the mode used for the trip. The Koa Ridge Makai and Waiawa Project represent a very balanced mix of land uses with great consideration given to the type of land use and the placement of each land use within the project to encourage the use of alternative transportation modes.

The Commonwealth of Virginia is one of those states that has refined ITE traffic impact study methodology by promulgating rigid administrative guidelines.[5] The Virginia Department of Transportation (VDOT) allows a 15% adjustment to ITE vehicle trip generation rates for residential components of a mixed-use development. The VDOT is the source of the adjustment factor applied to only the residential components of the Koa Ridge Makai and Waiawa project.

The Florida Department of Transportation (FDOT) sponsored a study of key quantitative databases of vehicle trip characteristics at six major multi-use sites. The results of this study are included as Appendix C in the ITE Trip Generation Handbook, 2nd Edition.[6] It was determined that the internal capture rate for multi-use development averaged 36%. The FDOT evaluation published by ITE is the source for the adjustment factor applied to only the commercial components of the Koa Ridge Makai and Waiawa project.

[5] VDOT, Required Elements Of A Traffic Impact Analysis – Administrative Guidelines; July, 2008.
[6] ITE Trip Generation Handbook, 2nd Edition; June 2004; Appendix C; pages 129 to 132.

Other land use components of the project were determined to have high internal capture rates because they are land uses designed specifically to serve other land uses within the project. These include community centers, schools, churches and parks.

The overall internal capture rate for the project for all daily trips was calculated to be 21%. This rate is validated by independent research conducted for North Carolina.[7] The research was for Traditional Neighborhood Developments (TNDs), projects comparable to that envisioned for Koa Ridge Makai and Waiawa with a balanced mix of land uses and great consideration given to the use of alternative transportation modes. The best ITE land use code for a TND is a multi-use development. ITE defines multi-use developments as "typically a single real-estate project that consists of two or more ITE land use classifications between which trips can be made without using the off-site road system."

TNDs, like Koa Ridge Makai and Waiawa, are expected to encourage the use of alternative transportation modes; thereby, increasing internal trip capture rates. The study found that TND households substituted driving trips with alternative modes. The TND examined in the study internally captured 20.2% of all trips, very comparable to the 21.3% computed for this analysis using different data sources.

Vehicle Trip Adjustments: Pass-By

The third row in Table VI.1 contains the vehicle trip adjustment for those trips that are assumed to pass-by the site even if no development were to occur. This is a relatively minor vehicle trip generation adjustment, especially for morning peak hour conditions.

The Koa Ridge Makai and Waiawa Project included no pass-by vehicle trip adjustment factor with just one exception – commercial land uses to be located along Ka Uka Boulevard. The VDOT administrative guidelines allow for a 25% pass-by trip reduction for shopping centers which was applied to the big box and retail land uses along Ka Uka Boulevard. Retail land uses located within the project were not given any pass-by reduction.

[7] Traditional Neighborhood Development Trip Generation Study; Khattak et al; February 2005; page v.

Vehicle Trip Reductions: Transit

The fourth row in Table VI.1 contains the vehicle trip generation rate adjustment for those person trips that use public transportation rather than a vehicle. Table V.1 summarized six potential TheBus transit service options serving Koa Ridge Makai and Waiawa in the year 2025. Variables included various assumptions regarding bus routing, rail services and a possible H-2 Central Oahu Regional Bus Transit Station.

The Central Oahu Regional Bus Transit Station would be located in the H-2 center median between the Plantation Road bridge over H-2 and the Ka Uka Boulevard bridge over H-2. Access to the Central Oahu Regional Bus Transit Station would be by a pedestrian and bicycle only bridge over H-2 with direct, curb-separated, safely-designed and highly-functional alternative transportation pathway connections fully integrated into the Koa Ridge site plan. Such a scheme would certainly attract an extraordinary percent of person trips away from personal vehicle trips regardless of whether a rail system exists or not given the current and anticipated levels of bus service that would be available via such an endeavor. ITE 's Transportation Impact Analysis for Site Development report offers the following guidance: "...bus transit corridors can provide vehicle trip reductions in the range of 2 to 10 percent...around transit centers...can provide vehicle trip reductions in the range of 5 to 20 percent."[8] Options #5 and #6 are believed to be able to produce such a 20 percent reduction, especially in the peak hour.

Option #4 was selected for the purposes of this traffic impact analysis because it represents the most predictable transit outcome in the year 2025 given current circumstances on Oahu. Option #4 is defined by the bus routes and service characteristics presented in Table V.5. Option #4 assumes the creation of a new H-2 interchange located between the Mililani and Waipio interchanges. Option #4 assumes Routes 50 and 52 are realigned to take advantage of the new interchange to serve through Koa Ridge Makai.

The distinction between the ITE vehicle trip reduction achieved within the "transit" category and the additional ITE vehicle trip reduction achieved in the "TDM" category is that the "transit" category only seeks credit for the provision of transit service to a level comparable to most of the areas of Oahu developed before 1970. Developments on Oahu after 1970 sometimes disregarded good alternative transportation infrastructure and program design practices and were designed to be auto-oriented. The standard, unadjusted ITE rates may have been appropriate in these situations. But, Koa Ridge Makai and Waiawa in the year 2025 will benefit from improved practices with regard to the provision of transit services. This is reflected in the transit adjustments included under the "transit" category.

[8] Transportation Impact Analyses for Site Development; ITE Proposed Recommended Practice; 2005; Page 72.

ITE trip generation rates assume little or no transit service. Option #4 reflects a comparable level of transit service enjoyed by areas of Oahu where the transit mode split is over eight percent. The trip adjustment factor applied for "transit" ranged from zero to ten percent depending upon the land use consistent with the "bus transit corridors can provide vehicle trip reductions in the range of 2 to 10 percent" cited in the ITE publication.

The "TDM" agreement proposed later in this report is intended to assure the provision of these bus route services in a timely manner in conjunction with aggressive incentive programs designed to boost the shift from use of a private vehicle to alternative forms of transportation including transit beyond the ITE trip generation rate reductions used under the "transit" classification which will occur without the "TDM" ITE vehicle trip generation reductions.

Vehicle Trip Reductions: Pedestrian and Bicycle

The fifth row in Table VI.1 contains the vehicle trip generation rate adjustment for those person trips that use pedestrian and bicycle transportation rather than a vehicle. These adjustments assume high level of service pedestrian and bicycle infrastructure investments including some connection such as might be provided by the Central Oahu Regional Bus Transit Station pedestrian and bicycle bridge even if the transit component of this concept is not implemented.

Access to the Central Oahu Regional Bus Transit Station would be by a pedestrian and bicycle only bridge over H-2 with direct, curb-separated, safely-designed and highly-functional alternative transportation pathway connections fully integrated into the Koa Ridge site plan. This linkage would attract person trips away from vehicle travel regardless of whether the transit connection exists. The function of such a crossing, whether located as proposed or in some other place, is to provide a safe passage way for both recreational and more functional trip purposes.

The functional trip purposes served by a properly designed H-2 pedestrian and bicycle crossing would include work, shop or school trips between Waiawa and Koa Ridge Makai and other destinations such as the commercial establishments makai of Ka Uka Boulevard. The ITE vehicle trip reductions used might be difficult to fully justify if a safe and functional pathway doesn't exist that is carefully integrated into a meaningful regional pedestrian and bicycle network, although most ITE based methods only require a mere "accommodation" of pedestrian and bicycle movements to warrant vehicle trip generation reductions.

VDOT defines a pedestrian "accommodation" as "...sidewalks, intersection treatments and exclusive, or shared (with bicyclists) off-street trails or paths." VDOT defines a bicycle "accommodation" as "...on-street bike lanes, paved shoulders of roadways that are not part of the designated travel way for vehicles, or exclusive, and shared (with pedestrians) off-street bicycle paths."

VDOT requires that the traffic impact analysis provide both the route and segment quality of service as determined using procedures offered by one of three documents.[9] The Koa Ridge Makai and Waiawa Project will equal or exceed the "accommodation" standards set forth in such procedures with a Level of Service "A" standard.

VDOT's administrative procedures for traffic impact studies are the most recent (published July 2008) and one of the most rigorous known to comprehensively address alternative transportation components using the best documentation available from FHWA, ITE, TRB and other state DOTs. These administrative procedures allow for a 4% reduction from ITE vehicle trip generation rates when a level of service A exists for pedestrian travel. It allows for a 3% reduction from ITE vehicle trip generation rates when a level of service A exists for bicycle travel. This is an overall combined reduction of 7% for both pedestrian and bicycle modes. Table VI.1 shows an overall reduction of 3% for daily and PM peak hour vehicle trips and 4% for AM peak hour vehicle trips. This is about half of what is allowed to avoid double counting credit taken for land use classifications inherent in using a "high-rise" code and adjustments made for internal trips.

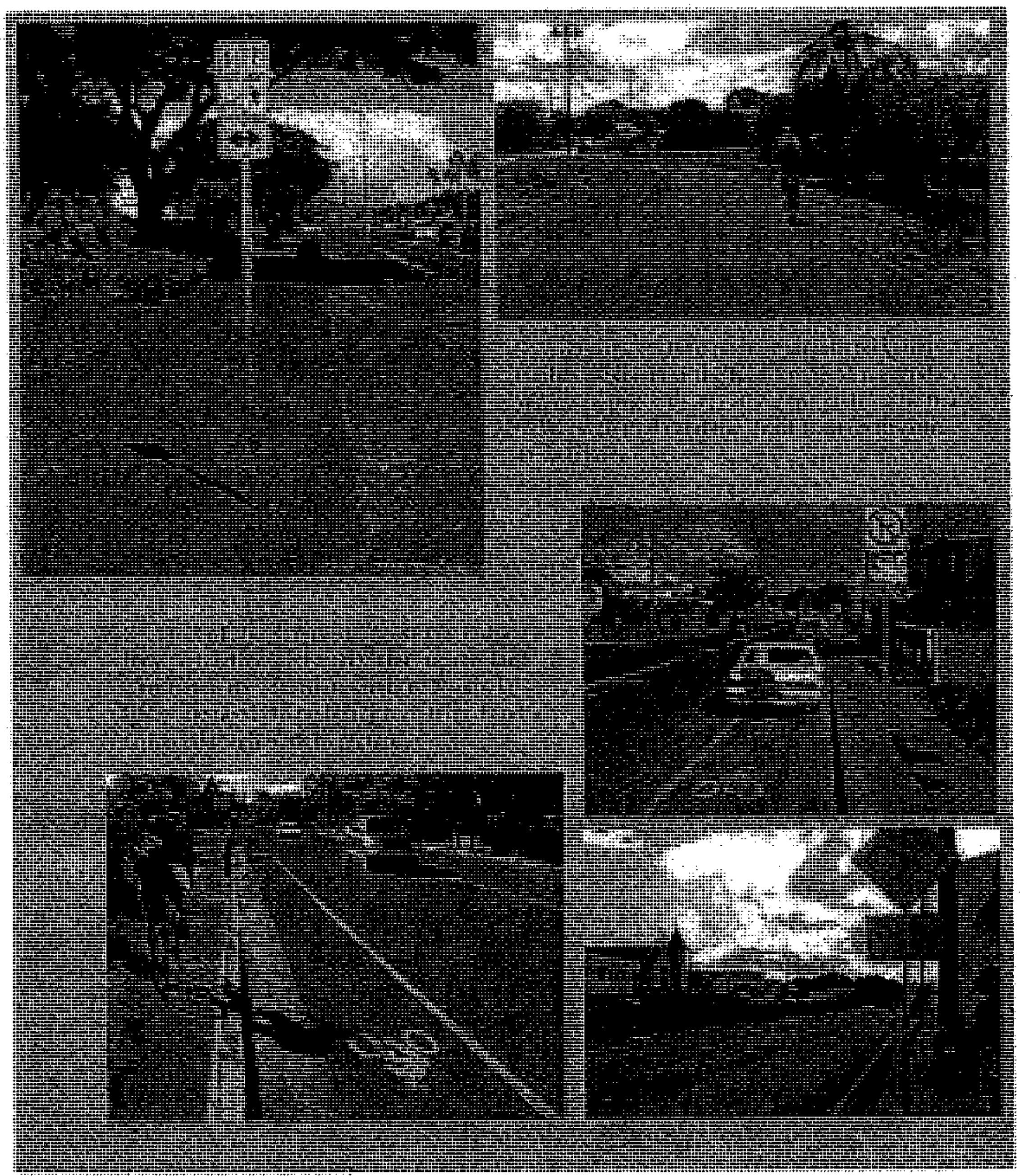
The application of the pedestrian and bicycle vehicle trip reductions took into consideration other current best practices used in other states to reflect excellence and high quality in pedestrian and bicycle infrastructure design. Research for the Florida Department of Transportation has shown existence of statistically significant factors correlating with the quality of pedestrian and bicycle network design. These include sidewalk and pathway network completeness. The California practices allow for up to a 9% reduction to ITE vehicle trip generation rates.[10]

There are both bad and good examples of pedestrian and bicycle infrastructure on Oahu as shown in Figure VI.1. The Appendix includes a section on alternative transportation component terms and definitions with emphasis on many examples of high quality pedestrian and bicycle modal accommodation. These international best practices are the types of design features envisioned for Koa Ridge Makai and Waiawa when using the vehicle trip reductions noted in this report.

[9] Note: The three documents are: 1) The Bicycle Compatibility Index: A Level of Service Concept, Implementation Manual (FHWA); 2) Bicycle and Pedestrian Level of Service Performance Measures and Standards for Congestion Management Systems; TRB 1538 (Quality/Level of Service Handbook (FDOT); and, 3) TRB Transit Capacity and Quality of Service Manual.

[10] Crediting Low-Traffic Developments, Adjusting Site-Level Vehicle Trip Generation Using URBEMIS; August 2005; page 14.

Figure VI.1: Examples Of Pedestrian and Bicycle Infrastructure On Oahu



Vehicle Trip Reductions: TDM

The sixth row in Table VI.1 contains the vehicle trip generation rate adjustment for those person trips that participate in the project TDM program rather than use a vehicle. These adjustments assume a TDM program more aggressive than any other ever proposed for Hawaii and superior to most of those found on the mainland.

The ITE Trip Generation Handbook, 2nd Edition, Appendix B, includes guidelines based on a number of documents with the following statement: "TDM programs with economic incentives to not drive alone were found to reduce the number of commuter vehicles generated by an employment site (not in number of vehicle-trips) by an average of 16 percent.[11] Table VI.1. shows that the calculation for the project for the AM and PM peak hours resulted in a 16% vehicle trip rate reduction.

The ITE Trip Generation Handbook, 2nd Edition, Appendix B, also included the following statement: "TDM programs that combine economic incentives with transportation services produce the most significant effect on commuter vehicles (not vehicle-trips) generated by a site (an average 24 percent reduction at survey sites)." Table VI.1. shows that the calculation for the project for the AM and PM peak hours resulted in a 24% vehicle trip rate reduction when transit and TDM are combined.

Other sources have found TDM programs with reductions in employee vehicle trips of up to 38%.[12] These are often the result of such TDM programs being part of a legally enforceable agreement (such as the Unilateral Agreements entered into by developers in Hawaii) that guarantees the TDM program will be implemented. Three types of TDM elements have been found to have the greatest impact on travel behavior: 1) parking pricing attains up to a 25% trip reduction with a $6.00 daily charge, 2) free transit passes attain up to 25% where good transit service is available and 3) work schedule programs including telecommuting, flextime or compressed work schedules can attain up to a 25% trip reduction. These vehicle trip adjustments have been observed from different sources and careful attention must be given to avoid double counting.

[11] Referenced documents include: NCHRP Report 323, Travel Characteristics at Large-Scale Suburban Activity Centers; TCRP Project B-4; ITE Recommended Practice Traditional Neighborhood Development Street Design Guidelines, 1999; ODOT/DLCD Transportation and Growth Management Program; and, LACMTA (Los Angeles County Metropolitan Transportation Authority), 1993.

[12] Crediting Low-Traffic Developments, Adjusting Site-Level Vehicle Trip Generation Using URBEMIS; August 2005; page 16.

ITE vehicle trip generation rates for office buildings assume multi-tenant space with typical suburban work schedule variations. These rates do not reflect trip generation that will occur if all employees worked the same schedules. However, these rates also assume little or no transit service. Again, careful understanding of the interaction of the variables available to adjust and reduce the ITE vehicle trip generation rates is essential to producing an objective and credible traffic impact analysis.

The role of TDM in this alternative transportation component report to the Koa Ridge Makai and Waiawa project is to provide a comprehensive program wherein, at a minimum, residents and employees are encouraged to use the excellent transit service provided through the additional incentive of a free transit pass for every resident and every employee.

Although a wide array of other TDM program elements are to be included in the TDM program, the reduction to ITE vehicle trip generation rates is technically only being linked to a transit pass program. Those other TDM program elements, while very worthwhile and included in the Koa Ridge Makai project, tend not to have been proven to have a significant impact on travel behavior. Such TDM program elements, many illustrated in the Appendix, include the following:

- bike sharing and rental programs
- secure and ample bicycle parking
- guaranteed ride home and taxi scrip insurance
- car club and sharing programs
- carpool and vanpool brokering services
- real time traveler information and trip planning

The detailed vehicle trip adjustment calculations used a 25% vehicle trip reduction for residential land uses based on a subsidized transit pass program provided by the developer wherein new residents use a transit pass or a comparable set of related subsidized TDM benefits (such as participation in the bike sharing program).

The detailed vehicle trip adjustment calculations used a vehicle trip reduction ranging from 0 to 25% depending upon the land use based on a subsidized transit pass program wherein new employees use a transit pass or a comparable set of related subsidized TDM benefits such participation in a vanpooling program up to the maximum value of the TDM program benefit. Employers are responsible to support the TDM program, except those with less than 25 employees.

APPENDIX A: TheBus Routes

The following are TheBus route schedules and maps for those services in proximity to Koa Ridge Makai and Waiawa:

Route 52 Schedule -- 6 pages

Route 62 Schedule -- 6 pages

Route 83 Schedule -- 1 page

Route 83A Schedule -- 1 page

Route 84 Schedule -- 1 page

Route 84A Schedule -- 1 page

Route 96 Schedule -- 1 page

Route 98 Schedule -- 1 page

Route 433 Schedule -- 1 page

Route 52 Map -- 1 page

Route 62 Map -- 1 page

Route 433 Map -- 1 page

Route 83, 83A, 84, 84A, 96 and 98 Map -- 1 page

Route 5[illegible] - Wahiawa Circle Isle / Route 55 - Kaneohe Circle Isle / 88A - North Shore Express

Effective [illegible]/08

Weekday: Westbound: Via H-1/H-2 to Mililani/Wahiawa/North Shore/Kaneohe/Honolulu

O Ala Moana Center Kona St	M Downtown Alapai/Hotel	N Downtown Beretania/Punchbowl	I Downtown King/Beretania	H Kalihi Kam Hwy/Middle	G Mililani Park & Ride	F Mililani Transit Center	E Mililani Kam Hwy/Kuahelani	D Wahiawa California/Cane	C Haleiwa Beach Park	B Pupukea Beach Park	A Turtle Bay Resort	V Laie/Polynesian Cultural Center	U Hauula Elementary School	T Kaaawa Beach Park	S Kahaluu Kam/Kahekili	R Kaneohe Kam/Heeia	P Kaneohe Kam/Ukelike	J Downtown Bishop/Hotel	O Ala Moana Center Kona St
88A EXPRESS							● 415a	417a	434a	442a	459a	513a	519a	533a	547a	EXPRESS		618a	631a
88A EXPRESS					❤ 408a via Kam Hwy		427a	434a	451a	459a	516a	530a	536a	550a	603a	EXPRESS		634a	647a
					❤ 438a via Kam Hwy		454a	505a	525a	533a	548a	602a	607a	622a	637a	649a	702a	732a	747a
.....	.....	.....	.....	.....	❤ 503a via Kam Hwy		519a	530a	550a	558a	621a	635a	640a	655a	710a	722a	735a	805a	820a
.....	.....	.....	.....	.....	.....	.....	● 606a	608a	628a	638a	655a	710a	717a	732a	747a	758a	810a	835a	848a
.....	.....	.....	.....	.....	617a	622a	626a	637a	657a	705a	732a	748a	755a	809a	824a	834a	846a	911a	924a
								709a	733a	741a	810a	827a	834a	847a	901a	910a	922a	947a	1000a
630a	642a	644a	650a	659a	719a	724a	728a	739a	803a	811a	845a	902a	909a	922a	936a	945a	957a	1022a	1035a
700a	712a	714a	720a	729a	749a	754a	758a	809a	833a	841a	920a	937a	944a	957a	1011a	1020a	1032a	1057a	1110a
735a	747a	749a	755a	804a	824a	829a	833a	844a	908a	916a	955a	1012a	1019a	1032a	1046a	1055a	1107a	1132a	1145a
810a	822a	824a	830a	839a	859a	904a	908a	919a	943a	951a	1025a	1042a	1049a	1102a	1116a	1125a	1137a	1202p	1215p
845a	857a	859a	905a	914a	934a	939a	943a	954a	1020a	1030a	1100a	1117a	1124a	1137a	1151a	1200p	1212p	1237p	1250p
916a	928a	930a	936a	946a	1005a	1010a	1014a	1025a	1051a	1101a	1130a	1147a	1154a	1207p	1221p	1230p	1242p	107p	120p
951a	1003a	1005a	1011a	1020a	1040a	1045a	1049a	1100a	1126a	1136a	1205p	1222p	1229p	1242p	1256p	105p	117p	142p	155p
1021a	1033a	1035a	1041a	1050a	1110a	1115a	1119a	1130a	1156a	1206p	1235p	1252p	1259p	112p	126p	135p	147p	212p	235p
1054a	1106a	1108a	1114a	1125a	1145a	1150a	1154a	1205p	1231p	1241p	110p	127p	134p	147p	201p	209p	221p	245p	308p
.....	.....	.....	.....	.....	.....	.....	.....	Wednesday school days only -			✖ 135p	144p	151p	204p	218p	.....	.....	.....	.....
1123a	1135a	1138a	1144a	1155a	1215p	1220p	1224p	1235p	101p	111p	140p	157p	204p	217p	231p	239p	251p	315p	338p
.....	.....	.....	.....	.....	.....	.....	.....	Mon-Tues-Thur-Fri school days only -			✖ 225p	237p	244p	257p	311p	.....	.....	.....	.....
1158a	1210p	1213p	1219p	1230p	1250p	1255p	1259p	110p	136p	146p	220p	240p	247p	300p	314p	322p	334p	358p	421p
1228p	1240p	1243p	1249p	100p	120p	125p	129p	140p	204p	214p	245p	305p	312p	325p	339p	347p	359p	423p	447p
1258p	110p	113p	119p	130p	150p	156p	202p	216p	240p	250p	320p	339p	346p	401p	415p	423p	435p	459p	519p
129p	141p	144p	151p	202p	222p	228p	234p	248p	312p	322p	359p	418p	425p	440p	454p	502p	514p	538p	558p
213p	226p	229p	237p	248p	308p	314p	320p	334p	359p	409p	430p	448p	455p	508p	521p	529p	541p	604p	622p
239p	252p	255p	303p	314p	341p	347p	353p	407p	432p	442p	505p	523p	532p	544p	557p	604p	613p	634p	652p
301p	314p	317p	325p	338p	407p	413p	419p	433p	458p	507p	535p	553p	602p	614p	626p	633p	642p	703p	721p
332p	345p	348p	356p	409p	438p	444p	450p	504p	529p	538p	605p	618p	625p	637p	649p	656p	705p	726p	744p
410p	423p	426p	434p	447p	516p	522p	528p	542p	605p	614p	635p	648p	655p	707p	719p	726p	735p	756p	814p
436p	449p	452p	500p	513p	542p	548p	552p	606p	629p	638p	705p	718p	725p	737p	749p	756p	805p	826p	844p
515p	528p	531p	539p	552p	619p	624p	628p	639p	659p	708p	740p	753p	800p	812p	824p	831p	840p	901p	919p
615p	627p	629p	635p	647p	707p	712p	716p	727p	747p	756p	820p	833p	840p	852p	904p	911p	920p	941p	959p
715p	727p	729p	735p	746p	806p	811p	814p	824p	844p	853p	915p	928p	935p	947p	959p	1006p	1015p	1036p	1054p
815p	826p	828p	833p	843p	903p	908p	911p	921p	941p	950p	1010p	1023p	1030p	1042p	1054p	1101p	1110p	1131p	1149p

Route 52 & 55 Circle Isle Destination Signs:

Westbound: To Circle Isle via Mililani & Wahiawa - 52 MILILANI WAHIAWA CIRCLE ISLE

To Ala Moana Center - 55 HONOLULU ALA MOANA

To Bishop/King or Alakea/King - 55 DOWNTOWN BISHOP ST

Eastbound: To Circle Isle via Pali Hwy - 55 KANEOHE CIRCLE ISLE

To Ala Moana Center - 52 or 62 HONOLULU VIA PEARLRIDGE (see note)

To Kam/Honomanu - 52 or 62 PEARLRIDGE (see note)

To Alapai Street - 52 or 62 ALAPAI ST (see note)

(Note: Several p.m. buses leaving Wahiawa will continue along Kamehameha Hwy to Pearlridge, Alapai Street or Ala Moana. In Wahiawa, buses will change their signs to read either 62 PEARLRIDGE, 62 ALAPAI ST OR 62 HONOLULU ALA MOANA.)

Route 88A Destination Signs:

AM: From Kam/Honomanu & Kam/Avocado - 52 WAHIAWA CIRCLE ISLE

From Turtle Bay Resort - 88A EXPRESS DOWNTOWN VIA KAHEKILI

From Pali/Vineyard - 55 HONOLULU ALA MOANA

PM: From Ala Moana Center - 88A EXPRESS NORTH SHORE VIA KAHEKILI

From Kam/Kahekili - 55 KANEOHE CIRCLE ISLE

From Turtle Bay Resort - 52 ALAPAI ST or 52 PEARLRIDGE

**NOTE: Route 88A will also run on State Holidays

Bold indicates PM service.

Schedule to change without notice.

All buses are lift and bicycle rack equipped.

Route 52/55 Symbols

❤ - Starts/ends at Kamehameha Hwy/Honomanu

● - Starts at Kamehameha Hwy/Avocado

✖ - Starts at Kamehameha/Pualalea Road

Route 52 - Wahiawa Circle Isle / Route 55 - Kaneohe Circle Isle / 88A - North Shore Express

Effective [illegible]/24/08

Weekd[illegible] Eastbound: Via Pali Hwy/Kam Hwy to Kaneohe/North Shore/Wahia[illegible] Mililani/Honolulu

	O Ala Moana Center Kona St	K Downtown Alakea/Hotel	P Kaneohe Kam Hwy/Likelike	Q Kaneohe Kam Hwy/Haiku	S Kahaluu Kam Hwy/Kahekili	T Kaaawa Beach Park	U Hauula Elementary School	V Laie/Polynesian Cultural Center	A Turtle Bay Resort	B Pupukea Beach Park	C Haleiwa Beach Park	D Wahiawa California/Cane	E Mililani Kam Hwy/Kuahelani	F Mililani Transit Center	G Mililani Park & Ride	H Kalihi Kam Hwy/Middle	I Downtown King/Beretania	L Downtown Kapiolani/South	O Ala Moana Center Kona St
									430a	439a	447a	507a	518a	521a	525a	544a	553a	600a	605a
			408a	414a	425a	438a	451a	455a	510a	519a	527a	551a	602a	606a	610a	630a	640a	650a	657a
			453a	459a	510a	523a	536a	540a	555a	608a	616a	638a	649a	653a	657a	723a	739a	749a	759a
	.....	.....	518a	524a	535a	548a	601a	605a	625a	638a	646a	708a	719a	723a	730a	751a	807a	818a	828a
	.....	▲ 510a	532a	538a	549a	603a	617a	622a	645a	658a	706a	728a	739a	743a	748a	809a	825a	836a	846a
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	750a	806a	810a	814a	833a	849a	900a	.....
		▲ 545a	607a	613a	624a	638a	652a	657a	725a	738a	746a	811a	824a	828a	832a	851a	907a	918a	928a
	555a	608a	631a	638a	650a	705a	720a	725a	800a	813a	822a	849a	900a	904a	908a	927a	943a	954a	1004a
	625a	638a	701a	708a	721a	736a	751a	756a	830a	844a	853a	920a	931a	935a	939a	958a	1014a	1025a	1035a
	655a	708a	731a	739a	752a	807a	820a	827a	905a	919a	928a	955a	1006a	1010a	1014a	1033a	1049a	1100a	1110a
	725a	740a	805a	813a	825a	838a	851a	858a	935a	949a	958a	1025a	1036a	1040a	1044a	1103a	1119a	1130a	1140a
	805a	820a	845a	853a	905a	918a	931a	938a	1010a	1024a	1033a	1100a	1111a	1115a	1119a	1138a	1154a	**1205p**	**1215p**
	840a	855a	920a	928a	940a	953a	1006a	1013a	1040a	1054a	1103a	1130a	1141a	1145a	1149a	**1208p**	**1220p**	**1231p**	**1241p**
	915a	930a	955a	1003a	1015a	1028a	1041a	1048a	1115a	1129a	1138a	**1205p**	**1216p**	**1220p**	**1224p**	**1243p**	**1255p**	**106p**	**116p**
	945a	1000a	1025a	1033a	1045a	1058a	1111a	1118a	1145a	1159a	**1209p**	**1236p**	**1247p**	**1251p**	**1255p**	**114p**	**126p**	**137p**	**147p**
	1020a	1035a	1100a	1108a	1120a	1133a	1146a	1153a	**1220p**	**1234p**	**1244p**	**111p**	**122p**	**126p**	**130p**	**149p**	**201p**	**213p**	**223p**
	1050a	1105a	1130a	1138a	1150a	**1203p**	**1216p**	**1223p**	**1250p**	**104p**	**114p**	**141p**	**152p**	**156p**	**200p**	**219p**	**231p**	**243p**	**253p**
	1125a	1140a	**1205p**	**1213p**	**1225p**	**1238p**	**1251p**	**1258p**	**125p**	**139p**	**149p**	**216p**	**227p**	**231p**	**235p**	**254p**	**306p**	**318p**	**328p**
	1155a	**1210p**	**1235p**	**1243p**	**1255p**	**108p**	**121p**	**128p**	**155p**	**210p**	**220p**	**247p**	**258p**	**302p**	**306p**	**325p**	**337p**	**349p**	**359p**
	1230p	**1245p**	**110p**	**118p**	**130p**	**143p**	**156p**	**203p**	**230p**	**245p**	**255p**	**322p**	**333p**	**337p**	**341p**	**400p**	**412p**	**424p**	**434p**
	100p	**115p**	**140p**	**148p**	**200p**	**213p**	**226p**	**233p**	**300p**	**315p**	**325p**	**352p**	**403p**	**407p**	**411p**	**430p**	**442p**	**454p**	**504p**
	135p	**150p**	**215p**	**223p**	**235p**	**248p**	**301p**	**308p**	**335p**	**350p**	**400p**	**427p**	**438p**	**442p**	**446p**	**505p**	**517p**	**529p**	**539p**
	203p	**218p**	**243p**	**251p**	**303p**	**315p**	**328p**	**334p**	**410p**	**425p**	**435p**	**502p**	**513p**	**517p**	**521p**	**540p**	**548p**	**600p**	**610p**
	230p	**245p**	**310p**	**318p**	**330p**	**344p**	**358p**	**404p**	**440p**	**455p**	**505p**	**531p**	**542p**	**546p**	**550p**	**609p**	**617p**	**627p**	**637p**
	308p	**325p**	**350p**	**358p**	**411p**	**425p**	**439p**	**445p**	**510p**	**525p**	**535p**	**601p**	**612p**	**616p**	**620p**	**639p**	**647p**	**657p**	**705p**
	338p	**355p**	**420p**	**428p**	**441p**	**455p**	**508p**	**514p**	**545p**	**600p**	**610p**	**635p**	**646p**	**650p**	**654p**	**712p**	**719p**	**726p**	**733p**
**88A	**415p**	**435p**	EXPRESS	.....	**513p**	**526p**	**543p**	**548p**	**605p**	**618p**	**628p**	**652p**	**701p**	.....	Kam Hwy	**737p**	**743p**	■ **748p**	.....
	447p	**505p**	**530p**	**538p**	**551p**	**605p**	**618p**	**624p**	**652p**	**705p**	**714p**	**734p**	**745p**	**749p**	**753p**	**811p**	**818p**	**825p**	**832p**
**88A	**500p**	**530p**	EXPRESS	.....	**608p**	**621p**	**635p**	**643p**	**702p**	**721p**	**732p**	**752p**	**800p**	.....	Kam Hwy	❤ **821p**	.....	.....	.....
	540p	**601p**	**626p**	**632p**	**645p**	**657p**	**710p**	**715p**	**745p**	**758p**	**807p**	**827p**	**838p**	.....	Kam Hwy	**910p**	**917p**	**924p**	**931p**
	635p	**654p**	**717p**	**723p**	**735p**	**747p**	**800p**	**805p**	**825p**	**838p**	**847p**	**907p**	**918p**		Kam Hwy	**950p**	**957p**	**1004p**	**101p**
	750p	**808p**	**831p**	**837p**	**849p**	**901p**	**914p**	**919p**	**945p**	**958p**	**1007p**	**1027p**	**1038p**		Kam Hwy	**1110p**	**117p**	■ **1124p**	.....
	900p	**918p**	**941p**	**947p**	**959p**	**1011p**	**1024p**	**1029p**	**1050p**	**1103p**	**1112p**	**1132p**	**1143p**		Kam Hwy	1215a	1222a	■ **1229p**	
	1015p	**1033p**	**1056p**	**1102p**	**1114p**	**1126p**	**1139p**	**1144p**	1212a	1225a	1234a	1254a	105a	.....	Kam Hwy	▼ 117a	.....	.....	.....

Route 52 & 55 Circle Isle Destination Signs:

Westbound: To Circle Isle via Mililani & Wahiawa - 52 MILILANI WAHIAWA CIRCLE ISLE

To Ala Moana Center - 55 HONOLULU ALA MOANA

To Bishop/King or Alakea/King - 55 DOWNTOWN BISHOP ST

Eastbound: To Circle Isle via Pali Hwy - 55 KANEOHE CIRCLE ISLE

To Ala Moana Center - 52 or 62 HONOLULU VIA PEARLRIDGE (see note)

To Kam/Honomanu - 52 or 62 PEARLRIDGE (see note)

To Alapai Street - 52 or 62 ALAPAI ST (see note)

(Note: Several p.m. buses leaving Wahiawa will continue along Kamehameha Hwy to Pearlridge, Alapai Street or Ala Moana. In Wahiawa, buses will change their signs to read either 62 PEARLRIDGE, 62 ALAPAI ST OR 62 HONOLULU ALA MOANA.)

Route 88A Destination Signs:

AM: From Kam/Honomanu & Kam/Avocado - 52 WAHIAWA CIRCLE ISLE

From Turtle Bay Resort - 88A EXPRESS DOWNTOWN VIA KAHEKILI

From Pali/Vineyard - 55 HONOLULU ALA MOANA

PM: From Ala Moana Center - 88A EXPRESS NORTH SHORE VIA KAHEKILI

From Kam/Kahekili - 55 KANEOHE CIRCLE ISLE

From Turtle Bay Resort - 52 ALAPAI ST or 52 PEARLRIDGE

**NOTE: Route 88A will also run on State Holidays

Bold indicates PM service.

Schedule to change without notice.

All buses are lift and bicycle rack equipped.

Route 52/55 Symbols

▲ - Starts at Alakea/Queen 1 minute earlier

■ - Ends at Alapai St

❤ - Starts/ends at Kamehameha Hwy/Honomanu

Route 52 - Wahiawa Circle Isle / Route 55 - Kaneohe Circle Isle / 88A - North Shore Express

Effective [illegible]24/08

Saturday/State Holiday: Westbound: Via H-1/H-2 to Mililani/Wahiawa/North Shore/Kaneohe/Honolulu

O Ala Moana Center Kona St	M Downtown Alapai/Hotel	N Downtown Beretania/Punchbowl	I Downtown King/Beretania	H Kalihi Kam Hwy/Middle	G Mililani Park & Ride	F Mililani Transit Center	E Mililani Kam Hwy/Kuahelani	D Wahiawa California/Cane	C Haleiwa Beach Park	B Pupukea Beach Park	A Turtle Bay Resort	V Laie/Polynesian Cultural Center	U Hauula Elementary School	T Kaaawa Beach Park	S Kahaluu Kam/Kahekili	R Kaneohe Kam/Heeia	P Kaneohe Kam/Ulelike	J Downtown Bishop/Hotel	O Ala Moana Center Kona St
**88A							★ ● 415a	★ 417a	★ 434a	★ 442a	★ 459a	★ 513a	★ 519a	★ 533a	★ 547a	EXPRESS		★ 618a	★ 631a
**88A					★ ❤ 408a via Kam Hwy		★ 427a	★ 434a	★ 451a	★ 459a	★ 516a	★ 530a	★ 536a	★ 550a	★ 603a	EXPRESS		★ 634a	★ 647a
					★ ❤ 430a via Kam Hwy		★ 455a	★ 505a	★ 525a	★ 534a	★ 550a	★ 605a	★ 610a	★ 622a	★ 635a	★ 643a	★ 652a	★ 714a	★ 733a
.....	.....	.....	.....		❤ 500a via Kam Hwy		525a	535a	555a	604a	625a	640a	645a	657a	710a	718a	728a	751a	810a
.....	.....	.....	.....	.....	.....	.....	● 607a	609a	629a	638a	700a	715a	720a	733a	746a	754a	805a	828a	847a
.....	.....	.....	.....	.....	.....	.....	.....	631a	651a	700a	730a	745a	750a	803a	816a	824a	836a	859a	918a
.....	.....						● 707a	709a	729a	738a	801a	817a	822a	835a	848a	856a	908a	931a	950a
635a	645a	647a	652a	702a	722a	726a	729a	740a	800a	809a	834a	850a	855a	908a	921a	929a	941a	1004a	1023a
700a	710a	712a	718a	729a	749a	753a	756a	807a	827a	836a	906a	922a	928a	941a	954a	1002a	1014a	1037a	1056a
730a	740a	742a	748a	759a	819a	823a	826a	837a	857a	906a	939a	955a	1001a	1014a	1027a	1035a	1047a	1110a	1129a
803a	813a	815a	821a	832a	852a	856a	859a	910a	934a	943a	1012a	1028a	1034a	1047a	1100a	1108a	1120a	1143a	1202p
834a	844a	846a	852a	903a	923a	928a	932a	943a	1007a	1017a	1045a	1101a	1107a	1120a	1133a	1141a	1153a	1216p	1235p
904a	917a	919a	925a	936a	956a	1001a	1005a	1016a	1040a	1050a	1118a	1134a	1140a	1153a	1206p	1214p	1226p	1249p	108p
937a	950a	952a	958a	1009a	1029a	1034a	1038a	1049a	1113a	1123a	1151a	1207p	1213p	1226p	1239p	1247p	1259p	122p	141p
1006a	1020a	1023a	1030a	1041a	1101a	1106a	1110a	1122a	1146a	1156a	1224p	1240p	1246p	1259p	112p	120p	132p	155p	214p
1037a	1051a	1054a	1101a	1112a	1132a	1138a	1143a	1155a	1219p	1229p	1257p	113p	119p	132p	145p	153p	205p	228p	247p
1110a	1124a	1127a	1134a	1145a	1205p	1211p	1216p	1228p	1252p	102p	130p	146p	152p	205p	218p	226p	238p	301p	320p
1143a	1157a	1200p	1207p	1218p	1238p	1244p	1249p	101p	125p	139p	203p	219p	225p	238p	251p	259p	311p	334p	353p
1216p	1230p	1233p	1240p	1251p	111p	117p	122p	134p	158p	212p	236p	252p	258p	311p	324p	332p	344p	407p	426p
1249p	103p	106p	113p	124p	144p	150p	155p	207p	231p	245p	309p	325p	331p	344p	357p	405p	417p	440p	459p
120p	137p	139p	146p	157p	217p	223p	228p	240p	304p	318p	342p	358p	404p	417p	430p	438p	450p	513p	532p
153p	210p	212p	219p	230p	250p	256p	301p	313p	337p	351p	415p	431p	437p	450p	503p	511p	523p	546p	605p
226p	243p	245p	252p	303p	323p	329p	334p	346p	410p	424p	448p	504p	510p	523p	536p	544p	556p	617p	636p
257p	314p	316p	323p	334p	356p	402p	407p	419p	443p	457p	522p	538p	544p	557p	610p	618p	627p	✚ 647p	.....
327p	344p	346p	353p	404p	429p	435p	440p	452p	516p	524p	558p	613p	618p	630p	643p	651p	700p	720p	739p
403p	420p	422p	429p	440p	504p	510p	515p	525p	549p	557p	631p	646p	651p	703p	716p	724p	733p	✚ 753p	.....
442p	457p	459p	506p	517p	537p	543p	548p	558p	620p	628p	705p	720p	725p	737p	750p	758p	807p	827p	846p
520p	532p	534p	541p	552p	612p	617p	621p	631p	653p	701a	735p	750p	755p	807p	820p	828p	837p	857p	910p
610p	622p	624p	631p	639p	659p	704p	708p	718p	740p	748a	805p	820p	825p	837p	850p	858p	907p	927p	939p
710p	722p	724p	731p	739p	759p	804p	808p	818p	840p	848p	905p	920p	925p	937p	950p	958p	1007p	1027p	1039p
810p	822p	824p	831p	839p	859p	904p	908p	918p	940p	948a	1000p	1015p	1020p	1032p	1045p	1053p	1102p	1122p	1134p

Route 52 & 55 Circle Isle Destination Signs:

Westbound: To Circle Isle via Mililani & Wahiawa - 52 MILILANI WAHIAWA CIRCLE ISLE
To Ala Moana Center - 55 HONOLULU ALA MOANA
To Bishop/King or Alakea/King - 55 DOWNTOWN BISHOP ST
Eastbound: To Circle Isle via Pali Hwy - 55 KANEOHE CIRCLE ISLE
To Ala Moana Center - 52 or 62 HONOLULU VIA PEARLRIDGE (see note)
To Kam/Honomanu - 52 or 62 PEARLRIDGE (see note)
To Alapai Street - 52 or 62 ALAPAI ST (see note)
(Note: Several p.m. buses leaving Wahiawa will continue along Kamehameha Hwy to Pearlridge, Alapai Street or Ala Moana. In Wahiawa, buses will change their signs to read either 62 PEARLRIDGE, 62 ALAPAI ST OR 62 HONOLULU ALA MOANA.)

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 88A Destination Signs:

AM: From Kam/Honomanu & Kam/Avocado -
52 WAHIAWA CIRCLE ISLE
From Turtle Bay Resort -
88A EXPRESS DOWNTOWN VIA KAHEKILI
From Pali/Vineyard -
55 HONOLULU ALA MOANA
PM: From Ala Moana Center -
88A EXPRESS NORTH SHORE VIA KAHEKILI
From Kam/Kahekili - 55 KANEOHE CIRCLE ISLE
From Turtle Bay Resort - 52 ALAPAI ST or 52 PEARLRIDGE
**NOTE: Route 88A will also run on State Holidays

◆ - Ends at Kamehameha Hwy/Pali Momi

Route 52/55 Symbols

- ▲ - Starts at Alakea/Queen 1 minute earlier
- ✚ - Ends at Bishop/King 1 minute later
- ■ - Ends at Alapai St
- ✓ - Starts at Beretania/Punchbowl
- ❤ - Starts/ends at Kamehameha Hwy/Honomanu
- ● - Starts at Kamehameha Hwy/Avocado
- ✖ - Starts at Kamehameha/Pualalea Road
- ◆ - School holiday operation only
- ★ - State holiday operation only
- ○ - Saturday operation only: Does not run on State holidays
- □ - Does not service bus stop fronting Windward City Shopping Center

Route 52 - Wahiawa Circle Isle / Route 55 - Kaneohe Circle Isle / 88A - North Shore Express

Effecti… 24/08

Saturday/State Holiday: Eastbound: Via Pali Hwy/Kam Hwy to Kaneohe/North Shore/Wahiawa/Mililani/Honolulu

U Ala Moana Center Kona St	K Downtown Alakea/Hotel	P Kaneohe Kam Hwy/Likelike	Q Kaneohe Kam Hwy/Haiku	S Kahaluu Kam Hwy/Kahekili	T Kaaawa Beach Park	U Hauula Elementary School	V Laie/Polynesian Cultural Center	A Turtle Bay Resort	B Pupukea Beach Park	C Haleiwa Beach Park	D Wahiawa California/Cane	E Mililani Kam Hwy/Kuahelani	F Mililani Transit Center	G Mililani Park & Ride	H Kalihi Kam Hwy/Middle	I Downtown King/Beretania	L Downtown Kapiolani/South	O Ala Moana Center Kona St
								★428a	★441a	★450a	★513a	★520a	★527a	★533a	★552a	★602a	★607a	★613a
		□★405a	★410a	★422a	★436a	★449a	★455a	★510a	★523a	★532a	★555a	★605a	★609a	★615a	★634a	★644a	★649a	★655a
		□445a	450a	502a	516a	529a	535a	555a	608a	617a	640a	650a	654a	700a	719a	729a	737a	743a
.....	.....	□★510a	★515a	★527a	★541a	★554a	★600a	★625a	★638a	★647a	★710a	★721a	★725a	★731a	★750a	★800a	★808a	★814a
.....	▲510a	531a	536a	548a	602a	615a	621a	650a	703a	712a	735a	746a	750a	756a	815a	825a	833a	839a
.....	▲545a	606a	611a	623a	637a	650a	656a	720a	733a	742a	805a	816a	820a	826a	845a	855a	906a	914a
555a	608a	629a	634a	646a	700a	713a	719a	747a	800a	809a	832a	843a	847a	853a	912a	924a	935a	943a
620a	633a	654a	659a	711a	725a	738a	744a	820a	833a	842a	905a	916a	920a	926a	945a	957a	1008a	1016a
650a	703a	724a	729a	741a	755a	808a	814a	850a	906a	915a	938a	949a	953a	959a	1018a	1030a	1041a	1049a
720a	733a	754a	759a	811a	825a	838a	844a	922a	938a	947a	1011a	1022a	1026a	1032a	1051a	1103a	1114a	1122a
750a	804a	825a	832a	844a	858a	911a	917a	950a	1006a	1018a	1044a	1055a	1059a	1105a	1124a	1136a	1147a	1155a
821a	837a	858a	905a	917a	931a	944a	950a	1023a	1039a	1051a	1117a	1128a	1132a	1138a	1157a	1209p	1220p	1228p
852a	908a	931a	938a	950a	1004a	1017a	1023a	1056a	1112a	1124a	1150a	1203p	1207p	1213p	1232p	1244p	1255p	103p
925a	941a	1004a	1011a	1023a	1037a	1050a	1056a	1129a	1145a	1157a	1223p	1236p	1240p	1246p	105p	117p	128p	136p
958a	1014a	1037a	1044a	1056a	1110a	1123a	1129a	1202p	1218p	1230p	1256p	109p	113p	119p	138p	150p	201p	209p
1031a	1047a	1110a	1117a	1129a	1143a	1156a	1202p	1235p	1251p	103p	129p	142p	146p	152p	211p	223p	234p	242p
1104a	1120a	1143a	1150a	1202p	1216p	1229p	1235p	108p	124p	136p	202p	215p	219p	225p	244p	256p	307p	315p
1137a	1153a	1216p	1223p	1235p	1249p	102p	108p	141p	157p	209p	235p	248p	252p	258p	317p	329p	337p	345p
1210p	1226p	1249p	1256p	108p	122p	135p	141p	214p	230p	242p	308p	321p	325p	331p	356p	407p	415p	423p
1243p	1259p	122p	129p	141p	155p	208p	214p	247p	303p	315p	341p	354p	358p	404p	429p	440p	448p	456p
116p	132p	155p	202p	214p	228p	241p	247p	320p	336p	348p	414p	425p	429p	435p	454p	505p	513p	521p
149p	205p	228p	235p	247p	301p	314p	320p	353p	409p	421p	447p	458p	502p	508p	527p	538p	■546p	.....
216p	238p	301p	308p	320p	334p	347p	353p	426p	442p	454p	520p	531p	535p	541p	600p	609p	■617p	.....
249p	311p	334p	341p	353p	407p	420p	426p	459p	515p	527p	553p	604p	608p	614p	633p	642p	■650p	.....
322p	344p	407p	414p	426p	440p	453p	459p	535p	551p	603p	626p	637p	641p	647p	706p	715p	722p	729p
355p	417p	440p	447p	459p	513p	526p	532p	610p	626p	638p	701p	712p	716p	722p	741p	750p	757p	804p
★415p	★435p	EXPRESS	.....	★513p	★526p	★543p	★548p	★605p	★618p	★628p	★652p	★701p	.....	Kam Hwy	★737p	★743p	■748p	.....
428p	450p	513p	520p	532p	546p	559p	605p	645p	701p	713p	731p	742p	.....	Kam Hwy	❖806p	.....	.....	.....
★500p	★530p	EXPRESS	.....	★608p	★621p	★635p	★643p	★702p	★721p	★732p	★752p	★800p	.....	Kam Hwy	★❤821p	.....	.....	.....
525p	547p	609p	616p	628p	642p	655p	701p	720p	734p	746p	804p	813p	.....	Kam Hwy	844p	853a	900p	907p
635p	649p	710p	717p	729p	743p	756p	802p	825p	839p	847p	905p	914p	.....	Kam Hwy	945p	954p	1001p	1008p
745p	759p	820p	827p	839p	853p	906p	912p	930p	944p	952p	1010p	1019p	.....	Kam Hwy	1047p	1056p	■1103p	.....
900p	914p	935p	942p	954p	1008p	1021p	1027p	1045p	1059p	1107p	1125p	1134p	.....	Kam Hwy	1202a	1211a	■1218a	.....
1010p	1024p	1045p	1052p	1104p	1118p	1131p	1137p	1155p	1209a	1217a	1235a	1244a	.....	Kam Hwy	112a	121a	■128a	.....

Route 52 & 55 Circle Isle Destination Signs:

Westbound: To Circle Isle via Mililani & Wahiawa - 52 MILILANI WAHIAWA CIRCLE ISLE

To Ala Moana Center - 55 HONOLULU ALA MOANA

To Bishop/King or Alakea/King - 55 DOWNTOWN BISHOP ST

Eastbound: To Circle Isle via Pali Hwy - 55 KANEOHE CIRCLE ISLE

To Ala Moana Center - 52 or 62 HONOLULU VIA PEARLRIDGE (see note)

To Kam/Honomanu - 52 or 62 PEARLRIDGE (see note)

To Alapai Street - 52 or 62 ALAPAI ST (see note)

(Note: Several p.m. buses leaving Wahiawa will continue along Kamehameha Hwy to Pearlridge, Alapai Street or Ala Moana. In Wahiawa, buses will change their signs to read either 62 PEARLRIDGE, 62 ALAPAI ST OR 62 HONOLULU ALA MOANA.)

Route 88A Destination Signs:

AM: From Kam/Honomanu & Kam/Avocado -

52 WAHIAWA CIRCLE ISLE

From Turtle Bay Resort -

88A EXPRESS DOWNTOWN VIA KAHEKILI

From Pali/Vineyard -

55 HONOLULU ALA MOANA

PM: From Ala Moana Center -

88A EXPRESS NORTH SHORE VIA KAHEKILI

From Kam/Kahekili - 55 KANEOHE CIRCLE ISLE

From Turtle Bay Resort - 52 ALAPAI ST or 52 PEARLRIDGE

**NOTE: Route 88A will also run on State Holidays

Route 52/55 Symbols

▲ - Starts at Alakea/Queen 1 minute earlier

■ - Ends at Alapai St

★ - State holiday operation only

□ - Does not service bus stop fronting Windward City Shopping Center

❖ - Ends at Kamehameha Hwy/Pali Momi

Bold indicates PM service.

Schedule to change without notice.

All buses are lift and bicycle rack equipped.

Route 52 - Wahiawa Circle Isle / Route 55 - Kaneohe Circle Isle / 88A - North Shore Express

Effective 8/24/08

Sunday: Westbound: Via H-1/H-2 to Mililani/Wahiawa/North Shore/Kaneohe/Honolulu

Ala Moana Center Kona St (O)	Downtown Alapai/Hotel (M)	Downtown Beretania/Punchbowl (N)	Downtown King/Beretania (I)	Kalihi Kam Hwy/Middle (H)	Mililani Park & Ride (G)	Mililani Transit Center (F)	Mililani Kam Hwy/Kuahelani (E)	Wahiawa California/Cane (D)	Haleiwa Beach Park (C)	Pupukea Beach Park (B)	Turtle Bay Resort (A)	Laie/Polynesian Cultural Center (V)	Hauula Elementary School (U)	Kaaawa Beach Park (T)	Kahaluu Kam/Kahekili (S)	Kaneohe Kam/Haiku (R)	Kaneohe Kam/Likelike (P)	Downtown Bishop/Hotel (J)	Ala Moana Center Kona St (O)
							●543a	545a	603a	614a	634a	648a	653a	707a	721a	730a	738a	800a	812a
							●637a	639a	657a	708a	732a	746a	751a	806a	821a	832a	842a	907a	920a
							●707a	709a	727a	738a	802a	816a	821a	836a	851a	902a	912a	937a	950a
636a	646a	648a	654a	702a	721a	726a	729a	739a	758a	809a	832a	846a	851a	906a	921a	932a	942a	1007a	1020a
700a	712a	714a	720a	729a	749a	754a	758a	809a	829a	840a	902a	916a	921a	936a	951a	1002a	1012a	1037a	1050a
Then every 30 minutes from Ala Moana Center until																			
230p	242p	244p	250p	259p	319p	324p	328p	339p	359p	410p	432p	446p	451p	504p	517p	525p	534p	556p	608p
300p	312p	314p	320p	329p	349p	354p	358p	409p	429p	440p	505p	519p	524p	536p	548p	556p	605p	627p	639p
330p	342p	344p	350p	359p	419p	424p	428p	439p	459p	510p	535p	549p	554p	606p	618p	626p	635p	657p	709p
400p	412p	414p	420p	429p	449p	454p	458p	509p	529p	540p	605p	619p	624p	636p	648p	656p	705p	✚727p	.....
430p	442p	444p	450p	459p	519p	524p	528p	539p	558p	609p	630p	644p	649p	701p	713p	721p	730p	✚752p	.....
500p	512p	514p	520p	529p	549p	554p	558p	608p	627p	638p	700p	714p	719p	731p	743p	751p	800p	822p	834p
530p	542p	544p	550p	559p	618p	623p	626p	636p	655p	706p	730p	744p	749p	801p	813p	821p	830p	852p	904p
615p	625p	627p	633p	641p	700p	705p	708p	718p	737p	748p	805p	819p	824p	836p	848p	856p	905p	927p	939p
715p	725p	727p	733p	741p	800p	805p	808p	818p	837p	848p	905p	919p	924p	936p	948p	956p	1005p	1027p	1039p
815p	824p	826p	831p	839p	856p	900p	903p	913p	931p	942p	1000p	1014p	1019p	1031p	1043p	1051p	1100p	1122p	1134p

Route 52 & 55 Circle Isle Destination Signs:

Westbound: To Circle Isle via Mililani & Wahiawa - 52 MILILANI WAHIAWA CIRCLE ISLE
To Ala Moana Center - 55 HONOLULU ALA MOANA
To Bishop/King or Alakea/King - 55 DOWNTOWN BISHOP ST
Eastbound: To Circle Isle via Pali Hwy - 55 KANEOHE CIRCLE ISLE
To Ala Moana Center - 52 or 62 HONOLULU VIA PEARLRIDGE (see note)
To Kam/Honomanu - 52 or 62 PEARLRIDGE (see note)
To Alapai Street - 52 or 62 ALAPAI ST (see note)
(Note: Several p.m. buses leaving Wahiawa will continue along Kamehameha Hwy to Pearlridge, Alapai Street or Ala Moana. In Wahiawa, buses will change their signs to read either 62 PEARLRIDGE, 62 ALAPAI ST OR 62 HONOLULU ALA MOANA.)

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 88A Destination Signs:

AM: From Kam/Honomanu & Kam/Avocado -
52 WAHIAWA CIRCLE ISLE
From Turtle Bay Resort -
88A EXPRESS DOWNTOWN VIA KAHEKILI
From Pali/Vineyard -
55 HONOLULU ALA MOANA
PM: From Ala Moana Center -
88A EXPRESS NORTH SHORE VIA KAHEKILI
From Kam/Kahekili - 55 KANEOHE CIRCLE ISLE
From Turtle Bay Resort - 52 ALAPAI ST or 52 PEARLRIDGE
**NOTE: Route 88A will also run on State Holidays

Route 52/55 Symbols

▲ - Starts at Alakea/Queen 1 minute earlier
✚ - Ends at Bishop/King 1 minute later
■ - Ends at Alapai St
✓ - Starts at Beretania/Punchbowl
❤ - Starts/ends at Kamehameha Hwy/Honomanu
● - Starts at Kamehameha Hwy/Avocado
✖ - Starts at Kamehameha/Pualalea Road
◆ - School holiday operation only
★ - State holiday operation only
o - Saturday operation only. Does not run on State holidays
◻ - Does not service bus stop fronting Windward City Shopping Center
✧ - Ends at Kamehameha Hwy/Pali Momi

Route 52 - Wahiawa Circle Isle / Route 55 - Kaneohe Circle Isle / 88A - North Shore Express

Effective [illegible]/24/08

Sunday: Eastbound: Via Pali Hwy/Kam Hwy to Kaneohe/North Shore/Wahiawa/Mililani/Honolulu

Ala Moana Center Kona St (O)	Downtown Alakea/Hotel (K)	Kaneohe Kam Hwy/Likelike (P)	Kaneohe Kam Hwy/Haiku (Q)	Kahaluu Kam Hwy/Kahekili (S)	Kaaawa Beach Park (T)	Hauula Elementary School (U)	Laie/Polynesian Cultural Center (V)	Turtle Bay Resort (A)	Pupukea Beach Park (B)	Haleiwa Beach Park (C)	Wahiawa California/Cane (D)	Mililani Kam Hwy/Kuahelani (E)	Mililani Transit Center (F)	Mililani Park & Ride (G)	Kalihi Kam Hwy/Middle (H)	Downtown King/Beretania (I)	Downtown Kapiolani/South (L)	Ala Moana Center Kona St (O)
		□ 453a	459a	510a	523a	536a	540a	555a	609a	620a	640a	651a	654a	700a	719a	728a	736a	742a
	▲ 510a	532a	538a	549a	603a	617a	622a	652a	706a	717a	737a	748a	751a	757a	816a	825a	833a	839a
	▲ 545a	607a	613a	624a	638a	652a	657a	722a	736a	747a	807a	818a	821a	827a	846a	856a	903a	909a
555a	608a	631a	638a	650a	705a	720a	725a	752a	806a	817a	837a	848a	851a	857a	916a	925a	933a	939a
625a	638a	701a	708a	720a	735a	750a	755a	822a	836a	847a	907a	918a	921a	927a	946a	955a	1003a	1009a
649a	702a	725a	732a	745a	800a	814a	819a	852a	906a	917a	937a	948a	951a	957a	1016a	1025a	1033a	1039a
719a	734a	759a	807a	820a	833a	846a	851a	922a	936a	947a	1007a	1018a	1021a	1027a	1046a	1055a	1103a	1109a
749a	804a	829a	837a	850a	903a	916a	921a	952a	1006a	1017a	1037a	1048a	1051a	1057a	1116a	1125a	1133a	1139a
819a	834a	859a	907a	920a	933a	946a	951a	1022a	1036a	1047a	1107a	1118a	1121a	1127a	1146a	1155a	1203p	1209p
849a	904a	929a	937a	950a	1003a	1016a	1021a	1052a	1106a	1117a	1137a	1148a	1151a	1157a	1216p	1225p	1233p	1239p
919a	934a	959a	1007a	1020a	1033a	1048a	1051a	1122a	1136a	1147a	1207p	1218p	1221p	1227p	1246p	1255p	103p	109p
949a	1004a	1029a	1037a	1050a	1103a	1118a	1121a	1152a	1206p	1217p	1237p	1248p	1251p	1257p	116p	125p	133p	139p
1019a	1034a	1059a	1107a	1120a	1133a	1146a	1151a	1222p	1236p	1247p	107p	118p	121p	127p	146p	155p	203p	209p
1049a	1104a	1129a	1137a	1150a	1203p	1216p	1221p	1252p	106p	117p	137p	148p	151p	157p	216p	225p	233p	239p
1119a	1134a	1159a	1207p	1220p	1233p	1246p	1251p	122p	136p	147p	207p	218p	221p	227p	246p	255p	303p	309p
1149a	1204p	1229p	1237p	1250p	103p	116p	121p	152p	206p	217p	237p	248p	251p	257p	316p	325p	333p	339p
1219p	1234p	1259p	107p	120p	133p	146p	151p	222p	236p	247p	307p	318p	321p	327p	346p	355p	403p	409p
1249p	104p	129p	137p	150p	203p	216p	221p	252p	306p	317p	337p	348p	351p	357p	416p	425p	433p	439p
119p	134p	159p	207p	220p	233p	246p	251p	322p	336p	347p	407p	418p	421p	427p	446p	455p	503p	509p
149p	204p	229p	237p	250p	303p	316p	321p	352p	406p	417p	437p	448p	451p	457p	516p	525p	■ 533p	.....
219p	234p	259p	307p	320p	333p	346p	351p	422p	436p	447p	507p	518p	521p	527p	546p	555p	■ 603p	.....
249p	304p	329p	337p	350p	403p	416p	421p	452p	506p	517p	537p	548p	551p	557p	616p	623p	■ 633p	.....
319p	334p	359p	407p	420p	433p	446p	451p	522p	536p	547p	607p	617p	620p	624p	644p	650p	■ 703p	.....
349p	404p	429p	437p	450p	503p	516p	521p	552p	605p	616p	635p	647p	.....	Kam Hwy	❖ 705p	.....	.....	.....
419p	434p	459p	507p	520p	533p	546p	551p	622p	635p	646p	705p	715p	718p	722p	739p	748p	755p	800p
449p	504p	529p	537p	548p	600p	613p	617p	652p	705p	715p	733p	744p	.....	Kam Hwy	❖ 802p	.....	.....	.....
535p	548p	611p	617p	628p	640p	653p	657p	725p	737p	747p	805p	814p	.....	Kam Hwy	843p	851p	857p	902p
635p	648p	710p	716p	727p	739p	752p	756p	825p	837p	847p	905p	914p	.....	Kam Hwy	943p	951p	957p	1002p
745p	758p	820p	826p	837p	849p	902p	906p	932p	944p	954p	1012p	1021p	.....	Kam Hwy	1050p	1058p	■ 1104p	.....
900p	913p	935p	941p	952p	1004p	1017p	1021p	1040p	1052p	1102p	1120p	1129p	.....	Kam Hwy	1158p	1206a	■ 1212a	.....
1010p	1023p	1045p	1051p	1102p	1114p	1127p	1131p	1155p	1207a	1217a	1235a	1244a	.....	Kam Hwy	113a	121a	■ 127a	.....

Route 52 & 55 Circle Isle Destination Signs:

Westbound: To Circle Isle via Mililani & Wahiawa - 52 MILILANI WAHIAWA CIRCLE ISLE

To Ala Moana Center - 55 HONOLULU ALA MOANA

To Bishop/King or Alakea/King - 55 DOWNTOWN BISHOP ST

Eastbound: To Circle Isle via Pali Hwy - 55 KANEOHE CIRCLE ISLE

To Ala Moana Center - 52 or 62 HONOLULU VIA PEARLRIDGE (see note)

To Kam/Honomanu - 52 or 62 PEARLRIDGE (see note)

To Alapai Street - 52 or 62 ALAPAI ST (see note)

(Note: Several p.m. buses leaving Wahiawa will continue along Kamehameha Hwy to Pearlridge, Alapai Street or Ala Moana. In Wahiawa, buses will change their signs to read either 62 PEARLRIDGE, 62 ALAPAI ST OR 62 HONOLULU ALA MOANA.)

Route 88A Destination Signs:

AM: From Kam/Honomanu & Kam/Avocado -

52 WAHIAWA CIRCLE ISLE

From Turtle Bay Resort -

88A EXPRESS DOWNTOWN VIA KAHEKILI

From Pali/Vineyard -

55 HONOLULU ALA MOANA

PM: From Ala Moana Center -

88A EXPRESS NORTH SHORE VIA KAHEKILI

From Kam/Kahekili - 55 KANEOHE CIRCLE ISLE

From Turtle Bay Resort - 52 ALAPAI ST or 52 PEARLRIDGE

**NOTE: Route 88A will also run on State Holidays

Route 52/55 Symbols

▲ - Starts at Alakea/Queen 1 minute earlier

■ - Ends at Alapai St

❖ - Ends at Kamehameha Hwy/Pali Momi

□ - Does not service bus stop fronting Windward City Shopping Center

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 6[illegible] Wahiawa Heights and 62 - Wahiawa

Effecti[illegible]24/08

Weekday: Eastbound: To Honolulu

A Wahiawa Heights California/Grand View	B Wahiawa California/Cane	C Mililani Kam Hwy/ Kuahelani	D Waikele Kam Hwy/ Lumiauau	E Kam Hwy Opp Pearl City Shopping Ctr	F Opp Pearlridge Kam/Pali Momi	G Aiea Kam Hwy/Salt Lake	H Rodgers Nimitz	I Kalihi Kam Hwy/Middle	K Downtown King St/ Beretania	L Downtown Kapiolani/ South	Q Ala Moana Center Kona St
440a	450a	500a	507a	511a	516a	518a	526a	531a	540a	547a	552a
.....	◆ 500a	510a	517a	521a	526a	528a	536a	541a	550a	557a	602a
510a	520a	531a	538a	543a	548a	551a	559a	604a	614a	624a	629a
.....	◆ 535a	546a	555a	601a	608a	611a	621a	627a	637a	647a	654a
540a	550a	603a	615a	621a	630a	633a	643a	650a	702a	712a	722a
605a	615a	627a	639a	645a	654a	657a	709a	716a	732a	742a	752a
	628a	639a	651a	657a	706a	709a	720a	727a	743a	754a	804a
633a	645a	656a	708a	714a	724a	727a	737a	744a	800a	811a	821a
704a	715a	726a	738a	744a	754a	757a	807a	814a	830a	841a	851a
730a	740a	754a	806a	812a	822a	825a	835a	842a	858a	909a-Alapai	
750a	800a	816a	828a	834a	844a	847a	857a	904a	916a	927a	937a
816a	826a	842a	854a	900a	910a	913a	923a	930a	942a	953a	1003a
851a	901a	917a	929a	935a	945a	948a	958a	1005a	1017a	1028a	1038a
926a	936a	952a	1004a	1010a	1020a	1023a	1033a	1040a	1052a	1103a	1113a
958a	1008a	1024a	1036a	1042a	1052a	1055a	1105a	1112a	1124a	1135a	1145a
1031a	1041a	1057a	1109a	1115a	1125a	1128a	1138a	1145a	1157a	**1208p**	**1218p**
1103a	1113a	1129a	1141a	1147a	1157a	**1200p**	**1210p**	**1217p**	**1229p**	**1240p**	**1250p**
1136a	1146a	**1202p**	**1214p**	**1220p**	**1230p**	**1233p**	**1243p**	**1250p**	**102p**	**114p**	**124p**
1208p	**1218p**	**1234p**	**1246p**	**1252p**	**102p**	**105p**	**115p**	**122p**	**134p**	**146p**	**156p**
1241p	**1251p**	**105p**	**117p**	**123p**	**133p**	**136p**	**146p**	**153p**	**205p**	**217p**	**227p**
113p	**123p**	**134p**	**146p**	**152p**	**202p**	**205p**	**215p**	**222p**	**234p**	**246p**	**256p**
146p	**156p**	**207p**	**219p**	**225p**	**235p**	**238p**	**248p**	**255p**	**307p**	**319p**	**329p**
218p	**228p**	**239p**	**251p**	**257p**	**307p**	**310p**	**320p**	**327p**	**339p**	**351p**	**401p**
255p	**305p**	**316p**	**328p**	**334p**	**344p**	**347p**	**357p**	**404p**	**416p**	**428p**	**438p**
333p	**343p**	**354p**	**406p**	**412p**	**422p**	**425p**	**435p**	**442p**	**454p**	**506p**	**516p**
405p	**415p**	**426p**	**438p**	**444p**	**454p**	**457p**	**507p**	**514p**	**526p**	**538p**	**548p**
411p	**421p**	**422p**-Kam/Olive		.....	.....	.....	.....	.....	.....	.....	.....
440p	**450p**	**501p**	**513p**	**519p**	**529p**	**532p**	**542p**	**549p**	**557p**	**608p**	**618p**
517p	**527p**	**538p**	**550p**	**555p**	**602p**						
555p	**604p**	**615p**	**626p**	**631p**	**638p**	**640p**	**648p**	**653p**	**701p**	**708p**	**715p**
610p	**619p**	**630p**	**641p**	**646p**	**653p**						
642p	**651p**	**702p**	**710p**	**715p**	**720p**						
715p	**724p**	**735p**	**743p**	**748p**	**753p**	.....	.....	.....	.....	.....	.....
815p	**824p**	**825p**-Kam/Olive		**831p**-Schofield		**839p**-Foote Gate		**(FRIDAY ONLY)**		.....	.....
815p	**824p**	**825p**-Kam/Olive		**(MONDAY-THURSDAY ONLY)**			.....	.....	.....	.....	.....
.....	**827p**	**838p**	**846p**	**851p**	**856p**	**858p**	**905p**	**910p**	**917p**	**924p**	**931p**
.....	**907p**	**918p**	**926p**	**931p**	**936p**	**938p**	**945p**	**950p**	**957p**	**1004p**	**1011p**
910p	**919p**	**920p**-Kam/Olive									
.....	**1027p**	**1038p**	**1046p**	**1051p**	**1056p**	**1058p**	**1105p**	**1110p**	**1117p**	**1124p**-Alapai	
.....	**1132p**	**1143p**	**1151p**	**1156p**	1201a	1203a	1210a	1215a	1222a	1229a-Alapai	
1145p	**1154p**	**1155p**-Kam/Olive		1201a-Schofield		1209a-Foote Gate		**(FRIDAY ONLY)**		.....	.....
1145p	**1154p**	**1155p**-Kam/Olive		**(MONDAY-THURSDAY ONLY)**			.....	.....	.....	.....	.....
.....	1254a	105a	113a	117a-Kam/Acacia		.....	.....	.....	.....	.....	.....

Route 62 Wahiawa Heights & 62 Wahiawa Destination Signs:

Westbound:

To Wahiawa Heights - 62 WAHIAWA HEIGHTS

To Wahiawa Only - 62 WAHIAWA

To Wahiawa Hts ending in Schofield - 62 WAHIAWA HEIGHTS SCHOFIELD

Eastbound:

To Ala Moana Center - 62 HONOLULU ALA MOANA

To Kam Hwy/Olive - 62 WAHIAWA HEIGHTS

To Kam/Honomanu - 62 PEARLRIDGE

To Alapai Street - 62 ALAPAI ST

Route 62 Symbols

◆ - Starts Lehua St 1 minute earlier

★ - State Holiday operation only

○ - Saturday operation only, does not run on State holidays

% - Runs one minute earlier on State Holidays

- Ends at Kam/Olive 1 minute later Monday-Thursday and runs to Schofield on Fridays only

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 62 Wahiawa Heights and 62 - Wahiawa

Effective 4/08

Weekday: Westbound: To Wahiawa Heights

Q Ala Moana Center Kona St	P Alapai/ King	O Beretania Punchbowl	K Downtown King Street/ Beretania	I Kalihi Kam Hwy/Middle	H Rodgers Nimitz	G Aiea Kam Hwy/Salt Lake	F Pearlridge Kam & Pali Momi	E Pearl City Shopping Ctr	D Waikele Kam Hwy/ Lumiauau	C Mililani Kam Hwy/ Kuahelani	B Wahiawa California/Cane	A Wahiawa Heights
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		426a	428a	439a
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		456a	458a	509a
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		526a	528a	539a
.....	453a	455a	501a	510a	515a	523a	526a	531a	535a	542a	553a	604a
								Kam Hwy/Avocado-		620a	622a	633a
	527a	529a	535a	544a	549a	557a	600a	606a	610a	617a	628a	
								Kam Hwy/Avocado-		647a	649a	701a
535a	547a	549a	555a	604a	610a	619a	623a	630a	636a	648a	659a	
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		716a	718a	730a
600a	612a	614a	620a	629a	635a	644a	648a	655a	701a	713a	724a	736a
629a	641a	643a	649a	658a	704a	713a	717a	724a	730a	742a	753a	805a
704a	716a	718a	724a	733a	739a	748a	752a	759a	805a	817a	828a	840a
739a	751a	753a	759a	808a	814a	823a	827a	834a	840a	852a	903a	915a
814a	826a	828a	834a	843a	849a	858a	902a	909a	915a	927a	938a	950a
846a	858a	900a	906a	915a	921a	930a	934a	941a	947a	959a	1010a	1022a
919a	931a	933a	939a	948a	954a	1003a	1007a	1014a	1020a	1032a	1043a	1055a
951a	1003a	1005a	1011a	1020a	1026a	1035a	1039a	1046a	1052a	1104a	1115a	1126a
1023a	1035a	1037a	1043a	1052a	1058a	1107a	1111a	1120a	1125a	1137a	1148a	1159a
1051a	1103a	1105a	1111a	1121a	1128a	1137a	1141a	1152a	1157a	1209p	1220p	1231p
1119a	1131a	1134a	1140a	1151a	1158a	1207p	1211p	1222p	1227p	1239p	1250p	101p
1149a	1201p	1204p	1210p	1221p	1228p	1237p	1241p	1252p	1257p	109p	120p	131p
1225p	1237p	1240p	1246p	1257p	104p	113p	117p	128p	133p	145p	159p	210p
100p	112p	115p	121p	132p	139p	148p	152p	207p	213p	226p	240p	251p
135p	147p	150p	158p	209p	216p	225p	229p	244p	250p	303p	317p	327p
159p	212p	215p	223p	234p	241p	250p	254p	309p	315p	328p	342p	352p
.....	.....	.....	.....	.....	.....	.....	313p	328p	333p	346p	400p	410p
235p	248p	251p	259p	310p	317p	328p	332p	347p	352p	405p	419p	429p
255p	308p	311p	319p	332p	340p	351p	355p	410p	415p	428p	442p	452p
318p	331p	334p	342p	355p	403p	414p	418p	433p	438p	451p	505p	515p
341p	354p	357p	405p	418p	426p	437p	441p	456p	501p	514p	528p	538p
404p	417p	420p	428p	441p	449p	500p	504p	519p	524p	537p	551p	601p
428p	441p	444p	452p	505p	513p	524p	528p	543p	548p	601p	615p	624p
450p	503p	506p	514p	527p	535p	546p	550p	605p	610p	622p	633p	642p
530p	543p	546p	554p	607p	615p	624p	628p	639p	643p	655p	706p	715p
637p	649p	651p	657p	709p	715p	724p	728p	739p	743p	754p	804p	813p
745p	756p	758p	803p	813p	818p	826p	829p	836p	840p	851p	901p	910p
915p	926p	928p	933p	943p	948p	956p	959p	1006p	1010p	1021p	1031p	1040p
1020p	1031p	1033p	1038p	1048p	1053p	1101p	1104p	1111p	1115p	1126p	1136p	1145p

Route 62 Wahiawa Heights & 62 Wahiawa Destination Signs:

Westbound:

To Wahiawa Heights - 62 WAHIAWA HEIGHTS

To Wahiawa Only - 62 WAHIAWA

To Wahiawa Hts ending in Schofield - 62 WAHIAWA HEIGHTS SCHOFIELD

Eastbound:

To Ala Moana Center - 62 HONOLULU ALA MOANA

To Kam Hwy/Olive - 62 WAHIAWA HEIGHTS

To Kam/Honomanu - 62 PEARLRIDGE

To Alapai Street - 62 ALAPAI ST

Route 62 Symbols

◆ - Starts Lehua St 1 minute earlier

★ - State Holiday operation only

O - Saturday operation only, does not run on State holidays

% - Runs one minute earlier on State Holidays

- Ends at Kam/Olive 1 minute later Monday-Thursday and runs to Schofield on Fridays only

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route - Wahiawa Heights and 62 - Wahiawa

Effec /24/08

Saturday/State Holiday: Eastbound: To Honolulu

A Wahiawa Heights California/Grand View	B Wahiawa California/Cane	C Mililani Kam Hwy/ Kuahelani	D Waikele Kam Hwy/ Lumiauau	E Kam Hwy Opp Pearl City Shopping Ctr	F Opp Pearlridge Kam/Pali Momi	G Aiea Kam Hwy/Salt Lake	H Rodgers Nimitz	I Kalihi Kam Hwy/Middle	K Downtown King St/ Beretania	L Downtown Kapiolani/ South	Q Ala Moana Center Kona St
440a	449a	459a	509a	515a	521a	523a	529a	533a	543a	548a	554a
.....★	◆505a	★515a	★525a	★531a	★537a	★539a	★545a	★549a	★559a	★604a	★610a
510a	520a	530a	540a	546a	552a	554a	600a	604a	614a	619a	625a
.....★	◆535a	★545a	★555a	★601a	★607a	★609a	★615a	★619a	★629a	★634a	★640a
540a	550a	600a	610a	616a	622a	624a	630a	634a	644a	649a	655a
★	◆605a	★615a	★625a	★631a	★637a	★639a	★645a	★649a	★659a	★704a	★710a
610a	620a	630a	640a	646a	652a	654a	700a	704a	714a	721a	727a
★	◆630a	★640a	★650a	★656a	★702a	★704a	★710a	★714a	★724a	★732a	★738a
640a	650a	700a	710a	716a	722a	724a	730a	734a	744a	752a	758a
.....○	◆705a	○715a	○725a	○731a	○737a	○739a	○745a	○749a	○759a	○807a	○813a
710a	721a	732a	742a	748a	754a	756a	803a	808a	818a	826a	832a
745a	756a	807a	817a	824a	832a	834a	843a	848a	858a	909a	917a
815a	827a	838a	848a	856a	903a	905a	914a	919a	931a	942a	950a
855a	907a	918a	930a	940a	948a	950a	959a	1004a	1016a	1027a	1035a
935a	947a	958a	1010a	1020a	1028a	1030a	1039a	1044a	1056a	1107a	1115a
1015a	1027a	1038a	1050a	1100a	1108a	1110a	1119a	1124a	1136a	1147a	1155a
1055a	1107a	1118a	1130a	1140a	1148a	1150a	1159a	**1204p**	**1216p**	**1227p**	**1235p**
1135a	1147a	**1200p**	**1212p**	**1222p**	**1230p**	**1232p**	**1241p**	**1246p**	**1258p**	**109p**	**117p**
1215p	**1227p**	**1240p**	**1252p**	**102p**	**110p**	**112p**	**121p**	**126p**	**138p**	**149p**	**157p**
1255p	**107p**	**120p**	**132p**	**142p**	**150p**	**152p**	**201p**	**206p**	**218p**	**229p**	**237p**
135p	**147p**	**200p**	**212p**	**222p**	**229p**	**231p**	**240p**	**245p**	**257p**	**308p**	**316p**
215p	**227p**	**240p**	**252p**	**302p**	**309p**	**311p**	**320p**	**325p**	**336p**	**344p**	**352p**
255p	**307p**	**320p**	**332p**	**342p**	**349p**	**351p**	**400p**	**405p**	**416p**	**424p**	**432p**
335p	**347p**	**400p**	**412p**	**422p**	**429p**	**431p**	**440p**	**445p**	**456p**	**504p**	**512p**
415p	**427p**	**438p**	**450p**	**457p**	**504p**	**506p**	**515p**	**520p**	**531p**	**539p**	**547p**
455p	**506p**	**517p**	**529p**	**536p**	**543p**	**545p**	**554p**	**559p**	**608p**	**616p**	**624p**
535p	**545p**	**556p**	**608p**	**615p**	**622p**	**624p**	**631p**	**635p**	**644p**	**652p**	**700p**
615p	**625p**	**636p**	**648p**	**655p**	**702p**	**704p**	**711p**	**715p**	**724p**	**731p**	**738p**
623p	**633p**	**634p**-Kam/Olive		.....	.....	.....	.....	.....	.....	.....	.....
659p	**709p**	**710p**-Kam/Olive		.....	.....	.....	.....	.....	.....	.....	.....
	731p	**742p**	**754p**	**801p**	**806p**	.....	.....	.....	.....	.....	.....
733p	**743p**	**744p**-Kam/Olive		.....	.....	.....	.....	.....	.....	.....	.....
.....	**804p**	**813p**	**822p**	**829p**	**834p**	**836p**	**841p**	**844p**	**853p**	**900p**	**907p**
815p	**825p**	**832p**-Schofield		**840p**-Foote Gate		.....	.....	.....	.....	.....	.....
.....	**905p**	**914p**	**923p**	**930p**	**935p**	**937p**	**942p**	**945p**	**954p**	**1001p**	**1008p**
913p	**923p**	**924p**-Kam/Olive		.....	.....	.....	.....	.....	.....	.....	.....
.....	**%1016p**	**%1025p**	**%1034p**	**%1037p**-Kam/Acacia		.....	.....	.....	.....	.....	.....
★**1037p**	★**1047p**	★**1054p**-Schofield		★**1102p**-Foote Gate		.....	.....	.....	.....	.....	.....
.....	**1125p**	**1134p**	**1143p**	**1147p**	**1152p**	**1154p**	**1159p**	1202a	1211a	1218a-Alapai	
1137p	**1147p**	**1154p**-Schofield		1202a-Foote Gate							
.....	1244a	1253a	102a	105a-Kam/Acacia		.....	.....	.....	.....	.....	

Route 62 Wahiawa Heights & 62 Wahiawa Destination Signs:

Westbound:

To Wahiawa Heights - 62 WAHIAWA HEIGHTS

To Wahiawa Only - 62 WAHIAWA

To Wahiawa Hts ending in Schofield -

62 WAHIAWA HEIGHTS SCHOFIELD

Eastbound:

To Ala Moana Center - 62 HONOLULU ALA MOANA

To Kam Hwy/Olive - 62 WAHIAWA HEIGHTS

To Kam/Honomanu - 62 PEARLRIDGE

To Alapai Street - 62 ALAPAI ST

Route 62 Symbols

◆ - Starts Lehua St 1 minute earlier

★ - State Holiday operation only

○ - Saturday operation only, does not run on State holidays

% - Runs one minute earlier on State Holidays

- Ends at Kam/Olive 1 minute later Monday-Thursday and runs to Schofield on Fridays only

Bold indicates PM service.

Schedule to change without notice.

All buses are lift and bicycle rack equipped.

Route 62 - Wahiawa Heights and 62 - Wahiawa

Effective 8/24/08

Saturday/State Holiday: Westbound: To Wahiawa Heights

Q Ala Moana Center Kona St	P Alapai/ King	O Beretania Punchbowl	K Downtown King Street/ Beretania	I Kalihi Kam Hwy/Middle	H Rodgers Nimitz	G Aiea Kam Hwy/Salt Lake	F Pearlridge Kam & Pali Momi	E Pearl City Shopping Ctr	D Waikele Kam Hwy/ Lumiauau	C Mililani Kam Hwy/ Kuahelani	B Wahiawa California/Cane	A Wahiawa Heights
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		430a	432a	439a
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		500a	502a	509a
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		530a	532a	539a
.....	453a	455a	500a	510a	516p	524a	527a	534a	541a	551a	601a	608a
513a	523a	525a	530a	540a	546p	554a	557a	604a	611a	621a	631a	
								Kam Hwy/Avocado-		629a	631a	638a
	553a	555a	600a	610a	616p	624a	627a	634a	641a	651a	701a	708a
610a	620a	622a	627a	637a	643p	651a	654a	701a	708a	718a	729a	736a
640a	650a	652a	657a	708a	714p	722a	725a	732a	739a	749a	800a	807a
705a	715a	717a	723a	734a	740p	748a	751a	758a	805a	815a	826a	833a
745a	755a	757a	803a	814a	820p	828a	831a	838a	845a	855a	906a	913a
825a	835a	837a	843a	854a	900p	908a	911a	918a	925a	935a	946a	953a
859a	912a	914a	920a	931a	937p	945a	948a	955a	1003a	1016a	1027a	1034a
925a	938a	940a	946a	957a	1003p	1013a	1016a	1026a	1036a	1051a	1102a	1109a
1010a	1024a	1027a	1034a	1045a	1051p	1101a	1104a	1114a	1126a	1139a	1151a	1158a
1050a	1104a	1107a	1114a	1125a	1131p	1141a	1144a	1154a	**1206p**	**1219p**	**1231p**	**1238p**
1130a	1144a	1147a	1154a	**1205p**	**1211p**	**1221p**	**1224p**	**1234p**	**1246p**	**1259p**	**111p**	**118p**
1210p	**1224p**	**1227p**	**1234p**	**1245p**	**1251p**	**101p**	**104p**	**114p**	**126p**	**139p**	**151p**	**158p**
1250p	**104p**	**107p**	**114p**	**125p**	**131p**	**141p**	**144p**	**154p**	**206p**	**219p**	**231p**	**239p**
130p	**147p**	**149p**	**156p**	**207p**	**213p**	**223p**	**226p**	**236p**	**248p**	**301p**	**313p**	**321p**
210p	**227p**	**229p**	**236p**	**247p**	**253p**	**303p**	**306p**	**316p**	**328p**	**341p**	**353p**	**401p**
250p	**307p**	**309p**	**316p**	**327p**	**333p**	**343p**	**346p**	**356p**	**408p**	**421p**	**433p**	**441p**
330p	**347p**	**349p**	**356p**	**407p**	**413p**	**423p**	**426p**	**433p**	**441p**	**454p**	**506p**	**514p**
410p	**426p**	**428p**	**435p**	**446p**	**452p**	**502p**	**505p**	**512p**	**520p**	**533p**	**545p**	**553p**
445p	**500p**	**502p**	**509p**	**520p**	**526p**	**536p**	**539p**	**546p**	**554p**	**605p**	**615p**	**623p**
525p	**540p**	**542p**	**549p**	**600p**	**605p**	**613p**	**616p**	**622p**	**630p**	**641p**	**651p**	**659p**
605p	**617p**	**619p**	**626p**	**634p**	**639p**	**647p**	**650p**	**656p**	**704p**	**715p**	**725p**	**733p**
645p	**657p**	**659p**	**706p**	**714p**	**719p**	**727p**	**730p**	**736p**	**744p**	**755p**	**805p**	**813p**
745p	**757p**	**759p**	**806p**	**814p**	**819p**	**827p**	**830p**	**836p**	**844p**	**855p**	**905p**	**913p**
915p	**925p**	**927p**	**932p**	**940p**	**945p**	**953p**	**956p**	**1002p**	**1008p**	**1019p**	**1029p**	★ **1037p**
1015p	**1025p**	**1027p**	**1032p**	**1040p**	**1045p**	**1053p**	**1056p**	**1102p**	**1108p**	**1119p**	**1129p**	**1137p**

Route 62 Wahiawa Heights & 62 Wahiawa Destination Signs:

Westbound:

To Wahiawa Heights - 62 WAHIAWA HEIGHTS

To Wahiawa Only - 62 WAHIAWA

To Wahiawa Hts ending in Schofield - 62 WAHIAWA HEIGHTS SCHOFIELD

Eastbound:

To Ala Moana Center - 62 HONOLULU ALA MOANA

To Kam Hwy/Olive - 62 WAHIAWA HEIGHTS

To Kam/Honomanu - 62 PEARLRIDGE

To Alapai Street - 62 ALAPAI ST

Route 62 Symbols

◆ - Starts Lehua St 1 minute earlier

★ - State Holiday operation only

O - Saturday operation only, does not run on State holidays

% - Runs one minute earlier on State Holidays

- Ends at Kam/Olive 1 minute later Monday-Thursday and runs to Schofield on Fridays only

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 62 - Wahiawa Heights and 62 - Wahiawa   Effective 8/24/08

Sunday: Eastbound: To Honolulu

A Wahiawa Heights California/Grand View	B Wahiawa California/Cane	C Mililani Kam Hwy/ Kuahelani	D Waikele Kam Hwy/ Lumiauau	E Kam Hwy Opp Pearl City Shopping Ctr	F Opp Pearlridge Kam/Pali Momi	G Aiea Kam Hwy/Salt Lake	H Rodgers Nimitz	I Kalihi Kam Hwy/Middle	K Downtown King St/ Beretania	L Downtown Kapiolani/ South	Q Ala Moana Center Kona St
510a	520a	530a	537a	541a	546a	548a	556a	601a	610a	617a	622a
540a	550a	600a	607a	611a	616a	618a	626a	631a	640a	647a	652a
610a	620a	630a	637a	641a	646a	648a	656a	701a	710a	717a	722a
640a	650a	701a	708a	713a	718a	720a	728a	733a	744a	752a	758a
712a	722a	733a	740a	745a	750a	752a	800a	805a	817a	828a	835a
742a	752a	803a	810a	815a	826a	828a	837a	842a	854a	905a	912a
812a	823a	833a	840a	845a	856a	858a	907a	912a	924a	935a	942a
845a	856a	906a	913a	918a	929a	931a	940a	945a	957a	1008a	1015a
920a	931a	941a	948a	953a	1004a	1006a	1015a	1020a	1032a	1043a	1050a
955a	1006a	1016a	1023a	1028a	1039a	1041a	1050a	1055a	1107a	1118a	1125a
1030a	1041a	1051a	1058a	1103a	1114a	1116a	1125a	1130a	1142a	1153p	1200p
1105a	1116a	1126a	1133a	1138a	1149a	1151a	1200p	1205p	1217p	1228p	1235p
1140a	1151a	1201p	1208p	1213p	1224p	1226p	1235p	1240p	1252p	103p	110p
1215p	1226p	1236p	1243p	1248p	1259p	101p	110p	115p	127p	138p	145p
1250p	101p	111p	118p	123p	134p	136p	145p	150p	202p	213p	220p
125p	136p	146p	153p	158p	209p	211p	220p	225p	237p	248p	255p
200p	211p	221p	228p	233p	244p	246p	255p	300p	312p	323p	330p
235p	246p	256p	303p	308p	319p	321p	330p	335p	347p	358p	405p
310p	321p	331p	338p	343p	354p	356p	405p	410p	422p	433p	440p
345p	356p	406p	413p	418p	429p	431p	440p	445p	457p	508p	515p
420p	431p	441p	448p	453p	504p	506p	515p	520p	530p	538p	544p
513p	524p	534p	541p	545p	550p	552p	600p	605p	614p	621p	626p
548p	558p	608p	615p	619p	624p	626p	634p	639p	648p	655p	700p
623p	633p	643p	650p	654p	659p	701p	709p	714p	723p	730p	735p
.....	637p	647p	654p	658p	705p	.....	.....	.....	.....	.....	.....
639p	649p	650p -Kam/Olive		.....	.....	.....	.....	.....	.....	.....	.....
.....	734p	744p	751p	755p	802p	.....	.....	.....	.....	.....	
725p	735p	736p -Kam/Olive		.....	.....	.....	.....	.....	.....	.....	.....
.....	805p	814p	820p	824p	828p	830p	838p	843p	851p	857p	902p
815p	824p	831p		839p	.....	.....	.....	.....	.....	.....	.....
.....	905p	914p	920p	924p	928p	930p	938p	943p	951a	957p	1002p
903p	912p	913p -Kam/Olive		.....	.....	.....	.....	.....	.....	.....	.....
.....	1019p	1028p	1034p	1037p -Kam/Acacia		.....	.....	.....	.....	.....	
.....	1120p	1129p	1135p	1139p	1143p	1145p	1153p	1158p	1206a	1212a -Alapai	
1132p	1141p	1148p -Schofield		1156p -Foote Gate		.....	.....	.....	.....	.....	.....
.....	1247a	1256a	102a	105a -Kam/Acacia		.....	.....	.....	.....	.....	.....

Route 62 Wahiawa Heights & 62 Wahiawa Destination Signs:

Westbound:

To Wahiawa Heights - 62 WAHIAWA HEIGHTS

To Wahiawa Only - 62 WAHIAWA

To Wahiawa Hts ending in Schofield - 62 WAHIAWA HEIGHTS SCHOFIELD

Eastbound:

To Ala Moana Center - 62 HONOLULU ALA MOANA

To Kam Hwy/Olive - 62 WAHIAWA HEIGHTS

To Kam/Honomanu - 62 PEARLRIDGE

To Alapai Street - 62 ALAPAI ST

Route 62 Symbols

◆ - Starts Lehua St 1 minute earlier

★ - State Holiday operation only

O - Saturday operation only, does not run on State holidays

% - Runs one minute earlier on State Holidays

- Ends at Kam/Olive 1 minute later Monday-Thursday and runs to Schofield on Fridays only

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 62 - Wahiawa Heights and 62 - Wahiawa Effective 8/24/08

Sunday: Westbound: To Wahiawa Heights

Q Ala Moana Center Kona St	P Alapai/ King	O Beretania Punchbowl	K Downtown King Street/ Beretania	I Kalihi Kam Hwy/Middle	H Rodgers Nimitz	G Aiea Kam Hwy/Salt Lake	F Pearlridge Kam & Pali Momi	E Pearl City Shopping Ctr	D Waikele Kam Hwy/ Lumiauau	C Mililani Kam Hwy/ Kuahelani	B Wahiawa California/Cane	A Wahiawa Heights
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		456a	458a	509a
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		526a	528a	539a
.....	.....	.....	.....	.....	.....	.....	.....	Kam Hwy/Avocado-		556a	558a	609a
.....	529a	531a	537a	545a	550p	558a	601a	606a	610a	617a	627a	638a
[illegible]	559a	601a	607a	615a	620a	628a	631a	636a	640a	647a	657a	708a
613a	623a	625a	631a	641a	646a	654a	657a	702a	706a	713a	723a	735a
643a	653a	655a	701a	711a	716a	724a	727a	733a	737a	744a	754a	806a
706a	718a	720a	726a	736a	742a	751a	754a	801a	806a	813a	824a	835a
736a	746a	750a	756a	807a	813a	821a	824a	834a	839a	846a	857a	908a
806a	818a	820a	826a	838a	844a	852a	855a	905a	910a	917a	928a	939a
845a	857a	859a	905a	917a	923a	931a	934a	944a	949a	956a	1007a	1018a
920a	932a	934a	940a	952a	958a	1006a	1009a	1019a	1024a	1031a	1042a	1053a
955a	1007a	1009a	1015a	1027a	1033a	1041a	1044a	1054a	1059a	1106a	1117a	1128a
1030a	1042a	1044a	1050a	1102a	1108a	1116a	1119a	1129a	1134a	1141a	1152a	**1203p**
1105a	1117a	1119a	1125a	1137a	1143a	1151a	1154a	**1204p**	**1209p**	**1216p**	**1227p**	**1238p**
1140a	1152a	1154a	**1200p**	**1212p**	**1219p**	**1226p**	**1229p**	**1239p**	**1244p**	**1251p**	**102p**	**113p**
1215p	**1227p**	**1229p**	**1235p**	**1247p**	**1253p**	**101p**	**104p**	**114p**	**119p**	**126p**	**137p**	**148p**
1250p	**102p**	**104p**	**110p**	**122p**	**128p**	**136p**	**139p**	**149p**	**154p**	**201p**	**212p**	**223p**
125p	**137p**	**139p**	**145p**	**157p**	**203p**	**211p**	**214p**	**224p**	**229p**	**236p**	**247p**	**258p**
200p	**212p**	**214p**	**220p**	**232p**	**238p**	**246p**	**249p**	**259p**	**304p**	**311p**	**322p**	**333p**
235p	**247p**	**249p**	**255p**	**307p**	**313p**	**321p**	**324p**	**334p**	**339p**	**346p**	**357p**	**408p**
310p	**322p**	**324p**	**330p**	**342p**	**348p**	**356p**	**359p**	**409p**	**414p**	**421p**	**432p**	**443p**
345p	**357p**	**359p**	**405p**	**417p**	**423p**	**431p**	**434p**	**441p**	**446p**	**453p**	**504p**	**515p**
420p	**432p**	**434p**	**440p**	**452p**	**458p**	**506p**	**509p**	**516p**	**521p**	**528p**	**539p**	**550p**
455p	**507p**	**509p**	**515p**	**527p**	**533p**	**541p**	**544p**	**551p**	**556p**	**603p**	**614p**	**625p**
523p	**535p**	**537p**	**543p**	**555p**	**601p**	**609p**	**612p**	**618p**	**623p**	**630p**	**641p**	**653p**
550p	**602p**	**604p**	**610p**	**622p**	**628p**	**636p**	**639p**	**645p**	**649p**	**656p**	**707p**	**719p**
645p	**655p**	**657p**	**703p**	**713p**	**718p**	**726p**	**729p**	**735p**	**739p**	**746p**	**756p**	**808p**
745p	**754p**	**756p**	**801p**	**809p**	**814p**	**822p**	**825p**	**831p**	**835p**	**842p**	**852p**	**903p**
915p	**924p**	**926p**	**931p**	**939p**	**944p**	**952p**	**955p**	**1000p**	**1004p**	**1011p**	**1021p**	.....
1015p	**1024p**	**1026p**	**1031p**	**1039p**	**1044p**	**1052p**	**1055p**	**1100p**	**1104p**	**1111p**	**1121p**	**1132p**

Route 62 Wahiawa Heights & 62 Wahiawa Destination Signs:

Westbound:

To Wahiawa Heights - 62 WAHIAWA HEIGHTS

To Wahiawa Only - 62 WAHIAWA

To Wahiawa Hts ending in Schofield - 62 WAHIAWA HEIGHTS SCHOFIELD

Eastbound:

To Ala Moana Center - 62 HONOLULU ALA MOANA

To Kam Hwy/Olive - 62 WAHIAWA HEIGHTS

To Kam/Honomanu - 62 PEARLRIDGE

To Alapai Street - 62 ALAPAI ST

Route 62 Symbols

◆ - Starts Lehua St 1 minute earlier

★ - State Holiday operation only

O - Saturday operation only, does not run on State holidays

% - Runs one minute earlier on State Holidays

- Ends at Kam/Olive 1 minute later Monday-Thursday and runs to Schofield on Fridays only

Bold indicates PM service.

Schedule to change without notice.

All buses are lift and bicycle rack equipped.

Route 83 - Wahiawa Town Express (Downtown/University of Hawaii)

Effective 8/25/08

A.M. Weekday Only: To Downtown Honolulu and University of Hawaii at Manoa

B Waialua Kam Hwy & Weed Circle	C Haleiwa Kam Hwy & Achiu Ln	F Wahiawa Hts California & Grand View	D Wahiawa California & Cane	G Wheeler Kam Hwy & Wright Gate	H Wahiawa Park & Ride (Armory)	Y Vineyard & Palama	C Downtown Alapai & King	Z Beretania & Punchbowl	a King & Cooke	e Makiki Wilder & Makiki	h U of H University & Metcalf
			◆ 500a	505a	507a	535a	545a	547a			
		514a	524a	529a	531a	559a			611a	626a	630a
458a	520a	.....	◆ 540a	545a	547a	621a	631a	633a	.....	.....	.....
.....	.....	547a	557a	602a	604a	642a	.....	.....	654a	709a	713a
528a	550a		◆ 610a	615a	617a	655a	705a	707a			
		617a	628a	633a	635a	713a			725a	740a	744a
.....	.....	.....	◆ 645a	650a	652a	730a	740a	742a	.....	.....	.....

State Holiday

B	C	F	D	G	H	Y	C	Z	a	e	h
			◆ 500a	505a	507a	535a	545a	546a			
458a	520a		540a	545a	547a	622a	632a	633a			
528a	550a	.....	610a	615a	617a	657a	707a	708a	.....	.....	.....
.....	.....	617a	625a	630a	632a	708a	718a	719a	.....	.....	.....

P.M. Weekday Only: To Wahiawa/Wahiawa Heights/Waialua/Haleiwa

d Alapai Transit Center	Z Beretania & Punchbowl	Y Vineyard & Palama	H Wahiawa Park & Ride (Armory)	D Wahiawa California & Cane	F Wahiawa Hts California & Grand View	E Wahiawa Kam Hwy & Olive Ave	A Waialua Goodale & Nahoa	B Waialua Kam Hwy & Weed Circle
340p	**345p**	**355p**	**432p**	**439p**	.....	**444p**	.....	.....
405p	**410p**	**420p**	**500p**	**507p**	**517p**	**526p**	.....	.....
425p	**430p**	**442p**	**522p**	**529p**	.....	.....	**552p**	**611p**
435p	**440p**	**452p**	**532p**	**539p**	**549p**	**558p**	.....	.....
450p	**455p**	**507p**	**547p**	**554p**	**604p**	**613p**	.....	.....
510p	**515p**	**527p**	**607p**	**614p**	.....	.....	**637p**	**656p**
540p	**545p**	**557p**	**637p**	**644p**	.....	**649p**	.....	.....

State Holiday

d	Z	Y	H	D	F	E	A	B
400p	**404p**	**412p**	**445p**	**453p**	**503p**	**514p**	.....	.....
420p	**424p**	**432p**	**505p**	**513p**	.....	.....	**533p**	**550p**
450p	**454p**	**502p**	**535p**	**543p**	**553p**	**604p**	.....	.....
510p	**514p**	**522p**	**555p**	**603p**	.....	.....	**623p**	**640p**

Route 83 Destination Signs

AM:

To Downtown & UH - 83 EXPRESS DOWNTOWN UNIVERSITY

To Downtown Only - 83 EXPRESS DOWNTOWN

PM:

To Waialua/Haleiwa - 83 EXPRESS WAHIAWA WAIALUA HALEIWA

To Wahiawa Heights - 83 EXPRESS WAHIAWA HEIGHTS

To Wahiawa Only - 83 EXPRESS WAHIAWA

Route 83 Symbols

◆ - Begins Lehua/California one minute earlier

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 83A - Wahiawa - Mililani Express (Pearl Harbor)

Revised 3/5/07

A.M. Weekday Only: To Pearl Harbor

F Wahiawa Hts California & Gnd View	D Wahiawa California & Cane	G Wheeler Kam Hwy & Wright Gte	J Waipio Acres Kam Hwy & Waikalani	L Mililani Kam Hwy & Kuahelani	T Waipio Entry Kam Hwy & Waipio Uka	U Crestview Kam Hwy & Lumiaina	K Mililani Park & Ride	Q Mililani Kamalo & Polapola	M Mililani Meheula & Kuahelani	X Pearl Harbor Nimitz Gte	V Navy Supply Center
▲ 515a	▲ 529a	▲ 534a	▲ 539a	▲ 541a	▲ 546a	▲ 547a	.....	.....	.....	▲ 604a	▲ 619a
.....	.....	.....	.....	.....	.....	.....	▲ 510a	▲ 525a	▲ 535a	▲ 555a	▲ 610a
State Holiday											
515a	525a	530a	535a	537a	542a	543a	.....	.....	.....	600a	615a
.....	.....	.....	.....	.....	.....	.....	510a	525a	535a	555a	610a

P.M. Weekday Only: To Mililani/Wahiawa/Wahiawa Heights

W Pearl Harbor Safeguard & Club	V Navy Supply Center	U Crestview Kam Hwy & Lumiaina	T Waipio Entry Kam Hwy & Waipio Uka	L Mililani Kam Hwy & Kuahelani	N Mililani Ainamakua & Meheula Parkway	P Mililani Lanikuhana & Kaukapuu	M Mililani Meheula Parkway & Kuahelani	D Wahiawa California & Cane	F Wahiawa Hts California & Gnd View	E Wahiawa Kamehameha & Olive Street
▲ 310p	**▲ 324p**	**▲ 339p**	**▲ 340p**	**▲ 350p**	.....	.....	.....	**▲ 400p**	**▲ 410p**	**▲ 419p**
▲ 310p	**▲ 324p**	.....	.....	.....	**▲ 345p**	**▲ 359p**	**▲ 410p**	.....	.....	.....
State Holiday										
310p	**324p**	**339p**	**340p**	**350p**	.....	.....	.....	**400p**	**412p**	**423p**
310p	**324p**	.....	.....	.....	**345p**	**359p**	**410p**	.....	.....	.....

Route 83A Destination Signs

AM:

To Pearl Harbor via H-2 Fwy - 83A EXPRESS PEARL HARBOR

To Pearl Harbor via Kamehameha Hwy - 83A EXPRESS PEARL HARBOR VIA KAM HWY

PM:

To Wahiawa Heights - 83A EXPRESS WAHIAWA HEIGTS

(At Kamehameha Hwy and Lumiauau Street, sign will change to 62 WAHIAWA HEIGTS

To Mililani - 83A EXPRESS MILILANI

Route 83A Symbols

▲ - Service on Route 83A does not operate on New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Discoverers' Day, Veterans' Day, Thanksgiving Day, Christmas Day and during emergency military base closures.

◆ - Regular local service along Kamehameha Hwy via Route 52

Note: State Holiday Express service operating on Martin Luther King Jr. Day, Kuhio Day, Good Friday, Kamehameha Day, Admission Day and Election Day holidays.

Bold indicates PM service.

Schedule to change without notice.

All buses are lift and bicycle rack equipped.

Route 84 - Mililani Express (Downtown/University of Hawaii) Revised 8/2508

A.M. Weekday Only: To Downtown Honolulu and University of Hawaii at Manoa

H Wahiawa Armory	J Waipio Acres	P Mililani Lanikuhana & Kauakapuu	M Mililani Meheula & Kuahelani	Y Downtown Vineyard & Palama	C Downtown Alapai & King	Z Downtown Beretania & Punchbowl	a King & Cooke	f Makiki Wilder & Alexander	i U of H University & Dole
455a	458a	506a	521a	548a	558a	600a			
525a	528a	536a	551a	625a	635a	637a			
550a	553a	601a	616a	653a	.....	.....	708a	718a	722a
620a	623a	631a	646a	723a	733a	735a	.....	.....	.....

State Holiday

H	J	P	M	Y	C	Z	a	f	i
455a	458a	506a	520a	547a	557a	558a			
555a	558a	606a	620a	652a	702a	703a			

P.M. Weekday Only: To Mililani

d Alapai Transit Center	Z Downtown Beretania & Punchbowl	Y Vineyard & Palama	M Mililani Meheula & Kuahelani	Q Mililani Kamaio & Polapola	J Waipio Acres	H Wahiawa Armory
345p	350p	400p	437p	451p	459p	501p
415p	420p	430p	509p	523p	531p	533p
445p	**450p**	**502p**	**540p**	**554p**	**602p**	**604p**
515p	**520p**	**532p**	**608p**	**622p**	**630p**	**632p**

State Holiday

d	Z	Y	M	Q	J	H
435p	438p	445p	517p	531p	539p	542p
515p	518p	525p	557p	611p	619p	622p

Route 84 Destination Signs

AM:

84 EXPRESS DOWNTOWN or DOWNTOWN/UNIVERSITY

PM:

84 EXPRESS MILILANI

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 84A - Mililani Express (Downtown/University of Hawaii)

Revised 8/25/08

A.M. Weekday Only: To Downtown Honolulu and University of Hawaii at Manoa

M Mililani Meheula & Kuahelani	R Mililani Meheula & Keaoopua	O Mililani Meheula & Lanikuhana	M Mililani Meheula & Kuahelani	Y Downtown Vineyard & Palama	C Downtown Alapai & King	Z Downtown Beretania & Punchbowl	b King & Cooke	f Makiki Wilder & Alexander	h U of H University & Dole
510a	519a	526a	527a	554a	604a	606a			
540a	549a	556a	557a	633a	643a	645a			
610a	619a	626a	627a	704a	.....	.....	719a	729a	733a
640a	649a	656a	657a	734a	.....	.....	749a	759a	803a

State Holiday

M	R	O	M	Y	C	Z	b	f	h
510a	521a	529a	530a	557a	607a	608a			
610a	621a	629a	630a	702a	712a	713a			

P.M. Weekday Only: To Mililani

d Alapai Transit Center	Z Downtown Beretania & Punchbowl	Y Downtown Vineyard & Palama	M Mililani Meheula & Kuahelani	O Mililani Meheula & Lanikuhana	R Mililani Meheula & Keaoopua	M Mililani Meheula & Kuahelani
405p	410p	420p	459p	500p	508p	519p
435p	440p	452p	531p	532p	540p	551p
505p	510p	522p	559p	600p	608p	619p
535p	540p	552p	628p	629p	637p	648p

State Holiday

d	Z	Y	M	O	R	M
435p	438p	445p	517p	518p	526p	537p
535p	538p	545p	617p	618p	626p	637p

Route 84A Destination Signs

AM:

84A EXPRESS DOWNTOWN or DOWNTOWN/UNIVERSITY

PM:

84A EXPRESS MILILANI

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 96 - Waipio Gentry Express (Downtown)

Revised 12/8/07

A.M. Weekday Only: To Downtown Honolulu

S Waipio Uka Blvd & Ukee	T Kamehameha Hwy & Waipio Uka Blvd	Y Downtown Vineyard & Palama	d Downtown Alapai & Hotel	Z Downtown Beretania & Punchbowl
545a	552a	617a	627a	629a
615a	622a	647a	657a	659a

State Holiday

S	T	Y	d	Z
545a	552a	617a	627a	628a

P.M. Weekday Only: To Waipio Gentry

d Alapai Transit Center	Z Downtown Beretania & Punchbowl	Y Downtown Vineyard & Palama	U Kamehameha Hwy & Lumiauau	S Waipio Uka Blvd & Ukee	T Kamehameha Hwy & Waipio Uka Blvd
430p	435p	447p	513p	515p	522p
500p	505p	517p	543p	545p	552p

State Holiday

d	Z	Y	U	S	T
500p	**503p**	**512p**	**533p**	**535p**	**542p**

Route 96 Destination Signs

AM:

96 EXPRESS DOWNTOWN

PM:

96 EXPRESS WAIPIO GEN TRY

Note: State Holiday Express service operating on Martin Luther King d Day, Kuhio Day, Good Fiday, Kamehameha Day, Admission Day and Election Day holidays.

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 98 - Wahiawa/Mililani Park and Ride Express and Route 98A Kunia/Wahiawa/Mililani/Waikiki Express

Effective 8/25/08

A.M. Weekday Only: To Downtown Honolulu/Waikiki

Route	I Kunia Kunia Drive & Kunia Road	M Mililani Meheula & Kuahelani	J Waipio Acres Kam Hwy & Waikalani	H Wahiawa Park & Ride (Armory)	O Mililani Transit Center	K Mililani Park & Ride	Y Downtown Vineyard & Palama	C Downtown Alapai & King	Z Downtown Beretania & Punchbowl	b Kapiolani & South	g Ala Moana Blvd Ala Moana Center	j Monsarrat & Kalakaua
98A	449a			458a	508a	513a	541a			551a	556a	613a
98	.....	518a	523a	525a	.....	532a	600a	610a	612a	.....	.....	.....
98A	527a			536a	546a	551a	619a			631a	636a	653a
98	.....	546a	553a	555a	.....	602a	634a	644a	646a	.....	.....	.....
98	.....	618a	623a	625a	.....	632a	712a	722a	724a	.....	.....	.....

State Holiday

Route	I	M	J	H	O	K	Y	C	Z	b	g	j
98A	449a			458a	508a	513a	541a			551a	556a	613a
98	.....	518a	523a	525a	.....	532a	600a	610a	611a	.....	.....	.....
98A	529a			538a	548a	553a	621a			631a	636a	653a
98	.....	603a	608a	610a	.....	617a	656a	706a	707a	.....	.....	.....

P.M. Weekday Only: To Mililani/Wahiawa/Kunia

Route	j Waikiki Monsarrat & Kalakaua	g Ala Moana Blvd Ala Moana Center	C Downtown Alapai & King	Z Downtown Beretania & Punchbowl	Y Downtown Vineyard & Palama	K Mililani Park & Ride	O Mililani Transit Center	H Wahiawa Park & Ride (Armory)	J Waipio Acres Kam Hwy & Waikalani	M Mililani Meheula & Kuahelani	I Kunia Kunia Drive & Kunia Road
98	.....	.....	**415p**	**420p**	**430p**	**508p**	.....	**513p**	**515p**	**520p**	.....
98A	**400p**	**427p**	**436p**	**441p**	**453p**	**527p**	**532p**	**542p**	.....	.....	**552p**
98	.....	.....	**445p**	**450p**	**502p**	**535p**	.....	**540p**	**542p**	**547p**	.....
98A	**440p**	**507p**	**516p**	**521p**	**533p**	**606p**	**611p**	**621p**	.....	.....	**631p**
98	.....	.....	**525p**	**530p**	**542p**	**615p**	.....	**620p**	**622p**	**627p**	.....

State Holiday

Route	j	g	C	Z	Y	K	O	H	J	M	I
98	.....	.....	**430p**	**434p**	**442p**	**515p**	.....	**520p**	**522p**	**527p**	.....
98A	**400p**	**427p**	**436p**	**440p**	**448p**	**521p**	**526p**	**536p**	.....	.....	**546p**
98A	**440p**	**507p**	**516p**	**520p**	**528p**	**601p**	**606p**	**616p**	.....	.....	**626p**
98	.....	.....	**525p**	**529p**	**537p**	**610p**	.....	**615p**	**617p**	**622p**	.....

Route 98 and Route 98A Destination Signs

AM:

To Beretania/Punchbowl: 98 EXPRESS DOWNTOWN

To Monsarrat/Kalakaua: 98A EXPRESS DOWNTOWN WAIKIKI

PM:

To Mililani: 98 EXPRESS MILILANI-WAHIAWA PARK & RIDE

To Kunia Dr/Kunia Rd: 98A EXPRESS MILILANI WAHIAWA KUNIA CAMP

Route 98A Local and Express Service

Eastbound from Kunia to Downtown Honolulu/Ala Moana/Waikiki

Buses will service all local stops from Kunia to Mililani, then "EXPRESS" from H-2 South to H-1 East, exiting at Vineyard Blvd. Buses will service all local stops from Vineyard Blvd. to Kapiolani Blvd./South St., then "EXPRESS" to Ala Moana Blvd. opposite Ala Moana Center. Buses will service all local stops from opposite Ala Moana Center into Waikiki, ending at Monsarrat Ave./Kalakaua Ave.

Westbound from Waikiki to Kunia

Buses will service all local stops from Waikiki to Ala Moana Blvd. fronting Ala Moana Center, then "EXPRESS" to Alapai Transit Center. Buses will service all local stops from Beretania Street to Vineyard Blvd./Palama St., then "EXPRESS" from H-1 West to H-2 North, exiting at Meheula Parkway. Buses will service all local stops through Mililani, ending at Kunia Dr.

Bold indicates PM service.
Schedule to change without notice.
All buses are lift and bicycle rack equipped.

Route 4[illegible] Waipahu - Waikele Shopping Center

Effective [illegible]/08

Weekday: To Waikele /Waipio/Waipahu

A Waipahu Transit Center	H Kamehameha Hwy & Lumiaina	O Kamehameha Hwy & Lumiauau	U Moaniani & Ukee	H Kamehameha Hwy & Lumiaina	A Waipahu Transit Center
500a	513a			513a	526a
530a	543a			543a	556a
600a	613a			613a	626a
630a	643a	.....	.....	643a	656a
700a	713a	.....	.....	713a	726a
730a	743a	.....	.....	743a	756a
800a		816a	825a	839a	855a
830a		846a	855a	909a	925a
900a		916a	925a	939a	955a
930a	.....	946a	955a	1009a	1025a
1000a	.....	1016a	1025a	1039a	1055a
1030a	.....	1046a	1055a	1109a	1125a
1100a		1116a	1125a	1139a	1155a
1130a		1146a	1155a	1209p	1225p
1200p	.....	1216p	1225p	1239p	1255p
1230p	.....	1246p	1255p	109p	125p
100p	.....	116p	125p	139p	155p
130p	.....	146p	155p	209p	225p
200p	.....	216p	225p	239p	255p
230p	.....	246p	255p	309p	325p
300p	.....	316p	325p	339p	355p
330p	.....	346p	355p	409p	425p
400p	.....	416p	425p	439p	455p
430p	.....	446p	455p	509p	525p
500p	.....	516p	525p	539p	555p
530p	.....	546p	555p	609p	625p
600p	.....	616p	625p	639p	655p
630p	643p	.....	.....	.....	.....
700p	713p	.....	.....	713p	726p
730p	743p	.....	.....	743p	756p
800p	813p	.....	.....	813p	826p
900p	913p	.....	.....	913p	926p
1000p	1013p	.....	.....	1013p	1026p
1105p	1118p	.....	.....	1118p	1131p

Saturday/State Holiday: To Waikele/Waipio/Waipahu

A Waipahu Transit Center	H Kamehameha Hwy & Lumiaina	O Kamehameha Hwy & Lumiauau	U Moaniani & Ukee	H Kamehameha Hwy & Lumiaina	A Waipahu Transit Center
500a	513a			513a	526a
600a	613a			613a	626a
700a	713a			713a	726a
800a	.....	816a	825a	839a	855a
900a	.....	916a	925a	939a	955a
1000a	.....	1016a	1025a	1039a	1055a
1030a		1046a	1055a	1109a	1125a
1100a		1116a	1125a	1139a	1155a
1130a		1146a	1155a	1209p	1225p
1200p	.....	1216p	1225p	1239p	1255p
1230p	.....	1246p	1255p	109p	125p
100p	.....	116p	125p	139p	155p
130p	.....	146p	155p	209p	225p
200p	.....	216p	225p	239p	255p
230p	.....	246p	255p	309p	325p
300p	.....	316p	325p	339p	355p
330p	.....	346p	355p	409p	425p
400p	.....	416p	425p	439p	455p
430p	.....	446p	455p	509p	525p
500p	.....	516p	525p	539p	555p
530p	.....	546p	555p	609p	625p
600p	.....	616p	625p	639p	655p
630p	.....	646p	.....	.....	.....
700p	713p	.....	.....	713p	726p
800p	813p	.....	.....	813p	826p
900p	913p	.....	.....	913p	926p
1000p	1013p	.....	.....	1013p	1026p
1100p	1113p	.....	.....	1113p	1126p

Sunday: To Waikele/Waipahu

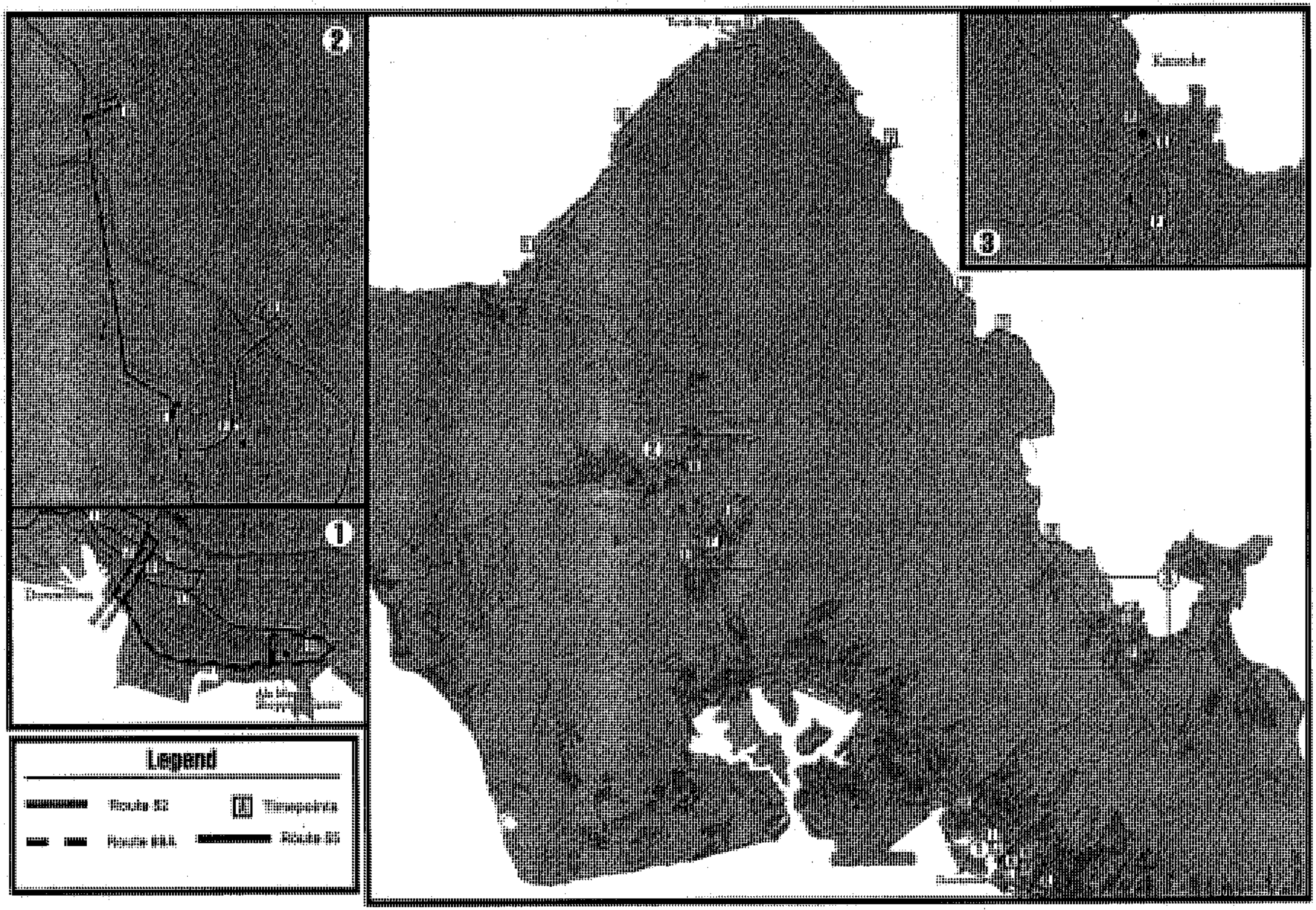
A Waipahu Transit Center	O Kamehameha Hwy & Lumiaina	A Waipahu Transit Center
500a	513a	526a
600a	613a	626a
700a	713a	726a
800a	813a	826a
900a	913a	926a
1000a	1013a	1026a
1030a	1043a	1056a
1100a	1113a	1126a
1130a	1143a	1156a
1200p	1213p	1226p
1230p	1243p	1256p
100p	113p	126p
130p	143p	156p
200p	213p	226p
230p	243p	256p
300p	313p	326p
330p	343p	356p
400p	413p	426p
430p	443p	456p
500p	513p	526p
530p	543p	556p
600p	613p	626p
630p	643p	656p
700p	713p	726p
800p	813p	826p
900p	913p	926p
1000p	1013p	1026p
1100p	1113p	1126p

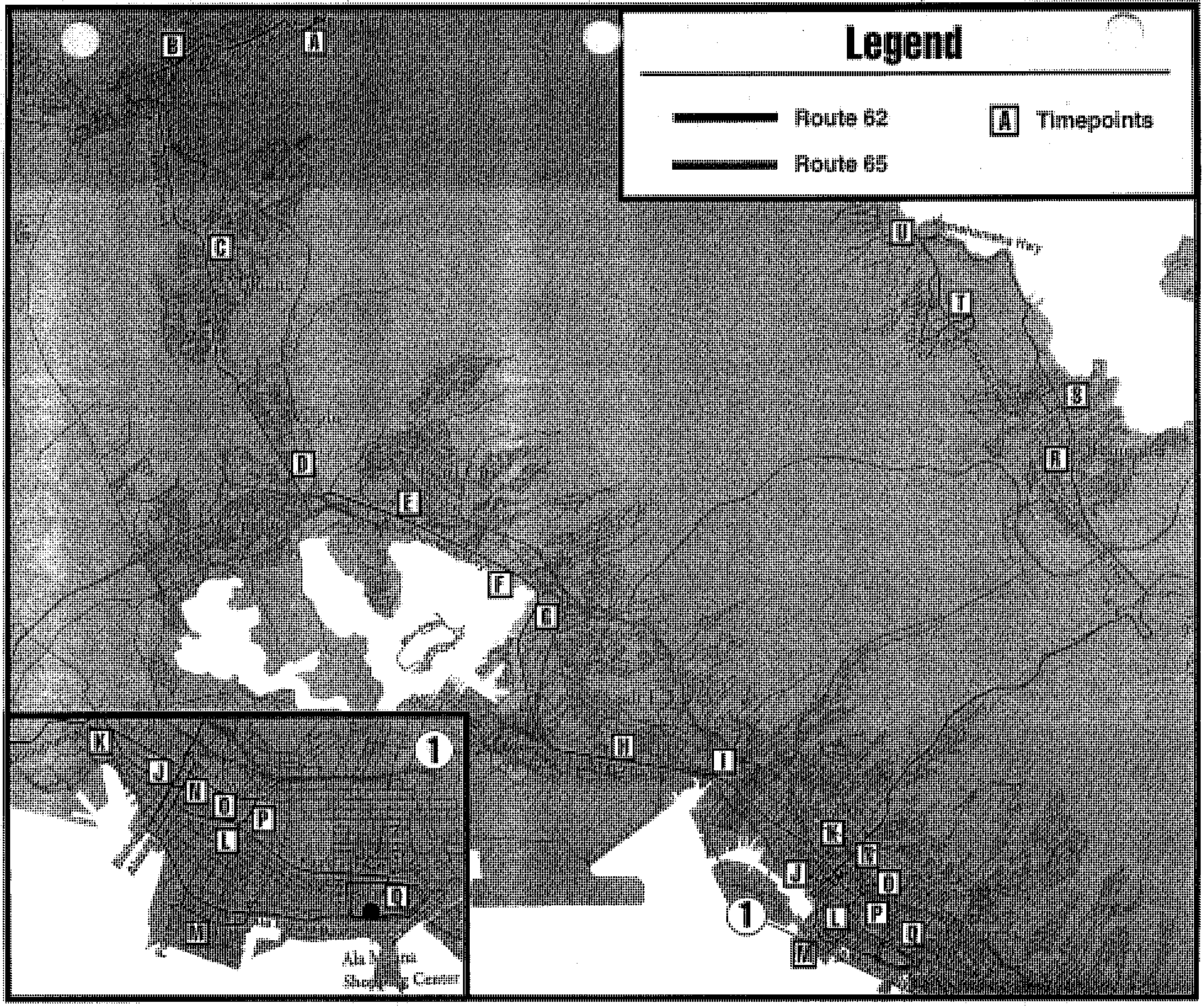
Route 433 Destination Signs

To Waikele:
433 WAIKELE
To Waipahu Transit Center:
433 WAIPAHU TRANSIT CENTER

State holiday service operating on Martin Luther King Jr. Day, Kuhio Day, Good Friday, Kamehameha Day, Admission Day and Election Day holidays

Bold indicates PM service. Schedule to change without notice. All buses are lift and bicycle rack equipped.


Legend


Legend
Route 62
Route 65
A Timepoints
A
B
C
D
E
F
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Q
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S
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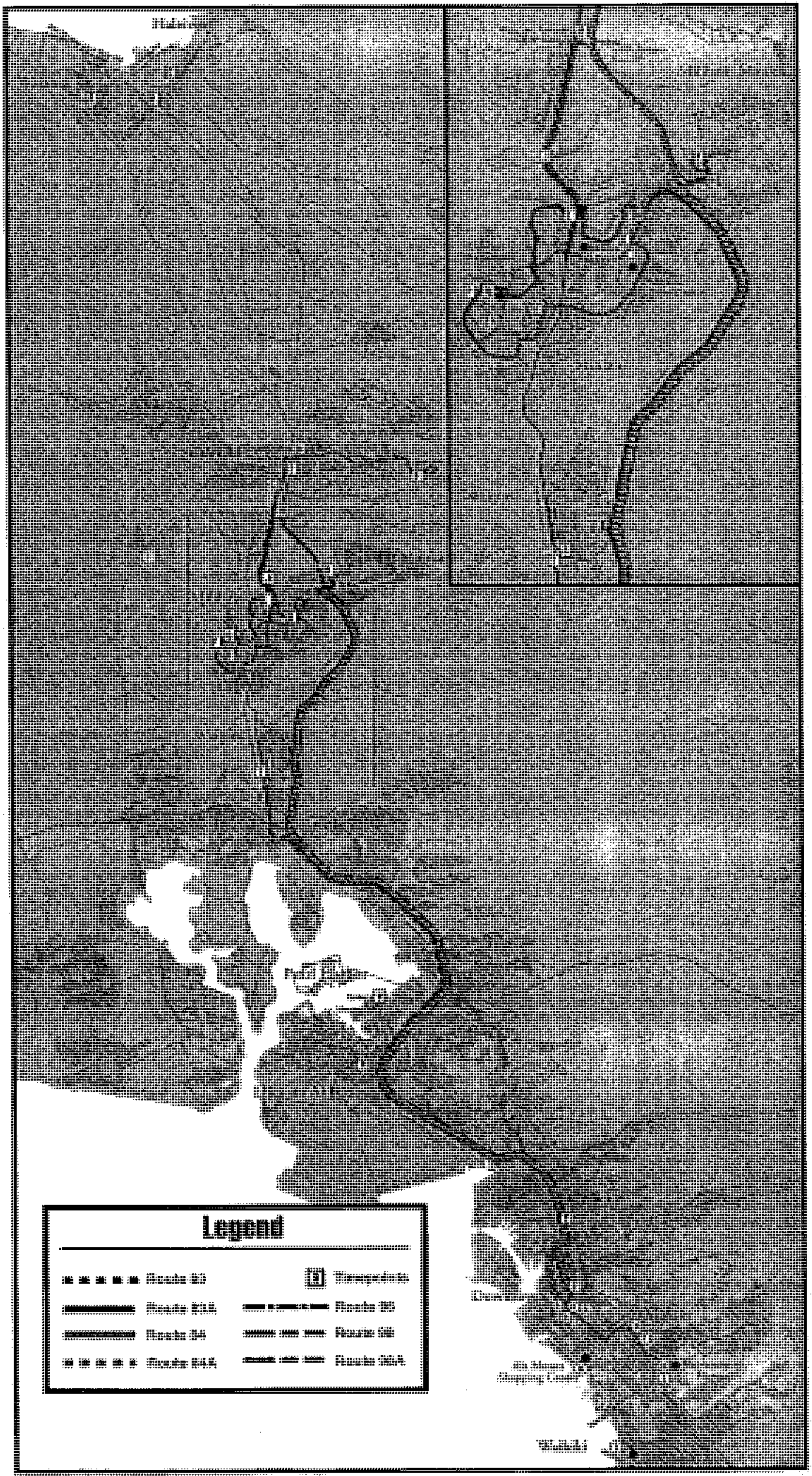
U
1
Ala Moana
Shopping Center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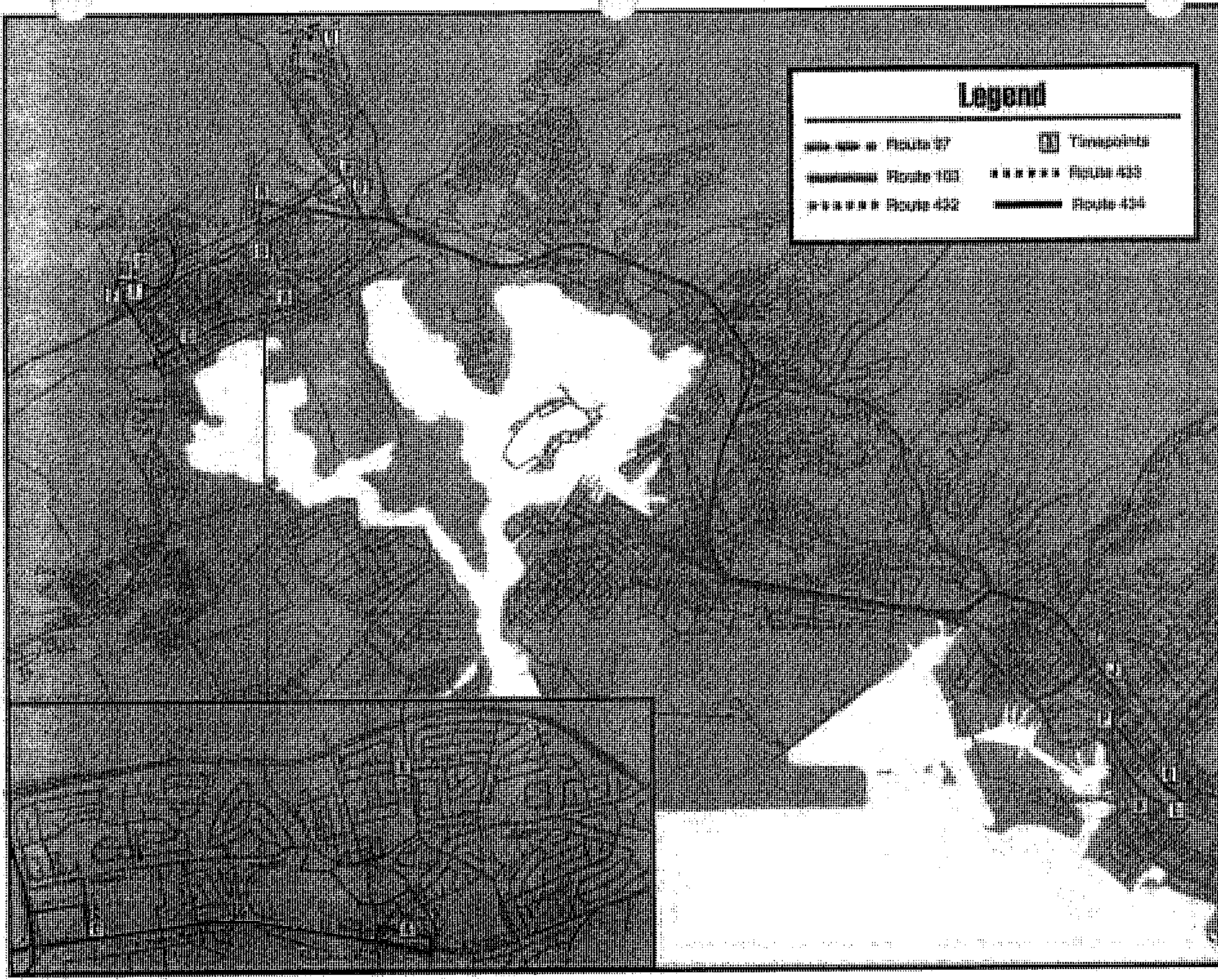


Legend
Route 97
Route 103
Route 432
Timepoints
Route 433
Route 434

APPENDIX B: TheBus Route Profiles

The following are TheBus route profiles from the Transit Rider Database (TRD) for those services in proximity to Koa Ridge Makai and Waiawa:

Route 52 -- 1 page

Route 62 -- 1 page

Route 83 -- 1 page

Route 83a -- 1 page

Route 84 -- 1 page

Route 84a -- 1 page

Route 96 -- 1 page

Route 98 -- 1 page

Note:The data was collected in 2004 and Route 433 did not exist at that time.

TheBus Route 52

TURTLE BAY-ALA MOANA

Key Rider Characteristics For Route 52 (with 55, 62 & 65)

53.0 %	Are licensed drivers
25.2 %	Have a vehicle available
27.2 %	Are students
47.0 %	Are employed full-time
8.3 %	Are visitors or tourists
80.5 %	Are Title VI minorities
49.8 %	Have household incomes $25,000 or less
15.2 %	Are 18 years of age or younger
7.5 %	Are 65 years of age or older
26.1 %	Have been riding for 15 years or more
76.4 %	Rate TheBus as being good or better

Connecting Mode To And From The Route

	Percent By Mode		
	Walk	Bus	Other
To TheBus	66.0%	22.9%	11.1%
From TheBus	75.0%	18.5%	6.5%

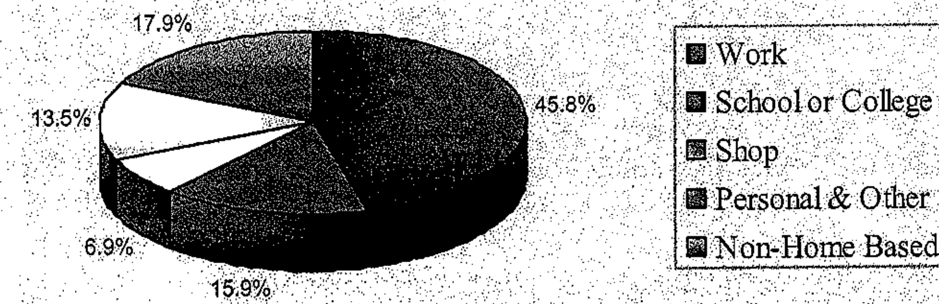
Distance Walked To And From Bus Stop Along Route

	Percent By Number Of Blocks		
	One or Less	Two or Three	Four or More
To TheBus	38.6%	44.7%	16.4%
From TheBus	43.6%	37.8%	18.6%

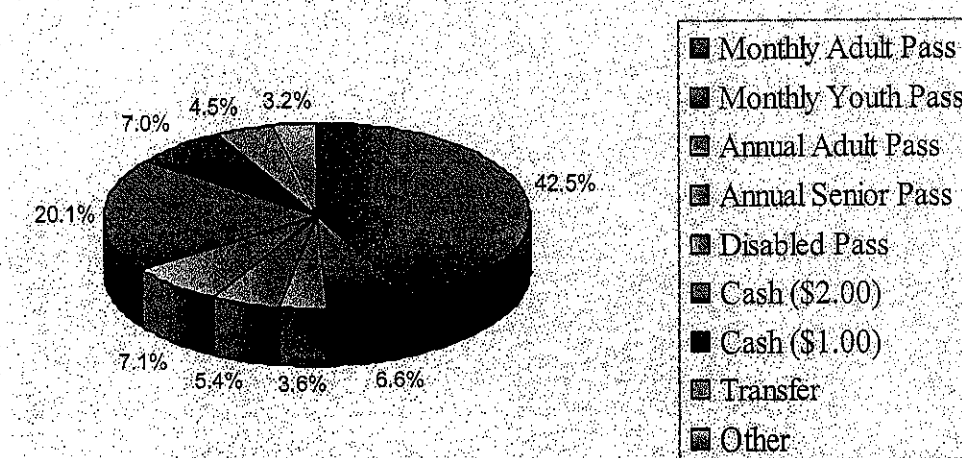
Route Sample

727 Valid Surveys
16,953 Weekday Ridership Expansion Total

Trip Purpose



Fare Payment



TheBus Route 62

WAHIAWA-ALA MOANA

Key Rider Characteristics For Route 62 (with 52, 55 & 65)

53.0 %	Are licensed drivers
25.2 %	Have a vehicle available
27.2 %	Are students
47.0 %	Are employed full-time
8.3 %	Are visitors or tourists
80.5 %	Are Title VI minorities
49.8 %	Have household incomes $25,000 or less
15.2 %	Are 18 years of age or younger
7.5 %	Are 65 years of age or older
26.1 %	Have been riding for 15 years or more
76.4 %	Rate TheBus as being good or better

Connecting Mode To And From The Route

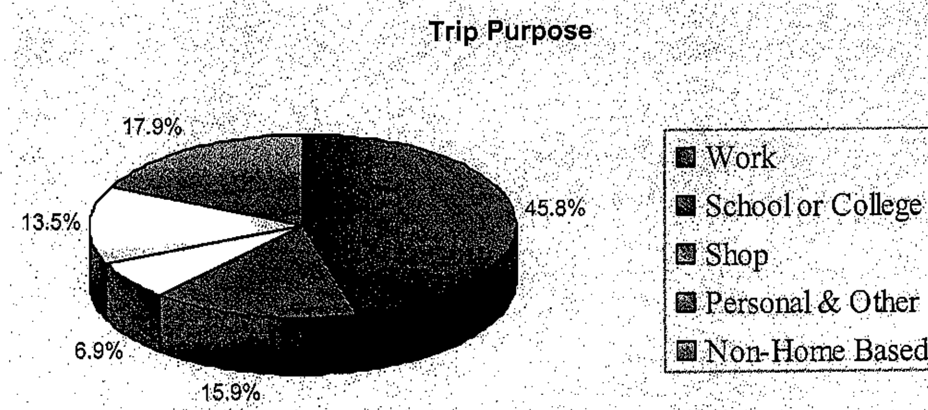
	Percent By Mode		
	Walk	Bus	Other
To TheBus	66.0%	22.9%	11.1%
From TheBus	75.0%	18.5%	6.5%

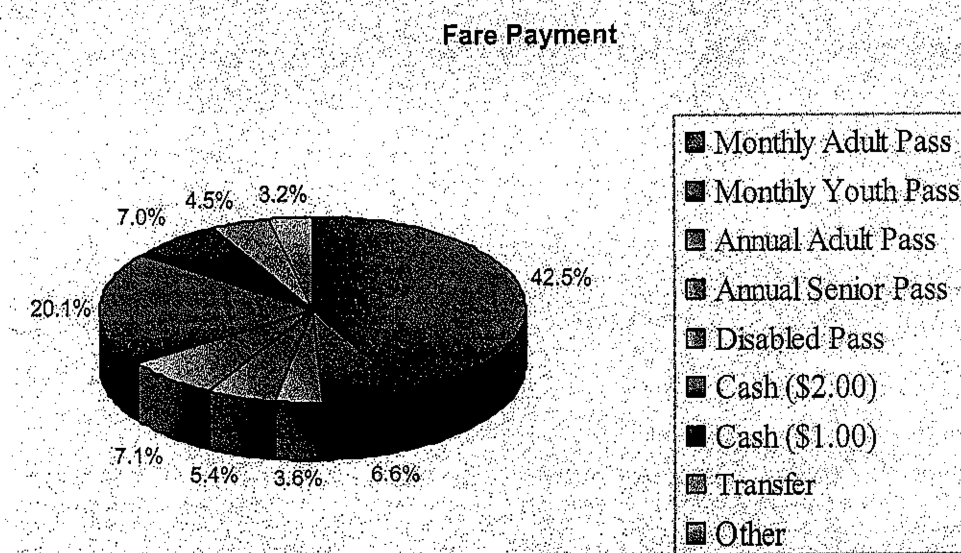
Distance Walked To And From Bus Stop Along Route

	Percent By Number Of Blocks		
	One or Less	Two or Three	Four or More
To TheBus	38.6%	44.7%	16.4%
From TheBus	43.6%	37.8%	18.6%

Route Sample

727 Valid Surveys
16,953 Weekday Ridership Expansion Total





TheBus Route 83

WAIALUA-WAHIAWA-DOWNTOWN-U.H.

Key Rider Characteristics For Route 83

59.4 % Are licensed drivers
60.2 % Have a vehicle available
13.1 % Are students
77.6 % Are employed full-time
0.0 % Are visitors or tourists
86.3 % Are Title VI minorities
39.3 % Have household incomes $25,000 or less
7.0 % Are 18 years of age or younger
4.5 % Are 65 years of age or older
23.2 % Have been riding for 15 years or more
85.1 % Rate TheBus as being good or better

Connecting Mode To And From The Route

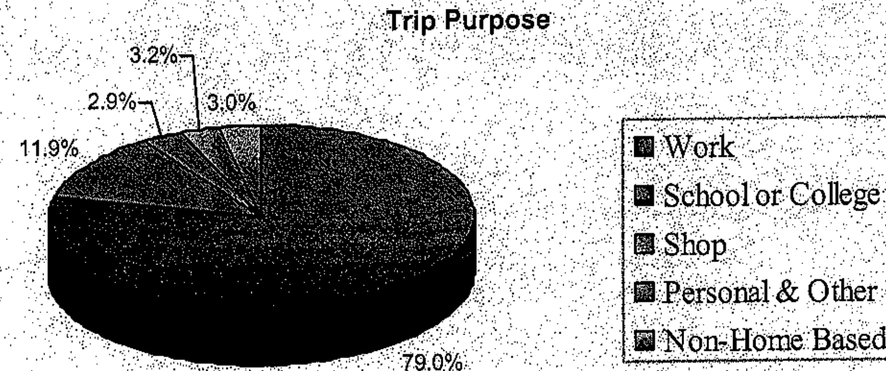
	Percent By Mode		
	Walk	Bus	Other
To TheBus	63.6%	13.0%	23.4%
From TheBus	68.5%	18.3%	13.2%

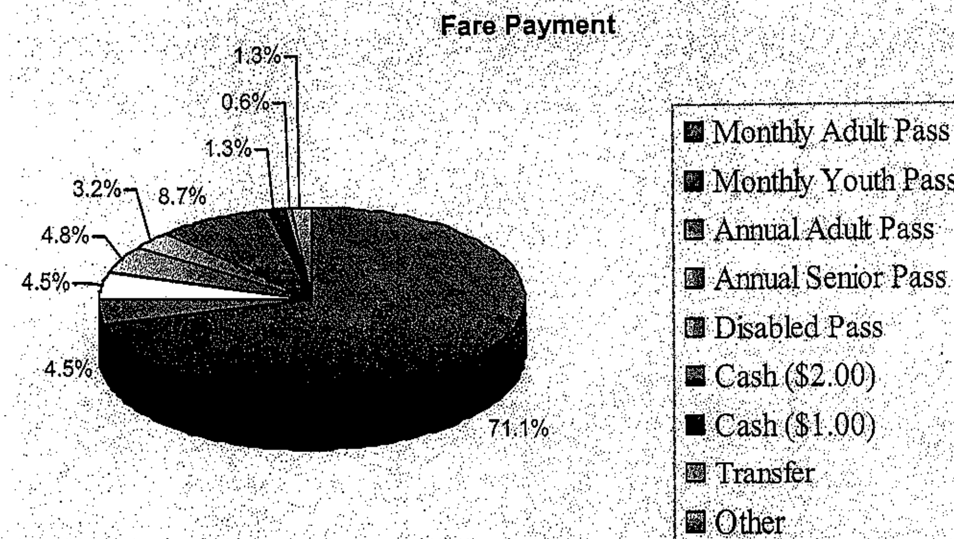
Distance Walked To And From Bus Stop Along Route

	Percent By Number Of Blocks		
	One or Less	Two or Three	Four or More
To TheBus	71.1%	19.8%	9.1%
From TheBus	45.7%	51.6%	2.7%

Route Sample

312 Valid Surveys
615 Weekday Ridership Expansion Total





TheBus Route 83a

WAHIAWA-PEARL HARBOR

Key Rider Characteristics For Route 83A

84.2 %	Are licensed drivers
73.7 %	Have a vehicle available
15.8 %	Are students
100.0 %	Are employed full-time
0.0 %	Are visitors or tourists
100.0 %	Are Title VI minorities
5.6 %	Have household incomes $25,000 or less
0.0 %	Are 18 years of age or younger
0.0 %	Are 65 years of age or older
10.5 %	Have been riding for 15 years or more
100.0 %	Rate TheBus as being good or better

Connecting Mode To And From The Route

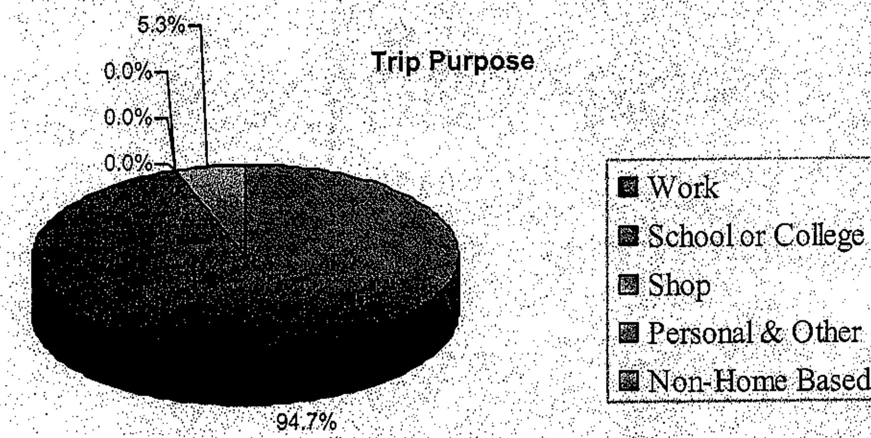
	Percent By Mode		
	Walk	Bus	Other
To TheBus	84.2%	0.0%	15.8%
From TheBus	89.5%	0.0%	10.5%

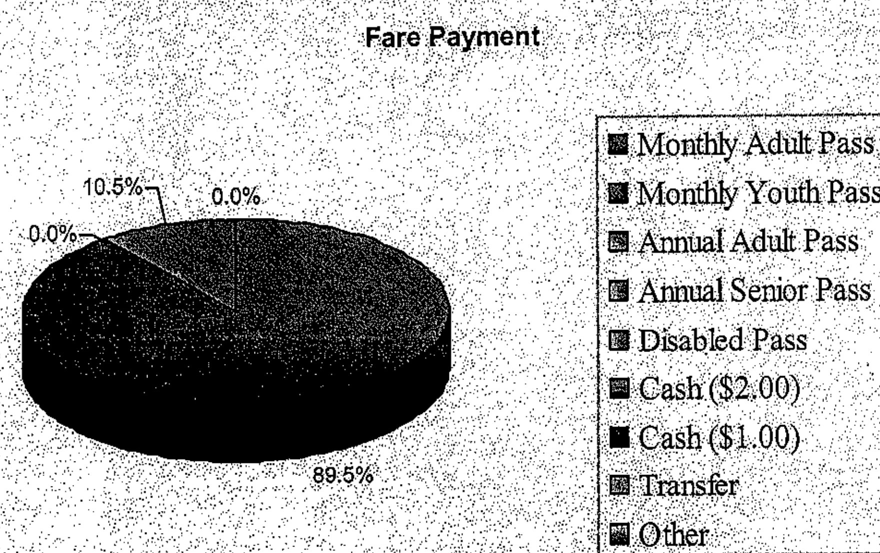
Distance Walked To And From Bus Stop Along Route

	Percent By Number Of Blocks		
	One or Less	Two or Three	Four or More
To TheBus	75.0%	16.6%	8.4%
From TheBus	61.6%	15.4%	23.0%

Route Sample

19 Valid Surveys
105 Weekday Ridership Expansion Total





TheBus Route 84
WAHIAWA ARMORY-U.H.

Key Rider Characteristics For Route 84

62.3 %	Are licensed drivers
51.9 %	Have a vehicle available
6.5 %	Are students
90.7 %	Are employed full-time
0.0 %	Are visitors or tourists
91.3 %	Are Title VI minorities
52.0 %	Have household incomes $25,000 or less
1.3 %	Are 18 years of age or younger
5.3 %	Are 65 years of age or older
15.6 %	Have been riding for 15 years or more
90.9 %	Rate TheBus as being good or better

Connecting Mode To And From The Route

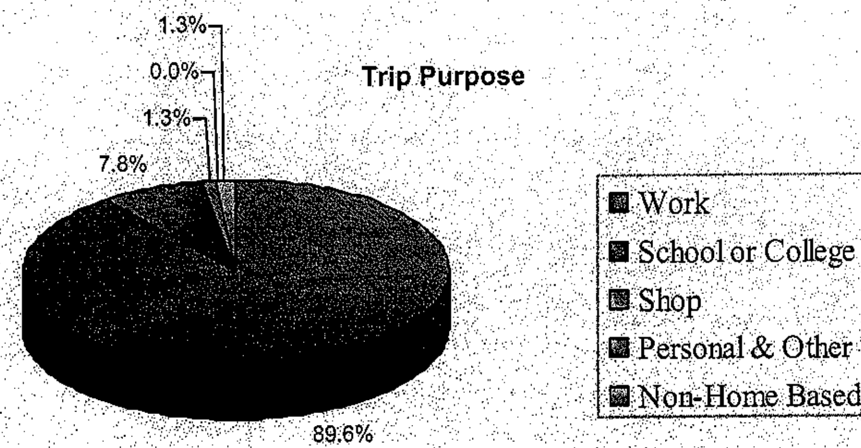
	Percent By Mode		
	Walk	Bus	Other
To TheBus	74.0%	15.6%	10.4%
From TheBus	89.5%	0.0%	10.5%

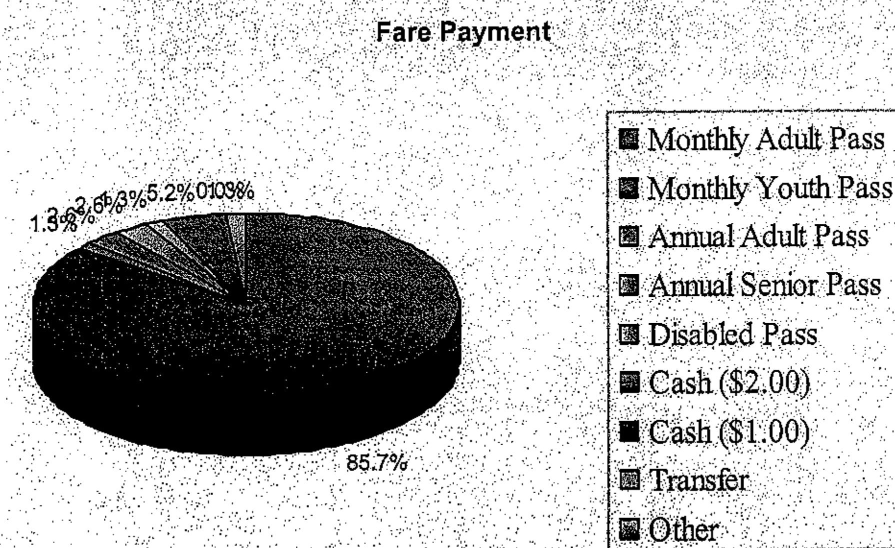
Distance Walked To And From Bus Stop Along Route

	Percent By Number Of Blocks		
	One or Less	Two or Three	Four or More
To TheBus	79.6%	16.4%	4.0%
From TheBus	37.8%	52.8%	9.4%

Route Sample

207 Valid Surveys
752 Weekday Ridership Expansion Total





TheBus Route 84a

MILILANI-U.H.

Key Rider Characteristics For Route 84A

73.9 % Are licensed drivers
58.3 % Have a vehicle available
20.8 % Are students
79.2 % Are employed full-time
0.0 % Are visitors or tourists
91.7 % Are Title VI minorities
23.9 % Have household incomes $25,000 or less
9.1 % Are 18 years of age or younger
4.5 % Are 65 years of age or older
29.2 % Have been riding for 15 years or more
81.8 % Rate TheBus as being good or better

Connecting Mode To And From The Route

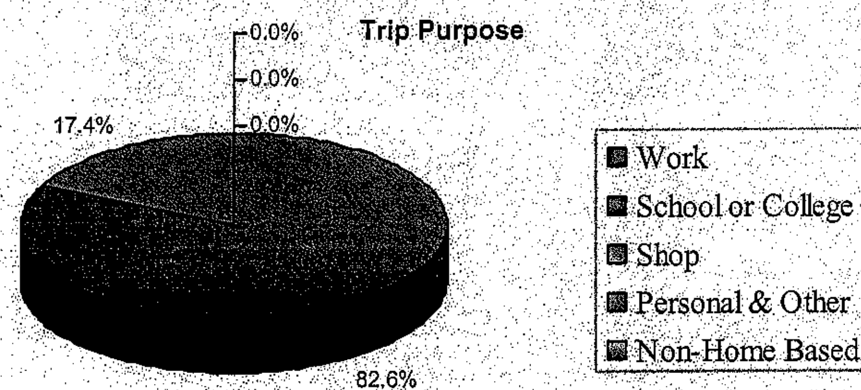
	Percent By Mode		
	Walk	Bus	Other
To TheBus	83.3%	0.0%	16.7%
From TheBus	66.7%	25.0%	8.3%

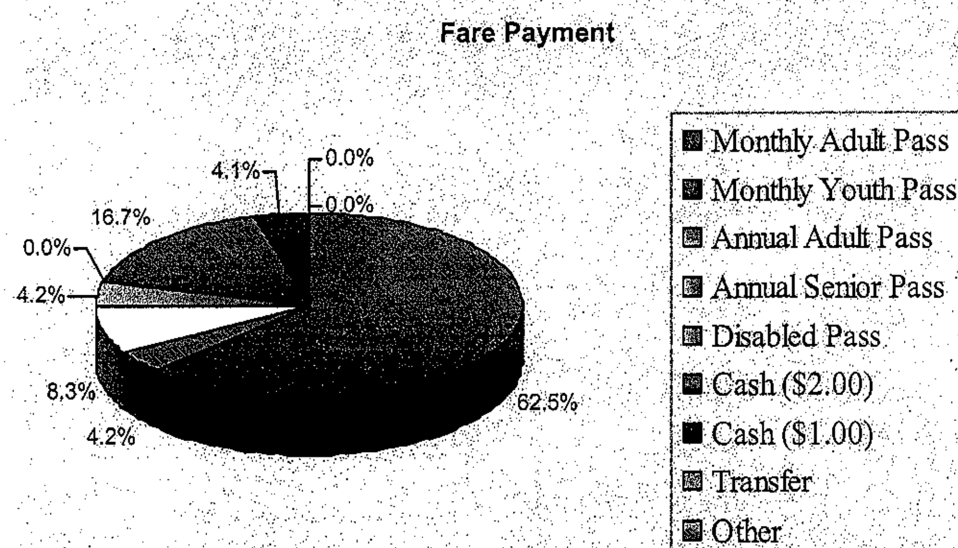
Distance Walked To And From Bus Stop Along Route

	Percent By Number Of Blocks		
	One or Less	Two or Three	Four or More
To TheBus	61.5%	23.1%	15.4%
From TheBus	63.7%	36.3%	0.0%

Route Sample

24 Valid Surveys
Weekday Ridership Expansion Total





TheBus Route 96

WAIPIO GENTRY-DOWNTOWN

Key Rider Characteristics For Route 96

82.2 %	Are licensed drivers
64.6 %	Have a vehicle available
8.9 %	Are students
92.1 %	Are employed full-time
0.0 %	Are visitors or tourists
86.6 %	Are Title VI minorities
13.2 %	Have household incomes $25,000 or less
5.6 %	Are 18 years of age or younger
5.6 %	Are 65 years of age or older
26.3 %	Have been riding for 15 years or more
90.8 %	Rate TheBus as being good or better

Connecting Mode To And From The Route

	Percent By Mode		
	Walk	Bus	Other
To TheBus	69.0%	23.0%	8.0%
From TheBus	90.1%	7.9%	2.0%

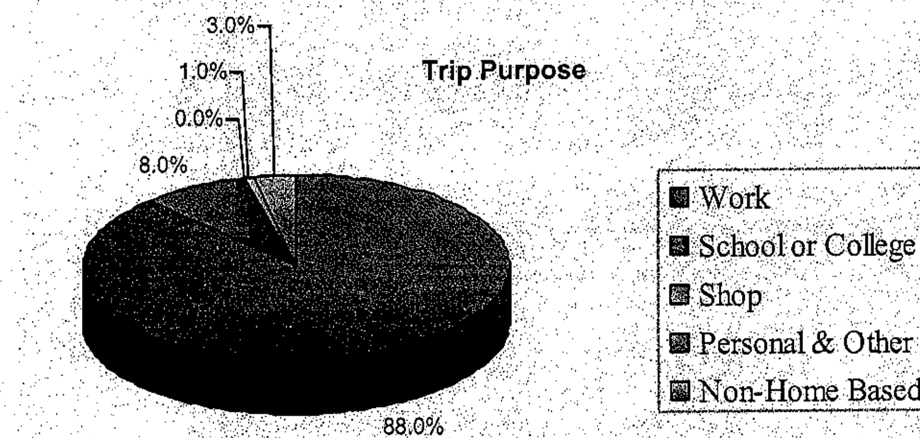
Distance Walked To And From Bus Stop Along Route

	Percent By Number Of Blocks		
	One or Less	Two or Three	Four or More
To TheBus	42.9%	46.9%	10.2%
From TheBus	42.2%	42.2%	15.6%

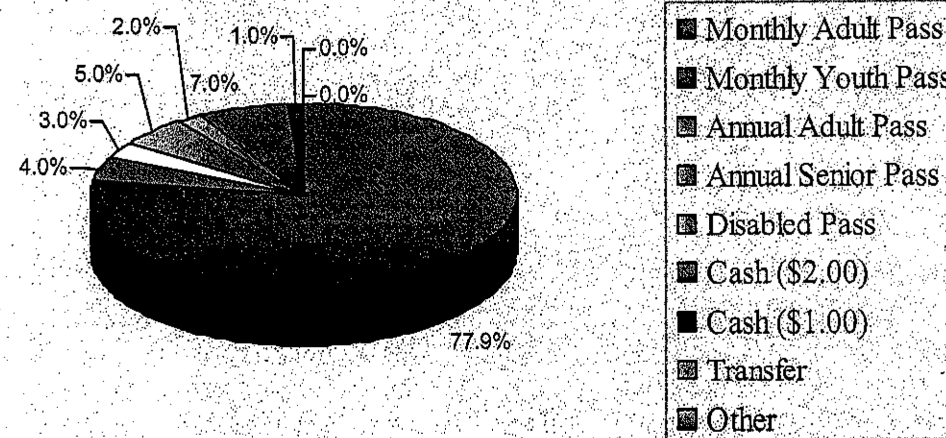
Route Sample

101 Valid Surveys
144 Weekday Ridership Expansion Total

Trip Purpose



Fare Payment



TheBus Route 98

WAHIAWA PARK AND RIDE-MILILANI PARK AND RIDE-DOWNTOWN

Key Rider Characteristics For Route 98

91.1 %	Are licensed drivers
81.4 %	Have a vehicle available
7.1 %	Are students
92.1 %	Are employed full-time
0.0 %	Are visitors or tourists
84.8 %	Are Title VI minorities
8.9 %	Have household incomes $25,000 or less
2.6 %	Are 18 years of age or younger
5.8 %	Are 65 years of age or older
26.0 %	Have been riding for 15 years or more
87.6 %	Rate TheBus as being good or better

Connecting Mode To And From The Route

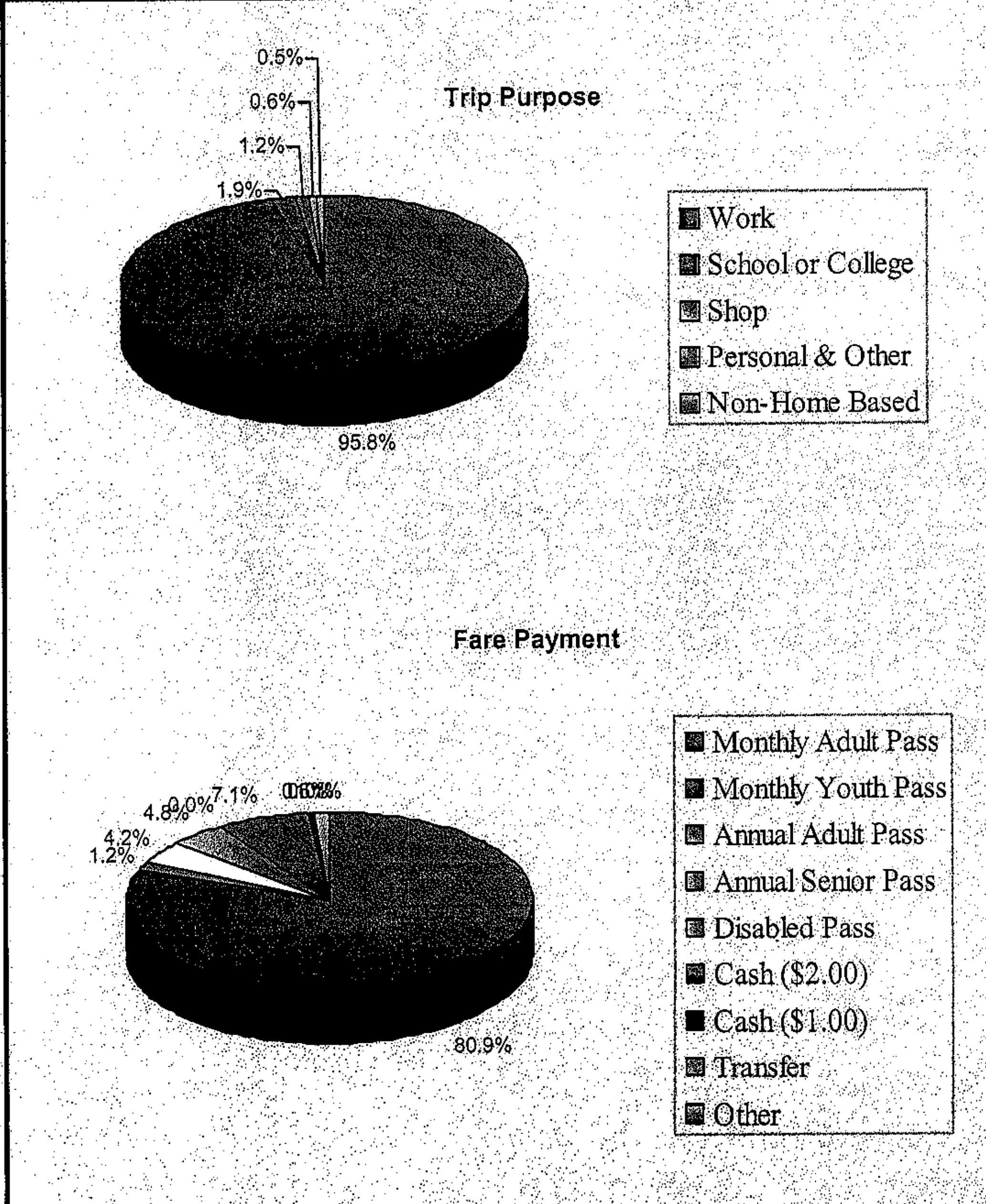
	Percent By Mode		
	Walk	Bus	Other
To TheBus	46.7%	6.5%	46.8%
From TheBus	69.6%	11.3%	19.1%

Distance Walked To And From Bus Stop Along Route

	Percent By Number Of Blocks		
	One or Less	Two or Three	Four or More
To TheBus	34.0%	48.0%	18.0%
From TheBus	50.7%	39.1%	10.2%

Route Sample

168 Valid Surveys
214 Weekday Ridership Expansion Total



APPENDIX C: DTS Central Oahu Bus Service Plan

The following correspondence from DTS to the Honolulu City Council dated October 21, 2005 presents the Central Oahu Bus Service Plan.

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 523-4529 • Fax: (808) 523-4730 • Internet: www.co.honolulu.hi.us

MUFI HANNEMANN
MAYOR

ALFRED A. TANAKA, P.E.
ACTING DIRECTOR

October 21, 2005

RECEIVED
OCT 28 11 15 AM '05
CITY CLERK
HONOLULU, HAWAII

The Honorable Donovan M. Dela Cruz, Chair
and Members of the City Council
City and County of Honolulu
530 South King Street
Honolulu, Hawaii 96813

Dear Chair Dela Cruz and Councilmembers:

Subject: Resolution No. 05-248 Urging the Department of Transportation Services to Evaluate and Improve Bus Service for Central Oahu

Please find attached our Central Oahu Bus Service Plan. This report reviews the current services in Central Oahu and discusses our proposed plan and implementation phases. We also reviewed the proposed service recommendations as outlined in Resolution No. 05-248. This plan does not include express bus services.

Our service plan was developed based on ridership analysis and surveys, as well as comments and input received at various community forums conducted in the past.

Sincerely,

ALFRED A. TANAKA, P.E.
Acting Director

Attachment

APPROVED:

JEFF COELHO
Managing Director

Dept. Com. No. 1012

Central Oahu Bus Service Plan

This report reviews the current services in Central Oahu and discusses our proposed plan and implementation phases. We also reviewed the proposed service recommendations as outlined in Resolution 05-248. This plan does not include express bus services.

Our service plan was developed based on ridership analysis and surveys as well as comments and input received at various community forums conducted in the past.

The Central Oahu Bus Service Plan service area extends from Waipio Gentry to Haleiwa. It includes Waipio Gentry, Mililani (North and South), Waikalani, Launani, Wheeler/Schofield, Wahiawa, Whitmore, Haleiwa, and Waialua.

Exhibit I shows the current services.

Route 52 – Wahiawa-Circle Island is an all-day, every day service. It traverses in local service between Haleiwa, Wahiawa, and Mililani. Route 52 travels on the freeway between Mililani and Downtown Honolulu.

Route 62 – Wahiawa/Wahiawa Heights-Ala Moana Center is a local service that travels between Wahiawa to Ala Moana Center. Route 62 travels on Kamehameha Highway between Wahiawa and Downtown Honolulu.

Route 72 – Wahiawa-Schofield-Whitmore is a shuttle service between Schofield and Whitmore through Wahiawa. Limited service is provided to the Naval Computers and Telecommunications Area Master Station (NCTAMS) Pacific.

Route 76 – Waialua-Haleiwa is a shuttle service between Waialua and Haleiwa.

Route 503 – Mililani-Waikalani-Launani is a community access shuttle. This shuttle service uses a Handi-Van type vehicle to provide shuttle service between Launani Valley, Waikalani, and Mililani.

Exhibit II is our proposed service plan.

This service plan shows service operating from three hub locations.

Routes 50, 501, 502, 503, 504, and 505 originate and terminate at the Mililani hub at the Mililani Town Center.

ENCL TO D 101

Routes 51, 511, 512, and 513 originate and terminate at the Wahiawa hub at the Wahiawa Civic Center.

Route 52 is a through route serving both the Mililani and Wahiawa hubs as well as the Haleiwa hub.

We propose to implement the Central Oahu Service Plan in four phases.

Phase 1:

Extension of Route 433 – Waipahu Transit Center-Waikele to Waipio (Moaniani). This service was funded in the Fiscal Year 2006 budget and provides service to the Kaiser Clinic/Costco area in Waipio.

Anticipated Implementation Date: December 2005

Phase 2: Assumes no additional funding.

Route 51 – Honolulu to Wahiawa is implemented, with the exception of the Mililani via Meheula and Lanikuhana extension. Route 62 is discontinued.

Route 511 – Wahiawa Heights shuttle to the Wahiawa hub is implemented.

Routes 512/513 – Wahiawa-Whitmore and Wahiawa-Schofield from the Wahiawa hub is implemented. The Route 72 one-bus operation is discontinued.

Route 521/522 – Haleiwa-Waialua Beach and Haleiwa-Mokuleia Beach from the Haleiwa hub is implemented. The Route 76 one bus operation is discontinued.

Anticipated Implementation Date: June 2006

Phase 3: Requires about 40,500 additional service hours.

If we assume a service hour to cost $65.00, this means implementation of Phase 3 will cost at least $2,632,500 at today's prices. Phase 3 implements Route 50. Route 50 provides service between the Mililani hub, Waipahu Transit Center, and the Kapolei Transit Center. Since Route 50 will provide service along Lumiaina through Waikele, Route 433 will be modified to provide service to upper Waikele and Manager's Drive. Schedule adjustment modifications to Route 52 are also planned in Phase 3.

Anticipated Implementation Date: December 2006 Pending Funding

Phase 4:

Implements Mililani Shuttle Routes 501, 502, and 504. This is about 19,000 additional service hours. Again, if we assume a service hour to cost $65, then Phase 4 costs at least $1,235,000 at today's prices.

Phase 4 also modifies Route 51 to include service to Mililani via Meheula and Lanikuhana.

Anticipated Implementation Date: June 2007 Pending Funding

Resolution No. 05-248 proposes the following service modifications.

1. Modify Route 62 to operate as a shuttle between the end of the route and the California, Lehua, Center, and N. Cane block, eliminates bus service to and from Honolulu. This is not recommended.

2. Adding an extension to the Wahiawa Heights shuttle that would provide service to Whitmore Village and Schofield Barracks duplicates service that is currently provided by Route 72 - Schofield/Wahiawa/Whitmore. This is not recommended.

3. Replacing the current handivan vehicles that are being used to service Route 503 Launani Valley, Waikalani, and Mililani with 40 foot buses will for all intents and purposes eliminate this service. A 40 foot transit bus cannot safely operate on a regular schedule in Launani Valley and Waikalani.

4. The Mililani Trolley, a privately operated public transportation service, provides shuttle services to the Mililani Mauka area, from 7:00 a.m. till 4:00 p.m. Monday through Saturday. Extended hours services are recommended to provide connections from regular Routes 52, and 62 and from commuter express route 84, 84A and 98.

This concludes discussion of our Central Oahu Bus Service Plan and review of proposed service recommendations in Resolution No. 05-248.

Comments received in support of Resolution No. 05-248 are attached.

EXHIBIT I

Central Oahu Bus Service Plan
Current Service

Route	Service Area	Service Span (Time)	Headway (minutes)	Average daily Riders	Annualized Bus Hours
52	Wahiawa-Circle Isle	430a-130a	32.5	16,152*	88,486.40+
62	Wahiawa /Wahiawa Heights	430a-1145p	32.5	16,152*	83,576.00++
72	Schofield/Wahiawa/Whitmore	527a-656p	60	450	9,424.00
76	Waialua/Haleiwa	600a-715p	40	295	10,106.00
503	Mililani-Waikalani-Launani (Community Access Shuttle)	433a-753p	60	128	12,573.60

*Total average daily ridership for Routes 52/55/62/65

EXHIBIT II

Central Oahu Bus Service Plan
Proposed Service

Route	Service Area	Service Span (Time)	Headway (minutes)	Annualized Bus Hours
50	Mililani-Waipahu-Kapolei *(New Route)*	500a-1100p	30	40,261
501	Mililani Mauka *(New Route)*	530a-1000p	30	13,068
502	Mililani-Lanikuhana *(New Route)*			
503	Mililani-Waikalani-Launani			
504	Mililani-Makaunulau-Kuahelani *(New Route)*	530a-700p	60	5,367
505	Mililani Mauka-Ainamakua *(New Route)*			
51	Honolulu-Wahiawa	430a-1200a	30	43,781
511	Wahiawa Heights	430a-1130p	30	7,114
512	Wahiawa-California-Kilani-Whitmore	500a-800p	30	5,647
513	Wahiawa-Wilikina-Schofield	500a-800p	60	5,647
52	Honolulu-Mililani-Wahiawa	430a-1200a	30	58,375
521	Haleiwa-Waialua Beach	500a-800p	60	5,647
522	Haleiwa-Mokuleia	500a-800p	60	

Shaded routes are interlined

APPENDIX D: DTS Bus Service Improvement Plan

The following are routes proposed by DTS as part of the recent Bus Service Improvement Plan:

Route 50 Mililani Transit Center – Kapolei Transit Center -- 1 page

Route 51 Wahiawa Transit Center – Ala Moana Transit Center -- 1 page

Route 52 Haleiwa Transit Hub – Ala Moana Transit Center -- 1 page

BUS SERVICE IMPROVEMENT PLAN

Route Restructuring Proposal

Description: Route 50 provides daily local service between the Mililani and Kapolei Transit Centers.

Classification: Suburban Trunk

Route Turning Movements:

Eastbound: From Kapolei Transit Center, Kamokila, Farrington, Old Farrington, Farrington, lf Waipahu Depot, rt Hikimoe, rt Mokuola, lf Farrington, lf Paiwa, rt Lumiaina, lf Lumikula, rt Waipio Uka, rt Moaniani, rt Ka Uka, lf H-2 North ONRAMP, H-2 North, EXIT 5B "MILILANI TOWN", rt Meheula to Mililani Transit Center.

Westbound: From Mililani Transit Center, Meheula, rt H-2 South ONRAMP, H-2 South, EXIT 2 "KA UKA BLVD/WAIPIO", Moaniani, lf Waipio Uka, lf Lumikula, rt Lumiaina, lf Paiwa, rt Farrington, rt Mokuola, lf Hikimoe, lf Waiapahu Depot, rt Farrington, Old Farrington, Farrington, Kamokila to Kapolei Transit Center.

Route Characteristics:

Day	Service Frequency (minutes)				
	AM	Mid	PM	Eve	Owl
Weekday	30	30	30	30	-----
Saturday	30	30	30	30	-----
Sunday	30	30	30	30	-----

Day	Span of Service	Trips	Cycle Time
Weekday	5:00A - 11:00P	36	150
Saturday	5:00A - 11:00P	34	150
Sunday	5:00A - 11:00P	34	150

BUS SERVICE IMPROVEMENT PLAN

Route Restructuring Proposal

<u>Description:</u> Route 51 provides daily local service between the Wahiawa Transit Center and Ala Moana Transit Center.

<u>Classification:</u> Suburban Trunk

<u>Route Turning Movements:</u>

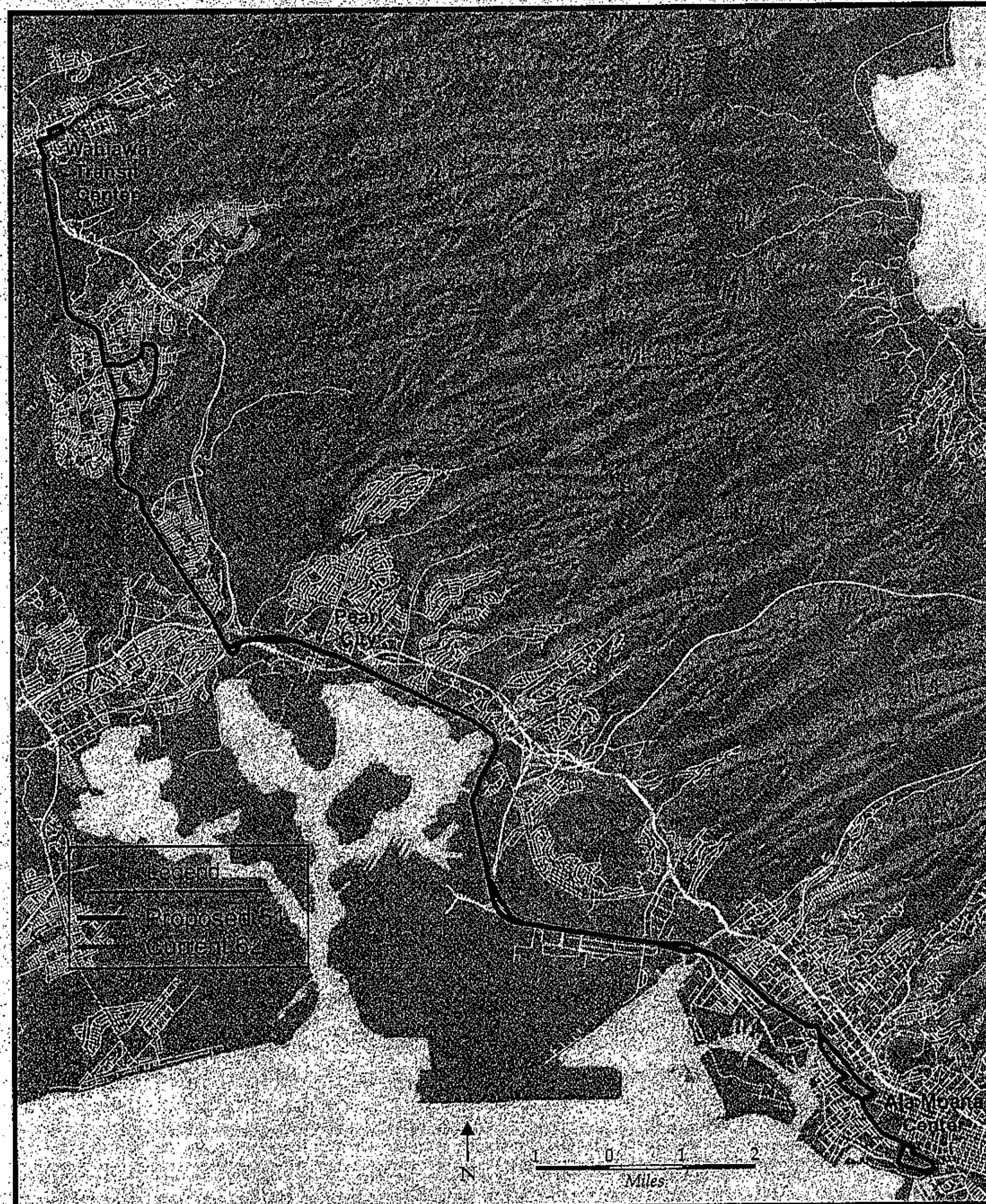
Eastbound: From California/Cane, California, lf Kamehameha, lf Meheula, rt Lanikuhana, lf Kamehameha, Nimitz, Kamehameha, Dillingham, rt King, Hotel, rt Richards, lf King, Kapiolani, rt Kona Iki, lf Kona to Kona/Kona Iki.

Westbound: From Kona/Keeaumoku, Kona, rt Mahukona, rt Atkinson, rt Piikoi, lf Kapiolani, rt South, Alapai, lf Beretania, King, lf Dillingham, Kamehameha, Nimitz, Kamehameha, rt Lanikuhana, lf Meheula, Mililani Transit Center, Meheula, rt Kamehameha, rt California, lf Lehua, rt Center, rt Cane, lf California to California/Cane.

<u>Route Characteristics:</u>

Day	Service Frequency (minutes)				
	AM	Mid	PM	Eve	Owl
Weekday	15	30	15	30	90
Saturday	30	30	30	30	90
Sunday	30	30	30	30	90

Day	Span of Service	Trips	Cycle Time
Weekday	4:30A - 12:00 A	42	210
Saturday	4:30A - 12:00 A	34	210
Sunday	4:30A - 12:00 A	34	210



BUS SERVICE IMPROVEMENT PLAN

Route Restructuring Proposal

Description: Route 52 provides daily local service between the Haleiwa Transit Hub and and Ala Moana Transit Center.

Classification: Urban Trunk

Route Turning Movements:

Eastbound: Haleiwa Transit Hub, lf Kamehameha, lf California, lf Lehua, rt Center, rt Cane, rt California, lf Kamehameha, lf Meheula, lf Ainamakua, lf Ukuwai, rt Makaikai, rt Ainamakua, entrance H-2 South, H-2 South, exit Dillingham, Dillingham, rt King, Hotel, lf Richards, rt King, rt Kapiolani, rt Kona Iki, lf Kona to Ala Moana Transit Center.

Westbound: Ala Moana Transit Center, Kona, rt Mahukona, rt Atkinson, rt Ala Moana, rt Piikoi, lf Kapiolani, rt Alapai, lf Beretania, King, lf Dillingham, entrance H-1 West, H-1 West, exit Mililani Mauka, rt Meheula, lf Ainamakua, lf Ukuwai, rt Makaikai, rt Ainamakua, rt Meheula, rt Kamehameha, rt California, lf Lehua, rt Center, rt Cane, rt California, rt Kamehameha to Haleiwa Transit Hub

Route Characteristics:

Day	Service Frequency (minutes)				
	AM	Mid	PM	Eve	Owl
Weekday	30	30	30	30	90
Saturday	30	30	30	30	90
Sunday	30	30	30	30	90

Day	Span of Service	Trips	Cycle Time
Weekday	24 hour	40	180
Saturday	24 hour	40	180
Sunday	24 hour	40	180

APPENDIX E: Koa Ridge Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

The following is a five page table with vehicle trip calculations for the year 2016:

Size of Development and ITE Vehicle Trip Generation Rates -- 1 page

Year 2016 Weekday Daily Trips -- 1 page

Year 2016 Weekday AM Peak Hour Trips -- 1 page

Year 2016 Weekday PM Peak Hour Trips -- 1 page

Notes On Sources And Assumptions -- 1 page

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

PROJECT PREFERRED PROGRAM	YEAR 2016 SIZE OF DEVELOPMENT				ITE VEHICLE TRIP GENERATION RATE [2]				
	AREA [1]			UNITS [1]					
LAND USE TYPE [1]	Total Land (Square Feet)	Floor Area (Square Feet)	Total (Acres)	Number	Code	Type	Weekday	AM Weekday Peak Hour	PM Weekday Peak Hour
Residential - Koa Ridge									
Single Family				479	210	Single-Family Detached Housing	9.57/DU	0.77/DU	1.02/DU
Multi-Family				573	230	Residential Condominium/Townhouse	5.86/DU	0.44/DU	0.52/DU
High Density Multi Family				339	232	High-Rise Residential Condominium/Townhouse	4.18/DU	0.34/DU	0.38/DU
Residential Total				1,391					
Commercial - Koa Ridge									
Big Box		150,000			820	Shopping Center [13][18]	.04294/sq.ft.	.00103/sq.ft.	.00375/sq.ft.
Retail (in residential area)		30,000			820	Shopping Center [13][18]	.04294/sq.ft.	.00103/sq.ft.	.00375/sq.ft.
Retail (near Ka Uka)		95,000			820	Shopping Center [13][18]	.04294/sq.ft.	.00103/sq.ft.	.00375/sq.ft.
Office		10,000			710	General Office Building	.01101/sq.ft.	.00155/sq.ft.	.00149/sq.ft.
Hotel - 150 rooms				0	310	Hotel [4][18]	8.62/room	0.56/room	0.59/room
Industrial - Light		43,000			110	General Light Industrial	.00697/sq.ft.	.00101/sq.ft.	.00108/sq.ft.
Commercial Total		328,000							
Other - Koa Ridge									
Health Care [11]	1,191,294	255,277	10.00		610	Hospital	.01757/sq.ft.	.00147/sq.ft.	.00161/sq.ft.
Elementary School [7]	523,582	130,896	12.00	550	520	Elementary School	1.29/student	0.42/student	0.28/student
District Park (restricted) [9]					412	County Park	2.28/acre	0.52/acre	0.59/acre
Community Center (restricted) [5]	32,370	16,185	1.00		495	Recreational Community Center	.02288/sq.ft. [6]	.00162/sq.ft.	.00164/sq.ft.
Church	68,397	22,571	2.00		560	Church	.00911/sq.ft.	.00072/sq.ft.	.00066/sq.ft.
Other Total	1,815,643	424,929							
Residential - Waiawa									
Single Family				0	210	Single-Family Detached Housing	9.57/DU	0.77/DU	1.02/DU
Multi-Family				200	230	Residential Condominium/Townhouse	5.86/DU	0.44/DU	0.52/DU
Residential Total				200					
Commercial - Waiawa									
Retail (in residential area)		0			820	Shopping Center [13][18]	.04294/sq.ft.	.00103/sq.ft.	.00375/sq.ft.
Commercial Total		0							
Other - Waiawa									
Elementary School [7]		0	0.00		520	Elementary School	.01449/sq.ft.	.00469/sq.ft.	.00313/sq.ft.
Other Total		0							
Totals									

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

PROJECT PREFERRED PROGRAM	YEAR 2016 WEEKDAY DAILY TRIPS														
	A	B	C		D		E		F		G		H	I	J
			ADJUSTMENTS TO ITE VEHICLE TRIPS (calculated as a percent of column "B")												
	ITE Vehicle Trip Generation Rate *(Vehicle Trips Per Day Per Measurement Unit)*	Maximum External Vehicle Trips *(Vehicle Trips Per Day)*	Internal Capture Vehicle Trips (14)(18)(19)		Pass-By Vehicle Trips (13)(18)		Transit Mode Reduction (15)(17)(20)(22)		Pedestrian and Bicycle Mode Reduction (21)(23)		Other TDM Alternative Mode Reduction (15)(16)(22)		Total External Vehicle Trip Adjustments *(C+D+E+F+G)*	Overall Trip Reduction Rate	Project Estimated External Vehicle Trips *(B-H)*
LAND USE TYPE (1)			%	No.	%	No.	%	No.	%	No.	%	No.			
Residential - Koa Ridge															
Single Family	9.57	4,584	0.15	688	0.00	0	0.10	458	0.00	0	0.25	1,146	2,292	0.50	2,292
Multi-Family	5.86	3,358	0.15	504	0.00	0	0.10	336	0.00	0	0.25	839	1,679	0.50	1,679
High Density Multi Family	4.18	1,417	0.15	213	0.00	0	0.10	142	0.00	0	0.25	354	709	0.50	709
Residential Total		9,359	0.15	1,404	0.00	0	0.10	936	0.00	0	0.25	2,340	4,679	0.50	4,679
Commercial - Koa Ridge															
Big Box	0.04294	6,441	0.36	2,319	0.25	1,610	0.05	322	0.00	0	0.05	322	4,574	0.71	1,867
Retail (in residential area)	0.04294	1,288	0.36	464	0.00	0	0.05	64	0.09	116	0.25	322	967	0.75	321
Retail (near Ka Uka)	0.04294	4,079	0.10	408	0.25	1,020	0.10	408	0.00	0	0.10	408	2,244	0.55	1,835
Office	0.01101	110	0.10	11	0.00	0	0.10	11	0.00	0	0.10	11	33	0.30	77
Hotel - 150 rooms	8.62	0	0.30	0	0.00	0	0.05	0	0.00	0	0.10	0	0	-	0
Industrial - Light	0.00700	301	0.36	108	0.00	0	0.10	30	0.00	0	0.10	30	169	0.56	132
Commercial Total		12,220	0.27	3,310	0.22	2,630	0.07	836	0.01	116	0.09	1,093	7,988	0.65	4,232
Other - Koa Ridge															
Health Care (11)	0.01757	4,485	0.10	449	0.00	0	0.10	449	0.09	404	0.10	449	1,750	0.39	2,736
Elementary School (7)	1.290	710	0.80	568	0.00	0	0.00	0	0.09	64	0.00	0	632	0.89	77
District Park (restricted) (9)	2.280	0	0.80	0	0.00	0	0.00	0	0.09	0	0.00	0	1	-	-1
Community Center (restricted) (8)	0.02288	370	0.80	296	0.00	0	0.00	0	0.09	33	0.00	0	330	0.89	40
Church	0.00911	206	0.80	164	0.00	0	0.00	0	0.09	19	0.00	0	184	0.89	22
Other Total		5,771	0.26	1,477	0.00	0	0.08	449	0.09	519	0.08	449	2,897	0.50	2,873
Residential - Waiawa															
Single Family	9.57	0	0.15	0	0.00	0	0.10	0	0.00	0	0.25	0	1	-	-1
Multi-Family	5.86	1,172	0.15	176	0.00	0	0.10	117	0.00	0	0.25	293	587	0.50	586
Residential Total		1,172	0.15	176	0.00	0	0.10	117	0.00	0	0.25	293	587	0.50	585
Commercial - Waiawa															
Retail (in residential area)	0.04294	0	0.36	0	0.00	0	0.00	0	0.09	0	0.25	0	1	-	-1
Commercial Total		0	-	0	-	0	-	0	-	0	-	0	1	-	-1
Other - Waiawa															
Elementary School (7)	0.01449	0	0.80	0	0.00	0	0.00	0	0.09	0	0.00	0	1	-	-1
Other Total		0	-	0	-	0	0.00	0	0.00	0	0.00	0	1	-	-1
Totals		28,521	0.22	6,368	0.09	2,630	0.08	2,337	0.02	635	0.15	4,174	16,153	0.57	12,368

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

PROJECT PREFERRED PROGRAM	YEAR 2016 WEEKDAY AM PEAK HOUR TRIPS														
	A	B	C		D		E		F		G		H	I	J
			ADJUSTMENTS TO ITE VEHICLE TRIPS (calculated as a percent of column "B")												
LAND USE TYPE [1]	ITE Vehicle Trip Generation Rate *(Vehicle Trips Per AM Peak Hour Per Measurement Unit)*	Maximum Vehicle Trips *(Vehicle Trips Per Hour)*	Internal Capture Vehicle Trips [14][18][19]		Pass-By Vehicle Trips [13][19]		Transit Mode Reduction [16][17][20][22]		Pedestrian and Bicycle Mode Reduction [21][23]		Other TDM Alternative Mode Reduction [15][18][22]		Total External Vehicle Trip Adjustments *(C+D+E+F+G)*	Overall Trip Reduction Rate	Project Estimated External Vehicle Trips *(B-H)*
			%	No.	%	No.	%	No.	%	No.	%	No.			
Residential - Koa Ridge															
Single Family	0.77	369	0.15	55	0.00	0	0.10	37	0.00	0	0.25	92	184	0.50	184
Multi-Family	0.44	252	0.15	38	0.00	0	0.10	25	0.00	0	0.25	63	126	0.50	126
High Density Multi Family	0.34	115	0.15	17	0.00	0	0.10	12	0.00	0	0.25	29	58	0.50	58
Residential Total		736	0.15	110	0.00	0	0.10	74	0.00	0	0.25	184	368	0.50	368
Commercial - Koa Ridge															
Big Box	0.00103	155	0.36	56	0.25	39	0.05	8	0.00	0	0.05	8	110	0.71	44
Retail (in residential area)	0.00103	31	0.36	11	0.00	0	0.05	2	0.09	3	0.25	8	24	0.77	7
Retail (near Ka Uka)	0.00103	98	0.10	10	0.25	24	0.10	10	0.00	0	0.10	10	54	0.56	43
Office	0.00155	16	0.10	2	0.00	0	0.10	2	0.00	0	0.10	2	5	0.32	11
Hotel - 150 rooms	0.56	84	0.30	25	0.00	0	0.05	4	0.00	0	0.10	8	38	0.46	46
Industrial - Light	0.00101	43	0.36	16	0.00	0	0.10	4	0.00	0	0.10	4	25	0.57	19
Commercial Total		426	0.28	119	0.15	63	0.07	29	0.01	3	0.09	40	257	0.60	169
Other - Koa Ridge															
Health Care [11]	0.00147	375	0.10	38	0.00	0	0.10	38	0.09	34	0.10	38	147	0.39	229
Elementary School [7]	0.420	231	0.80	185	0.00	0	0.00	0	0.09	21	0.00	0	206	0.89	25
District Park (restricted) [9]	0.520	0	0.80	0	0.00	0	0.00	0	0.09	0	0.00	0	1	-	-1
Community Center (restricted) [8]	0.00162	26	0.80	21	0.00	0	0.00	0	0.09	2	0.00	0	24	0.92	2
Church	0.00072	16	0.80	13	0.00	0	0.00	0	0.09	1	0.00	0	15	0.94	1
Other Total		649	0.40	256	0.00	0	0.06	38	0.09	58	0.06	38	394	0.61	255
Residential - Waiawa															
Single Family	0.77	0	0.15	0	0.00	0	0.10	0	0.00	0	0.25	0	1	-	-1
Multi-Family	0.44	88	0.15	13	0.00	0	0.10	9	0.00	0	0.25	22	45	0.51	44
Residential Total		88	0.15	13	0.00	0	0.10	9	0.00	0	0.25	22	45	0.51	43
Commercial - Waiawa															
Retail (in residential area)	0.00103	0	0.36	0	0.00	0	0.00	0	0.09	0	0.25	0	1	-	-1
Commercial Total		0	-	0	-	0	-	0	-	0	-	0	1	-	-1
Other - Waiawa															
Elementary School [7]	0.00469	0	0.80	0	0.00	0	0.00	0	0.09	0	0.00	0	1	-	-1
Other Total		0	-	0	-	0	0.00	0	0.00	0	0.00	0	1	-	-1
Totals		1,899	0.26	499	0.03	63	0.08	149	0.03	61	0.15	283	1,065	0.56	834

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

PROJECT PREFERRED PROGRAM	YEAR 2016 WEEKDAY PM PEAK HOUR TRIPS														
	A	B	C		D		E		F		G		H	I	J
LAND USE TYPE (1)	ITE Vehicle Trip Generation Rate *(Vehicle Trips Per PM Peak Hour Per Measurement Unit)*	Maximum Vehicle Trips *(Vehicle Trips Per Hour)*	ADJUSTMENTS TO ITE VEHICLE TRIPS (calculated as a percent of column "B")										Total External Vehicle Trip Adjustments *(C+D+E+F+G)*	Overall Trip Reduction Rate	Project Estimated External Vehicle Trips *(B-H)*
			Internal Capture Vehicle Trips (14)(18)(19)		Pass-By Vehicle Trips (13)(19)		Transit Mode Reduction (15)(17)(20)(22)		Pedestrian and Bicycle Mode Reduction (21)(23)		Other TDM Alternative Mode Reduction (15)(16)(22)				
			%	No.	%	No.	%	No.	%	No.	%	No.			
Residential - Koa Ridge															
Single Family	1.02	489	0.15	73	0.00	0	0.10	49	0.00	0	0.25	122	244	0.50	244
Multi-Family	0.52	298	0.15	45	0.00	0	0.10	30	0.00	0	0.25	74	149	0.50	149
High Density Multi Family	0.38	129	0.15	19	0.00	0	0.10	13	0.00	0	0.25	32	64	0.50	64
Residential Total		915	0.15	137	0.00	0	0.10	92	0.00	0	0.25	229	458	0.50	458
Commercial - Koa Ridge															
Big Box	0.00375	563	0.36	203	0.25	141	0.05	28	0.00	0	0.05	28	400	0.71	162
Retail (in residential area)	0.00375	113	0.36	41	0.00	0	0.05	6	0.09	10	0.25	28	85	0.76	27
Retail (near Ka Uka)	0.00375	356	0.10	36	0.25	89	0.10	36	0.00	0	0.10	36	196	0.55	160
Office	0.00149	15	0.10	1	0.00	0	0.10	1	0.00	0	0.10	1	5	0.32	10
Hotel - 150 rooms	0.59	89	0.30	27	0.00	0	0.05	4	0.00	0	0.10	9	40	0.46	48
Industrial - Light	0.00108	46	0.36	17	0.00	0	0.10	5	0.00	0	0.10	5	27	0.57	20
Commercial Total		1,181	0.27	323	0.19	230	0.07	80	0.01	10	0.09	107	753	0.64	428
Other - Koa Ridge															
Health Care (11)	0.00161	411	0.10	41	0.00	0	0.10	41	0.09	37	0.10	41	161	0.39	250
Elementary School (7)	0.280	154	0.80	123	0.00	0	0.00	0	0.09	14	0.00	0	138	0.90	16
District Park (restricted) (9)	0.590	0	0.80	0	0.00	0	0.00	0	0.09	0	0.00	0	1	-	-1
Community Center (restricted) (6)	0.00164	27	0.80	21	0.00	0	0.00	0	0.09	2	0.00	0	25	0.92	2
Church	0.00066	15	0.80	12	0.00	0	0.00	0	0.09	1	0.00	0	14	0.95	1
Other Total		606	0.33	197	0.00	0	0.07	41	0.09	55	0.07	41	338	0.56	268
Residential - Walawa															
Single Family	1.02	0	0.15	0	0.00	0	0.10	0	0.00	0	0.25	0	1	-	-1
Multi-Family	0.52	104	0.15	16	0.00	0	0.10	10	0.00	0	0.25	26	53	0.50	52
Residential Total		104	0.15	16	0.00	0	0.10	10	0.00	0	0.25	26	53	0.51	51
Commercial - Walawa															
Retail (in residential area)	0.00375	0	0.36	0	0.00	0	0.00	0	0.09	0	0.25	0	1	-	-1
Commercial Total		0	-	0	-	0	-	0	-	0	-	0	1	-	-1
Other - Walawa															
Elementary School (7)	0.00313	0	0.80	0	0.00	0	0.00	0	0.09	0	0.00	0	1	-	-1
Other Total		0	-	0	-	0	0.00	0	0.00	0	0.00	0	1	-	-1
Totals		2,807	0.24	674	0.08	230	0.08	223	0.02	65	0.14	403	1,604	0.57	1,203

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

Notes:
1) Source: Koa Ridge Mauka and Waiawa Traffic Absorption; September 2, 2008.
2) Source: ITE Trip Generation 7th Edition.
3) Assumption: Weekday rate for ITE code 231 not available, used weekday rate for ITE code 230.
4) Assumption: ITE code 310 uses number of rooms, size of hotel is 150 rooms.
5) Assumption: Adjustments to ITE rates assume facility use is essentially restricted to residents and employees from within the project, external use is negligible.
6) Source: One study in ITE Manual (page 881). Caution noted in using small sample data.
7) Assumptions: ITE rates are based on student enrollment of 550. Adjustments to ITE rates assume introduction of "walking bus", "safe routes to school" and other school transportation programs.
8) Assumption: ITE code 411 had no peak period data, used code ITE code 412 vehicle trip generation rates for peak period.
9) Assumption: Open Space use is essentially restricted to residents and employees from within project, external use is negligible.
10) Assumption: Open Space use of plaza/plazze is essentially restricted to residents and employees from within project, however external use is included in vehicle trip calculations.
11) Assumption: Health Care land area converted to building floor area using an FAR of 0.6
12) Assumption: School-Elementary land area converted to building floor area using an FAR of 0.6. Internal capture is 80%.
13) Source: VDOT, Required Elements Of A Traffic Impact Analysis - Administrative Guidelines; July 2008; page 10. 25% of vehicle trips may be considered pass-by for shopping centers.
14) Source: VDOT, Required Elements Of A Traffic Impact Analysis - Administrative Guidelines; July 2008; page 9. 15% of vehicle trips may be internal for mixed-use residential components.
15) Source: Adjusting Site-Level Vehicle Trip Generation Using URBEMIS; Nelson/Nygaard Consulting Associates; August 2005; page 3.
16) Source: Transportation Impact Analyses for Site Development; ITE; 2005; pages 71-72. 25% of vehicle trips in peak periods if conditions specified are achieved.
17) Source: ITE Trip Generation Handbook Second Edition; June 2004; Appendix B (ODOT/DLCD); page 125. 10% of vehicle trips may be considered to be by transit if specified conditions are satisfied.
18) Source: ITE Trip Generation Handbook Second Edition; June 2004; Appendix C (FDOT); page 129-131. 36% of vehicle trips may be considered internal trips if comparable conditions are proposed.
19) Source: Traditional Neighborhood Development Trip Generation Study; Khattak et al; February 2005; page v. 20.2% internal capture observed for TND, comparable to the project's concept.
20) Source: TCRP Report 128, Effects of TOD on Housing, Parking, and Travel; pages 69-80.
21) Source: Adjusting Site-Level Vehicle Trip Generation Using URBEMIS; Nelson/Nygaard Consulting Associates; August 2005; pages14-15.
22) Assumption: Maximum vehicle trip reduction possible is reduced to avoid double counting with other related variables.
23) Assumption: Many pedestrian and bicycle trips have already been accounted for through the use of "high-rise" ITE land use codes and adjustment for internal trips in column C.

APPENDIX F: Koa Ridge Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

The following is a five page table with vehicle trip calculations for the year 2025:

Size of Development and ITE Vehicle Trip Generation Rates -- 1 page

Year 2025 Weekday Daily Trips -- 1 page

Year 2025 Weekday AM Peak Hour Trips -- 1 page

Year 2025 Weekday PM Peak Hour Trips -- 1 page

Notes On Sources And Assumptions -- 1 page

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

PROJECT PREFERRED PROGRAM	YEAR 2025 SIZE OF DEVELOPMENT				ITE VEHICLE TRIP GENERATION RATE [2]				
	AREA [1]			UNITS [1]					
LAND USE TYPE [1]	Total Land *(Square Feet)*	Floor Area *(Square Feet)*	Total *(Acres)*	Number	Code	Type	Weekday	AM Weekday Peak Hour	PM Weekday Peak Hour
Residential - Koa Ridge									
Single Family				1,054	210	Single-Family Detached Housing	9.57/DU	0.77/DU	1.02/DU
Multi-Family				1,162	230	Residential Condominium/Townhouse	5.86/DU	0.44/DU	0.52/DU
High Density Multi Family				1,284	232	High-Rise Residential Condominium/Townhouse	4.18/DU	0.34/DU	0.38/DU
Residential Total				3,500					
Commercial - Koa Ridge									
Big Box		150,000			820	Shopping Center [13][18]	.04294/sq.ft.	.00103/sq.ft.	.00375/sq.ft.
Retail (in residential area)		60,000			820	Shopping Center [13][18]	.04294/sq.ft.	.00103/sq.ft.	.00375/sq.ft.
Retail (near Ka Uka)		140,000			820	Shopping Center [13][18]	.04294/sq.ft.	.00103/sq.ft.	.00375/sq.ft.
Office		30,000			710	General Office Building	.01101/sq.ft.	.00155/sq.ft.	.00149/sq.ft.
Hotel - 150 rooms				150	310	Hotel [4][18]	8.62/room	0.56/room	0.59/room
Industrial - Light		83,000			110	General Light Industrial	.00697/sq.ft.	.00101/sq.ft.	.00108/sq.ft.
Commercial Total		463,000							
Other - Koa Ridge									
Health Care [11]	1,191,294	714,776	28.00		610	Hospital	.01757/sq.ft.	.00147/sq.ft.	.00161/sq.ft.
Elementary School [7]	523,582	130,896	12.00	550	520	Elementary School	1.29/student	0.42/student	0.28/student
District Park (restricted) [9]	840,942		17.00		412	County Park	2.28/acre	0.52/acre	0.59/acre
Community Center (restricted) [6]	97,109	48,555	3.00		495	Recreational Community Center	.02288/sq.ft. [6]	.00162/sq.ft.	.00164/sq.ft.
Church	136,793	45,142	4.00		560	Church	.00911/sq.ft.	.00072/sq.ft.	.00066/sq.ft.
Other Total	2,789,720	939,369							
Residential - Walawa									
Single Family				255	210	Single-Family Detached Housing	9.57/DU	0.77/DU	1.02/DU
Multi-Family				1,245	230	Residential Condominium/Townhouse	5.86/DU	0.44/DU	0.52/DU
Residential Total				1,500					
Commercial - Walawa									
Retail (in residential area)		30,000			820	Shopping Center [13][18]	.04294/sq.ft.	.00103/sq.ft.	.00375/sq.ft.
Commercial Total		30,000							
Other - Walawa									
Elementary School [7]	523,582	130,896	12.00		520	Elementary School	.01449/sq.ft.	.00469/sq.ft.	.00313/sq.ft.
Other Total		130,896							
Totals									

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

PROJECT PREFERRED PROGRAM	YEAR 2025 (BUILD OUT) WEEKDAY DAILY TRIPS														
	A	B	C		D		E		F		G		H	I	J
			ADJUSTMENTS TO ITE VEHICLE TRIPS (calculated as a percent of column "B")												
LAND USE TYPE (1)	ITE Vehicle Trip Generation Rate *(Vehicle Trips Per Day Per Measurement Unit)*	Maximum External Vehicle Trips *(Vehicle Trips Per Day)*	Internal Capture Vehicle Trips (14)(18)(19)		Pass-By Vehicle Trips (13)(19)		Transit Mode Reduction (16)(17)(20)(22)		Pedestrian and Bicycle Mode Reduction (21)(23)		Other TDM Alternative Mode Reduction (15)(18)(22)		Total External Vehicle Trip Adjustments *(C+D+E+F+G)*	Overall Trip Reduction Rate	Project Estimated External Vehicle Trips *(B-H)*
			%	No.	%	No.	%	No.	%	No.	%	No.			
Residential - Koa Ridge															
Single Family	9.57	10,087	0.15	1,513	0.00	0	0.10	1,009	0.00	0	0.25	2,522	5,043	0.50	5,043
Multi-Family	5.86	6,809	0.15	1,021	0.00	0	0.10	681	0.00	0	0.25	1,702	3,405	0.50	3,405
High Density Multi Family	4.18	5,367	0.15	805	0.00	0	0.10	537	0.00	0	0.25	1,342	2,684	0.50	2,684
Residential Total		22,263	0.15	3,339	0.00	0	0.10	2,226	0.00	0	0.25	5,566	11,132	0.50	11,132
Commercial - Koa Ridge															
Big Box	0.04294	6,441	0.36	2,319	0.25	1,610	0.05	322	0.00	0	0.05	322	4,574	0.71	1,867
Retail (in residential area)	0.04294	2,576	0.36	928	0.00	0	0.05	129	0.09	232	0.25	644	1,933	0.75	643
Retail (near Ka Uka)	0.04294	6,012	0.10	601	0.25	1,503	0.10	601	0.00	0	0.10	601	3,307	0.55	2,705
Office	0.01101	330	0.10	33	0.00	0	0.10	33	0.00	0	0.10	33	99	0.30	231
Hotel - 150 rooms	8.62	1,293	0.30	388	0.00	0	0.05	65	0.00	0	0.10	129	582	0.45	711
Industrial - Light	0.00700	581	0.36	209	0.00	0	0.10	58	0.00	0	0.10	58	326	0.56	255
Commercial Total		17,233	0.26	4,478	0.18	3,113	0.07	1,208	0.01	232	0.10	1,788	10,821	0.63	6,412
Other - Koa Ridge															
Health Care (11)	0.01757	12,559	0.10	1,256	0.00	0	0.10	1,256	0.09	1,130	0.10	1,256	4,898	0.39	7,660
Elementary School (7)	1.290	710	0.80	568	0.00	0	0.00	0	0.09	64	0.00	0	632	0.89	77
District Park (restricted) (8)	2.280	39	0.80	31	0.00	0	0.00	0	0.09	3	0.00	0	35	0.91	3
Community Center (restricted) (5)	0.02288	1,111	0.80	889	0.00	0	0.00	0	0.09	100	0.00	0	990	0.89	121
Church	0.00911	411	0.80	329	0.00	0	0.00	0	0.09	37	0.00	0	367	0.89	44
Other Total		14,829	0.21	3,072	0.00	0	0.08	1,256	0.09	1,335	0.08	1,256	6,923	0.47	7,907
Residential - Waiawa															
Single Family	9.57	2,440	0.15	366	0.00	0	0.10	244	0.00	0	0.25	610	1,221	0.50	1,220
Multi-Family	5.86	7,296	0.15	1,094	0.00	0	0.10	730	0.00	0	0.25	1,824	3,648	0.50	3,647
Residential Total		9,736	0.15	1,460	0.00	0	0.10	974	0.00	0	0.25	2,434	4,869	0.50	4,867
Commercial - Waiawa															
Retail (in residential area)	0.04294	1,288	0.36	464	0.00	0	0.00	0	0.09	116	0.25	322	902	0.70	386
Commercial Total		1,288	0.36	464	0.00	0	0.00	0	0.09	116	0.25	322	902	0.70	386
Other - Waiawa															
Elementary School (7)	0.01449	1,897	0.80	1,517	0.00	0	0.00	0	0.09	171	0.00	0	1,689	0.89	208
Other Total		1,897	0.80	1,517	0.00	0	0.00	0	0.00	171	0.00	0	1,689	0.89	208
Totals		67,247	0.21	14,331	0.05	3,113	0.08	5,664	0.03	1,853	0.17	11,365	36,336	0.54	30,911

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

PROJECT PREFERRED PROGRAM	YEAR 2025 (BUILD OUT) AM WEEKDAY PEAK HOUR TRIPS														
	A	B	C		D		E		F		G		H	I	J
LAND USE TYPE [1]	ITE Vehicle Trip Generation Rate *(Vehicle Trips Per AM Peak Hour Per Measurement Unit)*	Maximum Vehicle Trips *(Vehicle Trips Per Hour)*	ADJUSTMENTS TO ITE VEHICLE TRIPS (calculated as a percent of column "B") — Internal Capture Vehicle Trips [14][16][19]		Pass-By Vehicle Trips [13][19]		Transit Mode Reduction [15][17][20][22]		Pedestrian and Bicycle Mode Reduction [21][23]		Other TDM Alternative. Mode Reduction [15][16][22]		Total External Vehicle Trip Adjustments *(C+D+E+F+G)*	Overall Trip Reduction Rate	Project Estimated External Vehicle Trips *(B-H)*
			%	No.	%	No.	%	No.	%	No.	%	No.			
Residential - Koa Ridge															
Single Family	0.77	812	0.15	122	0.00	0	0.10	81	0.00	0	0.25	203	406	0.50	406
Multi-Family	0.44	511	0.15	77	0.00	0	0.10	51	0.00	0	0.25	128	256	0.50	256
High Density Multi Family	0.34	437	0.15	65	0.00	0	0.10	44	0.00	0	0.25	109	216	0.50	218
Residential Total		1,759	0.15	264	0.00	0	0.10	176	0.00	0	0.25	440	880	0.50	880
Commercial - Koa Ridge															
Big Box	0.00103	155	0.36	56	0.25	39	0.05	8	0.00	0	0.05	8	110	0.71	44
Retail (in residential area)	0.00103	62	0.36	22	0.00	0	0.05	3	0.09	6	0.25	15	47	0.76	15
Retail (near Ka Uka)	0.00103	144	0.10	14	0.25	36	0.10	14	0.00	0	0.10	14	80	0.55	64
Office	0.00155	47	0.10	5	0.00	0	0.10	5	0.00	0	0.10	5	14	0.31	32
Hotel - 150 rooms	0.56	84	0.30	25	0.00	0	0.05	4	0.00	0	0.10	8	38	0.46	46
Industrial - Light	0.00101	84	0.36	30	0.00	0	0.10	8	0.00	0	0.10	8	48	0.57	36
Commercial Total		575	0.26	152	0.13	75	0.07	42	0.01	6	0.10	59	337	0.59	237
Other - Koa Ridge															
Health Care [11]	0.00147	1,051	0.10	105	0.00	0	0.10	105	0.09	95	0.10	105	410	0.39	641
Elementary School [7]	0.420	231	0.80	185	0.00	0	0.00	0	0.09	21	0.00	0	206	0.89	25
District Park (restricted) [9]	0.520	9	0.80	7	0.00	0	0.00	0	0.09	1	0.00	0	9	0.99	0
Community Center (restricted) [6]	0.00162	79	0.80	63	0.00	0	0.00	0	0.09	7	0.00	0	71	0.90	8
Church	0.00072	33	0.80	26	0.00	0	0.00	0	0.09	3	0.00	0	30	0.92	3
Other Total		1,402	0.28	386	0.00	0	0.07	105	0.09	126	0.07	105	726	0.52	676
Residential - Waiawa															
Single Family	0.77	196	0.15	29	0.00	0	0.10	20	0.00	0	0.25	49	99	0.50	98
Multi-Family	0.44	548	0.15	82	0.00	0	0.10	55	0.00	0	0.25	137	274	0.50	273
Residential Total		744	0.15	112	0.00	0	0.10	74	0.00	0	0.25	186	373	0.50	371
Commercial - Waiawa															
Retail (in residential area)	0.00103	31	0.36	11	0.00	0	0.00	0	0.09	3	0.25	8	22	0.72	9
Commercial Total		31	0.38	11	0.00	0	0.00	0	0.09	3	0.25	8	22	0.72	9
Other - Waiawa															
Elementary School [7]	0.00469	614	0.80	491	0.00	0	0.00	0	0.09	55	0.00	0	547	0.89	67
Other Total		614	0.80	491	0.00	0	0.00	0	0.00	55	0.00	0	547	0.89	67
Totals		5,125	0.28	1,416	0.01	75	0.08	398	0.04	190	0.16	798	2,886	0.56	2,239

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

PROJECT PREFERRED PROGRAM	YEAR 2025 (BUILD OUT) PM WEEKDAY PEAK HOUR TRIPS														
	A	B	C		D		E		F		G		H	I	J
LAND USE TYPE (1)	ITE Vehicle Trip Generation Rate *(Vehicle Trips Per PM Peak Hour Per Measurement Unit)*	Maximum Vehicle Trips *(Vehicle Trips Per Hour)*	ADJUSTMENTS TO ITE VEHICLE TRIPS (calculated as a percent of column "B")										Total External Vehicle Trip Adjustments *(C+D+E+F+G)*	Overall Trip Reduction Rate	Project Estimated External Vehicle Trips *(B-H)*
			Internal Captura Vehicle Trips (14)(18)(19)		Pass-By Vehicle Trips (13)(19)		Transit Mode Reduction (15)(17)(20)(22)		Pedestrian and Bicycle Mode Reduction (21)(23)		Other TDM Alternative Mode Reduction (15)(16)(22)				
			%	No.	%	No.	%	No.	%	No.	%	No.			
Residential - Koa Ridge															
Single Family	1.02	1,075	0.15	161	0.00	0	0.10	108	0.00	0	0.25	269	538	0.50	538
Multi-Family	0.52	604	0.15	91	0.00	0	0.10	60	0.00	0	0.25	151	302	0.50	302
High Density Multi Family	0.38	488	0.15	73	0.00	0	0.10	49	0.00	0	0.25	122	244	0.50	244
Residential Total		2,187	0.15	325	0.00	0	0.10	217	0.00	0	0.25	542	1,084	0.50	1,084
Commercial - Koa Ridge															
Big Box	0.00375	563	0.36	203	0.25	141	0.05	28	0.00	0	0.05	28	400	0.71	162
Retail (in residential area)	0.00375	225	0.36	81	0.00	0	0.05	11	0.09	20	0.25	56	170	0.75	56
Retail (near Ka Uka)	0.00375	525	0.10	53	0.25	131	0.10	53	0.00	0	0.10	53	289	0.55	236
Office	0.00149	45	0.10	4	0.00	0	0.10	4	0.00	0	0.10	4	14	0.31	31
Hotel - 150 rooms	0.59	89	0.30	27	0.00	0	0.05	4	0.00	0	0.10	9	40	0.46	48
Industrial - Light	0.00108	90	0.36	32	0.00	0	0.10	9	0.00	0	0.10	9	51	0.57	39
Commercial Total		1,535	0.26	399	0.18	272	0.07	110	0.01	20	0.10	159	964	0.63	572
Other - Koa Ridge															
Health Care (11)	0.00161	1,151	0.10	115	0.00	0	0.10	115	0.09	104	0.10	115	449	0.39	702
Elementary School (7)	0.280	154	0.80	123	0.00	0	0.00	0	0.09	14	0.00	0	138	0.90	16
District Park (restricted) (8)	0.590	10	0.80	8	0.00	0	0.00	0	0.09	1	0.00	0	10	0.98	0
Community Center (restricted) (6)	0.00164	80	0.80	64	0.00	0	0.00	0	0.09	7	0.00	0	72	0.90	8
Church	0.00066	30	0.80	24	0.00	0	0.00	0	0.09	3	0.00	0	27	0.92	2
Other Total		1,424	0.23	334	0.00	0	0.08	115	0.09	128	0.08	115	696	0.49	728
Residential - Waiawa															
Single Family	1.02	260	0.15	39	0.00	0	0.10	26	0.00	0	0.25	65	131	0.50	130
Multi-Family	0.52	647	0.15	97	0.00	0	0.10	65	0.00	0	0.25	162	324	0.50	323
Residential Total		908	0.15	136	0.00	0	0.10	91	0.00	0	0.25	227	455	0.50	453
Commercial - Waiawa															
Retail (in residential area)	0.00375	113	0.36	41	0.00	0	0.00	0	0.09	10	0.25	28	79	0.71	33
Commercial Total		113	0.36	41	0.00	0	0.00	0	0.09	10	0.25	28	79	0.71	33
Other - Waiawa															
Elementary School (7)	0.00313	410	0.80	328	0.00	0	0.00	0	0.09	37	0.00	0	366	0.89	44
Other Total		410	0.80	328	0.00	0	0.00	0	0.00	37	0.00	0	366	0.89	44
Totals		6,557	0.24	1,563	0.04	272	0.08	532	0.03	195	0.16	1,071	3,643	0.56	2,913

Koa Ridge - Vehicle Trip Generation and Adjustments By Project Preferred Program Land Use Type

Notes:
1) Source: Koe Ridge Mauka and Waiawa Traffic Absorption; September 2, 2008.
2) Source: ITE Trip Generation 7th Edition.
3) Assumption: Weekday rate for ITE code 231 not available, used weekday rate for ITE code 230.
4) Assumption: ITE code 310 uses number of rooms, size of hotel is 150 rooms.
5) Assumption: Adjustments to ITE rates assume facility use is essentially restricted to residents end employees from within the project, externel use is negligible.
6) Source: One study in ITE Manuel (page 881). Caution noted in using small sample data.
7) Assumptions: ITE rates are based on student enrollment of 550. Adjustments to ITE rates assume introduction of "walking bus", "safe routes to school" and other school transportation programs.
8) Assumption: ITE code 411 had no peak period data, used code ITE code 412 vehicle trip generation rates for peek period.
9) Assumption: Open Space use is essentially restricted to residents and employees from within project, external use is negligible.
10) Assumption: Open Space use of plaza/plazze is essentielly restricted to residents and employees from within project, however external use is included in vehicle trip calculations.
11) Assumption: Health Care lend area converted to building floor area using an FAR of 0.6
12) Assumption: School-Elementery land aree converted to building floor erea using an FAR of 0.6. Internal capture is 80%.
13) Source: VDOT, Required Elements Of A Traffic Impact Analysis - Administrative Guidelines; July 2008; page 10. 25% of vehicle trips mey be considered pass-by for shopping centers.
14) Source: VDOT, Required Elements Of A Traffic Impact Analysis - Administrative Guidelines; July 2008; page 9. 15% of vehicle trips may be internal for mixed-use residential components.
15) Source: Adjusting Site-Level Vehicle Trip Generation Using URBEMIS; Nelson/Nygaard Consulting Associates; August 2005; page 3.
16) Source: Transportation Impact Analyses for Site Development; ITE; 2005; pages 71-72. 25% of vehicle trips in peak periods if conditions specified are echievad.
17) Source: ITE Trip Generation Hendbook Second Edition; June 2004; Appendix B (ODOT/DLCD); page 125. 10% of vehicle trips may be considered to be by transit if specified conditions are satisfied.
18) Source: ITE Trip Generation Handbook Second Edition; June 2004; Appendix C (FDOT); page 129-131. 36% of vehicle trips may be considered internal trips if comperable conditions are proposed.
19) Source: Traditional Neighborhood Development Trip Generation Study; Khattak et al; February 2005; page v. 20.2% internal capture observed for TND, comparable to tha project's concept.
20) Source: TCRP Report 128, Effects of TOD on Housing, Parking, end Travel; pages 69-80.
21) Source: Adjusting Site-Level Vehicle Trip Generation Using URBEMIS; Nelson/Nygaard Consulting Associates; August 2005; pages14-15.
22) Assumption: Maximum vehicle trip reduction possible is reduced to avoid double counting with other releted variables.
23) Assumption: Many pedestrian and bicycle trips have already been accounted for through the use of "high-rise" ITE lend use codes and adjustment for internal trips in column C.

APPENDIX G: Terms and Definitions

The following defines terms used in this technical memorandum

A.1.1. Trip Chaining

Trip chaining traces an individual's daily movement by trip mode and by trip purpose. Trip chaining has two components:

- **Personal Travel Trip Chaining Demand** -- Refers to the places travelers want to visit and the sequence of those visits.
- **Trip Chaining Modal Accommodation** -- Refers to the capacity (and level of service in some instances) of the transportation system and its ability to provide safe and expedient passage to those making chained trips by alternative modes.

A front page example of trip chaining was provided on September 25, 2006 in the Seattle Times of how Trip Chain Modal Accommodation doesn't support at least one individual's Personal Travel Trip Chaining Demand. The headline read: "Denise Dougan, Kingston to Seattle: Car. Bus. Ferry. Feet. Bus. Train. Ferry. Bus. Car."[1] The article quoted the traveler as concluding, "No mystery to me why public transportation in the Puget Sound is not used by more people."[2]

A.1.2. Pedestrian Modal Accommodation

Pedestrian modal accommodation involves a wide array of traditional and innovative techniques to offer priority treatments for those who walk. One distinct difference between U.S. and non-U.S. approaches is that our crosswalks, sidewalks and other pedestrian treatments tend to be highly standardized with an emphasis on how the pedestrian is accommodated to the degree possible after consideration is given to the minimum roadway and intersection requirements to support optimum vehicle flow.

Non-U.S. approaches to pedestrian traffic tend to be less standardized with an emphasis on how the roadway and intersection is designed, or should be redesigned, to give priority to the safety of the pedestrian with less evident regard for optimum vehicle

[1] The amazing race to work: Four commuters' stories; The Seattle Times; Mike Lindblom; September 25, 2006; page A-1.

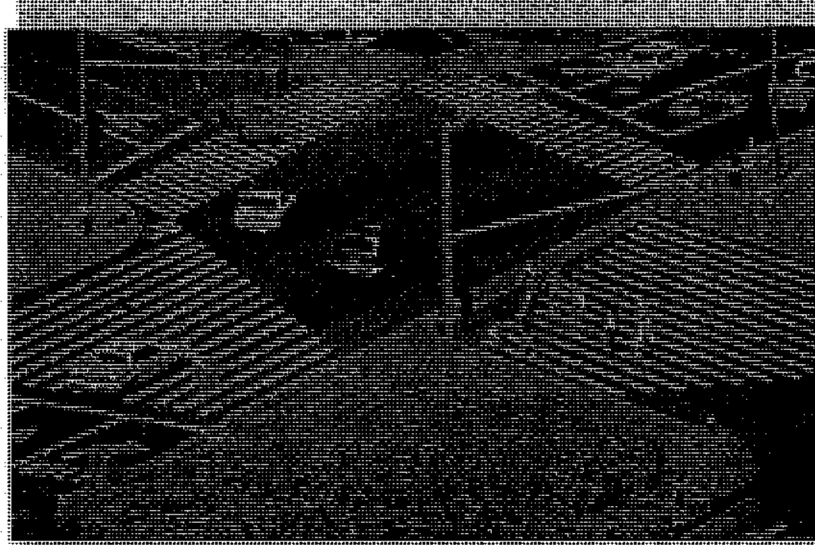
[2] For a technical explanation of trip chaining see: A Simultaneous Model of Household Activity Participation and Trip Chain Generation; Thomas F. Golob; Institute of Transportation Studies, University of California; July 1997 or Examining Trip-Chaining Behavior, A comparison of Travel by Men and Women; Nancy McGucklin and Elaine Murakami; Federal Highway Administration.

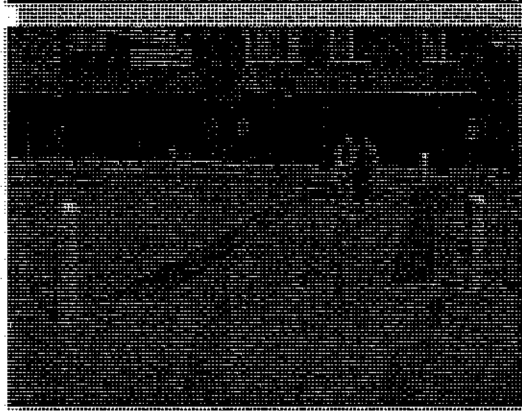
flow. There are many variations to the following list of approaches found more often in non-U.S. applications, but with increasing use in the U.S., including Oahu.

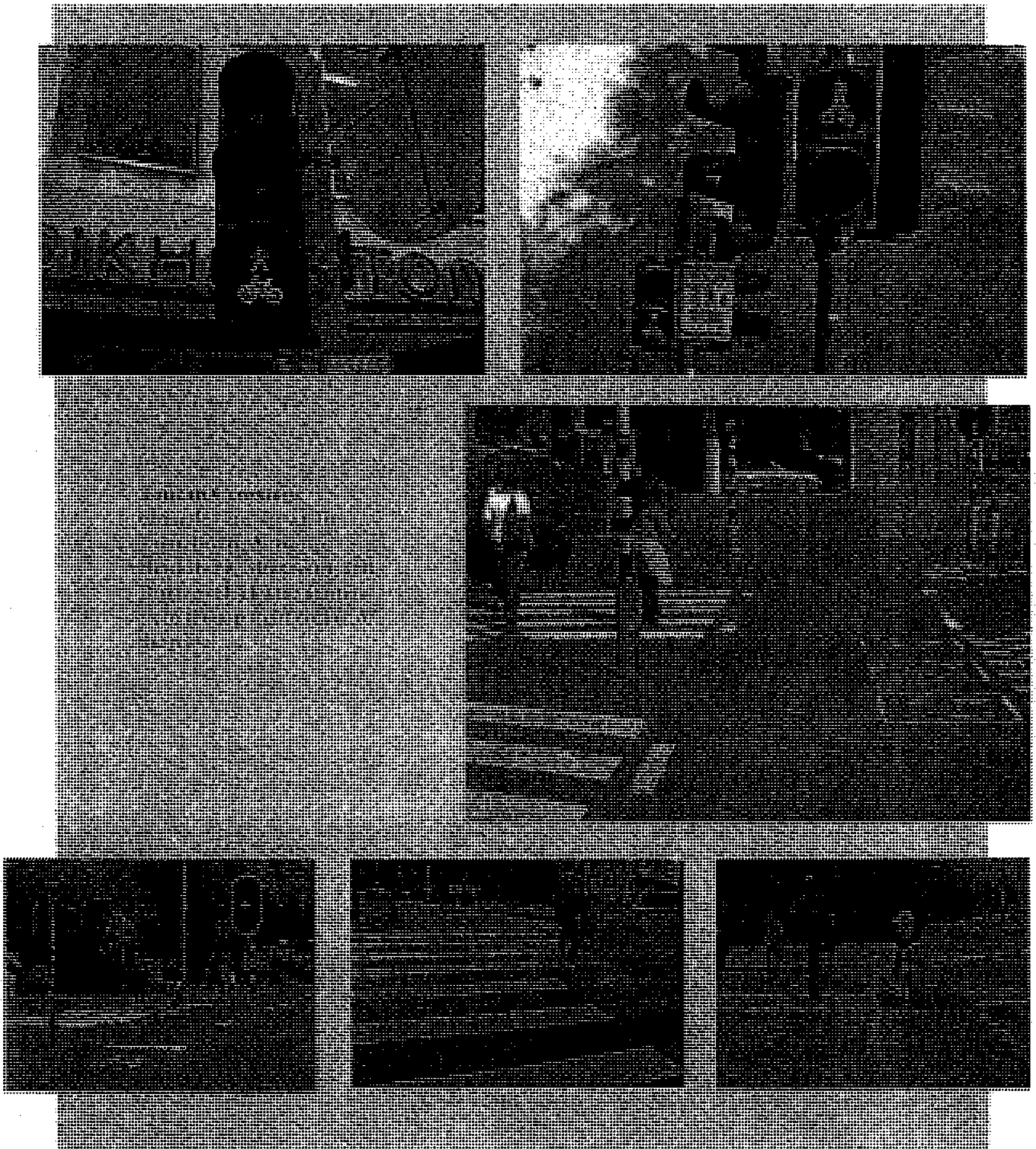
- **Zebra Crossings** -- Refers to the use of stripes across the road with dashed lines used to mark the crosswalk on both sides. Best Oahu example is on Kalia Road in Waikiki. Examples in London add "Belisha Beacons" (poles with flashing orange lights) placed on each side of the crosswalk. These crossings are installed at selected mid-block locations (rarely at intersections as is the case on Kalia). At zebra crossings, pedestrians have the right of way, and drivers must yield (i.e., slow or stop) to pedestrians in the crosswalk. Zebra crossings are preceded by zigzag pavement markings next to the curb on the vehicle approach.

- **Pelican Crossings** -- Refers to crossings controlled by traffic signals and push-button pedestrian signals. Best Oahu example is on Punchbowl between Honolulu Hale and the state capital building. The push-button hardware lights up and conveys specific messages to pedestrians during each interval. A walking green man symbol and a standing red man are displayed. A flashing green man indicates pedestrian clearance. A flashing green man on the pedestrian approach concurrent with flashing amber and red balls on the vehicle approach precedes the green ball indication on the vehicle approach in some applications. Other applications use a countdown warning to advise pedestrians of the time remaining. Pelican crossings may have dashed or solid parallel lines to mark the crosswalk. They may have a mid-crossing island with an offset.

- **Toucan Crossings** -- Refers to shared crossings for pedestrians and bicyclists (cyclists "too can" cross together) at selected crossings at the intersection of roadways with pedestrian and bicycle paths. Common on Oahu, but without special provisions. The preferred layout includes a tactile warning surface, audible beepers or tactile rotating knobs, pushbuttons with WAIT displayed in each corner of the crossing, infrared lamp monitoring, and vehicle detection on all approaches. The desirable crosswalk width is twelve feet; the minimum acceptable width is ten feet. Signal indications include standing red man, walking green man, and green bicycle. The flashing amber with the red ball indication is not used for the vehicle approach. Crosswalk lines are delineated by various colored squares and lines to separate pedestrians and bicyclists whenever possible.







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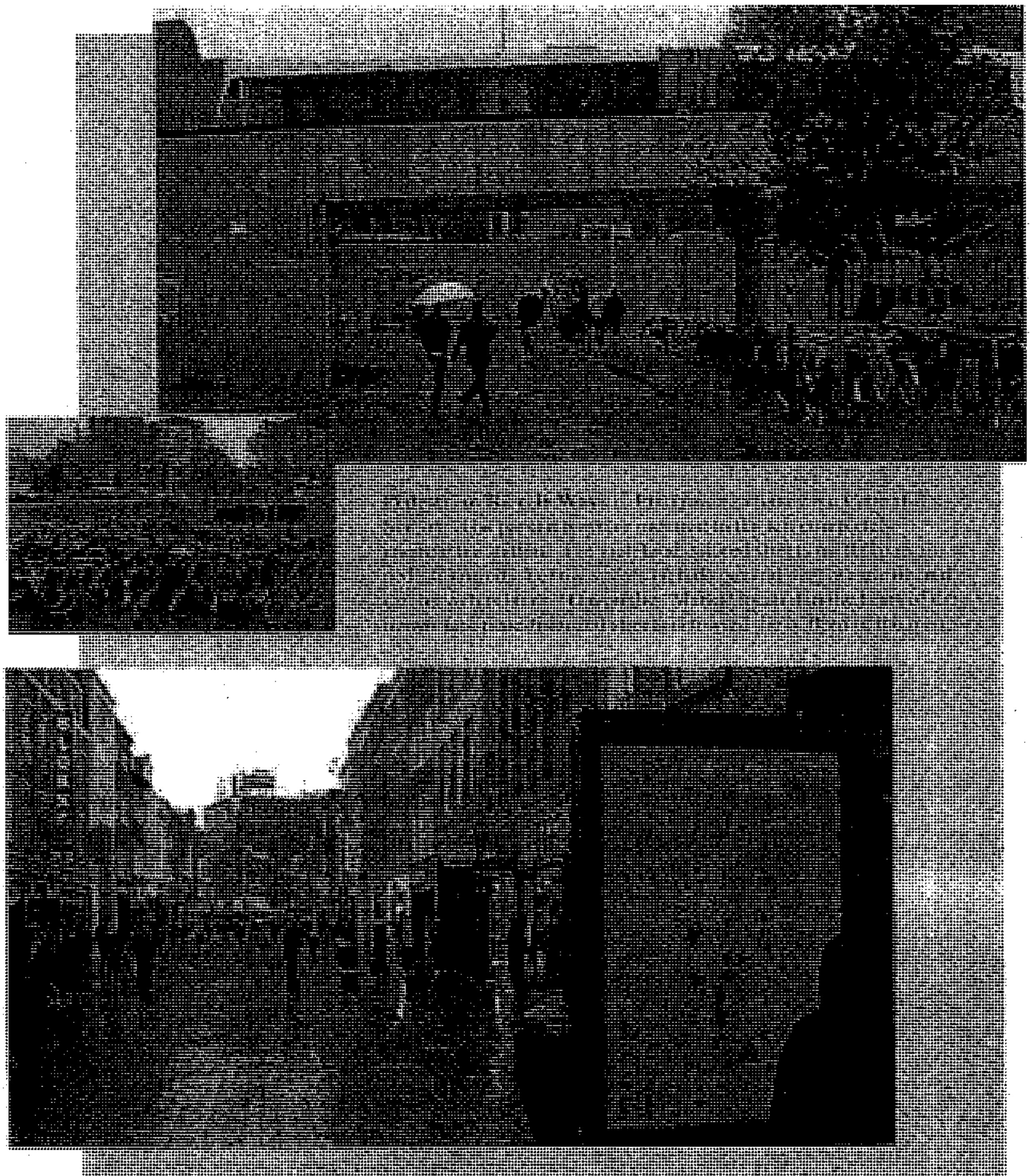
- **Pufin Crossings** -- Refers to Pedestrian User- Friendly INtersection (PUFIN) crossings, generally installed at intersections, consist of traffic and pedestrian signals with red push-button devices and infrared or pressure mat detectors. After a pedestrian pushes the button (or stands on the mat), a detector verifies their presence. If a pedestrian is present at the end of a vehicle cycle, the red traffic signal is indicated to motorists, and pedestrians see the green man (i.e., WALK display). A separate motion detector extends the green interval (if needed) to ensure that slower pedestrians have time to cross safely. If a pedestrian pushes the button, but fails to wait for the green man symbol, the detector will sense that no pedestrian is waiting and will not stop motor vehicle traffic needlessly. Pufin crossings are recent developments and are said to improve pedestrian safety and reduce unnecessary vehicle delay. Since the motion detector can detect only those pedestrians walking within the crosswalk lines, physical barriers are used on the curbs to channel pedestrians into the crosswalks. At some crossings, tactile surfaces have been introduced that guide a visually impaired person to the crosswalk. Pufin crossings are currently used at 27 demonstration sites in England.

- **Pedestrian Zones** -- Refers to areas involving several connected streets which can sometimes be used by cyclists during off-peak hours. These have been established on many downtown streets throughout Europe and are most often referred to as "Pedestrianized Zones". Not only are there fewer modal conflicts, but the presence of pedestrian and bicycle traffic helped eliminate crime and added an element of personal safety. The pedestrian zone sometimes allows bus, bike, goods delivery and taxi travel at certain times of the day only. The Fort Street Pedestrian Mall is not a pedestrian zone since it only involves one street. There are no examples of pedestrian zones on Oahu. Over ninety percent of all cities in Europe have pedestrian zones.

- **Pedestrian/Bicycle Ways** -- Refers to exclusive roadways for both pedestrians and cyclists sometimes with separate lanes for bicycles designed within a wide right-of-way and with full grade separation when warranted by high conflicting traffic conditions. Eindhoven is the best example of grade separated pedestrian/bicycle ways.[3]

[3] A Field Report: The Phileas Transit System In Eindhoven, Netherlands; Wes Frysztacki, Weslin Consulting Services, Inc.; December 2007; pages 10-15.



- **Woonerf Zone** -- Refers to a protected environment with street space shared equally among pedestrians, bicyclists and transit vehicles proceeding at a walking pace. Pedestrians and bicyclists have priority over motor vehicles in a Woonerf zone. Woonerf zones have no formal traffic signals or lane markings.

- **Pedestrian Friendly Design** -- Refers predominately to the aesthetic and urban design amenities associated with pedestrian facilities such as landscaping, lighting, benches, artwork, arbors, water features and pavement treatments. It normally does not refer to the functional traffic design needed to achieve safe and modal priority treatment for people to walk who might otherwise choose to drive a car.

A.1.3. Bicycle Modal Accommodation

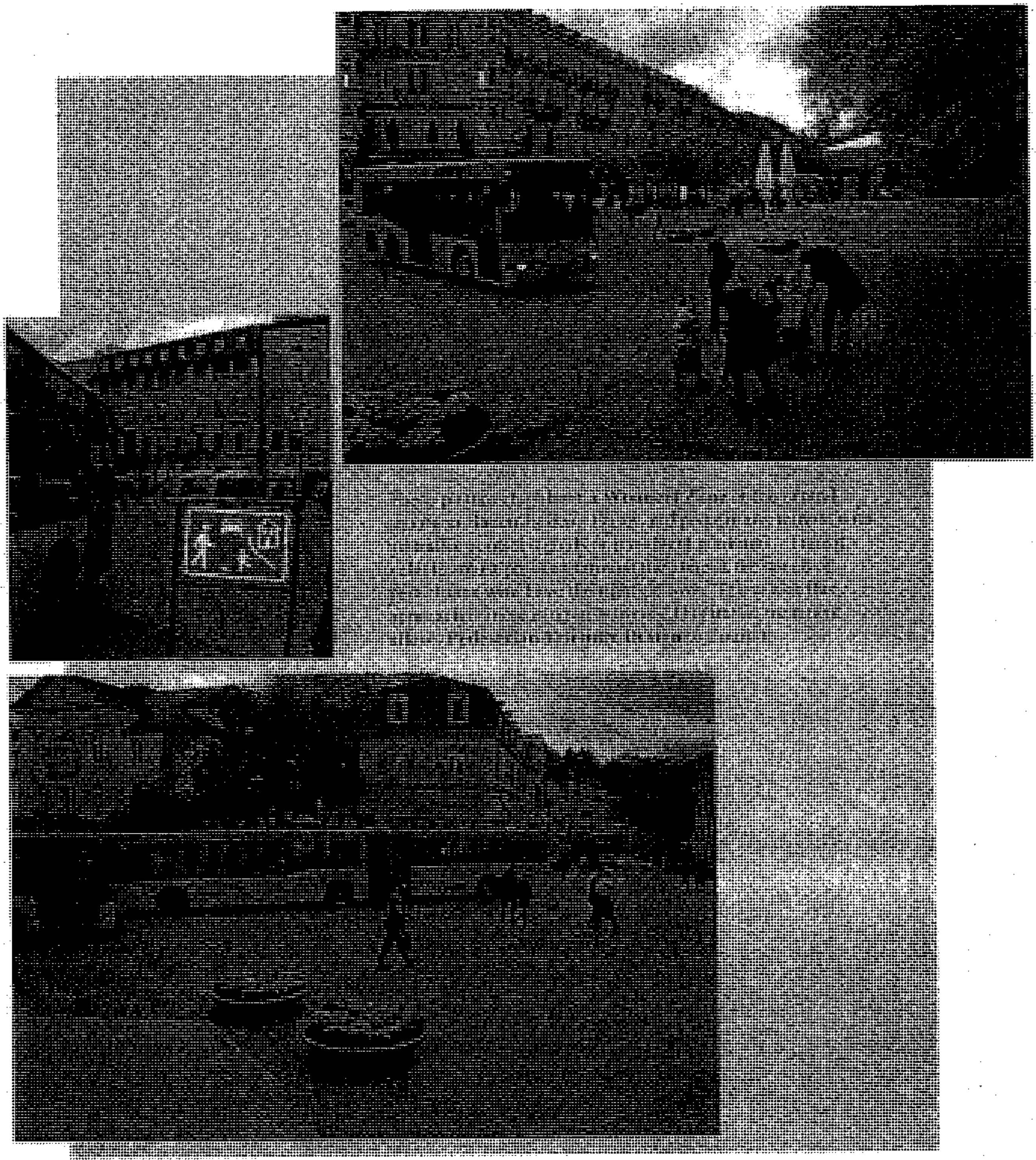
There is a tremendous difference between how the United States views the bicycle mode as compared to the rest of the world. The following offers examples from outside of the U.S. and uses terminology to draw distinctions.[4]

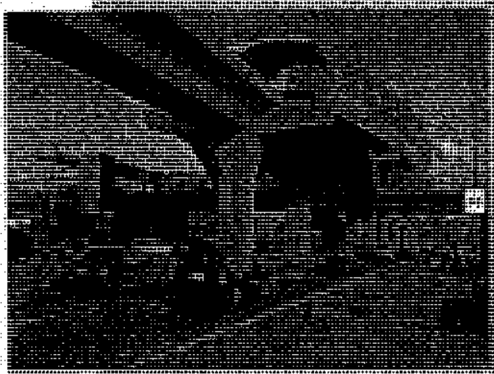
- **Bicycle Lanes** -- Refers to the accommodation of the bicycle within the right-of-way originally established for vehicle traffic. A lane marked on the roadway is designated for bicycle use. Many excellent examples exist of where this has been done effectively on Oahu and throughout the world. However, some countries view bicycle lanes as a temporary measure, "a quick and cheap first stage whenever possible."[5] In the U.S. it is the highest standard for non-recreational cycling, in Europe it is the lowest standard for non-recreational cycling.

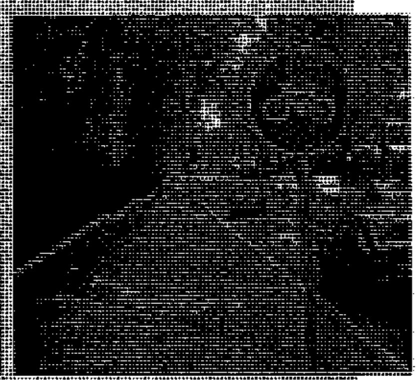
- **Community Bike Program** -- Refers to the type of program in Copenhagen, Amsterdam and Paris where bicycles are stationed at strategic locations throughout a zone and may be borrowed at one location and returned to another.

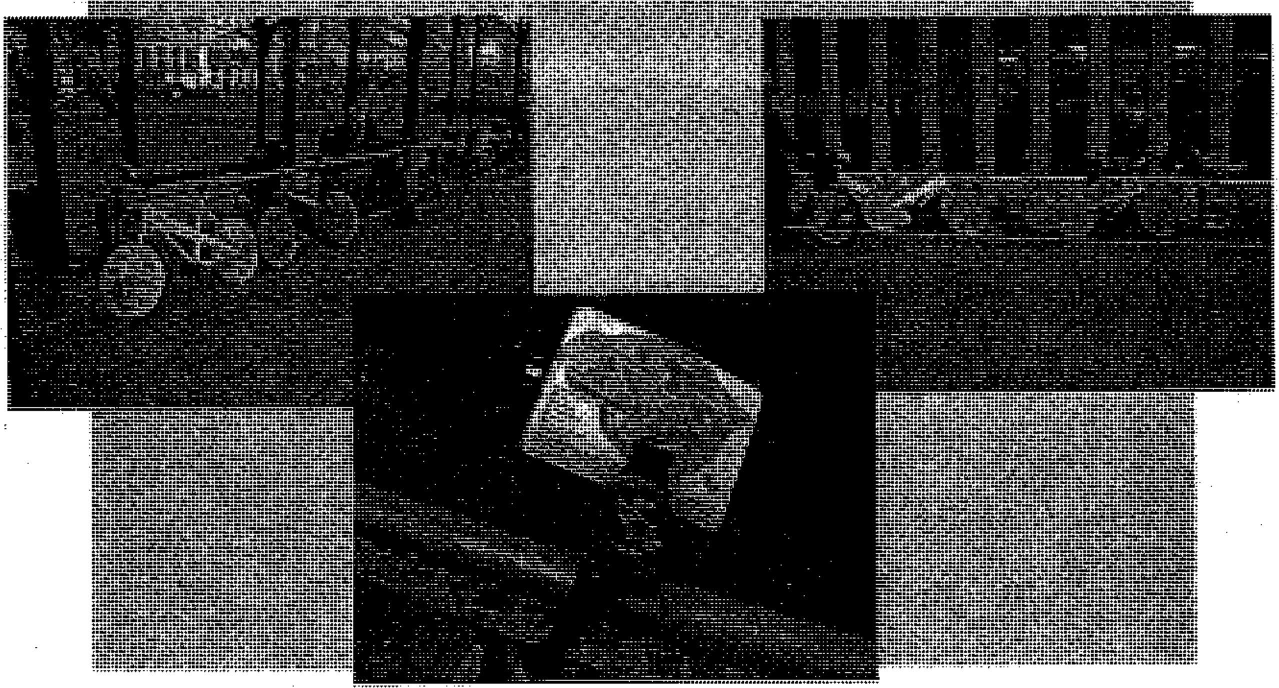
[4] This document uses definitions for planning and policy development purposes. More engineering based definitions and design specifications may be found in Bike Lane Design Guide; Chicago Department of Transportation.

[5] Cycle Policy 2002 - 2012 (Danish title: Cykelpolitik 2002-2012); City of Copenhagen, Building and Construction Administration, Roads and Parks Department; page 22.









- **Euro-Style Bicycle Lanes** -- Refers to the accommodation of the bicycle within the right-of-way originally established for vehicle traffic. A lane marked on the roadway is designated for bicycle use but the lane is positioned between the sidewalk and a parking lane instead of between a parking lane and a vehicle traffic lane. Also known as the "Copenhagen Treatment".

- **Bicycle Paths** --Refers to the accommodation of the bicycle in its own exclusive right-of-way or in a shared right-of-way established for low-speed recreational travel by people on bicycles. Bicycle paths are often created along abandoned rail right-of-way such as the Pearl Harbor Bike Path.

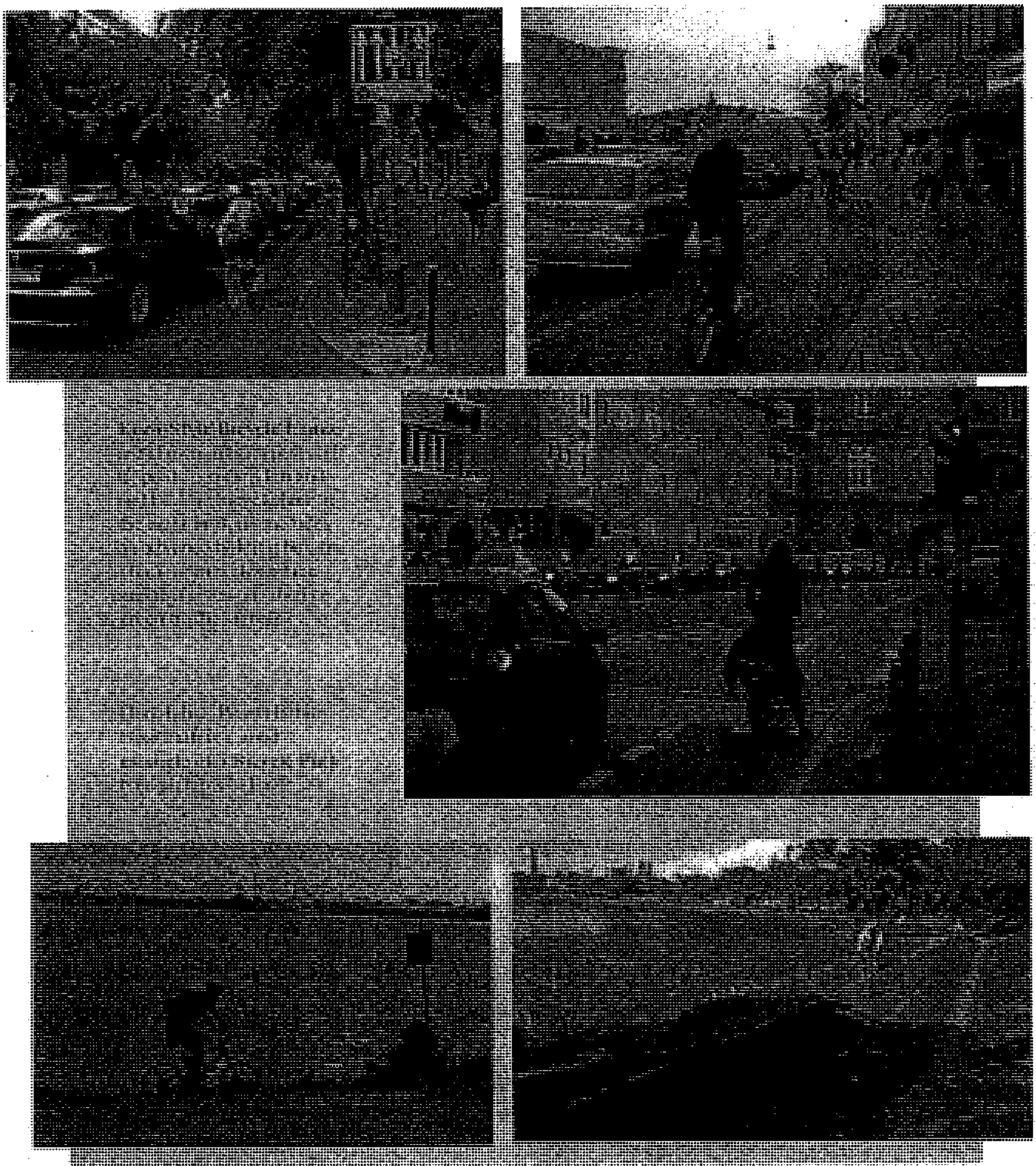
- **Bicycle Tracks or Cycle Tracks** --Refers to the accommodation of the bicycle in its own curb or barrier separated pathway within the overall street right-of-way. The pathway is designed for high-speed functional travel by people on bicycles. Cyclists on the pathway have right-of-way over other modes except where otherwise delineated by a variety of traffic lane markings and control techniques. Several excellent examples of this standard European treatment exist near Waipahu in the vicinity of the Waikele Shopping Center along Paiwa and Lumiaina Streets.

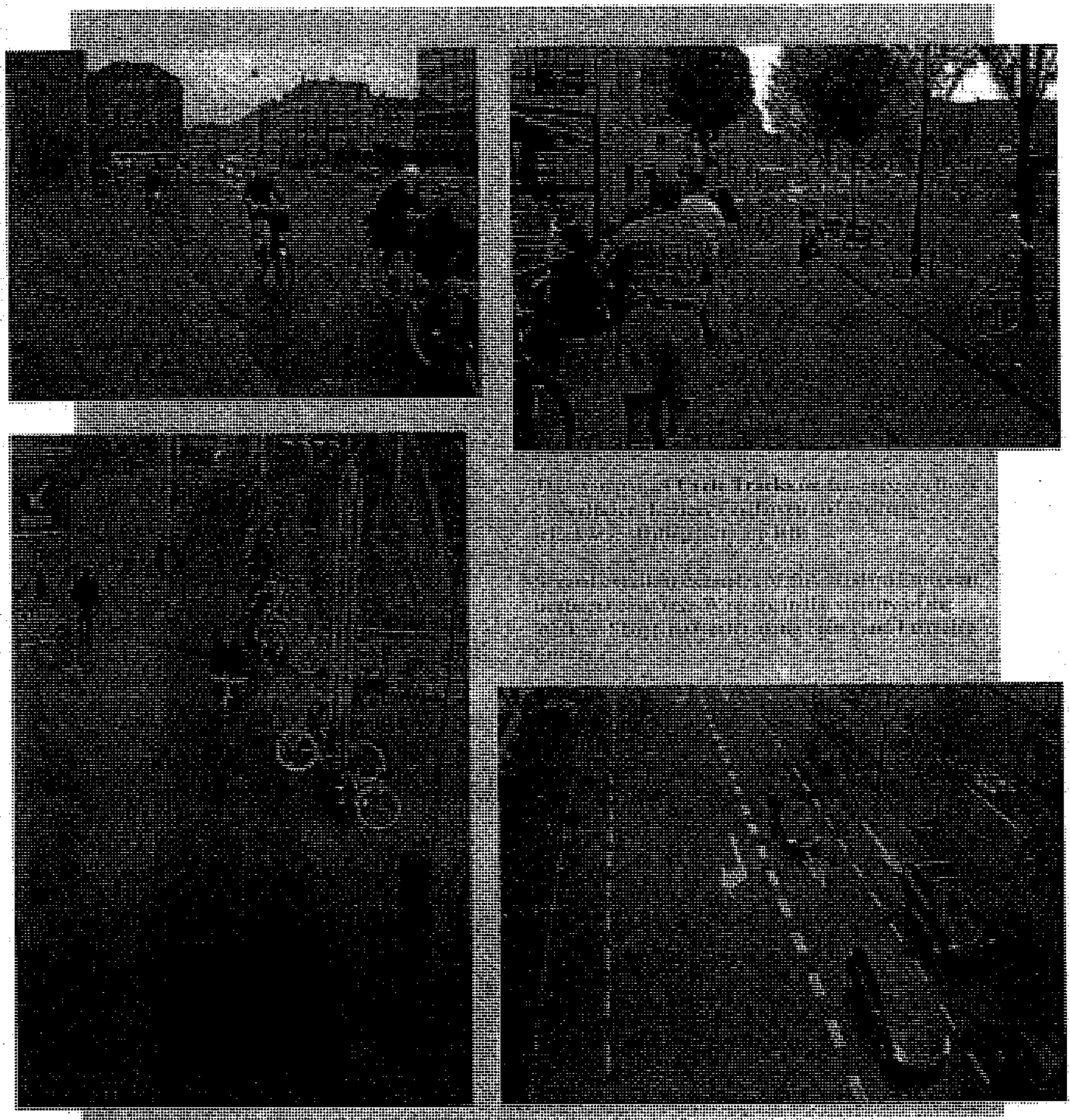
- **Bicycle Shed** -- Refers to a stand alone fully enclosed bicycle storage facility with key card control available in conjunction with special transportation pass programs.

- **Bicycle Stations** -- Refers to a facility where bicycles and other alternative transportation devices may be stored, repaired and rented. Larger facilities include rentals of electric cars, car sharing club counters, showers and other commuter services.

- **Bicycle Streets** -- Refers to a street for the exclusive use by bicyclists.

- **Bike Racks On Taxis** -- Refers to the requirement that any taxi using the premium taxi stand waiting area must be equipped with a bicycle rack.





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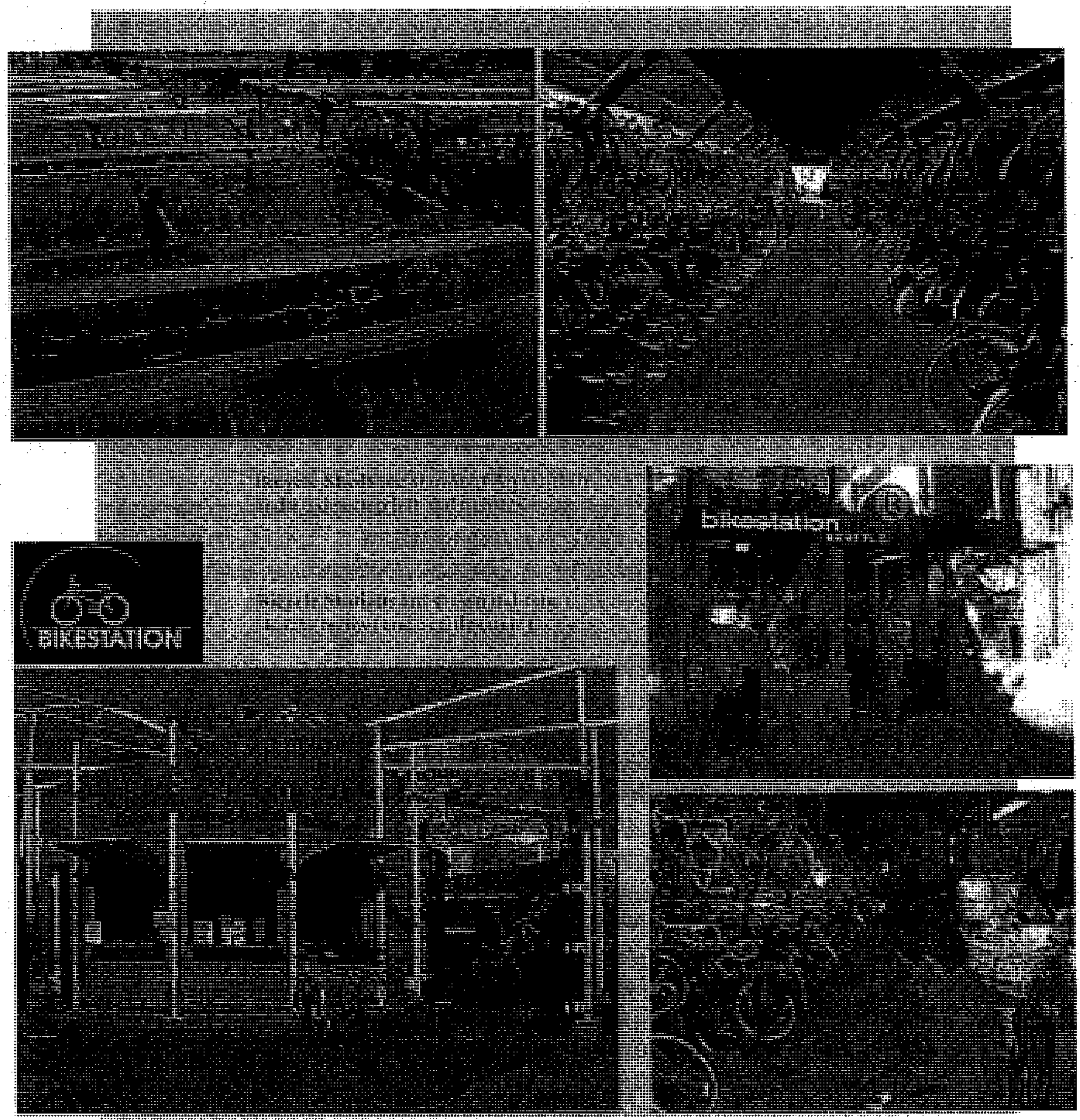
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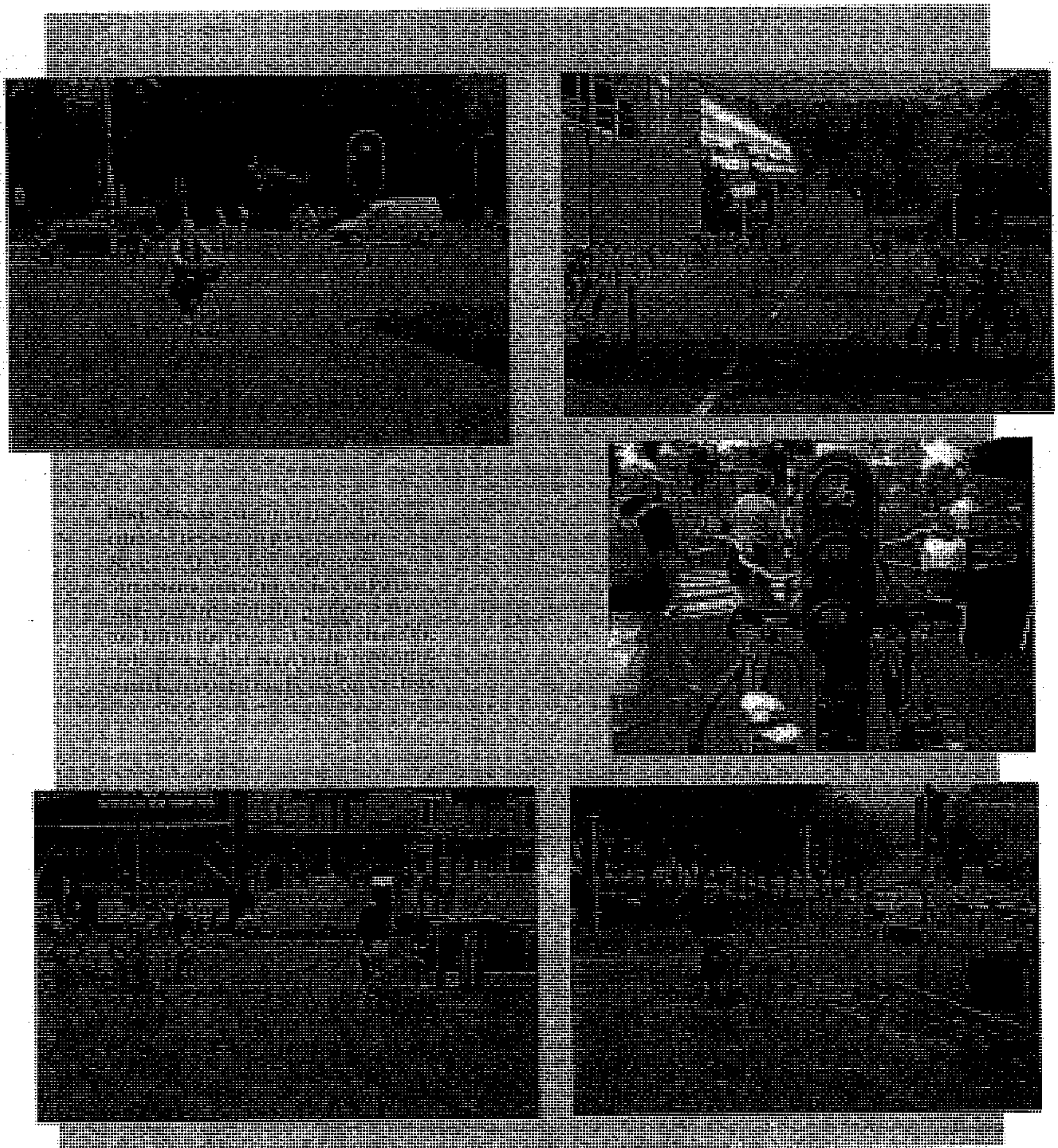
BIKESTATION



A.1.4. Street Network Terminology

The Waipahu Neighborhood TOD Plan offers new streets. Today, both Waipahu station areas are dominated by mega blocks. These tend to concentrate vehicular traffic on a few streets and intersections. The concentration of traffic is in conflict with the ability to provide safe pedestrian and bicycle access.

Pedestrian environments may be achieved by creating smaller blocks with wide sidewalks. All modes have more choices in selecting their travel path and more opportunities are created for on street parking. The following offers examples of some of the terminology emanating from the experiences with designing land use with smaller blocks:

- **TND's** -- Traditional Neighborhood Development's have been associated with the urbanist movement advocating designs for reducing resident's reliance on the automobile by creating compact, mixed use and pedestrian-friendly development.

- **Internal Capture** – The amount or percent of person trips not using a personal vehicle because the desired trip can now be made by an alternative mode within the development area.

- **Pass-By Trips** – The amount or percent of vehicle traffic diverted into a development because the trips already existed on adjacent streets and are not generated by new development.

- **Modal Share** – The amount or percent of trips made by all modes available to those person trips associated with a development or transportation facility.

A.1.5. Station Area Terminology

Different stations serve different functions. The plan of each station area needs to be different to properly serve the priority given to the access modes best suited to use each station. The process used to determine those priorities uses the following terminology:

- **Standard Access Modes** --Refers to the access modes that have traditionally served the greatest portion of station area passenger demands. These are primarily auto and bus.

- **Standard Egress Modes** -- Refers to the egress modes that have traditionally served the greatest portion of station area passenger demands. These are primarily walk and bus.

- **Alternative Access and Egress Modes** -- Refers to the non-standard modes providing station area access and egress such as bicycle travel and car sharing programs.

- **Car Sharing** -- Refers to those programs with a membership who shares the use of a group of private vehicles.

- **Catchment Shed** -- Refers to the geographic area within which the vast majority of transit passengers are traveling, especially by private vehicle, to a particular station or from that station. This includes the resident location of those who drive and park at a station.

- **Catchment Zone** -- Refers to the geographic area within which the vast majority of those using non-private vehicle alternative access and egress modes are traveling to a particular station or from that station. This includes the resident location of those who would bike using bicycle tracks.

- **Modal Share Projection** -- Refers to the output of the Travel Demand Forecasting Model based upon trends, national modeling standards and forecasts of socio-economic characteristics.

- **Modal Share Targets** -- Refers to policy targets developed based upon review of modal share projections, a policy analysis of influencing factors likely to produce better outcomes and extensive community interaction regarding the desired future.

- **Modal Hierarchy** -- Refers to the policy of designating which modes have priority over others within a station access plan area.

- **Personal Transporters** -- Refers primarily to Segway human transporters and some electric bikes that can operate at a speed of no more than eight miles per hour. This term also includes roller blades and scooters when used in a non-recreational context.

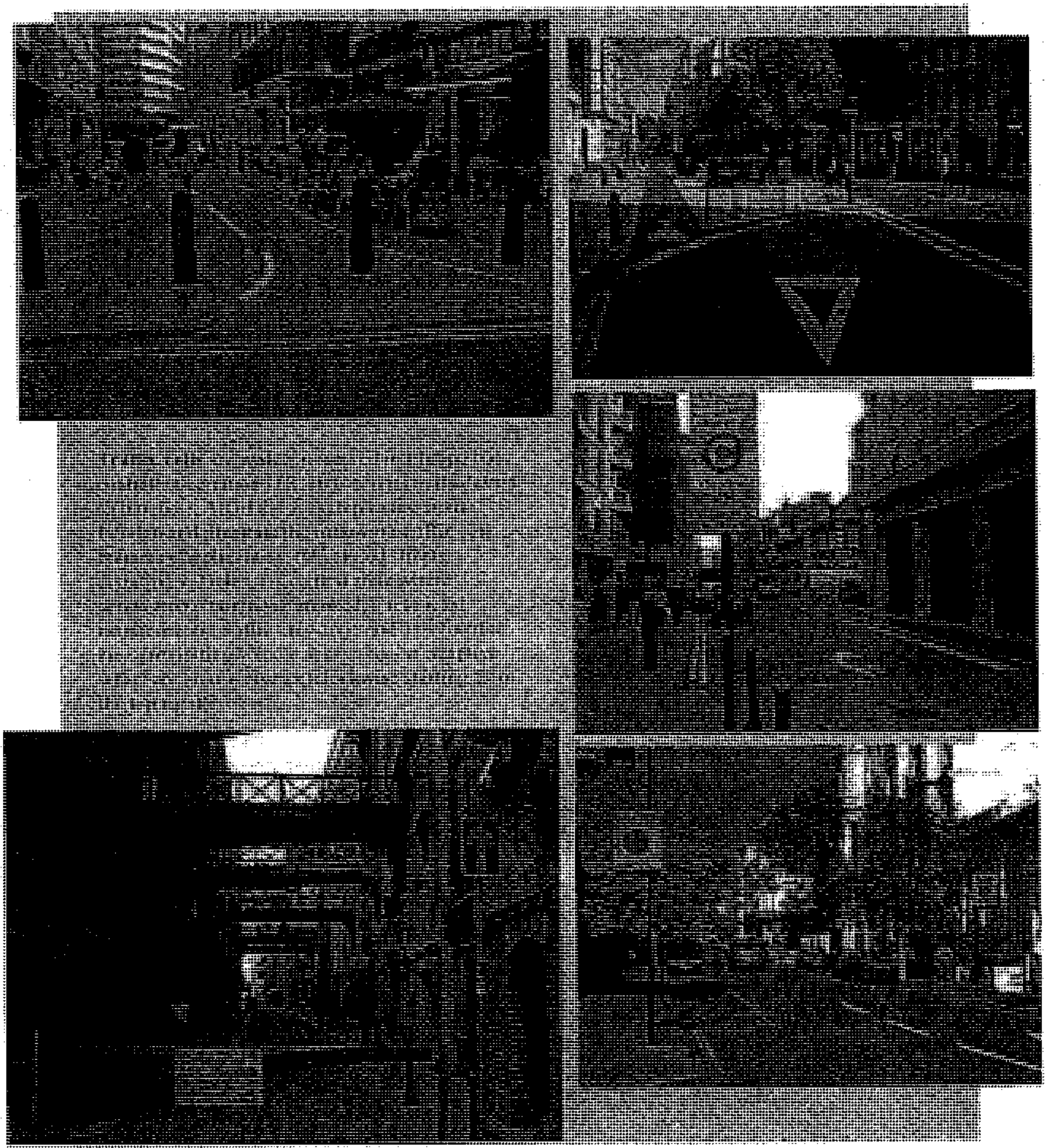
- **Parking Management** -- Refers to the use of various parking policies to govern the supply and use of parking such as shared parking, unbundled parking and maximum parking requirements.

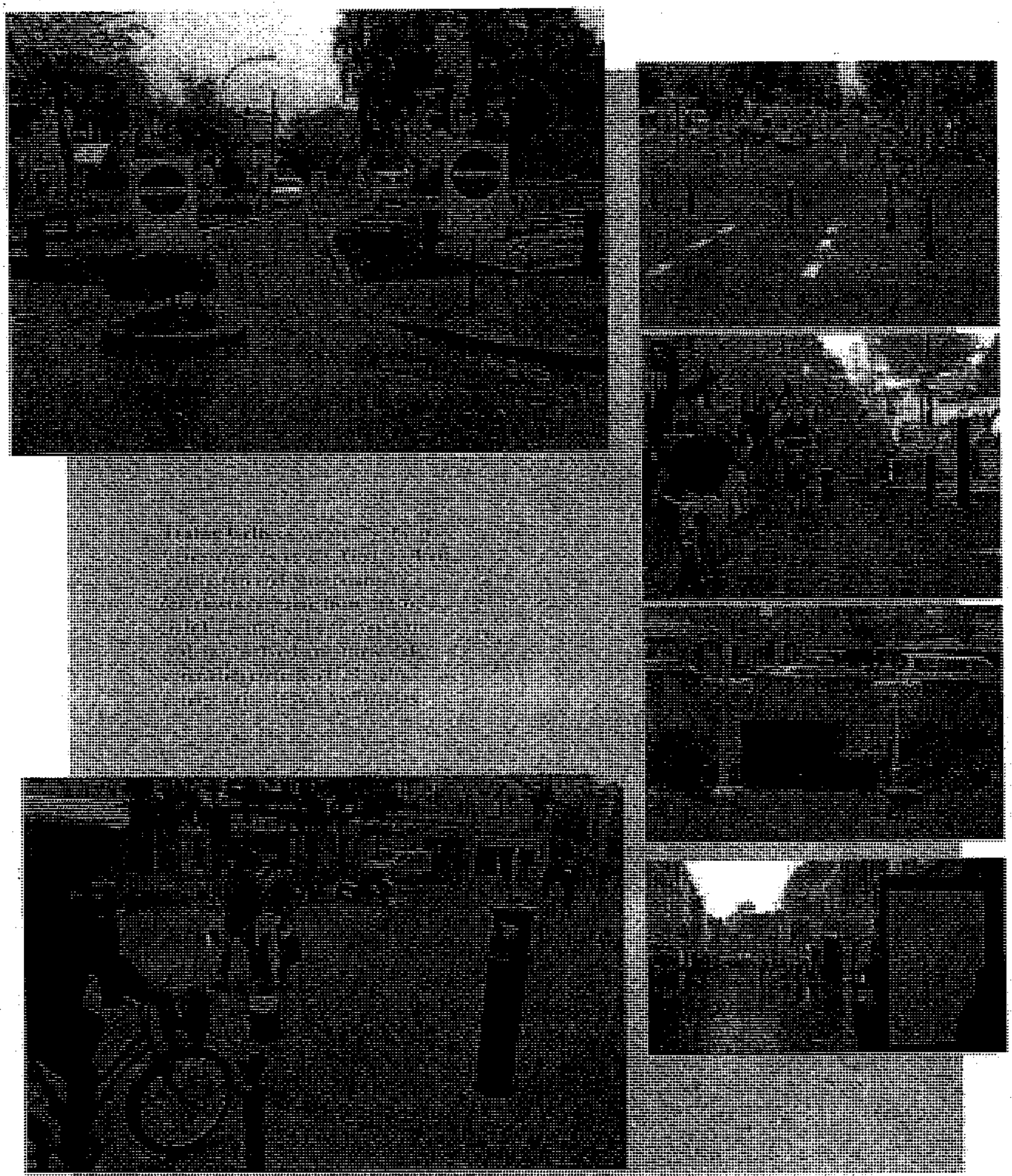
- **Shared Parking** -- A reduction of the minimum number of parking spaces required based upon the ability of mixed land uses with different peak parking demands to share parking spaces. Reduced parking creates higher alternative access mode expectations.
- **Unbundled Parking** -- Refers to the ability to allow tenants and homeowners to purchase parking separately, or not at all.
- **Traffic Cells** -- Refers to an arrangement of zones which limit automobile traffic movement. Vehicle traffic restrictions increase in the vicinity of a **Central Cell.** The central cell severely limits or prohibits vehicle traffic. The central cell may be a city center, public square, historical area, residential zone, park or transit station. Pedestrians and bicyclists are always given access. Traffic cell boundary techniques force vehicles to turn but allow bicycles and pedestrians to travel into the zone. The central cell is often a large pedestrianized zone where cyclists must often dismount.
- **Transition Plaza** -- Refers to an open area that connects and supports people transitioning from one mode to another.
- **Transportation Demand Management (TDM)** -- Refers to the collection of programs, policies and tactics designed to reduce the demand for private vehicle travel by influencing when people travel, how they travel and how far those people travel to access their desired destination.

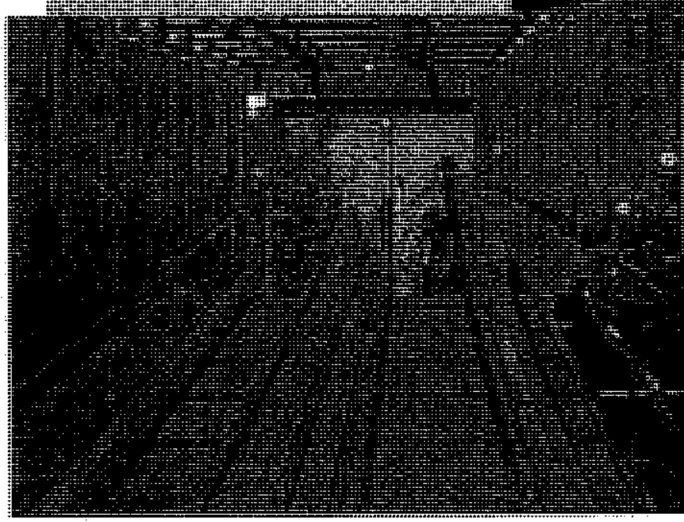
A.1.6. Transit Station Functional Classification

Different stations serve different functions. This report uses the following transit station functional classification definitions:

- **Park And Ride Station** -- Refers to the accommodation of the private vehicle over other access modes at a particular station, but not to the exclusion of other modes.
- **Transit Transfer Station** -- Refers to the accommodation of *TheBus* operations, private shuttles and taxis over other alternative modes at a particular station, but not to the exclusion of other modes.
- **Alternative Mode Access Station** -- Refers to the accommodation of pedestrian and bicycle modes at a particular station and throughout the station area, but not to the exclusion of other modes.







APPENDIX G

CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2016 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT
KOA RIDGE MAKAI ONLY

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	388	31	0	0	7	1	886	0	25	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0			5.0		5.0	5.0				
Lane Util. Factor	0.95	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			0.98		1.00	0.99				
Flt Protected	0.95	0.96			1.00		0.95	0.95				
Satd. Flow (prot)	1770	1787			3656		1770	1764				
Flt Permitted	0.95	0.96			1.00		0.95	0.95				
Satd. Flow (perm)	1770	1787			3656		1770	1764				
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	388	31	0	0	7	1	886	0	25	0	0	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	3	0	0	0	0
Lane Group Flow (vph)	210	209	0	0	7	0	461	447	0	0	0	0
Turn Type	Split						Perm					
Protected Phases	4	4			8			2				
Permitted Phases							2					
Actuated Green, G (s)	12.4	12.4			5.2		21.3	21.3				
Effective Green, g (s)	12.4	12.4			5.2		21.3	21.3				
Actuated g/C Ratio	0.23	0.23			0.10		0.40	0.40				
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	407	411			353		699	697				
v/s Ratio Prot	c0.12	0.12			c0.00							
v/s Ratio Perm							c0.26	0.25				
v/c Ratio	0.52	0.51			0.02		0.66	0.64				
Uniform Delay, d1	18.1	18.1			22.0		13.3	13.2				
Progression Factor	1.00	1.00			1.00		1.00	1.00				
Incremental Delay, d2	1.1	1.0			0.0		2.3	2.0				
Delay (s)	19.2	19.1			22.1		15.6	15.2				
Level of Service	B	B			C		B	B				
Approach Delay (s)		19.2			22.1			15.4			0.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM Average Control Delay	16.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	53.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

[illegible]												
Lane Configurations												
[illegible]												
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
[illegible]												
Lane Util. Factor	0.95	0.95			0.95		0.95	0.95				
Frt	1.00	1.00			0.94		1.00	1.00				
Flt Protected	0.95	0.96			1.00		0.95	0.95				
Satd. Flow (prot)	1770	1787			3516		1770	1770				
Flt Permitted	0.95	0.96			1.00		0.95	0.95				
Satd. Flow (perm)	1770	1787			3516		1770	1770				
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	628	53	0	0	50	30	2012	0	23	0	0	0
RTOR Reduction (vph)	0	0	0	0	29	0	0	1	0	0	0	0
Lane Group Flow (vph)	339	342	0	0	51	0	1026	1008	0	0	0	0
Turn Type	Split						Prot					
Protected Phases	4	4			8		5	2				
Permitted Phases												
Actuated Green, G (s)	21.7	21.7			3.1		57.3	57.3				
Effective Green, g (s)	21.7	21.7			3.1		57.3	57.3				
Actuated g/C Ratio	0.22	0.22			0.03		0.59	0.59				
Clearance Time (s)	5.0	5.0			5.0		5.0	5.0				
Vehicle Extension (s)	3.0	3.0			3.0		3.0	3.0				
Lane Grp Cap (vph)	396	399			112		1045	1045				
v/s Ratio Prot	c0.19	0.19			c0.01		c0.58	0.57				
v/s Ratio Perm												
v/c Ratio	0.86	0.86			0.45		0.98	0.96				
Uniform Delay, d1	36.2	36.2			46.2		19.4	18.9				
Progression Factor	1.00	1.00			1.00		1.00	1.00				
Incremental Delay, d2	16.4	16.4			2.9		23.4	19.7				
Delay (s)	52.6	52.6			49.1		42.7	38.6				
Level of Service	D	D			D		D	D				
Approach Delay (s)		52.6			49.1			40.7			0.0	
Approach LOS		D			D			D			A	

[illegible]				
HCM Average Control Delay	43.8	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.93			
Actuated Cycle Length (s)	97.1	Sum of lost time (s)	15.0	
Intersection Capacity Utilization	131.7%	ICU Level of Service	H	
Analysis Period (min)	15			
c Critical Lane Group				

HCM Unsignalized Intersection Capacity Analysis
26: Ka Uka Blvd & H-2 On (SB)

9/16/2009

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱↱	↰	↑↑		
Volume (veh/h)	420	1551	5	888	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.86	0.86	0.92	0.92
Hourly flow rate (vph)	442	1633	6	1033	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)	516			638		
pX, platoon unblocked			0.89		0.89	0.89
vC, conflicting volume			442		970	442
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			315		906	315
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			99		100	100
cM capacity (veh/h)			1109		245	608

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Volume Left	0	0	0	[illegible]	0	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
cSH	1700	1700	1700	1109	1700	1700
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Queue Length 95th (ft)	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	8.3	0.0	0.0
Lane LOS				A		
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↱↱	↰	↑↑		
Volume (veh/h)	683	1452	25	2038	0	0
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	683	1452	25	2038	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)	516			638		
pX, platoon unblocked			0.71		0.71	0.71
vC, conflicting volume			683		1752	683
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			353		1854	353
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			97		100	100
cM capacity (veh/h)			856		45	458

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	683	726	726	25	1019	1019
Volume Left	0	0	0	25	0	0
Volume Right	0	726	726	0	0	0
cSH	1700	1700	1700	856	1700	1700
Volume to Capacity	0.40	0.43	0.43	0.03	0.60	0.60
Queue Length 95th (ft)	0	0	0	2	0	0
Control Delay (s)	0.0	0.0	0.0	9.3	0.0	0.0
Lane LOS				A		
Approach Delay (s)	0.0			0.1		
Approach LOS						

Intersection Summary			
Average Delay	0.1		
Intersection Capacity Utilization	117.7%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑↑↱		↰↰	↑↑		↰		↱	↰	↑	↱
Volume (vph)	0	1614	54	177	701	0	28	0	328	11	158	245
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0		5.0	5.0		5.0		6.0	5.0	5.0	5.0
Lane Util. Factor		0.91		0.97	0.95		1.00		1.00	1.00	1.00	1.00
Frt		1.00		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		5327		3614	3725		1863		1667	1863	1961	1667
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		5327		3614	3725		1863		1667	1863	1961	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1614	54	177	701	0	28	0	328	11	158	245
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	99	0	0	0
Lane Group Flow (vph)	0	1665	0	177	701	0	28	0	229	11	158	245
Turn Type				Prot			Prot		custom	Prot		Free
Protected Phases		4		3	8		5		2	1	6	
Permitted Phases									3			Free
Actuated Green, G (s)		34.2		8.6	47.8		2.2		23.7	1.1	14.0	79.0
Effective Green, g (s)		34.2		8.6	47.8		2.2		21.7	1.1	14.0	79.0
Actuated g/C Ratio		0.43		0.11	0.61		0.03		0.27	0.01	0.18	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0		5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)		2306		393	2254		52		585	26	348	1667
v/s Ratio Prot		c0.31		0.05	0.19		c0.02		c0.07	0.01	0.08	
v/s Ratio Perm									0.07			c0.15
v/c Ratio		0.72		0.45	0.31		0.54		0.39	0.42	0.45	0.15
Uniform Delay, d1		18.5		33.0	7.6		37.9		23.3	38.6	29.1	0.0
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		1.1		0.8	0.1		10.3		0.4	10.7	0.9	0.2
Delay (s)		19.6		33.8	7.7		48.2		23.7	49.4	30.0	0.2
Level of Service		B		C	A		D		C	D	C	A
Approach Delay (s)		19.6			12.9			25.7			12.9	
Approach LOS		B			B			C			B	

HCM Average Control Delay	17.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	79.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
5: Ka Uka Blvd & H-2 Off (SB)

9/23/2009

[illegible]												
Lane Configurations												
[illegible]												
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
[illegible]												
Lane Util. Factor		0.91		1.00	0.95		1.00		1.00	1.00	1.00	1.00
Frt		0.99		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (prot)		5315		1863	3725		1863		1667	1863	1961	1667
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd. Flow (perm)		5315		1863	3725		1863		1667	1863	1961	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	0	1567	78	276	1748	0	81	0	522	19	192	308
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	68	0	0	0
Lane Group Flow (vph)	0	1640	0	276	1748	0	81	0	454	19	192	308
Turn Type				Prot			Prot		custom	Prot		Free
Protected Phases		4		3	8		5		2	1	6	
Permitted Phases									3			Free
Actuated Green, G (s)		33.0		17.4	55.4		6.6		38.8	2.2	17.0	94.0
Effective Green, g (s)		33.0		17.4	55.4		6.6		36.8	2.2	17.0	94.0
Actuated g/C Ratio		0.35		0.19	0.59		0.07		0.39	0.02	0.18	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0		5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)		1866		345	2195		131		759	44	355	1667
v/s Ratio Prot		c0.31		0.15	c0.47		c0.04		c0.19	0.01	0.10	
v/s Ratio Perm									0.14			0.18
v/c Ratio		0.88		0.80	0.80		0.62		0.60	0.43	0.54	0.18
Uniform Delay, d1		28.6		36.6	14.9		42.5		22.7	45.3	35.0	0.0
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		5.1		12.5	2.1		8.4		1.3	6.7	1.7	0.2
Delay (s)		33.7		49.1	17.0		50.9		24.0	51.9	36.6	0.2
Level of Service		C		D	B		D		C	D	D	A
Approach Delay (s)		33.7			21.4			27.6			15.6	
Approach LOS		C			C			C			B	

[illegible]			
HCM Average Control Delay	25.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↑	↱			↱	↰↰	↱	
Volume (vph)	95	899	73	149	476	346	0	0	141	629	0	171
Ideal Flow (vphpl)	1900	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		6.0	6.0	4.0			5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00			1.00	0.97	1.00	
Frt	1.00	0.99		1.00	1.00	0.85			0.86	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00			1.00	0.95	1.00	
Satd. Flow (prot)	1770	3684		1863	3725	1583			1611	3433	1583	
Flt Permitted	0.95	1.00		0.95	1.00	1.00			1.00	0.95	1.00	
Satd. Flow (perm)	1770	3684		1863	3725	1583			1611	3433	1583	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	95	899	73	149	476	346	0	0	141	629	0	171
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	0	0	125	0
Lane Group Flow (vph)	95	966	0	149	476	346	0	0	141	629	46	0
Turn Type	Prot			Prot		Free			Free	Prot		
Protected Phases	7	4		3	8					1	6	
Permitted Phases						Free			Free			
Actuated Green, G (s)	9.4	26.7		11.7	29.0	73.1			73.1	19.7	19.7	
Effective Green, g (s)	9.4	25.7		10.7	28.0	73.1			73.1	19.7	19.7	
Actuated g/C Ratio	0.13	0.35		0.15	0.38	1.00			1.00	0.27	0.27	
Clearance Time (s)	5.0	5.0		5.0	5.0					5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)	228	1295		273	1427	1583			1611	925	427	
v/s Ratio Prot	0.05	c0.26		c0.08	0.13					c0.18	0.03	
v/s Ratio Perm						c0.22			0.09			
v/c Ratio	0.42	0.75		0.55	0.33	0.22			0.09	0.68	0.11	
Uniform Delay, d1	29.3	20.8		28.9	16.0	0.0			0.0	23.9	20.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00			1.00	1.00	1.00	
Incremental Delay, d2	1.2	2.4		2.2	0.1	0.3			0.1	2.1	0.1	
Delay (s)	30.6	23.2		31.2	16.1	0.3			0.1	26.0	20.2	
Level of Service	C	C		C	B	A			A	C	C	
Approach Delay (s)		23.9			12.8			0.1			24.7	
Approach LOS		C			B			A			C	

HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	73.1	Sum of lost time (s)	17.0
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↑	↱			↱	↰↰	↱	
Volume (vph)	252	540	140	199	1007	930	0	0	344	757	0	205
Ideal Flow (vphpl)	1900	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		6.0	6.0	4.0			5.0	5.0	5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00			1.00	0.97	1.00	
Frt	1.00	0.97		1.00	1.00	0.85			0.86	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00			1.00	0.95	1.00	
Satd. Flow (prot)	1770	3610		1863	3725	1583			1611	3433	1583	
Flt Permitted	0.95	1.00		0.95	1.00	1.00			1.00	0.95	1.00	
Satd. Flow (perm)	1770	3610		1863	3725	1583			1611	3433	1583	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	252	540	140	199	1007	930	0	0	344	757	0	205
RTOR Reduction (vph)	0	23	0	0	0	0	0	0	0	0	147	0
Lane Group Flow (vph)	252	657	0	199	1007	930	0	0	344	757	58	0
Turn Type	Prot			Prot		Free			Free	Prot		
Protected Phases	7	4		3	8					1	6	
Permitted Phases						Free			Free			
Actuated Green, G (s)	16.8	31.5		14.5	29.2	84.9			84.9	23.9	23.9	
Effective Green, g (s)	16.8	30.5		13.5	28.2	84.9			84.9	23.9	23.9	
Actuated g/C Ratio	0.20	0.36		0.16	0.33	1.00			1.00	0.28	0.28	
Clearance Time (s)	5.0	5.0		5.0	5.0					5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)	350	1297		296	1237	1583			1611	966	446	
v/s Ratio Prot	c0.14	0.18		0.11	c0.27					c0.22	0.04	
v/s Ratio Perm						c0.59			0.21			
v/c Ratio	0.72	0.51		0.67	0.81	0.59			0.21	0.78	0.13	
Uniform Delay, d1	31.8	21.3		33.6	26.0	0.0			0.0	28.1	22.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00			1.00	1.00	1.00	
Incremental Delay, d2	6.9	0.3		5.9	4.2	1.6			0.3	4.2	0.1	
Delay (s)	38.8	21.6		39.5	30.2	1.6			0.3	32.3	22.9	
Level of Service	D	C		D	C	A			A	C	C	
Approach Delay (s)		26.3			18.6			0.3			30.3	
Approach LOS		C			B			A			C	

Intersection Summary			
HCM Average Control Delay	21.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	84.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	3	2	41	15	22	8	1031	69	87	476	78
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.99			0.96		1.00	0.99		1.00	0.98	
Flt Protected		0.96			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1771			1746		1863	3690		1863	3647	
Flt Permitted		0.78			0.82		0.44	1.00		0.24	1.00	
Satd. Flow (perm)		1429			1477		872	3690		479	3647	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	15	3	2	41	15	22	8	1031	69	87	476	78
RTOR Reduction (vph)	0	2	0	0	18	0	0	5	0	0	13	0
Lane Group Flow (vph)	0	18	0	0	60	0	8	1095	0	87	541	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		4.5			4.5		32.5	32.5		32.5	32.5	
Effective Green, g (s)		4.5			4.5		32.5	32.5		32.5	32.5	
Actuated g/C Ratio		0.10			0.10		0.69	0.69		0.69	0.69	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		137			141		603	2552		331	2522	
v/s Ratio Prot								c0.30			0.15	
v/s Ratio Perm		0.01			c0.04		0.01			0.18		
v/c Ratio		0.13			0.42		0.01	0.43		0.26	0.21	
Uniform Delay, d1		19.5			20.0		2.3	3.2		2.7	2.6	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.4			2.1		0.0	0.1		0.4	0.0	
Delay (s)		19.9			22.1		2.3	3.3		3.2	2.7	
Level of Service		B			C		A	A		A	A	
Approach Delay (s)		19.9			22.1			3.3			2.7	
Approach LOS		B			C			A			A	

[illegible]			
HCM Average Control Delay	4.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	47.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Volume (vph)	47	11	14	121	13	64	7	822	54	63	1074	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.97			0.96		1.00	0.99		1.00	0.99	
Flt Protected		0.97			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1757			1729		1863	3691		1863	3691	
Flt Permitted		0.80			0.77		0.20	1.00		0.29	1.00	
Satd. Flow (perm)		1453			1374		385	3691		572	3691	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	47	11	14	121	13	64	7	822	54	63	1074	70
RTOR Reduction (vph)	0	11	0	0	21	0	0	5	0	0	5	0
Lane Group Flow (vph)	0	61	0	0	177	0	7	871	0	63	1139	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		12.3			12.3		29.8	29.8		29.8	29.8	
Effective Green, g (s)		12.3			12.3		29.8	29.8		29.8	29.8	
Actuated g/C Ratio		0.25			0.25		0.59	0.59		0.59	0.59	
Clearance Time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		357			337		229	2195		340	2195	
v/s Ratio Prot								0.24			c0.31	
v/s Ratio Perm		0.04			c0.13		0.02			0.11		
v/c Ratio		0.17			0.52		0.03	0.40		0.19	0.52	
Uniform Delay, d1		14.9			16.4		4.2	5.4		4.6	5.9	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			1.5		0.1	0.1		0.3	0.2	
Delay (s)		15.1			17.8		4.2	5.5		4.9	6.2	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		15.1			17.8			5.5			6.1	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	7.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	50.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↑↱		↰	↑↑↱	
Volume (vph)	40	12	23	91	19	96	58	970	101	64	424	29
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.96			0.94		1.00	0.99		1.00	0.99	
Flt Protected		0.97			0.98		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1739			1708		1863	3673		1863	3690	
Flt Permitted		0.81			0.82		0.49	1.00		0.22	1.00	
Satd. Flow (perm)		1448			1435		962	3673		426	3690	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	40	12	23	91	19	96	58	970	101	64	424	29
RTOR Reduction (vph)	0	17	0	0	39	0	0	9	0	0	6	0
Lane Group Flow (vph)	0	58	0	0	167	0	58	1062	0	64	447	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		10.8			10.8		24.1	24.1		24.1	24.1	
Effective Green, g (s)		10.8			10.8		24.1	24.1		24.1	24.1	
Actuated g/C Ratio		0.24			0.24		0.54	0.54		0.54	0.54	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		348			345		516	1971		229	1981	
v/s Ratio Prot								c0.29			0.12	
v/s Ratio Perm		0.04			c0.12		0.06			0.15		
v/c Ratio		0.17			0.48		0.11	0.54		0.28	0.23	
Uniform Delay, d1		13.5			14.6		5.1	6.8		5.7	5.5	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			1.1		0.1	0.3		0.7	0.1	
Delay (s)		13.7			15.7		5.2	7.1		6.3	5.6	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		13.7			15.7			7.0			5.6	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	7.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	44.9	Sum of lost time (s)	10.0
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↑↱		↰	↑↱	
Volume (vph)	94	38	34	138	26	43	41	743	92	115	1051	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.97			0.97		1.00	0.98		1.00	0.99	
Flt Protected		0.97			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1761			1752		1863	3664		1863	3704	
Flt Permitted		0.76			0.75		0.20	1.00		0.30	1.00	
Satd. Flow (perm)		1368			1359		385	3664		592	3704	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	94	38	34	138	26	43	41	743	92	115	1051	42
RTOR Reduction (vph)	0	12	0	0	12	0	0	11	0	0	3	0
Lane Group Flow (vph)	0	154	0	0	195	0	41	824	0	115	1090	0
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		13.3			13.3		24.0	24.0		24.0	24.0	
Effective Green, g (s)		13.3			13.3		24.0	24.0		24.0	24.0	
Actuated g/C Ratio		0.28			0.28		0.51	0.51		0.51	0.51	
Clearance Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		385			382		195	1859		300	1879	
v/s Ratio Prot								0.22			c0.29	
v/s Ratio Perm		0.11			c0.14		0.11			0.19		
v/c Ratio		0.40			0.51		0.21	0.44		0.38	0.58	
Uniform Delay, d1		13.8			14.3		6.4	7.4		7.1	8.1	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.7			1.2		0.5	0.2		0.8	0.4	
Delay (s)		14.5			15.4		7.0	7.6		7.9	8.6	
Level of Service		B			B		A	A		A	A	
Approach Delay (s)		14.5			15.4			7.5			8.5	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM Average Control Delay	9.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	47.3	Sum of lost time (s)	10.0
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✥			✥	
Volume (vph)	58	800	85	140	389	8	83	12	319	3	7	7
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.90			0.94	
Flt Protected	0.95	1.00		0.95	1.00			0.99			0.99	
Satd. Flow (prot)	1863	3672		1863	3714			1652			1744	
Flt Permitted	0.95	1.00		0.95	1.00			0.93			0.95	
Satd. Flow (perm)	1863	3672		1863	3714			1548			1667	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	58	800	85	140	389	8	83	12	319	3	7	7
RTOR Reduction (vph)	0	8	0	0	2	0	0	156	0	0	5	0
Lane Group Flow (vph)	58	877	0	140	395	0	0	258	0	0	12	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	6.9	22.9		10.5	26.5			16.2			16.2	
Effective Green, g (s)	6.9	22.9		10.5	26.5			16.2			16.2	
Actuated g/C Ratio	0.11	0.35		0.16	0.41			0.25			0.25	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	199	1302		303	1524			388			418	
v/s Ratio Prot	0.03	c0.24		c0.08	c0.11							
v/s Ratio Perm								c0.17			0.01	
v/c Ratio	0.29	0.67		0.46	0.26			0.67			0.03	
Uniform Delay, d1	26.6	17.7		24.5	12.6			21.8			18.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.8	1.4		1.1	0.1			4.3			0.0	
Delay (s)	27.4	19.1		25.6	12.7			26.0			18.3	
Level of Service	C	B		C	B			C			B	
Approach Delay (s)		19.6			16.0			26.0			18.3	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM Average Control Delay	20.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	64.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑↱			✥			✥	
Volume (vph)	53	681	99	191	1024	7	149	19	181	12	22	108
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	
Frt	1.00	0.98		1.00	1.00			0.93			0.90	
Flt Protected	0.95	1.00		0.95	1.00			0.98			1.00	
Satd. Flow (prot)	1863	3655		1863	3722			1696			1664	
Flt Permitted	0.95	1.00		0.95	1.00			0.81			0.96	
Satd. Flow (perm)	1863	3655		1863	3722			1405			1606	
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	53	681	99	191	1024	7	149	19	181	12	22	108
RTOR Reduction (vph)	0	12	0	0	1	0	0	47	0	0	76	0
Lane Group Flow (vph)	53	768	0	191	1030	0	0	302	0	0	66	0
Turn Type	Prot			Prot			Perm			Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases							2			6		
Actuated Green, G (s)	6.2	22.1		12.6	28.5			20.6			20.6	
Effective Green, g (s)	6.2	22.1		12.6	28.5			20.6			20.6	
Actuated g/C Ratio	0.09	0.31		0.18	0.41			0.29			0.29	
Clearance Time (s)	5.0	5.0		5.0	5.0			5.0			5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	
Lane Grp Cap (vph)	164	1149		334	1509			412			471	
v/s Ratio Prot	0.03	0.21		c0.10	c0.28							
v/s Ratio Perm								c0.21			0.04	
v/c Ratio	0.32	0.67		0.57	0.68			0.73			0.14	
Uniform Delay, d1	30.1	20.9		26.4	17.2			22.4			18.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	1.1	1.5		2.4	1.3			6.6			0.1	
Delay (s)	31.2	22.4		28.7	18.5			29.0			18.5	
Level of Service	C	C		C	B			C			B	
Approach Delay (s)		23.0			20.1			29.0			18.5	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	22.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	70.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

	↗	→	↘	↙	←	↖	↖	↑	↗	↘	↓	↙
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱	↰	↑↑	↱	↰↰	↑↑	↱
Volume (vph)	16	20	4	217	16	249	8	456	254	675	913	17
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0		5.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	6.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3451		1863	1961	1667	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3451		1863	1961	1667	1863	3725	1667	3614	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	16	20	4	217	16	249	8	456	254	675	913	17
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	199	0	0	10
Lane Group Flow (vph)	16	20	0	217	16	249	8	456	55	675	913	7
Turn Type	Split			Split		Free	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			6
Actuated Green, G (s)	3.5	3.5		15.5	15.5	77.0	4.4	16.6	16.6	21.4	33.6	33.6
Effective Green, g (s)	3.5	3.5		15.5	15.5	77.0	4.4	16.6	16.6	21.4	33.6	32.6
Actuated g/C Ratio	0.05	0.05		0.20	0.20	1.00	0.06	0.22	0.22	0.28	0.44	0.42
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	6.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	80	157		375	395	1667	106	803	359	1004	1625	706
v/s Ratio Prot	0.01	0.01		c0.12	0.01		0.00	0.12		c0.19	c0.25	
v/s Ratio Perm						c0.15			0.03			0.00
v/c Ratio	0.20	0.13		0.58	0.04	0.15	0.08	0.57	0.15	0.67	0.56	0.01
Uniform Delay, d1	35.4	35.3		27.8	24.8	0.0	34.4	27.0	24.5	24.7	16.2	12.9
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.4		2.2	0.0	0.2	0.3	0.9	0.2	1.8	0.4	0.0
Delay (s)	36.6	35.7		30.0	24.8	0.2	34.7	27.9	24.7	26.5	16.7	12.9
Level of Service	D	D		C	C	A	C	C	C	C	B	B
Approach Delay (s)		36.0			14.4			26.9			20.7	
Approach LOS		D			B			C			C	

Intersection Summary			
HCM Average Control Delay	21.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	77.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	60.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↱		↰	↑	↱	↰	↑↑	↱	↰↰	↑↑	↱
Volume (vph)	32	41	36	393	78	817	35	814	430	367	592	51
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0		5.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	6.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Frt	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3291		1863	1961	1667	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3291		1863	1961	1667	1863	3725	1667	3614	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	32	41	36	393	78	817	35	814	430	367	592	51
RTOR Reduction (vph)	0	34	0	0	0	0	0	0	301	0	0	32
Lane Group Flow (vph)	32	43	0	393	78	817	35	814	129	367	592	19
Turn Type	Split			Split		Free	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			6
Actuated Green, G (s)	5.8	5.8		25.4	25.4	94.0	6.2	28.3	28.3	14.5	36.6	36.6
Effective Green, g (s)	5.8	5.8		25.4	25.4	94.0	6.2	28.3	28.3	14.5	36.6	35.6
Actuated g/C Ratio	0.06	0.06		0.27	0.27	1.00	0.07	0.30	0.30	0.15	0.39	0.38
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	109	203		503	530	1667	123	1121	502	557	1450	631
v/s Ratio Prot	0.02	0.01		c0.21	0.04		0.02	c0.22		c0.10	0.16	
v/s Ratio Perm						c0.49			0.08			0.01
v/c Ratio	0.29	0.21		0.78	0.15	0.49	0.28	0.73	0.26	0.66	0.41	0.03
Uniform Delay, d1	42.1	41.9		31.7	26.1	0.0	41.8	29.4	24.9	37.4	20.8	18.4
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	0.5		7.7	0.1	1.0	1.3	2.4	0.3	2.8	0.2	0.0
Delay (s)	43.6	42.5		39.5	26.2	1.0	43.1	31.8	25.2	40.2	21.0	18.4
Level of Service	D	D		D	C	A	D	C	C	D	C	B
Approach Delay (s)		42.8			14.3			29.9			27.9	
Approach LOS		D			B			C			C	

Intersection Summary			
HCM Average Control Delay	24.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	94.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	1	4	9	578	2	43	16	672	567	34	1098	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.86		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3433	1596		1863	3725	1667	1863	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3433	1596		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	1	4	9	578	2	43	16	672	567	34	1098	1
RTOR Reduction (vph)	0	0	0	0	32	0	0	0	351	0	0	1
Lane Group Flow (vph)	1	4	9	578	13	0	16	672	216	34	1098	0
Turn Type	Split		Free	Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	0.9	0.9	75.3	19.5	19.5		5.3	28.7	28.7	6.2	29.6	29.6
Effective Green, g (s)	0.9	0.9	75.3	19.5	19.5		5.3	28.7	28.7	6.2	29.6	29.6
Actuated g/C Ratio	0.01	0.01	1.00	0.26	0.26		0.07	0.38	0.38	0.08	0.39	0.39
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	21	22	1583	889	413		131	1420	635	153	1464	655
v/s Ratio Prot	0.00	c0.00		c0.17	0.01		0.01	0.18		c0.02	c0.29	
v/s Ratio Perm			c0.01						0.13			0.00
v/c Ratio	0.05	0.18	0.01	0.65	0.03		0.12	0.47	0.34	0.22	0.75	0.00
Uniform Delay, d1	36.8	36.8	0.0	24.9	20.8		32.8	17.6	16.6	32.3	19.7	13.9
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	4.0	0.0	1.7	0.0		0.4	0.3	0.3	0.7	2.2	0.0
Delay (s)	37.7	40.8	0.0	26.6	20.9		33.2	17.8	16.9	33.0	21.9	13.9
Level of Service	D	D	A	C	C		C	B	B	C	C	B
Approach Delay (s)		14.4			26.2			17.6			22.2	
Approach LOS		B			C			B			C	

Intersection Summary			
HCM Average Control Delay	21.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	75.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	60.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	7	16	41	618	17	59	84	1212	833	52	954	14
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.88		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	3614	1732		1863	3725	1667	1863	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3614	1732		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	7	16	41	618	17	59	84	1212	833	52	954	14
RTOR Reduction (vph)	0	0	0	0	45	0	0	0	411	0	0	8
Lane Group Flow (vph)	7	16	41	618	31	0	84	1212	422	52	954	6
Turn Type	Split		Free	Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			6
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Effective Green, g (s)	2.4	2.4	91.4	21.6	21.6		9.2	41.2	41.2	6.2	38.2	38.2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lane Grp Cap (vph)	46	49	1583	854	409		188	1679	751	126	1557	697
v/s Ratio Prot	0.00	c0.01		c0.17	0.02		c0.05	c0.33		0.03	0.26	
v/s Ratio Perm			0.03						0.25			0.00
v/c Ratio	0.15	0.33	0.03	0.72	0.08		0.45	0.72	0.56	0.41	0.61	0.01
Uniform Delay, d1	43.5	43.7	0.0	32.2	27.1		38.7	20.4	18.5	40.9	20.8	15.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	3.9	0.0	3.1	0.1		1.7	1.6	1.0	2.2	0.7	0.0
Delay (s)	45.0	47.6	0.0	35.2	27.2		40.4	22.0	19.4	43.0	21.5	15.5
Level of Service	D	D	A	D	C		D	C	B	D	C	B
Approach Delay (s)		16.8			34.3			21.7			22.5	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	24.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	91.4	Sum of lost time (s)	20.0
Intersection Capacity Utilization	71.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: Lumiaina St & Kam Hwy

9/17/2009

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	494	17	93	64	73	39	46	725	39	18	1068	600
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1681	1691	1583	1770	1765		1770	3539	1583	1770	3539	1583
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1681	1691	1583	1770	1765		1770	3539	1583	1770	3539	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	494	17	93	64	73	39	46	725	39	18	1068	600
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	23	0	0	0
Lane Group Flow (vph)	257	254	93	64	96	0	46	725	16	18	1068	600
Turn Type	Split		Free	Split			Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			Free
Actuated Green, G (s)	20.2	20.2	93.5	10.8	10.8		7.4	37.3	37.3	5.2	35.1	93.5
Effective Green, g (s)	20.2	20.2	93.5	10.8	10.8		7.4	37.3	37.3	5.2	35.1	93.5
Actuated g/C Ratio	0.22	0.22	1.00	0.12	0.12		0.08	0.40	0.40	0.06	0.38	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	363	365	1583	204	204		140	1412	632	98	1329	1583
v/s Ratio Prot	c0.15	0.15		0.04	0.05		0.03	0.20		0.01	c0.30	
v/s Ratio Perm			0.06						0.01			c0.38
v/c Ratio	0.71	0.70	0.06	0.31	0.47		0.33	0.51	0.02	0.18	0.80	0.38
Uniform Delay, d1	33.9	33.8	0.0	37.9	38.7		40.7	21.2	17.1	42.1	26.1	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.2	5.7	0.1	0.9	1.7		1.4	0.3	0.0	0.9	3.6	0.7
Delay (s)	40.1	39.5	0.1	38.6	40.4		42.1	21.6	17.1	43.0	29.7	0.7
Level of Service	D	D	A	D	D		D	C	B	D	C	A
Approach Delay (s)		33.7			39.8			22.5			19.5	
Approach LOS		C			D			C			B	

Intersection Summary			
HCM Average Control Delay	24.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	93.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰↑	↱	↰	↑↱		↰	↑↑	↱	↰	↑↑	↱
Volume (vph)	537	31	134	24	31	51	176	1557	105	28	870	714
Ideal Flow (vphpl)	2000	2000	2000	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.91		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1783	1667	1770	1689		1863	3725	1667	1863	3725	1667
Flt Permitted	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1783	1667	1770	1689		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	537	31	134	24	31	51	176	1557	105	28	870	714
RTOR Reduction (vph)	0	0	0	0	48	0	0	0	40	0	0	0
Lane Group Flow (vph)	285	283	134	24	34	0	176	1557	65	28	870	714
Turn Type	Split		Free	Split			Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						2			Free
Actuated Green, G (s)	21.0	21.0	100.5	6.3	6.3		14.8	49.0	49.0	4.2	38.4	100.5
Effective Green, g (s)	21.0	21.0	100.5	6.3	6.3		14.8	49.0	49.0	4.2	38.4	100.5
Actuated g/C Ratio	0.21	0.21	1.00	0.06	0.06		0.15	0.49	0.49	0.04	0.38	1.00
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	370	373	1667	111	106		274	1816	813	78	1423	1667
v/s Ratio Prot	c0.16	0.16		0.01	0.02		c0.09	c0.42		0.02	0.23	
v/s Ratio Perm			0.08						0.04			c0.43
v/c Ratio	0.77	0.76	0.08	0.22	0.32		0.64	0.86	0.08	0.36	0.61	0.43
Uniform Delay, d1	37.5	37.4	0.0	44.8	45.1		40.4	22.7	13.7	46.8	25.0	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.5	8.6	0.1	1.0	1.8		5.1	4.2	0.0	2.8	0.8	0.8
Delay (s)	47.0	45.9	0.1	45.7	46.8		45.4	26.9	13.8	49.7	25.8	0.8
Level of Service	D	D	A	D	D		D	C	B	D	C	A
Approach Delay (s)		37.6			46.6			27.9			15.2	
Approach LOS		D			D			C			B	

HCM Average Control Delay	25.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	100.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	117	12	321	173	12	14	30	678	55	3	1217	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1782	1583	1770	1712		1863	3725	1667	1863	3725	1667
Flt Permitted		0.73	1.00	0.67	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1354	1583	1256	1712		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	117	12	321	173	12	14	30	678	55	3	1217	11
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	27	0	0	0
Lane Group Flow (vph)	0	129	321	173	15	0	30	678	28	3	1217	11
Turn Type	Perm		Free	Perm			Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		Free	8					2			Free
Actuated Green, G (s)		16.9	72.6	16.9	16.9		6.9	36.5	36.5	4.2	33.8	72.6
Effective Green, g (s)		16.9	72.6	16.9	16.9		6.9	36.5	36.5	4.2	33.8	72.6
Actuated g/C Ratio		0.23	1.00	0.23	0.23		0.10	0.50	0.50	0.06	0.47	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		315	1583	292	399		177	1873	838	108	1734	1667
v/s Ratio Prot					0.01		0.02	0.18		0.00	c0.33	
v/s Ratio Perm		0.10	c0.20	c0.14					0.02			0.01
v/c Ratio		0.41	0.20	0.59	0.04		0.17	0.36	0.03	0.03	0.70	0.01
Uniform Delay, d1		23.6	0.0	24.8	21.6		30.2	11.0	9.1	32.3	15.4	0.0
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.9	0.3	3.2	0.0		0.5	0.1	0.0	0.1	1.3	0.0
Delay (s)		24.5	0.3	28.0	21.6		30.7	11.1	9.1	32.4	16.7	0.0
Level of Service		C	A	C	C		C	B	A	C	B	A
Approach Delay (s)		7.2			27.2			11.7			16.6	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM Average Control Delay	14.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	72.6	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	23	16	69	63	8	10	158	1815	171	11	994	28
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)		5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Frt		1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected		0.96	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)		1792	1583	1770	1708		1863	3725	1667	1863	3725	1667
Flt Permitted		0.76	1.00	0.74	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)		1412	1583	1375	1708		1863	3725	1667	1863	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	23	6	69	63	8	10	158	1815	171	11	994	28
RTOR Reduction (vph)	0	0	0	0	9	0	0	0	56	0	0	0
Lane Group Flow (vph)	0	29	69	63	9	0	158	1815	115	11	994	28
Turn Type	Perm		Free	Perm			Prot		Perm	Prot		Free
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		Free	8					2			Free
Actuated Green, G (s)		7.8	83.6	7.8	7.8		13.4	56.3	56.3	4.5	47.4	83.6
Effective Green, g (s)		7.8	83.6	7.8	7.8		13.4	56.3	56.3	4.5	47.4	83.6
Actuated g/C Ratio		0.09	1.00	0.09	0.09		0.16	0.67	0.67	0.05	0.57	1.00
Clearance Time (s)		5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)		3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		132	1583	128	159		299	2509	1123	100	2112	1667
v/s Ratio Prot					0.01		c0.08	c0.49		0.01	0.27	
v/s Ratio Perm		0.02	0.04	c0.05					0.07			0.02
v/c Ratio		0.22	0.04	0.49	0.06		0.53	0.72	0.10	0.11	0.47	0.02
Uniform Delay, d1		35.1	0.0	36.0	34.5		32.2	8.7	4.8	37.6	10.7	0.0
Progression Factor		1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2		0.8	0.1	3.0	0.1		1.7	1.1	0.0	0.5	0.2	0.0
Delay (s)		35.9	0.1	39.0	34.7		33.9	9.7	4.8	38.1	10.9	0.0
Level of Service		D	A	D	C		C	A	A	D	B	A
Approach Delay (s)		10.7			38.0			11.1			10.9	
Approach LOS		B			D			B			B	

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	83.6	Sum of lost time (s)	15.0
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↰	↱	↰	↑↑	↑↑	↱
Volume (vph)	119	618	139	643	1637	90
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1863	1667	1863	3725	3725	1667
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1863	1667	1863	3725	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	119	618	139	643	1637	90
RTOR Reduction (vph)	0	7	0	0	0	40
Lane Group Flow (vph)	119	611	139	643	1637	50
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	12.1	40.9	28.8	88.4	54.6	54.6
Effective Green, g (s)	12.1	40.9	28.8	88.4	54.6	54.6
Actuated g/C Ratio	0.11	0.37	0.26	0.80	0.49	0.49
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	204	692	486	2980	1841	824
v/s Ratio Prot	0.06	c0.23	0.07	0.17	c0.44	
v/s Ratio Perm		0.14				0.03
v/c Ratio	0.58	0.88	0.29	0.22	0.89	0.06
Uniform Delay, d1	46.8	32.6	32.6	2.7	25.2	14.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.2	12.8	0.3	0.0	5.7	0.0
Delay (s)	51.0	45.3	33.0	2.7	30.9	14.6
Level of Service	D	D	C	A	C	B
Approach Delay (s)	46.2			8.1	30.1	
Approach LOS	D			A	C	

Intersection Summary			
HCM Average Control Delay	28.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	110.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	87.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
47: Waipahu St & Kam Hwy

9/16/2009

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	257	456	292	1890	943	182
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1863	1667	1863	3725	3725	1667
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1863	1667	1863	3725	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	257	456	292	1890	943	182
RTOR Reduction (vph)	0	22	0	0	0	113
Lane Group Flow (vph)	257	434	292	1890	943	69
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	18.3	38.6	20.3	58.2	32.9	32.9
Effective Green, g (s)	18.3	38.6	20.3	58.2	32.9	32.9
Actuated g/C Ratio	0.21	0.45	0.23	0.67	0.38	0.38
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	394	840	437	2506	1417	634
v/s Ratio Prot	c0.14	0.12	0.16	c0.51	0.25	
v/s Ratio Perm		0.14				0.04
v/c Ratio	0.65	0.52	0.67	0.75	0.67	0.11
Uniform Delay, d1	31.2	17.2	30.0	9.4	22.2	17.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.8	0.5	3.8	1.3	1.2	0.1
Delay (s)	35.0	17.8	33.9	10.7	23.4	17.4
Level of Service	D	B	C	B	C	B
Approach Delay (s)	24.0			13.8	22.5	
Approach LOS	C			B	C	

Intersection Summary			
HCM Average Control Delay	18.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	86.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: JW
Agency/Co.:
Date performed: 9/11/09
Analysis time period: AM Peak
Freeway/Dir of Travel: H-2 Fwy NB Off-Ramp
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2016 With Project
Description: 15/15/15

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3178	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	911	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	389	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3178	911	389	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	883	253	108	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	1.5*		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	
Heavy vehicle adjustment, fHV	0.990		0.990		0.990	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	3566		1022		437	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1683 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3566	9400	No
$v_{FO} = v_F - v_R$	2544	9400	No
v_R	1022	3800	No
v_3 or v_{av34}	941 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	
If yes, v_{12A} = 1683		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1683	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 4.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable, D_S = 0.520

Space mean speed in ramp influence area, S_R = 53.0 mph

Space mean speed in outer lanes, S_0 = 71.3 mph

Space mean speed for all vehicles, S = 61.3 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: JW
Agency/Co.:
Date performed: 9/11/09
Analysis time period: PM Peak
Freeway/Dir of Travel: H-2 Fwy NB Off-Ramp
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2016 With Project
Description: 15/15/15

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5392	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	2	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	2035	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	0	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	658	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5392	2035	658	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1498	565	183	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	0.00	%	0.00	%	0.00	%
Length	0.00	mi	0.00	mi	0.00	mi
Trucks and buses PCE, ET	2.5		1.5		1.5	
Recreational vehicle PCE, ER	2.0		1.2		1.2	
Heavy vehicle adjustment, fHV	0.971		0.990		0.990	
Driver population factor, fP	1.00		1.00		1.00	
Flow rate, vp	6171		2284		738	pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.260 Using Equation 0

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 3295 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	6171	9400	No
$v_{FO} = v_F - v_R$	3887	9400	No
v_R	2284	3800	No
v_3 or v_{av34}	1438 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	
If yes, v_{12A} = 3295		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	3295	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 18.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.634

Space mean speed in ramp influence area, S_R = 50.4 mph

Space mean speed in outer lanes, S_0 = 69.6 mph

Space mean speed for all vehicles, S = 57.9 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: JW
Agency/Co.:
Date performed: 9/11/09
Analysis time period: AM Peak
Freeway/Dir of Travel: H-2 Fwy NB On Ramp (WB)
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2016 With Project
Description: 15/15/15

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2267	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	389	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	389	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2267	389	389	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	630	108	108	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2594	437	437	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.163 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 423 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3031	9400	No

v_3 or v_{av34} 1085 pc/h (Equation 25-4 or 25-5)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 1037 (Equation 25-8)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1037	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 12.4 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.289

Space mean speed in ramp influence area, S_R = 58.4 mph

Space mean speed in outer lanes, S_0 = 64.0 mph

Space mean speed for all vehicles, S = 61.1 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	PM Peak
Freeway/Dir of Travel:	H-2 Fwy NB On Ramp (WB)
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description: 15/15/15	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3356	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	658	vph
Length of first accel/decel lane	700	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2035	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	2930	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3356	658	2035	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	932	183	565	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	3841	738	2284	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.126 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 482 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4579	9400	No
v_3 or v_{av34}	1679 pc/h	(Equation 25-4 or 25-5)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12} /2		Yes	
If yes, v_{12A} = 1536		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1536	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 18.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, M_S = 0.310

Space mean speed in ramp influence area, S_R = 57.9 mph

Space mean speed in outer lanes, S_0 = 62.7 mph

Space mean speed for all vehicles, S = 60.2 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	AM Peak
Freeway/Dir of Travel:	H-2 Fwy SB Off-Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description:	15/15/15

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3950	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	414	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1556	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3950	414	1556	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1097	115	432	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	0.00	%	0.00	%	0.00	%	
Length	0.00	mi	0.00	mi	0.00	mi	
Trucks and buses PCE, ET	2.5		1.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		0.990		
Driver population factor, fP	1.00		1.00		1.00		
Flow rate, vp	4521		465		1746		pcph

Estimation of V12 Diverge Areas

$L_{EQ} =$ (Equation 25-8 or 25-9)

$P_{FD} =$ 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD} =$ 2233 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	4521	9400	No
$v_{FO} = v_F - v_R$	4056	9400	No
v_R	465	2000	No
v_3 or v_{av34}	1144 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	
If yes, v_{12A} = 2233		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2233	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\, v_{12} - 0.009\, L_D$ = 22.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, D_S = 0.470

Space mean speed in ramp influence area, S_R = 54.2 mph

Space mean speed in outer lanes, S_0 = 70.7 mph

Space mean speed for all vehicles, S = 61.5 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	PM Peak
Freeway/Dir of Travel:	H-2 Fwy SB Off-Ramp
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description:	15/15/15

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2918	vph

Off Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-Flow speed on ramp	35.0	mph
Volume on ramp	519	vph
Length of first accel/decel lane	150	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	1477	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2918	519	1477	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	811	144	410	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	0.00	%	0.00	%	0.00	%	
Length	0.00	mi	0.00	mi	0.00	mi	
Trucks and buses PCE, ET	2.5		1.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		0.990		
Driver population factor, fP	1.00		1.00		1.00		
Flow rate, vp	3339		582		1658		pcph

Estimation of V12 Diverge Areas

L_{EQ} = (Equation 25-8 or 25-9)

P_{FD} = 0.436 Using Equation 8

$v_{12} = v_R + (v_F - v_R) P_{FD}$ = 1784 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{Fi} = v_F$	3339	9400	No
$v_{FO} = v_F - v_R$	2757	9400	No
v_R	582	2000	No
v_3 or v_{av34}	777 pc/h	(Equation 25-15 or 25-16)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		No	
If yes, v_{12A} = 1784		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1784	4400	No

Level of Service Determination (if not F)

Density, $D_R = 4.252 + 0.0086\ v_{12} - 0.009\ L_D$ = 18.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable, D_S = 0.480

Space mean speed in ramp influence area, S_R = 54.0 mph

Space mean speed in outer lanes, S_0 = 71.3 mph

Space mean speed for all vehicles, S = 60.8 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	AM Peak
Freeway/Dir of Travel:	H-2 Fwy SB On Ramp (EB)
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description:	15/15/15

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3536	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1556	vph
Length of first accel/decel lane	820	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	414	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3536	1556	414	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	982	432	115	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	4047	1746	465	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = -0.000 Using Equation 4

$v_{12} = v_F (P_{FM})$ = -1 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5793	9400	No

v_3 or v_{av34} 2024 pc/h (Equation 25-4 or 25-5)

Is v_3 or v_{av34} > 2700 pc/h? No

Is v_3 or v_{av34} > 1.5 v_{12} /2 Yes

If yes, v_{12A} = 1618 (Equation 25-8)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1618	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 25.8 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.376

Space mean speed in ramp influence area, S_R = 56.3 mph

Space mean speed in outer lanes, S_0 = 62.4 mph

Space mean speed for all vehicles, S = 58.7 mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	JW
Agency/Co.:	
Date performed:	9/11/09
Analysis time period:	PM Peak
Freeway/Dir of Travel:	H-2 Fwy SB On Ramp (EB)
Junction:	H-2 Fwy/Ka Uka Blvd
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description: 15/15/15	

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2399	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	1477	vph
Length of first accel/decel lane	820	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	519	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	3450	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2399	1477	519	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	666	410	144	v
Trucks and buses	2	2	2	%
Recreational vehicles	0	0	0	%
Terrain type:	Rolling	Level	Level	

Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	2.5	1.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	0.990	
Driver population factor, fP	1.00	1.00	1.00	
Flow rate, vp	2746	1658	582	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 25-2 or 25-3)

P_{FM} = 0.011 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 29 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4404	9400	No
v_3 or v_{av34}	1358 pc/h	(Equation 25-4 or 25-5)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 1098		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1098	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 21.1 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.325

Space mean speed in ramp influence area, S_R = 57.5 mph

Space mean speed in outer lanes, S_0 = 63.8 mph

Space mean speed for all vehicles, S = 59.7 mph

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	AM Peak
Freeway/Direction:	H-2 Fwy NB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 With Project

Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	3178	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	883	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	909	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	909	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	13.3	pc/mi/ln
Level of service, LOS	B	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	PM Peak
Freeway/Direction:	H-2 Fwy NB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description:	South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	5392	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1498	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1543	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1543	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.3	mi/h
Number of lanes, N	4	
Density, D	22.6	pc/mi/ln
Level of service, LOS	C	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	AM Peak
Freeway/Direction:	H-2 Fwy NB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 With Project

Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	2656	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	738	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	760	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	760	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	11.1	pc/mi/ln
Level of service, LOS	B	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	PM Peak
Freeway/Direction:	H-2 Fwy NB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description:	North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	4014	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1115	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1148	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1148	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	16.8	pc/mi/ln
Level of service, LOS	B	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	AM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description:	South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	5092	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1414	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1457	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1457	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	21.3	pc/mi/ln
Level of service, LOS	C	

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	PM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description:	South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	3876	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1077	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1109	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1109	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	16.2	pc/mi/ln
Level of service, LOS	B	

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Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	AM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description:	North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	3950	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1097	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	1130	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1130	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	16.5	pc/mi/ln
Level of service, LOS	B	

HCS+: Basic Freeway Segments Release 5.4

Phone: Fax:
E-mail:

Operational Analysis

Analyst:	JW
Agency or Company:	
Date Performed:	9/11/09
Analysis Time Period:	PM Peak
Freeway/Direction:	H-2 Fwy SB
From/To:	
Jurisdiction:	
Analysis Year:	Year 2016 With Project
Description:	North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	2918	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	811	v
Trucks and buses	2	%
Recreational vehicles	0	%
Terrain type:	Rolling	
Grade	0.00	%
Segment length	0.00	mi
Trucks and buses PCE, ET	2.5	
Recreational vehicle PCE, ER	2.0	
Heavy vehicle adjustment, fHV	0.971	
Driver population factor, fp	1.00	
Flow rate, vp	835	pc/h/ln

Speed Inputs and Adjustments

Lane width	12.0	ft
Right-shoulder lateral clearance	6.0	ft
Interchange density	0.50	interchange/mi
Number of lanes, N	4	
Free-flow speed:	Base	
FFS or BFFS	70.0	mi/h
Lane width adjustment, fLW	0.0	mi/h
Lateral clearance adjustment, fLC	0.0	mi/h
Interchange density adjustment, fID	0.0	mi/h
Number of lanes adjustment, fN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	835	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.5	mi/h
Number of lanes, N	4	
Density, D	12.2	pc/mi/ln
Level of service, LOS	B	