

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 3

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 3

November 2008
Revised February 2009
Revised April 2010

VOLUME 3

APPENDIX

LIST OF APPENDICES

APPENDIX H	Capacity Analysis Calculations Projected Year 2020 Peak Hour Traffic Analysis With Project Koa Ridge Makai Only
APPENDIX I	Capacity Analysis Calculations Projected Year 2016 Peak Hour Traffic Analysis With Project Koa Ridge Makai and Waiawa Developments Without Additional Improvements
APPENDIX J	Capacity Analysis Calculations Projected Year 2016 Peak Hour Traffic Analysis With Project Koa Ridge Makai and Waiawa Developments With Additional Improvements
APPENDIX K	Capacity Analysis Calculations Projected Year 2025 Peak Hour Traffic Analysis With Project Koa Ridge Makai and Waiawa Developments Without Additional Improvements
APPENDIX L	Capacity Analysis Calculations Projected Year 2025 Peak Hour Traffic Analysis With Project Koa Ridge Makai and Waiawa Developments With Additional Improvements
APPENDIX M	Waipio Interchange Northbound Off-Ramp Alternatives Analysis

APPENDIX H

**CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2020 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT
KOA RIDGE MAKAI ONLY**

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

9/16/2009



Lane Configurations	←		↑		↑↓		↑		↓			
Volume (vph)	397	31	0	0	7	1	697	0	25	0	0	
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	
Lost Time (s)	0	5.0			5.0		5.0		5.0			
Lane Util. Factor	0.95	0.95			0.95		0.95		0.95			
Flt Protected	1.00	1.00			0.98		1.00		0.99			
Satd Flow (prot)	1770	1786			3656		1770		1764			
Flt Permitted	0.95	0.96			1.00		0.95		0.95			
Satd Flow (perm)	1770	1786			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	
Adj. Flow (vph)	397	31	0	0	7	1	697	0	25	0	0	
RTOR Reduction (vph)	0	0	0	0	1	0	0	2	0	0	0	
Lane Group Flow (vph)	213	212	0	0	7	0	466	454	0	0	0	
Turn Type	Split				Perm							
Protected Phases	4				2							
Permitted Phases					2							
Actuated Green, g (s)	12.5	12.5			5.2		21.5		21.5			
Effective Green, g (s)	12.5	12.5			5.2		21.5		21.5			
Actuated v/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)	408	412			351		702		700			
v/s Ratio Prot	0.12	0.12			0.00							
v/s Ratio Perm					0.26							
v/c Ratio	0.32	0.31			0.02		0.66		0.65			
Uniform Delay, d1	18.2	18.2			22.2		13.4		13.3			
Progression Factor	1.00	1.00			1.00		1.00		1.00			
Incremental Delay, d2	1.2	1.1			0.0		2.4		2.1			
Delay (s)	19.4	19.3			22.2		15.8		15.4			
Level of Service	B	B			C		B		B			
Approach Delay (s)	19.4				22.2		15.6			0.0		
Approach LOS	B				C		B			A		
HCM Average Control Delay	16.8				HCM Level of Service				B			
HCM Volume to Capacity ratio	0.53											
Actuated Cycle Length (s)	54.2				Sum of lost time (s)				15.0			
Intersection Capacity Utilization	63.8%				ICU Level of Service				B			
Analysis Period (min)	15											
Critical Lane Group												

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

9/16/2009



Lane Configurations	←		←		←		←		←		←																				
Volume (vph)	638	53	0	0	50	30	2036	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	0.95	0.95			0.95		0.95		0.95																						
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)	638	53	0	0	50	30	2036	0	23	0	0	0																			
RTOR Reduction (vph)	0	0	0	0	29	0	0	1	0	0	0	0																			
Lane Grp Flow (vph)	845	346	0	0	51	0	1038	1020	0	0	0	0																			
Turn Type	Split				Prot																										
Protected Phases	4				8																										
Permitted Phases	4				2																										
Actual Green, g (s)	21.9	21.9			3.1		57.3		57.3																						
Effective Green, g (s)	21.9	21.9			3.1		57.3		57.3																						
Actuated (C/B) Ratio	0.23	0.23			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)	398	402			112		1042		1042																						
v/s Ratio Prot	0.19	0.19			0.01		0.59		0.58																						
v/s Ratio Perm																															
v/s Ratio	0.87	0.86			0.45		1.00		0.98																						
Uniform Delay, d1	36.3	36.2			46.3		19.9		19.4																						
Progression Factor	1.00	1.00			1.00		1.00		1.00																						
Incremental Delay, d2	17.6	16.9			2.9		26.8		22.6																						
Delay (s)	53.9	53.1			49.2		46.6		42.0																						
Level of Service	D	D			D		D		D																						
Approach Delay (s)	53.5				49.2				44.4																						
Approach LOS	D				D				D																						
<table border="0" style="width:100%"> <tr> <td>HCM Average Control Delay</td> <td>46.7</td> <td>HCM Level of Service</td> <td>D</td> </tr> <tr> <td>HCM Volume to Capacity ratio</td> <td>0.94</td> <td></td> <td></td> </tr> <tr> <td>Actuated Cycle Length (s)</td> <td>97.3</td> <td>Sum of lost time (s)</td> <td>15.0</td> </tr> <tr> <td>Intersection Capacity Utilization</td> <td>132.8%</td> <td>ICU Level of Service</td> <td>H</td> </tr> <tr> <td>Analysis Period (min)</td> <td>15</td> <td></td> <td></td> </tr> </table>												HCM Average Control Delay	46.7	HCM Level of Service	D	HCM Volume to Capacity ratio	0.94			Actuated Cycle Length (s)	97.3	Sum of lost time (s)	15.0	Intersection Capacity Utilization	132.8%	ICU Level of Service	H	Analysis Period (min)	15		
HCM Average Control Delay	46.7	HCM Level of Service	D																												
HCM Volume to Capacity ratio	0.94																														
Actuated Cycle Length (s)	97.3	Sum of lost time (s)	15.0																												
Intersection Capacity Utilization	132.8%	ICU Level of Service	H																												
Analysis Period (min)	15																														
Critical Lane Group																															

HCM Unsignalized Intersection Capacity Analysis
 26: Ka Uka Blvd & H-2 On (SB)

9/16/2009



Lane Configurations						
	↑	↑↑	↑	↑↑		
Volume (Veh/h)	426	1570	5	899	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)	448	1653	5	1046	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			838		
pX, platoon unblocked			0.89	0.89	0.89	
IC, conflicting volume			448	988	448	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			317	918	317	
IC, single (s)			4.1	6.8	6.9	
IC, 2 stage (s)						
E (s)			2.2	3.5	3.3	
p0 queue free %			99	100	100	
IC capacity (veh/h)			1102	239	603	
Volume Left						
Volume Right	0	826	826	0	0	0
cSH	1700	1700	1700	1102	1700	1700
Volume to Capacity	0.26	0.49	0.49	0.01	0.31	0.31
Queue Length 95th (ft)	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	8.5	0.0	0.0
Lane LOS				A		
Approach Delay (s)	0.0			0.0		
Approach LOS						
Average Delay						
			0.0			
Intersection Capacity Utilization			63.8%	ICU Level of Service		B
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis

26: Ka Uka Blvd & H-2 On (SB)

9/16/2009



	1	2	3	4	5	6
Lane Configurations	↑	↑↑	↑	↑↑		
Volume (veh/h)	695	1467	25	2062	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)	695	1467	25	2062	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage (veh)						
Closest Lane Signal (ft)	516			638		
pX, platoon unblocked			0.71		0.71	0.71
vC, conflicting volume			695		1776	695
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			371		1887	371
tC, single (s)			4.1		6.8	6.9
tC, 2 stage (s)						
t (s)			2.2		3.5	3.3
p0 queue free %			97		100	100
vC capacity (veh/h)			844		1700	1700
Vehicle Data						
Volume Left	0	0	0	0	0	0
Volume Right	0	734	734	0	0	0
cSH	1700	1700	1700	844	1700	1700
Volume to Capacity	0.41	0.43	0.43	0.03	0.61	0.61
Queue Length 95th (ft)	0	0	0	2	0	0
Control Delay (s)	0.0	0.0	0.0	9.4	0.0	0.0
Lane LOS				A		
Approach Delay (s)	0.0			0		
Approach LOS						
Summary						
Average Delay			0.1			
Intersection Capacity Utilization			118.8%		ICU Level of Service	H
Analysis Period (min)			15			

HCM Signalized Intersection Capacity Analysis

5: Ka Uka Blvd & H-2 Off (SB)

9/23/2009



Lane Configurations	←←←			←←		←		→		→→		→→→	
Volume (vph)	0	1631	66	177	708	0	28	0	328	12	158	248	
Ideal Flow (vphpl)	2000	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	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	
Flt Protected	1.00			0.95	1.00	0.95			1.00	0.95	1.00	1.00	
Satd Flow (prot)	5326			3614	3725	1863			1667	1363	1961	1667	
Flt Permitted	1.00			0.95	1.00	0.95			1.00	0.95	1.00	1.00	
Satd Flow (perm)	5326			3614	3725	1863			1667	1363	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	1.00
Adj Flow (vph)	0	1631	66	177	708	0	28	0	328	12	158	248	
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	96	0	0	0	0
Lane Group Flow (vph)	0	1684	0	177	708	0	28	0	232	12	158	248	
Turn Type				Prot		Prot		custom		Prot			Free
Protected Phases	4			3	8	5		2		1		6	
Permitted Phases								3					Free
Actuated Green, G (s)	35.0			8.6	48.6	2.2		23.8		1.1		14.1	79.9
Effective Green, g (s)	35.0			8.6	48.6	2.2		21.8		1.1		14.1	79.9
Actuated v/c Ratio	0.44			0.11	0.61	0.03		0.27		0.01		0.18	1.93
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)	2333			389	2266	51		580		26		346	1667
v/s Ratio Prot	0.02			0.05	0.19	0.02		0.07		0.01		0.08	
v/s Ratio Perm								0.07					0.15
v/c Ratio	0.72			0.46	0.81	0.55		0.40		0.46		0.46	0.13
Uniform Delay, d1	18.4			33.5	7.6	38.4		23.7		39.1		29.5	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	11.5		0.5		12.4		1.0	0.2
Delay (s)	19.6			34.3	7.6	49.9		24.2		51.5		30.4	0.2
Level of Service	B			C	A	D		C		D		C	A
Approach Delay (s)	19.6				13.0		26.2					13.1	
Approach LOS	B				B		C						B
HCM Average Control Delay		17.7											
HCM Level of Service													B
HCM Volume to Capacity ratio		0.54											
Actuated Cycle Length (s)		79.9											10.0
Sum of lost time (s)													10.0
Intersection Capacity Utilization		67.1%											
ICU Level of Service													C
Analysis Period (min)		15											
Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 5: Ka Uka Blvd & H-2 Off (SB)

9/23/2009



	WB		WB		EB		SB		SB			
Lane Configurations	↑↑↑	↑	↑↑	↑	↑	↑	↑	↑	↑	↑		
Volume (vph)	0	1579	80	276	1764	0	84	0	522	19	192	
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	
Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	
Lane Util. Factor	0.91	1.00	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
Flt Protected	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00	1.00	
Satd Flow (prot)	5314	1863	3725	1863	1667	1667	1667	1667	1667	1667	1667	
Flt Permitted	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00	1.00	
Satd Flow (perm)	5314	1863	3725	1863	1667	1667	1667	1667	1667	1667	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	
Adj Flow (vph)	0	1579	80	276	1764	0	84	0	522	19	192	
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	68	0	0	
Lane Group Flow (vph)	0	1654	0	276	1764	0	84	0	454	19	192	
Turn Type			Prot			Prot		custom	Prot		Free	
Protected Phases	4		3		3		2		1		6	
Permitted Phases							3				Free	
Actuated Green, G (s)	39.1		17.0		55.1		6.6		36.7		17.3	
Effective Green, g (s)	33.1		17.0		55.1		6.6		36.7		17.3	
Actuated v/c Ratio	0.35		0.18		0.59		0.07		0.39		0.18	
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)	1871		337		2183		131		757		361	
v/s Ratio Prot	0.31		0.15		0.47		0.05		0.13		0.10	
v/s Ratio Perm									0.14		0.19	
v/c Ratio	0.88		0.82		0.81		0.64		0.60		0.53	
Uniform Delay, d1	28.6		37.0		15.3		42.5		22.8		34.7	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	5.4		14.3		2.3		10.3		1.3		6.7	
Delay (s)	34.0		51.3		17.6		52.8		24.2		41.4	
Level of Service	C		D		B		D		C		D	
Approach Delay (s)	34.0				22.2		28.1				15.3	
Approach LOS	C				C		C				B	
HCM Average Control Delay	26.2		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.86											
Actuated Cycle Length (s)	94.0		Sum of lost time (s)		21.0							
Intersection Capacity Utilization	78.0%		ICU Level of Service		D							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Ka Uka Blvd &

9/16/2009



Lane Configurations	↖	↕	↗	↖	↕	↗	↖	↕	↗	↖	↕	↗
Volume (vph)	104	916	73	149	485	346	0	0	141	631	0	135
Ideal Flow (vphpl)	1900	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900	1900
Red Loss Time (s)	5.0	5.0		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	0.97	1.00	
Flt Protected	1.00	0.99		1.00	1.00	0.85			0.86	1.00	0.85	
Flt Permitted	0.95	1.00		0.95	1.00	1.00			1.00	0.95	1.00	
Satd. Flow (prot)	1770	1684		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)	104	916	73	149	485	346	0	0	141	631	0	135
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	0	0	135	0
Lane Grp Flow (vph)	104	983	73	149	485	346	0	0	141	631	50	135
Turn Type	Prot			Prot		Free			Free	Prot		
Protected Phases	7	4		8	5					1		6
Permitted Phases						Free			Free			
Actuated Green, G (s)	9.7	27.2		10.7	28.2	73.9			73.9	20.0	20.0	
Effective Green, g (s)	9.7	26.2		10.7	28.2	73.9			73.9	20.0	20.0	
Actuated G/C Ratio	0.19	0.35		0.14	0.38	1.06			1.06	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)	232	1306		270	1421	1583			1611	929	428	
v/s Ratio Prot	0.06	0.27		0.08	0.13					0.18	0.09	
v/s Ratio Perm						0.22			0.09			
v/c Ratio	0.15	0.75		0.55	0.94	0.22			0.09	0.68	0.12	
Uniform Delay, d1	29.6	21.0		29.4	16.2	0.0			0.0	24.1	20.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00			1.00	1.00	1.00	
Incremental Delay, d2	1.4	2.5		2.4	0.1	0.3			0.1	2.0	0.1	
Delay (s)	31.0	23.5		31.8	16.4	0.3			0.1	26.1	20.4	
Level of Service	C	C		C	B	A			A	C	C	
Approach Delay (s)		24.7			13.1			0.1			24.6	
Approach LOS		C			B			A			C	
HCM Average Control Delay			19.6	HCM Level of Service			B					
HCM Volume to Capacity ratio			0.70									
Actuated Cycle Length (s)			73.9	Sum of lost time (s)			17.0					
Intersection Capacity Utilization			66.3%	ICU Level of Service			C					
Analysis Period (min)			15									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Ka Uka Blvd &

9/16/2009



Lane Configurations	↖	↕	↗	↖	↕	↗	↖	↕	↗	↖	↕	↗
Volume (vph)	267	550	140	199	1026	933	0	0	844	759	0	217
Ideal Flow (vphpl)	1900	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.97	1.00	1.00
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00
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)	267	550	140	199	1026	933	0	0	844	759	0	217
RTOR Reduction (vph)	0	22	0	0	0	0	0	0	0	0	156	0
Lane Grp Flow (vph)	267	668	0	199	1026	933	0	0	844	759	61	0
Turn Type	Prot			Prot		Free			Free	Prot		
Protected Phases	7	1		3	8					1		6
Permitted Phases						Free			Free			
Actuated Green, G (s)	17.5	31.7		13.7	28.9	87.0			87.0	24.6		24.6
Effective Green, g (s)	17.5	31.7		13.7	28.9	87.0			87.0	24.6		24.6
Actuated v/c Ratio	0.20	0.36		0.16	0.33	1.09			1.00	0.28		0.28
Clearance Time (s)	5.0	5.0		5.0	5.0					5.0		5.0
Vehicle Extension (s)	2.0	3.0		3.0	3.0					3.0		3.0
Lane Grp Cap (vph)	356	1316		293	1237	1583			1611	971		448
v/s Ratio Prot	0.15	0.19		0.11	0.28					0.22		0.04
v/s Ratio Perm						c0.59				0.21		
v/c Ratio	0.75	0.61		0.68	0.33	0.39			0.21	0.28		0.14
Uniform Delay, d1	32.7	21.6		34.6	26.8	0.0			0.0	28.7		23.3
Progression Factor	1.00	1.00		1.00	1.00	1.00			1.00	1.00		1.00
Incremental Delay, d2	8.6	0.3		6.1	4.7	1.6			0.3	4.2		0.1
Delay (s)	41.3	21.9		40.7	31.5	1.6			0.3	32.9		23.4
Level of Service	D	C		D	C	A			A	C		C
Approach Delay (s)		27.8			19.4			0.3				30.8
Approach LOS		C			B			A				C
HCM Average Control Delay	22.1		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.81		Sum of lost time (s)		16.0							
Actuated Cycle Length (s)	87.0		ICU Level of Service		D							
Intersection Capacity Utilization	76.7%		Analysis Period (min)		15							
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

35: Ukee (E) & Ka Uka Blvd

9/16/2009



Lane Configurations	↕		↕		↗		↕		↖		↕	
Volume (vph)	15	3	2	41	15	23	3	1057	69	90	190	80
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	
Flt Protected	0.96		0.97		0.95		1.00		0.95		1.00	
Satd. Flow (prot)	1771		1744		1853		1691		1863		1947	
Flt Permitted	0.73		0.83		0.44		1.00		0.23		1.00	
Satd. Flow (perm)	1399		1479		858		3691		453		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	23	3	1057	69	90	190	80
RTOR Reduction (vph)	0	2	0	0	18	0	0	5	0	0	14	0
Lane Group Flow (vph)	0	18	0	0	61	0	0	1121	0	90	536	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		2		6		6	
Permitted Phases	4		8		2		2		6		6	
Actuated Green, g (s)	6.0		6.0		32.9		32.9		32.9		32.9	
Effective Green, g (s)	6.0		6.0		32.9		32.9		32.9		32.9	
Actuated v/c Ratio	0.12		0.12		0.67		0.67		0.67		0.67	
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		181		577		2483		305		2454	
v/s Ratio Prot	0.01		c0.04		0.01		0.01		0.20		0.15	
v/s Ratio Perm	0.01		0.33		0.01		0.45		0.30		0.33	
Uniform Delay, d1	19.1		19.6		2.6		3.8		3.3		3.1	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.3		1.1		0.0		0.1		0.5		0.0	
Delay (s)	19.4		20.7		2.7		3.9		3.8		3.1	
Level of Service	B		C		A		A		A		A	
Approach Delay (s)	19.4		20.7		2.7		3.9		3.8		3.1	
Approach LOS	B		C		A		A		A		A	
HCM Average Control Delay	4.5		HCM Level of Service		A							
HCM Volume to Capacity ratio	0.43											
Actuated Cycle Length (s)	48.9		Sum of lost time (s)		10.0							
Intersection Capacity Utilization	51.6%		ICU Level of Service		A							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

35: Ukee (E) & Ka Uka Blvd

9/16/2009



Lane Configurations	↔		↔		↗ ↘		↕		↗ ↘		↕	
Volume (vph)	48	71	14	121	73	66	7	844	54	64	1099	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Satd Flow (prot) (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Fit Protected	0.97	0.97	0.97	0.97	0.97	0.97	0.95	1.00	0.95	1.00	0.95	1.00
Satd Flow (prot)	1757	1728	1728	1728	1728	1728	1863	1692	1863	1692	1863	1692
Fit Permitted	0.80	0.77	0.77	0.77	0.77	0.77	0.19	1.00	0.28	1.00	0.28	1.00
Satd Flow (perm)	1443	1375	1375	1375	1375	1375	372	1692	556	1692	556	1692
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)	48	71	14	121	73	66	7	844	54	64	1099	72
RTOR Reduction (vph)	0	11	0	0	22	0	0	5	0	0	5	0
Lane Grp Flows (vph)	0	62	0	0	173	0	7	893	0	64	1166	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		6		2		6		0		0	
Permitted Phases	4		8		2		6		0		0	
Actuated Green, G (s)	12.5		12.5		31.1		31.1		31.1		31.1	
Effective Green, g (s)	12.5		12.5		31.1		31.1		31.1		31.1	
Actuated v/c Ratio	0.24		0.24		0.60		0.60		0.60		0.60	
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)	350		333		224		2225		335		2225	
v/s Ratio Prot	0.04		0.13		0.02		0.12		0.02		0.12	
v/s Ratio Perm	0.04		0.13		0.02		0.12		0.02		0.12	
v/c Ratio	0.16		0.53		0.03		0.40		0.19		0.52	
Uniform Delay, d1	15.5		17.0		4.2		5.4		4.6		6.0	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.2		1.7		0.1		0.1		0.3		0.2	
Delay (s)	15.7		18.7		4.3		5.5		4.9		6.2	
Level of Service	B		B		A		A		A		A	
Approach Delay (s)	15.7		18.7		4.3		5.5		4.9		6.2	
Approach LOS	B		B		A		A		A		A	
HCM Average Control Delay	7.2		7.2		4.2		4.2		4.6		4.6	
HCM Volume to Capacity ratio	0.63		0.63		0.03		0.40		0.19		0.52	
Actuated Cycle Length (s)	51.6		51.6		51.6		51.6		51.6		51.6	
Sum of lost time (s)	8.0		8.0		8.0		8.0		8.0		8.0	
Intersection Capacity Utilization	57.4%		57.4%		3.1%		3.1%		3.1%		3.1%	
ICU Level of Service	B		B		A		A		A		A	
Analysis Period (min)	15		15		15		15		15		15	
Critical Lane Group	E		E		E		E		E		E	

HCM Signalized Intersection Capacity Analysis

4: Waipio Uka & Ka Uka Blvd

9/28/2009



Category	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB			
Lane Configurations	↕			↕			↖	↗	↖	↗	↖	↗			
Volume (vph)	40	12	23	91	19	98	58	993	101	66	484	39			
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	5.0	5.0			
Lane Util. Factor	1.00			1.00			1.00	0.95	1.00	1.00	0.95	1.00			
Fit Protected	0.97			0.98			0.95	1.00	0.95	1.00	0.95	1.00			
Satd Flow (perm)	1739			1707			1663	1674	1663	1689	1663	1689			
Fit Permitted	0.81			0.82			0.49	1.00	0.21	1.00	0.21	1.00			
Satd Flow (perm)	1446			1486			852	1674	411	1689	411	1689			
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	98	58	993	101	66	484	39			
RTOR Reduction (vph)	0	17	0	0	40	0	0	9	0	0	6	0			
Lane Group Flow (vph)	0	58	0	0	168	0	58	1085	0	66	458	0			
Turn Type	Perm			Perm			Perm		Perm						
Protected Phases	4			8			2		6						
Permitted Phases	4			8			2		6						
Actuated Green, G (s)	10.9			10.9			24.5		24.5						
Effective Green, g (s)	10.9			10.9			24.5		24.5						
Actuated g/C Ratio	0.24			0.24			0.54		0.54						
Clearance Time (s)	5.0			5.0			5.0		5.0						
Vehicle Extension (s)	3.0			3.0			3.0		3.0						
Lane Grp Cap (vph)	347			345			514		1983						
v/s Ratio Prot	0.04			0.12			0.06		0.16						
v/s Ratio Perm	0.04			0.12			0.06		0.16						
g/C Ratio	0.17			0.19			0.11		0.55						
Uniform Delay, d1	13.7			14.8			5.1		6.8						
Progression Factor	1.00			1.00			1.00		1.00						
Incremental Delay, d2	0.2			1.1			0.1		0.3						
Delay (s)	13.9			15.9			5.2		7.1						
Level of Service	B			B			A		A						
Approach Delay (s)	13.9			15.9			7.0		5.7						
Approach LOS	B			B			A		A						
HCM Average Control Delay															
			7.9	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															
			59.1%	ICU Level of Service			B								
Analysis Period (min)															
			15												
Critical Lane Group															

HCM Signalized Intersection Capacity Analysis

4: Waipio Uka & Ka Uka Blvd

9/16/2009



Lane Configurations	↕		↕		↗		↖		↗		↖	
Volume (vph)	97	38	34	138	26	44	41	760	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	
Flt Protected	0.97		0.97		0.97		0.98		1.00		0.99	
Flt Permitted	0.75		0.75		0.19		1.00		0.29		1.00	
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
RTOR Reduction (vph)	0	11	0	0	12	0	0	11	0	0	3	0
Turn Type	Perm											
Protected Phases	4		8		2		2		6		6	
Permitted Phases	4		8		2		2		6		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 v/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		297		1906	
v/s Ratio Prot	0.12		0.14		0.11		0.23		0.20		0.30	
v/s Ratio Perm	0.12		0.14		0.11		0.23		0.20		0.30	
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	
Level of Service	B		B		A		A		A		A	
Approach Delay (s)	15.0		16.0		6.9		7.5		8.0		8.6	
Approach LOS	B		B		A		A		A		A	
HCM Average Control Delay	9.2		9.2		6.4		7.4		7.1		8.1	
HCM Level of Service	B		B		A		A		A		A	
HCM Volume to Capacity Ratio	0.36		0.36		0.51		0.51		0.51		0.51	
Actuated Cycle Length (s)	48.2		48.2		48.2		48.2		48.2		48.2	
Sum of lost time (s)	10.0		10.0		10.0		10.0		10.0		10.0	
Intersection Capacity Utilization	60.3%		60.3%		60.3%		60.3%		60.3%		60.3%	
ICU Level of Service	B		B		A		A		A		A	
Analysis Period (min)	15		15		15		15		15		15	
Critical Lane Group	↕		↕		↗		↖		↗		↖	

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

9/16/2009



Lane Configurations	↙	↑↑	↘	↑↑	↙	↑↑	↘	↑↑	↘	↑↑	↘	↑↑
Volume (vph)	58	814	85	145	399	0	83	12	325	0	7	0
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	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	0.95	1.00	0.99	1.00	0.99	1.00	0.99
Flt Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.99	1.00	0.99	1.00	0.99	1.00
Satd. Flow (prot)	1863	3673	1863	3673	1863	3673	1863	3673	1863	3673	1863	3673
Flt Permitted	0.95	1.00	0.95	1.00	0.95	1.00	0.93	1.00	0.93	1.00	0.95	1.00
Satd. Flow (perm)	1863	3673	1863	3673	1863	3673	1649	1900	1649	1900	1665	1900
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	814	85	145	399	0	83	12	325	0	7	0
RTOR Reduction (vph)	0	8	0	0	2	0	0	159	0	0	5	0
Lane Group Flow (vph)	58	891	0	145	399	0	0	261	0	0	12	0
Turn Type	Prot		Prot				Perm		Perm		Perm	
Protected Phases	7	4	3	8				2			6	
Permitted Phases							2		6			
Actuated Green, G (s)	6.9	23.2		10.6	26.9			16.3			16.3	
Effective Green, g (s)	6.9	23.2		10.6	26.9			16.3			16.3	
Actuated v/c Ratio	0.11	0.36		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)	197	1309		303	1535			388			417	
v/s Ratio Prot	0.08	0.24		0.08	0.11							
v/s Ratio Perm								0.17			0.01	
v/c Ratio	0.29	0.68		0.45	0.26			0.67			0.03	
Uniform Delay, d1	26.9	17.8		24.7	12.6			22.0			18.4	
Regression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.8	1.5		1.2	0.1			4.6			0.0	
Delay (s)	27.7	19.3		25.9	12.6			26.6			18.4	
Level of Service	C	B		C	B			C			B	
Approach Delay (s)		19.8			16.2			26.6			18.4	
Approach LOS		B			B			C			B	
HCM Average Control Delay	20.2		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.70											
Actuated Cycle Length (s)	65.1		Sum of lost time (s)		20.0							
Intersection Capacity Utilization	76.0%		ICU Level of Service		D							
Analysis Period (min)	15											
g - Critical Lane Group												

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

9/16/2009



	EB		WB		NB		SB		WB		EB	
Lane Configurations	←	↑↓	←	↑↓	←	↑↓	←	↑↓	←	↑↓	←	↑↓
Volume (vph)	53	690	99	196	7	149	19	187	13	22	108	108
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95
Flt Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd Flow (prot)	1863	1865	1863	1865	1863	1865	1863	1865	1863	1865	1863	1865
Flt Permitted	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00	0.95	1.00
Satd Flow (perm)	1863	1865	1863	1865	1863	1865	1863	1865	1863	1865	1863	1865
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	7	149	19	187	13	22	108	108
RTOR Reduction (vph)	0	12	0	0	1	0	0	49	0	0	76	0
Lane Grp Flow (vph)	53	777	0	196	1046	0	0	305	0	0	67	0
Turn Type	Prot		Prot		Perm		Perm		Perm		Perm	
Protected Phases	7		4		3		3		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		0.11		0.28		0.04		0.04	
v/s Ratio Perm									0.22		0.04	
G/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				18.6	
Approach LOS			C				C				B	
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									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

3: Ka Uka Blvd & Kam Hwy

9/16/2009



Lane Configurations	↖	↗	↖	↗	↖	↗	↖	↗	↖	↗	↖	↗
Volume (vph)	16	20	4	219	16	253	8	464	257	687	931	107
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Lost Time (s)	5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
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
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
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
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	202	0	0	10
Turn Type	Split		Split		Free	Prot		Perm	Prot		Perm	
Protected Phases	4	4		8	8		3	2		1	6	
Permitted Phases					Free			2			6	
Actuated Green, g (s)	3.5	3.5		15.7	15.7	77.8	4.4	16.8	16.8	21.8	34.2	34.2
Effective Green, g (s)	3.5	3.5		15.7	15.7	77.8	4.4	16.8	16.8	21.8	34.2	33.2
Actuated v/c Ratio	0.04	0.04		0.20	0.20	1.00	0.06	0.22	0.22	0.28	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)	80	155		376	396	1667	105	804	360	1013	1637	711
v/s Ratio Prot	0.01	0.01		0.12	0.01		0.00	0.22		0.19	0.25	
v/s Ratio Perm						c0.15		0.03				0.00
v/s Ratio	0.20	0.13		0.58	0.04	0.15	0.08	0.68	0.15	0.68	0.57	0.04
Uniform Delay, d1	35.8	35.7		28.1	25.0	0.0	34.8	27.3	24.7	24.9	16.3	12.8
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		2.3	0.0	0.2	0.3	1.0	0.2	1.8	0.5	0.0
Delay (s)	37.0	36.1		30.4	25.0	0.2	35.1	28.3	24.9	26.7	16.7	12.8
Level of Service	D	D		C	C	A	D	C	C	C	B	B
Approach Delay (s)		36.5			14.6			27.2			20.9	
Approach LOS		D			B			C			C	
HCM Average Control Delay		21.6										
HCM Level of Service											C	
HCM Volume to Capacity ratio		0.53										
Actuated Cycle Length (s)		77.8									10.0	
Sum of lost time (s)												
Intersection Capacity Utilization		0.53										
ICU Level of Service											B	
Analysis Period (min)		15										
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

3: Ka Uka Blvd & Kam Hwy

9/16/2009



Lane Configurations	↖	↗	↖	↗	↖	↗	↖	↗	↖	↗	↖	↗
Volume (vph)	32	41	16	397	73	833	35	880	134	373	603	57
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	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	0.97	0.95	1.00
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (prot)	1770	3291	1863	1961	1667	1667	1667	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (perm)	1770	3291	1863	1961	1667	1667	1667	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	16	397	73	833	35	880	134	373	603	57
RTOR Reduction (vph)	0	34	0	0	0	0	0	0	303	0	0	32
Lane Grp Flow (vph)	32	48	0	397	73	833	35	880	134	373	603	19
Turn Type	Split	Split	Split	Split	Free	Prot	Prot	Perm	Prot	Prot	Perm	Perm
Protected Phases	4	4	8	8	5	2	1	6	1	1	6	6
Permitted Phases					Free			2				6
Actuated Green, G (s)	5.8	5.8	25.9	25.9	95.3	6.2	28.7	28.7	14.9	37.4	37.4	37.4
Effective Green, g (s)	5.8	5.8	25.9	25.9	95.3	6.2	28.7	28.7	14.9	37.4	37.4	36.4
Actuated G/C Ratio	0.06	0.06	0.27	0.27	1.00	0.07	0.30	0.30	0.16	0.39	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	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	3.0	3.0
Lane Grp Cap (vph)	108	200	506	533	1667	121	1122	502	565	1462	637	637
v/s Ratio Prot	0.02	0.01	0.21	0.02		0.02	0.22		0.10	0.16		
v/s Ratio Perm					c0.50			0.08				0.01
v/c Ratio	0.30	0.22	0.78	0.15	0.50	0.29	0.71	0.26	0.66	0.41	0.63	0.63
Uniform Delay, d1	42.8	42.6	32.1	26.3	0.0	42.5	29.9	25.3	37.8	21.0	18.4	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	1.00
Incremental Delay, d2	1.5	0.5	7.8	0.1	1.1	1.3	2.6	0.3	2.9	0.2	0.0	0.0
Delay (s)	44.3	43.1	39.9	26.4	1.1	43.8	32.5	25.5	40.7	21.2	18.4	18.4
Level of Service	D	D	D	C	A	D	C	C	D	C	B	B
Approach Delay (s)		43.5		24.4			30.5			28.1		
Approach LOS		D		B			C			C		
HCM Average Control Delay			24.6	HCM Level of Service			C					
HCM Volume to Capacity Ratio			0.7									
Actuated Cycle Length (s)			95.3	Sum of lost time (s)			15.0					
Intersection Capacity Utilization			72.0%	ICU Level of Service			C					
Analysis Period (min)			15									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

19: Waipio Uka & Kam Hwy

9/16/2009



Lane Configuration	↖	↑	↗	↖↗	←	↖↗	↑	↖↗	↖	↑	↗	
Max Flow (vph)	1500	1500	1500	1500	1500	1500	2000	2000	2000	2000	2000	
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1493	1596	1363	9725	1667	1963	1725	1667	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	1.00
Satd. Flow (perm)	1770	1863	1583	1493	1596	1363	9725	1667	1963	1725	1667	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	48	16	683	567	34	1117	1
RTOR Reduction (vph)	0	0	0	0	32	0	0	0	347	0	0	1
Lane Group Flow (vph)	1	4	9	578	13	0	16	683	220	34	1117	0
Turn Type	Split		Free		Split		Prot		Perm		Prot	
Protected Phases	4	4			8	8	5		2		7	6
Permitted Phases			Free						2		6	
Actuated Green, G (s)	0.9	0.9	76.0	19.4	19.4	5.3	29.5	29.5	6.2	30.4	30.4	30.4
Effective Green, g (s)	0.9	0.9	76.0	19.4	19.4	5.3	29.5	29.5	6.2	30.4	30.4	30.4
Actuated v/s Ratio	0.01	0.01	1.00	0.26	0.26	0.07	0.39	0.39	0.08	0.40	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	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	3.0
Lane Grp Cap (vph)	21	22	1583	876	407	130	1446	647	152	1490	667	667
v/s Ratio Prot	0.00	0.00	0.17		0.01	0.01	0.18	0.18	0.02	0.30	0.30	0.30
v/s Ratio Perm			c0.01						0.13		0.00	
v/c Ratio	0.05	0.18	0.01	0.66	0.03	0.12	0.47	0.34	0.22	0.76	0.00	0.00
Uniform Delay, d1	37.1	37.2	0.0	25.3	21.2	33.2	17.4	16.4	32.6	19.5	13.7	13.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	4.0	0.0	1.8	0.0	0.4	0.2	0.3	0.7	2.1	0.0	0.0
Delay (s)	38.1	41.2	0.0	27.2	21.3	33.6	17.7	16.7	33.4	21.7	13.7	13.7
Level of Service	D	D	A	C	C	C	B	B	C	C	C	B
Approach Delay (s)	14.5				26.7		17.7				23.0	
Approach LOS	B				C		B				C	
HCM Average Control Delay			21.0						HCM Level of Service		C	
HCM Volume to Capacity ratio			0.61									
Actuated Cycle Length (s)			76.0						Sum of lost time (s)		15.0	
Intersection Capacity Utilization			60.8%						ICU Level of Service		E	
Analysis Period (min)			15									
c - Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 19: Waipio Uka & Kam Hwy

9/16/2009



Lane Configurations	↙	↑	↗	↙↗	↑	↙	↑↑	↗	↙	↑↑	↗
Volume (vph)	7	16	41	618	17	59	61	1292	633	52	969
Ideal Flow (vphpl)	1900	1900	1900	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	1.00	0.95
Fit 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 (perm)	1770	1863	1863	3614	1732	1863	3725	1667	1863	3725	1667
Fit 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	1863	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
Adj. Flow (vph)	7	16	41	618	17	59	61	1292	633	52	969
RTOR Reduction (vph)	0	0	0	0	45	0	0	0	403	0	0
Lane Group Flow (vph)	7	16	41	618	33	0	61	1292	430	52	969
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)	2.4	2.4	92.1	21.7	21.7		9.3	41.8	41.8	6.2	38.7
Effective Green, g (s)	2.4	2.4	92.1	21.7	21.7		9.3	41.8	41.8	6.2	38.7
Actuated g/C Ratio	0.03	0.03	1.00	0.24	0.24		0.10	0.45	0.45	0.07	0.42
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)	46	49	1583	852	408		188	1691	757	125	1565
v/s Ratio Prot	0.00	0.01		0.17	0.02		0.05	0.03		0.03	0.26
v/s Ratio Perm			0.03						0.26		0.00
v/c Ratio	0.15	0.33	0.03	0.73	0.08		0.45	0.73	0.57	0.42	0.62
Uniform Delay, d1	43.9	44.1	0.0	32.5	27.4		39.0	20.5	18.5	41.2	20.9
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	1.5	3.9	0.0	3.1	0.1		1.7	1.6	1.0	2.2	0.7
Delay (s)	45.4	47.9	0.0	35.5	27.5		40.7	22.1	19.5	43.5	21.7
Level of Service	D	D	A	D	C		D	C	B	D	C
Approach Delay (s)		17.0			34.7			21.8			22.7
Approach LOS		B			C			C			C
HCM Average Control Delay			24.2	HCM Level of Service				C			
HCM Volume to Capacity ratio			0.7								
Actuated Cycle Length (s)			92.1	Sum of lost time (s)				20.0			
Intersection Capacity Utilization			100%	ICU Level of Service				C			
Analysis Period (min)			15								
Critical Lane Group											

HCM Signalized Intersection Capacity Analysis

16: Lumiaina St & Kam Hwy

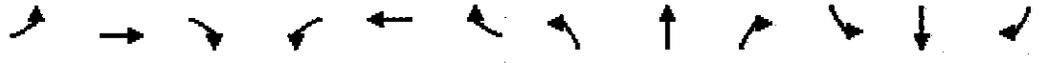
9/16/2009



Lane Configurations	↙	↕	↗	↙	↕	↗	↙	↕	↗	↙	↕	↗
Volume (vph)	494	17	98	64	79	39	46	739	39	17	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	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Prot	1.00	1.00	0.85	1.00	0.95	1.00	1.00	0.85	1.00	1.00	0.85	1.00
Flt Protected	0.95	0.96	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (prot)	1681	1691	1583	1770	1765	1770	3539	1583	1770	3539	1583	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	1.00
Satd Flow (perm)	1681	1691	1583	1770	1765	1770	3539	1583	1770	3539	1583	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
Vol Flow (vph)	494	17	98	64	79	39	46	739	39	17	1087	600
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	23	0	0	0
Lane Grp Flow (vph)	257	254	98	64	96	0	46	739	16	17	1087	600
Turn Type	Split		Free	Split			Prot		Perm	Prot		Free
Protected Phases	4	4		8	3		6	2		1		6
Permitted Phases			Free						2			Free
Actuated Green, G (s)	20.9	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	0.98	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	0.15	0.15		0.04	0.05		0.03	0.21		0.01	0.01	
v/s Ratio Perm			0.06						0.01			c0.38
v/c Ratio	0.71	0.70	0.06	0.32	0.40		0.98	0.52	0.02	0.17	0.81	0.38
Uniform Delay, d1	34.3	34.2	0.0	38.4	39.1		41.2	21.2	17.0	42.5	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	0.8	3.7	0.7
Delay (s)	40.8	40.0	0.1	39.3	40.9		42.6	21.5	17.0	43.4	29.9	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			29.7	
Approach LOS		C			D			C			B	
HCM Average Control Delay			24.1			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.69									
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									
Critical Lane Group												

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

9/16/2009



Lane Configurations	↖	↗	↖	↗	↖	↗	↑↑	↖	↗	↑↑	↖	
Volume (vph)	537	81	194	24	81	51	176	1584	105	28	886	74
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
Fit Protected	1.00	1.00	0.85	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85
Fit 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 (prot)	1770	1783	1667	1770	1689		1669	3725	1667	1669	3725	1667
Satd Flow (perm)	1770	1783	1667	1770	1689		1669	3725	1667	1669	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	81	194	24	81	51	176	1584	105	28	886	74
RTOR Reduction (vph)	0	0	0	0	48	0	0	0	40	0	0	0
Lane Grp Flow (vph)	285	283	194	24	84	0	176	1584	65	28	886	74
Turn Type	Split		Free	Split			Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		3	2		1	6	
Permitted Phases			Free						2			Free
Actuated Green, g (s)	21.1	21.1	101.2	6.3	6.3		14.8	49.6	49.6	4.2	39.0	101.2
Effective Green, g (s)	21.1	21.1	101.2	6.3	6.3		14.8	49.6	49.6	4.2	39.0	101.2
Actuated v/c Ratio	0.24	0.21	1.00	0.06	0.06		0.15	0.49	0.49	0.04	0.49	1.00
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)	369	372	1667	110	105		272	1826	817	77	1436	1667
v/s Ratio Prot	0.16	0.16		0.01	0.02		0.09	0.43		0.02	0.24	
v/s Ratio Perm			0.08						0.04			c0.43
v/c Ratio	0.77	0.76	0.08	0.22	0.33		0.63	0.87	0.08	0.36	0.62	0.33
Uniform Delay, d1	37.8	37.7	0.0	45.1	45.4		40.7	22.9	13.7	47.2	25.1	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	9.7	8.9	0.1	1.0	1.8		5.2	4.6	0.0	2.9	0.8	0.8
Delay (s)	47.4	46.5	0.1	46.1	47.2		46.0	27.5	13.7	50.1	25.9	0.8
Level of Service	D	D	A	D	D		D	C	B	D	C	A
Approach Delay (s)		38.0			47.0			28.6			15.3	
Approach LOS		D			D			C			B	
HCM Average Control Delay			25.5			HCM Level of Service		C				
HCM Volumetric Capacity Ratio			0.79									
Actuated Cycle Length (s)			101.2			Sum of lost time (s)		15.0				
Intersection Capacity Utilization			79.0%			ICU Level of Service		D				
Analysis Period (min)			15									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

2: Lumiauau & Kam Hwy

9/16/2009



Lane Configurations	←	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	117	12	321	173	12	14	30	690	55	3	1239	1
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000
Lost Time (s)		5.0	5.0	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	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Fit Protected		1.00	0.88	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.88
Sat. Flow (vph)		1782	1583	1770	1712		1863	3725	1667	1863	3725	1667
Fit Permitted		0.73	1.00	0.67	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Sat. Flow (perm)		1354	1883	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	690	55	3	1239	1
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	690	28	3	1239	1
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)	17.1		73.7	17.1			6.9		37.4		4.2	34.7
Effective Green, g (s)	17.1		73.7	17.1			6.9		37.4		4.2	34.7
Actuated C/R Ratio	0.23		1.00	0.23			0.09		0.51		0.06	0.47
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)	314		1583	291			174		1890		106	1754
v/s Ratio Prot							0.02		0.19		0.00	0.33
v/s Ratio Perm	0.10		c0.20	c0.14					0.02			0.01
v/c Ratio	0.71		0.20	0.69	0.91		0.17		0.37		0.03	0.71
Uniform Delay, d1	24.0		0.0	25.2	21.9		30.8		11.0		9.1	32.8
Progression Factor	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
Delay (s)	24.9		0.3	28.4	21.9		31.2		11.1		9.1	32.9
Level of Service	C		A	C	C		C		B		A	C
Approach Delay (s)	7.3				27.6				11.7			16.7
Approach LOS	A				C				B			B
HCM Average Control Delay			14.5									
HCM Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			73.7						10.0			
Sum of lost time (s)												
Intersection Capacity Utilization			57.1%									
ICU Level of Service												
Analysis Period (min)			15									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

2: Lumiauau & Kam Hwy

9/16/2009



Lane Configurations	←	↖	↗	→	←	↖	↗	→	←	↖	↗	→	
Volume (vph)	29	6	69	63	8	10	58	1847	171	11	1012	28	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000	
Total Lost time (s)	5.0	4.1	5.0	5.0	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	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00
Fit Protected	0.96	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd Flow (prot)	1792	1583	1776	1708	1663	1663	1663	1663	1663	1663	1663	1663	
Fit Permitted	0.76	1.00	0.74	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	
Satd Flow (perm)	1412	1583	1375	1708	1663	1663	1663	1663	1663	1663	1663	1663	
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)	29	6	69	63	8	10	58	1847	171	11	1012	28	
RTOR Reduction (vph)	0	0	0	0	9	0	0	0	55	0	0	0	
Lane Group Flow (vph)	6	29	69	63	9	0	58	1847	116	11	1012	28	
Turn Type	Perm	Free	Perm	Prot	Perm	Prot	Perm	Prot	Free	Free	Free	Free	
Protected Phases	4	4	8	5	2	4	6	6	6	6	6	6	
Permitted Phases	4	Free	8	2	Free								
Actuated Green, G (s)	7.9	85.5	7.9	7.9	13.5	58.1	58.1	4.5	49.1	85.5	85.5	85.5	
Effective Green, g (s)	7.9	85.5	7.9	7.9	13.5	58.1	58.1	4.5	49.1	85.5	85.5	85.5	
Actuated g/C Ratio	0.09	1.00	0.09	0.09	0.16	0.68	0.68	0.05	0.57	1.00	1.00	1.00	
Clearance Time (s)	5.0	5.0	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	3.0	3.0	
Lane Grp Cap (vph)	130	1583	127	158	294	2531	1133	98	2139	1667	1667	1667	
v/s Ratio Perm	0.02	0.04	c0.05	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	
v/s Ratio	0.22	0.04	0.30	0.06	0.54	0.73	0.19	0.11	0.47	0.09	0.09	0.09	
Uniform Delay, d1	36.0	0.0	36.9	35.4	33.1	8.7	4.7	38.6	10.6	0.0	0.0	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	1.00	
Incremental Delay, d2	0.9	0.1	3.0	0.1	1.9	1.1	0.0	0.5	0.2	0.0	0.0	0.0	
Delay (s)	36.8	0.1	39.9	35.5	35.0	9.8	4.8	39.1	10.8	0.0	0.0	0.0	
Level of Service	D	A	D	D	D	A	A	D	B	A	A	A	
Approach Delay (s)	10.9	10.9	39.0	39.0	14.2	14.2	14.2	10.8	10.8	10.8	10.8	10.8	
Approach LOS	B	B	D	D	B	B	B	B	B	B	B	B	
HCM Average Control Delay 11.8 HCM Level of Service B													
HCM Volume to Capacity ratio 0.73													
Actuated Cycle Length (s) 85.5 Sum of lost time (s) 15.0													
Intersection Capacity Utilization 74.5% ICU Level of Service D													
Analysis Period (min) 15													
Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 47: Waipahu St & Kam Hwy

9/16/2009



	EB	WB	EB	SB	SB	SAB
Lane Configurations	↵	↵	↵	↕	↕	↵
Volume (vph)	119	618	139	654	1667	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
Fit Protected	1.00	0.85	1.00	1.00	1.00	0.85
Fit Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd Flow (prot)	1863	1667	1863	1725	1725	1667
Satd Flow (perm)	1863	1667	1863	1725	1725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj Flow (vph)	119	618	139	654	1667	90
RTOR Reduction (vph)	0	6	0	0	0	40
Lane Group Flow (vph)	119	612	139	654	1667	90
Turn Type		pm+ov	Prot		Perm	
Protected Phases	4	5	5	2	6	
Permitted Phases		4			6	
Actuated Green, G (s)	12.2	41.1	28.9	89.2	55.3	55.3
Effective Green, g (s)	12.2	41.1	28.9	89.2	55.3	55.3
Actuated g/C Ratio	0.11	0.37	0.26	0.80	0.50	0.50
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	690	483	2983	1849	828
v/s Ratio Prot	0.06	0.23	0.07	0.18	0.45	
v/s Ratio Perm		0.14			0.03	
v/c Ratio	0.58	0.89	0.29	0.22	0.90	0.06
Uniform Delay, d1	47.2	33.0	33.0	2.7	25.6	14.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.2	13.1	0.3	0.0	6.5	0.0
Delay (s)	51.4	46.1	33.3	2.7	32.1	14.6
Level of Service	D	D	C	A	C	B
Approach Delay (s)	46.9			8.1	31.2	
Approach LOS	D			A	C	
HCM Average Control Delay		29.2		HCM Level of Service		C
HCM Volume to Capacity ratio		0.89				
Actuated Cycle Length (s)		111.4		Sum of lost time (s)		10.0
Intersection Capacity Utilization		88.5%		IGU Level of Service		E
Analysis Period (min)		15				
Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
 47: Waipahu St & Kam Hwy

9/16/2009



	W	E	N	S	S	W
Lane Configurations	↵	↶	↵	↕	↕	↶
Volume (vph)	257	455	292	1921	960	182
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Initial 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
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	455	292	1921	960	182
RTOR Reduction (vph)	0	21	0	0	0	111
Lane Group Flow (vph)	257	485	292	1921	960	111
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, g (s)	18.5	39.1	20.6	60.0	34.4	34.4
Effective Green, g (s)	18.5	39.1	20.6	60.0	34.4	34.4
Actuated g/C Ratio	0.21	0.24	0.23	0.68	0.39	0.39
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)	389	831	434	2525	1448	648
v/s Ratio Prot	0.14	0.12	0.16	0.52	0.26	
v/s Ratio Perm		0.14				0.04
w/C Ratio	0.66	0.52	0.67	0.76	0.66	0.11
Uniform Delay, d1	32.1	17.9	30.9	9.5	22.3	17.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.2	0.6	4.1	1.4	1.2	0.1
Delay (s)	36.3	18.5	35.0	10.9	23.4	17.3
Level of Service	D	B	C	B	C	B
Approach Delay (s)	24.9			14.1	22.5	
Approach LOS	C			B	C	
HCM Average Control Delay	18.3		HCM Level of Service		B	
HCM Volume to Capacity ratio	0.74					
Actuated Cycle Length (s)	88.5		Sum of lost time (s)		10.0	
Intersection Capacity Utilization	72.4%		ICU Level of Service		C	
Analysis Period (min)	15					
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 2020 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	3639	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	922	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	395	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)	3639	922	395	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	958	243	104	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	3945		980		420	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v_{12} = v_R + (v_F - v_R) P = 1751$ pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	3945	9400	No
$v_{12} = v_{12} - v_{12}$	2965	9400	No
v_{12}	980	3800	No
v_{12}	1097 pc/h	(Equation 25-15 or 25-16)	
Is $v_{12} > 2700$ pc/h?		No	
Is $v_{12} > 1.5 v_{12} / 2$		No	
If yes, $v_{12} = 1751$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1751	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L = 4.9$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	D = 0.516	
Space mean speed in ramp influence area,	S = 53.1	mph
Space mean speed in outer lanes,	S = 70.9	mph
Space mean speed for all vehicles,	S = 61.7	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 2020 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	6236	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	2059	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	668	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)	6236	2059	668	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1641	542	176	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	6761		2189		710	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$$v_{12} = v_R + (v_F - v_R) P = 3378 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v = v	6761	9400	No
Fi F			
v = v - v	4572	9400	No
FO F R			
v	2189	3800	No
R			
v v	1691 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is v v > 2700 pc/h?		No	
3 or av34			
Is v v > 1.5 v /2		No	
3 or av34 12			
If yes, v = 3378		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	3378	4400	No
12			

Level of Service Determination (if not F)

Density,	$D = 4.252 + 0.0086 v_{12} - 0.009 L_D$	=	18.9	pc/mi/ln
Level of service for ramp-freeway junction areas of influence B				

Speed Estimation

Intermediate speed variable,	D = 0.625	
	S	
Space mean speed in ramp influence area,	S = 50.6	mph
	R	
Space mean speed in outer lanes,	S = 68.6	mph
	0	
Space mean speed for all vehicles,	S = 58.3	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 2020 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	2717	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	395	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	922	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)	2717	395	922	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	715	104	243	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	2946	420	980 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.165$ Using Equation 4
 FM
 $v = v (P) = 487$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	3366	9400	No
FO			
v v	1229 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 = 1178		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1178	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 13.4$ pc/mi/ln
 R R 12 A
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.291	
	S	
Space mean speed in ramp influence area,	S = 58.3	mph
	R	
Space mean speed in outer lanes,	S = 63.6	mph
	0	
Space mean speed for all vehicles,	S = 61.0	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 2020 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	4178	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	668	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	2059	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)	4178	668	2059	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1099	176	542	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	4530	710	2189 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.129 Using Equation 4
 FM
 $v_{12} = v_F (P_{FM}) = 585 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	5240	9400	No
v _{3 or av34}	1972 pc/h	(Equation 25-4 or 25-5)	
Is v _{3 or av34} > 2700 pc/h?		No	
Is v _{3 or av34} > 1.5 v ₁₂ / 2		Yes	
If yes, v _{12A} = 1812		(Equation 25-8)	

Flow Entering Merge Influence Area

v	Actual	Max Desirable	Violation?
v _{12A}	1812	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 20.4 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.321	
Space mean speed in ramp influence area,	S _R = 57.6	mph
Space mean speed in outer lanes,	S ₀ = 61.9	mph
Space mean speed for all vehicles,	S = 59.8	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone:
E-mail:

Fax:

Diverge Analysis

Analyst:
Agency/Co.:
Date performed: 9/11/2009
Analysis time period: AM Peak
Freeway/Dir of Travel: H2 NB Off-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2020 w/ project
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3111	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	406	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	3111	406	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	819	107	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade	0.00	%	0.00	%	%
Length	0.00	mi	0.00	mi	mi
Trucks and buses PCE, ET	2.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		
Driver population factor, fP	1.00		1.00		
Flow rate, vp	3373		432		pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.436 Using Equation 8
 FD
 $v_{12} = v_R + (v_F - v_R) P = 1714$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	3373	9400	No
$v_{FO} = v_F - v_R$	2941	9400	No
v_R	432	2000	No
$v_{3} = v_{av34}$	829 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3} > 2700$ pc/h?		No	
Is $v_{3} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 1714$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1714	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L = 14.5$ pc/mi/ln
 R 12 D
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D = 0.467	
Space mean speed in ramp influence area,	S = 54.3	mph
Space mean speed in outer lanes,	S = 71.3	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:
Agency/Co.:
Date performed: 9/11/2009
Analysis time period: PM Peak
Freeway/Dir of Travel: H2 NB Off-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2020 w/ project
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4846	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	757	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	4846	757	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	1275	199	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade	0.00	%	0.00	%	%
Length	0.00	mi	0.00	mi	mi
Trucks and buses PCE, ET	2.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		
Driver population factor, fP	1.00		1.00		
Flow rate, vp	5254		805		pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.436 Using Equation 8
 FD
 $v_{12} = v_R + (v_F - v_R) P = 2745 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	5254	9400	No
$v_F = v - v_R$	4449	9400	No
$v_{FO} = v_F - v_R$	805	2000	No
$v_{3 \text{ or } 4} = v_{FO} / 3$	1254 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } 4} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } 4} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2745$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2745	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L = 23.4 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D = 0.500	
Space mean speed in ramp influence area,	S = 53.5	mph
Space mean speed in outer lanes,	S = 70.3	mph
Space mean speed for all vehicles,	S = 60.4	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: _____ Fax: _____
 E-mail: _____

Merge Analysis

Analyst: CL
 Agency/Co.:
 Date performed: 9/28/2009
 Analysis time period: AM Peak
 Freeway/Dir of Travel: H2 NB On-Ramp
 Junction: Pineapple Road
 Jurisdiction:
 Analysis Year: Year 2020 w/ project
 Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2705	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	103	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2705	103		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	712	27		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		

Grade Length	% mi	% mi	% mi
Trucks and buses PCE, ET	2.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	2933	110	pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.204$ Using Equation 4
 FM
 $v_{12} = v_{F \text{ FM}} = 598$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3043	9400	No
$v_{3 \text{ or } av34}$	1167 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12}$ /2		Yes	
If yes, $v_{12A} = 1173$		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1173	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 12.3$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	$M = 0.300$	
Space mean speed in ramp influence area,	$S_R = 58.1$	mph
Space mean speed in outer lanes,	$S_0 = 63.6$	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: CL
Agency/Co.:
Date performed: 9/28/2009
Analysis time period: PM Peak
Freeway/Dir of Travel: H2 NB On-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2020 w/ project
Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4089	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	93	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	4089	93	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	1076	24	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade Length	% mi	% mi	% mi
Trucks and buses PCE, ET	2.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4433	99	pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.205 Using Equation 4
 FM
 $v_{12} = v_{FM} (P) = 911 \text{ pc/h}$
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	4532	9400	No
FO			
v v	1761 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 = 1773		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1773	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 16.9 \text{ pc/mi/ln}$

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

Speed Estimation

Intermediate speed variable,	M = 0.311	
	S	
Space mean speed in ramp influence area,	S = 57.8	mph
	R	
Space mean speed in outer lanes,	S = 62.0	mph
	O	
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 2020 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	4692	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	418	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	1575	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)	4692	418	1575	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1235	110	414	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	5087		444		1674	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.436 Using Equation 8

FD

$$v_{12} = v_R + (v_F - v_R) P = 2468 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	5087	9400	No
$v_{12} = v_{12} - v_{12}$	4643	9400	No
v_{12}	444	2000	No
v_{12}	1309 pc/h	(Equation 25-15 or 25-16)	
Is $v_{12} > 2700$ pc/h?		No	
Is $v_{12} > 1.5 v_{12} / 2$		No	
If yes, $v_{12} = 2468$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2468	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L = 24.1$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	D = 0.468	
Space mean speed in ramp influence area,	S = 54.2	mph
Space mean speed in outer lanes,	S = 70.1	mph
Space mean speed for all vehicles,	S = 61.4	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 SB Off-Ramp
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2020 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	3575	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	523	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	1492	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)	3575	523	1492	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Trucks 15-min volume, v15	941	138	393	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	3876		556		1586	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.436 Using Equation 8

FD

v = v + (v - v) P = 2004 pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	3876	9400	No
Fi F			
v = v - v	3320	9400	No
FO F R			
v	556	2000	No
R			
v v	936 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is v v > 2700 pc/h?		No	
3 or av34			
Is v v > 1.5 v /2		No	
3 or av34 12			
If yes, v = 2004		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2004	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 20.1$ pc/mi/ln

R 12 D

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

Speed Estimation

Intermediate speed variable,	D = 0.478	
	S	
Space mean speed in ramp influence area,	S = 54.0	mph
	R	
Space mean speed in outer lanes,	S = 71.3	mph
	0	
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: AM Peak
Freeway/Dir of Travel: H-2 Fwy SB On Ramp (EB)
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2020 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	4274	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	1575	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	1575	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)	4274	1575	1575	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1125	414	414	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	4634	1674	1674 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.009$ Using Equation 4
 FM
 $v = v (P) = 40$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	6308	9400	No
FO			
v v	2297 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 = 1853		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1853	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 27.1$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.396	
	S	
Space mean speed in ramp influence area,	S = 55.9	mph
	R	
Space mean speed in outer lanes,	S = 61.8	mph
	O	
Space mean speed for all vehicles,	S = 58.3	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 2020 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	3052	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	1492	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	1492	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)	3052	1492	1492	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	803	393	393	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	3309	1586	1586 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
EQ
P = 0.020 Using Equation 4
FM
 $v_{12} = v_F (P_{FM}) = 65$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v	4895	9400	No
FO			
v	1622 pc/h	(Equation 25-4 or 25-5)	
Is v > 2700 pc/h?		No	
Is v > 1.5 v / 2		Yes	
If yes, v = 1323		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1323	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 22.3$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.335	
Space mean speed in ramp influence area,	S = 57.3	mph
Space mean speed in outer lanes,	S = 63.2	mph
Space mean speed for all vehicles,	S = 59.6	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst:
Agency/Co.:
Date performed: 9/11/2009
Analysis time period: AM Peak
Freeway/Dir of Travel: H2 SB On-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2020 With Project
Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4022	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	670	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	4022	670	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	1058	176	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade Length	% mi	% mi	% mi
Trucks and buses PCE, ET	2.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4361	712	pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.129 Using Equation 4
 FM
 $v_{12} = v_{F} (P_{FM}) = 562 \text{ pc/h}$

Capacity Checks

v	Actual	Maximum	LOS F?
FO	5073	9400	No
v	v	1899 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	= 1744	(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

v	Actual	Max Desirable	Violation?
12A	1744	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 21.2 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.331	
Space mean speed in ramp influence area,	S _R = 57.4	mph
Space mean speed in outer lanes,	S ₀ = 62.1	mph
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:
Agency/Co.:
Date performed: 9/11/2009
Analysis time period: PM Peak
Freeway/Dir of Travel: H2 SB On-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2020 With Project
Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2968	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	607	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2968	607		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	781	160		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		

Grade Length	% mi	% mi	% mi
Trucks and buses PCE, ET	2.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3218	645	pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.137$ Using Equation 4
 FM
 $v_{12} = v_{F \text{ FM}} = 441$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v	3863	9400	No
FO			
v	1388 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 1287		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1287	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 \frac{v}{R} + 0.0078 \frac{v}{R} - 0.00627 \frac{L}{A} = 10.8$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.243	
	S	
Space mean speed in ramp influence area,	S = 59.4	mph
	R	
Space mean speed in outer lanes,	S = 63.3	mph
	O	
Space mean speed for all vehicles,	S = 61.3	mph

Phone: Fax:
 E-mail:

Diverge Analysis

Analyst: CL
 Agency/Co.:
 Date performed: 9/28/2009
 Analysis time period: AM Peak
 Freeway/Dir of Travel: H2 SB Off-Ramp
 Junction: Pineapple Road
 Jurisdiction:
 Analysis Year: Year 2020 w/ project
 Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4084	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	62	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	4084	62	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	1075	16	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade	0.00	%	0.00	%	%
Length	0.00	mi	0.00	mi	mi
Trucks and buses PCE, ET	2.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		
Driver population factor, fP	1.00		1.00		
Flow rate, vp	4428		66		pcph

Estimation of V12 Diverge Areas

$$L = \frac{EQ}{P} \quad (\text{Equation 25-8 or 25-9})$$

$$P = 0.436 \quad \text{Using Equation 8}$$

$$FD = v_{12} + (v_F - v_R) P = 1968 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	4428	9400	No
$v_{12} = v_{12} - v_{12}$	4362	9400	No
v_{12}	66	2000	No
v_{12}	1230 pc/h	(Equation 25-15 or 25-16)	
Is $v_{12} > 2700$ pc/h?		No	
Is $v_{12} > 1.5 v_{12} / 2$		No	
If yes, $v_{12} = 1968$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1968	4400	No

Level of Service Determination (if not F)

$$\text{Density, } D = 4.252 + 0.0086 v_{12} - 0.009 L = 16.7 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	$D = 0.434$	
Space mean speed in ramp influence area,	$S = 55.0$	mph
Space mean speed in outer lanes,	$S = 70.4$	mph
Space mean speed for all vehicles,	$S = 62.6$	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: CL
Agency/Co.:
Date performed: 9/28/2009
Analysis time period: PM Peak
Freeway/Dir of Travel: H2 SB Off-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2020 w/ project
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3083	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	115	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3083	115		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	811	30		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		

Grade	0.00	%	0.00	%	%
Length	0.00	mi	0.00	mi	mi
Trucks and buses PCE, ET	2.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		
Driver population factor, fP	1.00		1.00		
Flow rate, vp	3343		122		pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.436 Using Equation 8
FD
 $v = v + (v - v) P = 1526 \text{ pc/h}$
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	3343	9400	No
Fi F			
$v = v - v$	3221	9400	No
FO F R			
v	122	2000	No
R			
$v = v$	908 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is $v = v > 2700 \text{ pc/h?}$		No	
3 or av34			
Is $v = v > 1.5 v / 2$		No	
3 or av34 12			
If yes, $v = 1526$		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	1526	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 12.9 \text{ pc/mi/ln}$
R 12 D
Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D = 0.439	
	S	
Space mean speed in ramp influence area,	S = 54.9	mph
	R	
Space mean speed in outer lanes,	S = 71.3	mph
	0	
Space mean speed for all vehicles,	S = 62.7	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 2020 With Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	3639	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	910	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	937	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	937	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	13.7	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 2020 With Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	6236	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1559	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	1285	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	5	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1285	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	5	
Density, D	18.4	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 2020 With Project
Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	3111	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	778	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	801	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	801	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	

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 2020 With Project
Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	4846	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1212	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	1248	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	1248	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	18.2	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 SB
From/To:
Jurisdiction:
Analysis Year: Year 2020 With Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	5849	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1463	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	1506	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	1506	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.4	mi/h
Number of lanes, N	4	
Density, D	22.0	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 2020 With Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	4544	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1136	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	1170	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	1170	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	17.1	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: AM Peak
Freeway/Direction: H-2 Fwy SB
From/To:
Jurisdiction:
Analysis Year: Year 2020 With Project
Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	4692	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1173	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	1208	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, flD	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	1208	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	17.6	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 2020 With Project
Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	3575	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	894	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	921	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	921	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	13.4	pc/mi/ln
Level of service, LOS	B	

APPENDIX I

**CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2016 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT
KOA RIDGE MAKAI AND WAIAWA DEVELOPMENTS
(WITHOUT ADDITIONAL IMPROVEMENTS)**

HCM Signalized Intersection Capacity Analysis

25: Ka Uka Blvd & H-2 On (NB)

6/9/2010



Approach	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Lane Configurations	↖↗	↕			↕↕↕	↖	↖	↕			
Volume (vph)	375	183	0	0	1413	194	884	0	0	0	0
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0			5.0	6.0	5.0	5.0			
Lane Util. Factor	0.97	0.95			0.91	1.00	0.95	0.95			
Frt	1.00	1.00			1.00	0.85	1.00	1.00			
Frt Protected	0.95	1.00			1.00	1.00	0.95	0.95			
Satd. Flow (prot)	3614	3725			5353	1667	1770	1770			
Frt Permitted	0.95	1.00			1.00	1.00	0.95	0.95			
Satd. Flow (perm)	3614	3725			5353	1667	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
Adj. Flow (vph)	375	183	0	0	1413	194	884	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	128	0	0	0	0	0
Lane Group Flow (vph)	375	183	0	0	1413	66	442	442	0	0	0
Turn Type	Prot					Perm	Perm				
Protected Phases	7	4			8			2			
Permitted Phases						8	2				
Actuated Green, G (s)	13.8	49.2			30.4	30.4	27.4	27.4			
Effective Green, g (s)	13.8	49.2			30.4	29.4	27.4	27.4			
Actuated g/C Ratio	0.16	0.57			0.35	0.34	0.32	0.32			
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)	576	2116			1879	566	560	560			
v/s Ratio Prot	c0.10	0.05			c0.26						
v/s Ratio Perm						0.04	c0.25	0.25			
v/c Ratio	0.65	0.09			0.75	0.12	0.79	0.79			
Uniform Delay, d1	34.1	8.5			24.8	19.7	27.0	27.0			
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00			
Incremental Delay, d2	2.6	0.0			1.7	0.1	7.3	7.3			
Delay (s)	36.8	8.5			26.5	19.8	34.3	34.3			
Level of Service	D	A			C	B	C	C			
Approach Delay (s)		27.5			25.7			34.3			0.0
Approach LOS		C			C			C			A
Intersection Summary											
HCM Average Control Delay	28.5		HCM Level of Service		C						
HCM Volume to Capacity ratio	0.75										
Actuated Cycle Length (s)	86.6		Sum of lost time (s)		15.0						
Intersection Capacity Utilization	71.9%		ICU Level of Service		C						
Analysis Period (min)	15										
c Critical Lane Group											

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

6/9/2010



	EBL	EBT	EBP	WBL	WBT	WBP	NBL	NBT	NBP	SBL	SPT	SBP
Lane Configurations	↑↑		↑↑		↑↑↑		↑	↑	↑			
Volume (vph)	621	543	0	0	1644	444	1912	0	0	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	6.0	5.0	5.0				
Lane Util. Factor	0.97	0.95			0.91	1.00	0.95	0.95				
Flt	1.00	1.00			1.00	0.85	1.00	1.00				
Flt Protected	0.95	1.00			1.00	1.00	0.95	0.95				
Satd. Flow (prot)	3614	3725			5353	1667	1770	1770				
Flt Permitted	0.95	1.00			1.00	1.00	0.95	0.95				
Satd. Flow (perm)	3614	3725			5353	1667	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)	621	543	0	0	1644	444	1912	0	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	292	0	0	0	0	0	0
Lane Group Flow (vph)	621	543	0	0	1644	152	956	956	0	0	0	0
Turn Type	Prot				Perm		Perm					
Protected Phases	7	4			8			2				
Permitted Phases						8		2				
Actuated Green, G (s)	16.0	46.0			25.0	25.0	44.0	44.0				
Effective Green, g (s)	16.0	46.0			25.0	24.0	44.0	44.0				
Actuated g/C Ratio	0.16	0.46			0.25	0.24	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)	578	1714			1338	400	779	779				
v/s Ratio Prot	c0.17	0.16			c0.31							
v/s Ratio Perm						0.09	c0.54	0.54				
v/c Ratio	1.07	0.32			1.23	0.38	1.23	1.23				
Uniform Delay, d1	42.0	17.1			37.5	31.8	28.0	28.0				
Progression Factor	1.00	1.00			1.00	1.00	1.00	1.00				
Incremental Delay, d2	59.0	0.1			109.7	0.6	113.5	113.5				
Delay (s)	101.0	17.2			147.2	32.4	141.5	141.5				
Level of Service	F	B			F	C	F	F				
Approach Delay (s)		61.9			122.8		141.5				0.0	
Approach LOS		E			F		F				A	

HCM Average Control Delay	116.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	132.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
 5: Ka Uka Blvd & H-2 Off (SB)

9/10/2009



Lane Configurations	↑↑		↖↗		↑↑		↖		↗		↖↗	
Volume (vph)	0	1469	54	240	773	0	29	0	440	99	158	244
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	5.0		5.0
Lane Util. Factor		0.95		0.97	0.95		1.00		1.00	0.95		0.95
Fit Protected		1.00		0.95	1.00		0.95		1.00	0.95		1.00
Fit Permitted		1.00		0.95	1.00		0.95		1.00	0.95		1.00
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
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	210	0	0	213
Turn Type				Prot			Prot		custom	Split		Perm
Protected Phases		1		3	8		5			6		6
Permitted Phases									5			6
Actuated Green, G (s)		41.1		7.0	53.1		15.4		14.4	13.2		13.2
Effective Green, g (s)		41.1		7.0	53.1		15.4		14.4	13.2		13.2
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)		1575		262	2045		297		248	242		253
v/s Ratio Prot		0.07		0.07	0.21		0.02			0.05		0.09
v/s Ratio Perm									c0.14			0.02
Uniform Delay, d1		27.1		44.6	12.4		34.7		40.6	38.0		39.6
Incremental Delay, d2		15.2		33.8	0.1		0.1		37.4	0.9		6.4
Level of Service		D		E	B		C		E	D		D
Approach Delay (s)		42.3		28.1	12.5		34.9		78.1	66.9		46.1
Approach LOS		D		C	B		E		E	D		D
Intersection Summary												
HCM Average Control Delay		42.4			HCM Level of Service			D				
HCM Volume to Capacity ratio		0.90										
Actuated Cycle Length (s)		96.7			Sum of lost time (s)			21.0				
Intersection Capacity Utilization		87.3%			ICU Level of Service			E				
Analysis Period (min)		15										
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 5: Ka Uka Blvd & H-2 Off (SB)

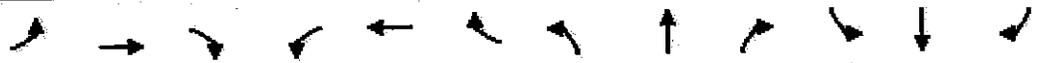
9/10/2009



Lane Configurations	↑↑		↑↑		↑↑		↑		↑		↑	
Volume (vph)	0	535	77	371	1702	0	81	0	701	307	192	243
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	5.0	5.0	5.0
Lane Util. Factor		0.95		0.97	0.95		1.00		1.00	0.95	0.95	1.00
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	0.99	1.00
Satd Flow (prot)		3699		3614	3725		1863		1667	1770	1841	1667
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	0.99	1.00
Satd Flow (perm)		3699		3614	3725		1863		1667	1770	1841	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	535	77	371	1702	0	81	0	701	307	192	243
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	135	0	0	222
Lane Group Flow (vph)	0	1609	0	371	1702	0	81	0	566	246	253	71
Turn Type				Prot		Prot		custom		Split		Perm
Protected Phases		4		3	3		5			6		6
Permitted Phases									5			6
Actuated Green, G (s)		42.0		10.0	57.0		29.0		29.0	18.4	18.4	18.4
Effective Green, g (s)		42.0		10.0	57.0		29.0		28.0	18.4	18.4	17.4
Actuated g/C Ratio		0.35		0.08	0.43		0.24		0.23	0.15	0.15	0.15
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)		1301		303	1778		452		391	273	284	243
v/c Ratio Prot		0.43		0.10	0.46		0.04			0.14	0.14	
v/s Ratio Perm									c0.34			0.04
v/c Ratio		1.24		1.22	0.95		0.16		1.45	0.90	0.89	0.29
Uniform Delay, d1		38.7		54.7	30.0		35.8		45.7	49.6	49.5	45.5
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	1.00
Incremental Delay, d2		113.2		126.8	12.6		0.2		214.8	30.1	27.4	0.7
Delay (s)		151.9		181.5	42.6		36.0		260.5	79.7	76.9	46.2
Level of Service		F		F	D		D		F	E	E	D
Approach Delay (s)		151.9			67.5		237.2				66.4	
Approach LOS		F			E		F				E	
Summary												
HCM Average Control Delay		118.5			HCM Level of Service			F				
HCM Volume to Capacity ratio		1.23										
Actuated Cycle Length (s)		119.4			Sum of lost time (s)			21.0				
Intersection Capacity Utilization		170.1%			IGU Level of Service			H				
Analysis Period (min)		15										
Critical Lane Group												

HCM Unsignalized Intersection Capacity Analysis
 31: Ka Uka Blvd & Spine Rd

9/10/2009



Lane Configurations	↙	↑↑	↘	↑↑	↙	↑↑	↘	↑	↙	↘	↓	↙
Volume (veh/h)	94	859	73	90	669	344	0	0	32	532	0	145
Sign Control	Free		Free		Free		Stop		Stop		Stop	
Grade	0%		0%		0%		0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (veh)	94	859	73	90	669	344	0	0	32	532	0	145
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked	0.91						0.91		0.91		0.91	
vC, conflicting volume	609		1052				1813		1972		516	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	367		1032				1693		1869		516	
tC, single (s)	4.1		4.1				7.5		6.5		6.9	
tC, 2 stage (s)												
p0 queue free %	91		87				100		100		94	
ICU capacity (veh/h)	1079		669				37		51		504	
Summary												
Volume Total	94	839	393	90	406	547	32	266	266	145		
Volume Left	94	0	0	90	0	0	0	266	266	0		
Volume Right	0	0	73	0	0	344	32	0	0	145		
cSH	1079	1700	1700	669	1700	1700	504	58	58	711		
Volume to Capacity	0.09	0.38	0.23	0.13	0.24	0.32	0.06	4.62	4.62	0.20		
Queue Length 95th (ft)	7	0	0	12	0	0	5	Err	Err	19		
Control Delay (s)	8.7	0.0	0.0	11.2	0.0	0.0	12.6	Err	Err	11.4		
Lane LOS	A		B				B		F		B	
Approach Delay (s)	9.7		1.0				12.6		7859.6			
Approach LOS	B		F				B		F			
Summary												
Average Delay	1849.7											
Intersection Capacity Utilization	59.0%											
ICU Level of Service	B											
Analysis Period (min)	15											

HCM Unsignalized Intersection Capacity Analysis
 31: Ka Uka Blvd & Spine Rd

9/10/2009



Lane Configurations	↙	↑↑	↘	↑↑	↙	↑↑	↘	↑	↙	↘	↓	↙
Volume (veh/h)	221	737	140	107	153	815	0	0	170	701	0	190
Sign Control	Free		Free		Free		Stop		Stop		Stop	
Grade	0%		0%		0%		0%		0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow rate (vph)	221	737	140	107	153	815	0	0	170	701	0	190
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None		None		None		None		None		None	
Median storage (veh)												
Upstream signal (ft)	848											
pX, platoon unblocked	0.55		0.55		0.55		0.55		0.55		0.55	
C, conflicting volume	1153		877		2230		2616		438		2758	
vC1, stage 1 conf vol												
C2, stage 2 conf vol												
vCu, unblocked vol	0		877		1609		2307		438		2558	
C, single (s)	4.1		4.1		7.5		6.5		6.8		7.5	
tC, 2 stage (s)												
P (s)	2.2		2.2		3.6		4.0		3.3		3.6	
p0 queue free %	75		86		100		100		70		0	
SM capacity (veh/h)	899		766		19		11		566		4	
Summary												
Volume Total	221	190	386	107	769	199	170	350	350	190		
Volume Left	221	0	0	107	0	0	0	350	350	0		
Volume Right	0	0	140	0	0	815	170	0	0	190		
cSH	899	1700	1700	766	1700	1700	566	4	4	601		
Volume to Capacity	0.25	0.29	0.23	0.14	0.45	0.71	0.30	94.66	94.66	0.32		
Queue Length 95th (ft)	24	0	0	12	0	0	31	Err	Err	34		
Control Delay (s)	10.3	0.0	0.0	10.3	0.0	0.0	14.1	Err	Err	13.7		
Lane LOS	B		B		B		F		F		B	
Approach Delay (s)	2.1		0.5		14.1		7869.7					
Approach LOS	B		F		B		F					
Average Delay												
Average Delay	1657.5											
Intersection Capacity Utilization	97.6%											
ICU Level of Service	F											
Analysis Period (min)	15											

HCM Signalized Intersection Capacity Analysis
 35: Ukee (E) & Ka Uka Blvd

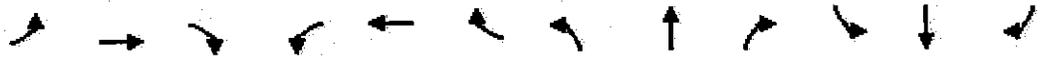
9/10/2009



Lane Configurations	↔		↔		↖ ↗		↖ ↗		↖ ↗		↖ ↗	
Volume (vph)	15	3	2	41	15	21	8	1092	69	87	584	77
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	
Fit Protected	0.96		0.97		0.95		1.00		0.95		1.00	
Satd Flow (prot)	1771		1746		1963		3692		1963		3660	
Fit Permitted	0.76		0.82		0.40		1.00		0.23		1.00	
Satd Flow (perm)	1398		1376		785		3692		444		3660	
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	21	8	1092	69	87	584	77
RTOR Reduction (vph)	0	2	0	0	17	0	0	4	0	0	10	0
Lane Group Flow (vph)	0	18	0	0	60	0	8	1157	0	87	651	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		2		0		0	
Permitted Phases	4		8		2		6		6		6	
Actuated Green, G (s)	4.6		4.6		34.4		34.4		34.4		34.4	
Effective Green, g (s)	4.6		4.6		34.4		34.4		34.4		34.4	
Actuated g/C Ratio	0.09		0.09		0.70		0.70		0.70		0.70	
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)	131		139		551		2592		312		2569	
v/s Ratio Prot	0.01		0.04		0.01		0.01		0.20		0.18	
v/c Ratio	0.14		0.43		0.01		0.45		0.28		0.25	
Uniform Delay, d1	20.4		21.0		2.2		3.2		2.7		2.6	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.5		2.1		0.0		0.1		0.5		0.1	
Delay (s)	20.9		23.1		2.2		3.3		3.2		2.7	
Level of Service	C		C		A		A		A		A	
Approach Delay (s)	20.9		23.1		3.3		2.6		2.6		2.6	
Approach LOS	C		C		A		A		A		A	
HCM Average Control Delay	4.0		HCM Level of Service		A		A		A		A	
HCM Volume to Capacity ratio	0.44		Sum of lost time (s)		10.0		10.0		10.0		10.0	
Actuated Cycle Length (s)	49.0		Intersection Capacity Utilization		52.3%		ICU Level of Service		A		A	
Analysis Period (min)	15		Critical Lane Group		6		6		6		6	

HCM Signalized Intersection Capacity Analysis
 35: Ukee (E) & Ka Uka Blvd

9/10/2009



Lane Configurations	↕		↕		↗		↖		↗		↖	
Volume (vph)	47	11	14	121	13	64	7	988	54	63	1205	70
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	
Flt Protected	0.97		0.96		0.95		1.00		0.95		1.00	
Satd Flow (prot)	1757		1739		1863		3697		1863		3695	
Flt Permitted	0.76		0.77		0.16		1.00		0.23		1.00	
Satd Flow (perm)	1383		1374		321		3697		460		3695	
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
Car Flow (vph)	47	11	14	121	13	64	7	988	54	63	1205	70
RTOR Reduction (vph)	0	11	0	0	21	0	0	4	0	0	4	0
Lane Group Flow (vph)	0	61	0	0	77	10	7	1038	10	63	1271	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		2		6		6	
Permitted Phases	4		8		2		2		6		6	
Actuated Green, G (s)	13.4		13.4		35.8		35.8		35.8		35.8	
Effective Green, g (s)	13.4		13.4		35.8		35.8		35.8		35.8	
Actuated g/C Ratio	0.23		0.23		0.60		0.60		0.60		0.60	
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)	313		311		194		2236		278		2234	
v/s Ratio Prot	0.04		0.13		0.02		0.28		0.14		0.34	
v/s Ratio Perm	0.04		0.13		0.02		0.28		0.14		0.34	
w/c Ratio	0.20		0.57		0.04		0.46		0.23		0.57	
Uniform Delay, d1	18.5		20.3		4.7		6.4		5.4		7.0	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.3		2.4		0.1		0.2		0.4		0.3	
Delay (s)	18.8		22.7		4.8		6.6		5.8		7.4	
Level of Service	B		C		A		A		A		A	
Approach Delay (s)	18.8		22.7		4.8		6.6		5.8		7.4	
Approach LOS	B		C		A		A		A		A	
HCM Average Control Delay	8.5		HCM Level of Service		A							
HCM Volume to Capacity ratio	0.57											
Actuated Cycle Length (s)	59.2		Sum of lost time (s)		10.0							
Intersection Capacity Utilization	62.6%		ICU Level of Service		B							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 4: Waipio Uka & Ka Uka Blvd

9/10/2009



Lane Configurations	←			←			←		←		←	
Volume (vph)	40	12	29	91	19	96	58	1031	101	64	532	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	
Lane Util. Factor	1.00			1.00			0.95		1.00		0.95	
Flt Protected	0.97			0.98			0.95		1.00		0.95	
Flt Permitted	0.81			0.82			0.44		1.00		0.20	
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
RTOR Reduction (vph)	0	17	0	0	39	0	0	9	0	0	5	0
Turn Type	Perm			Perm			Perm		Perm		Perm	
Protected Phases	4			8			2		6		6	
Permitted Phases	4			8			2		6		6	
Effective Green, g (s)	11.1			11.1			25.3		25.3		25.3	
Clearance Time (s)	5.0			5.0			5.0		5.0		5.0	
Lane Grp Cap (vph)	346			343			472		2004		211	
v/s Ratio Perm	0.04			0.12			0.07		0.17		0.15	
Uniform Delay, d1	14.0			15.2			5.1		6.9		5.7	
Incremental Delay, d2	0.2			1.1			0.1		0.4		0.8	
Level of Service	B			B			A		A		A	
Approach LOS	B			B			A		A		A	
Summary												
HCM Average Control Delay	7.9			HCM Level of Service			A					
Actuated Cycle Length (s)	46.4			Sum of lost time (s)			10.0					
Intersection Capacity Utilization	59.9%			ICU Level of Service			B					
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Waipio Uka & Ka Uka Blvd

9/10/2009



Lane Configurations	↕		↕		↖ ↗		↖ ↗		↖ ↗		↖ ↗	
Volume (vph)	94	38	34	186	26	43	41	916	92	115	1184	41
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	
Flt Protected	0.97		0.97		0.95		1.00		0.95		1.00	
Satd. Flow (prot)	1761		1752		1863		1874		1853		1707	
Flt Permitted	0.75		0.74		0.16		1.00		0.24		1.00	
Satd. Flow (perm)	1359		1345		318		3674		465		1707	
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	186	26	43	41	916	92	115	1184	41
RTOR Reduction (vph)	0	11	0	0	11	0	0	10	0	0	3	0
Lane Group Flow (vph)	0	155	0	0	196	0	41	992	0	115	1222	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		6		2		2		6		6	
Permitted Phases	4		8		2		6		6		6	
Actuated Green, G (s)	14.1		14.1		29.1		29.1		29.1		29.1	
Effective Green, g (s)	14.1		14.1		29.1		29.1		29.1		29.1	
Actuated V/C Ratio	0.27		0.27		0.55		0.55		0.55		0.55	
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)	360		356		174		2010		254		2028	
v/s Ratio Prot	0.11		0.15		0.13		0.25		0.25		0.33	
v/s Ratio Perm	0.11		0.15		0.13		0.25		0.25		0.33	
V/C Ratio	0.43		0.55		0.24		0.49		0.15		0.60	
Uniform Delay, d1	16.2		16.8		6.3		7.5		7.3		8.1	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.8		1.8		0.7		0.2		1.3		0.5	
Delay (s)	17.0		18.7		7.0		7.7		8.5		8.7	
Level of Service	B		B		A		A		A		A	
Approach Delay (s)	17.0		18.7		7.6		7.6		8.6		8.6	
Approach LOS	B		B		A		A		A		A	
Intersection Summary												
HCM Average Control Delay	9.5			HCM Level of Service			A					
HCM Volume to Capacity ratio	0.59			Sum of lost time (s)			10.0					
Actuated Cycle Length (s)	53.2			ICU Level of Service			B					
Intersection Capacity Utilization	63.3%			Analysis Period (min)			15					
Analysis Period (min)	15			Critical Lane Group								

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

9/10/2009



Lane Configurations	↙ ↑↑		↘ ↑↑		↙ ↑↑		↘ ↑↑		↕		↕	
Volume (vph)	58	861	85	199	498	8	83	12	319	8	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	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	0.95	1.00	0.95	1.00	1.00	1.00	1.00
Flt Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.99	0.99	0.99	0.99	0.99	0.99
Satd. Flow (prot)	1863	8675	1863	3717	1863	3717	1547	1547	1547	1547	1547	1547
Flt Permitted	0.95	1.00	0.95	1.00	0.95	1.00	0.93	0.93	0.93	0.93	0.93	0.93
Satd. Flow (perm)	1863	8675	1863	3717	1863	3717	1547	1547	1547	1547	1547	1547
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	861	85	199	498	8	83	12	319	8	7	7
RTOR Reduction (vph)	0	8	0	0	1	0	0	157	0	0	5	0
Lane Group Flow (vph)	58	938	0	199	505	0	0	257	0	0	12	0
Turn Type	Prot		Prot		Perm		Perm		Perm		Perm	
Protected Phases	7		4		3		8		2		2	
Permitted Phases							2				6	
Actuated Green, g (s)	6.9		24.4		10.3		27.8		16.3		16.3	
Effective Green, g (s)	6.9		24.4		10.3		27.8		16.3		16.3	
Actuated g/C Ratio	0.30		0.37		0.16		0.42		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)	195		1359		291		1566		382		411	
v/s Ratio Prot	0.00		0.26		0.07		0.14		0.17		0.01	
v/s Ratio Perm									0.17		0.01	
g/C Ratio	0.30		0.69		0.48		0.32		0.67		0.09	
Uniform Delay, d1	27.3		17.6		25.4		12.8		22.4		18.8	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.9		1.5		1.2		0.1		4.6		0.0	
Delay (s)	28.2		19.1		26.6		12.9		27.1		18.9	
Level of Service	C		B		C		B		C		B	
Approach Delay (s)			19.7				15.9		27.1		18.9	
Approach LOS			B				B		C		B	
HCM Average Control Delay			20.0				HCM Level of Service				B	
HCM Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			66.0				Sum of lost time (s)				20.0	
Intersection Capacity Utilization			76.5%				ICU Level of Service				D	
Analysis Period (min)			15									
Critical Lane Group												

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

9/10/2009

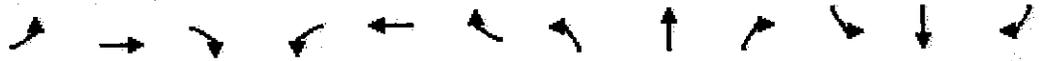


Lane Configurations	↙ ↑↑		↘ ↑↑		↕		↕					
Volume (vph)	53	849	99	191	1157	7	149	19	180	11	22	108
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total LOS time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.98	1.00	0.98	1.00	0.98	1.00
Satd Flow (prot)	1863	3667	1863	3722	1863	3722	1696	3396	1696	3396	1696	3396
Flt Permitted	0.95	1.00	0.95	1.00	0.95	1.00	0.81	0.97	0.81	0.97	0.81	0.97
Satd Flow (perm)	1863	3667	1863	3722	1863	3722	1396	2796	1396	2796	1396	2796
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	849	99	191	1157	7	149	19	180	11	22	108
RTOR Reduction (vph)	0	9	0	0	1	0	0	48	0	0	77	0
Lane Group Flow (vph)	56	989	0	191	1168	0	0	360	0	0	64	0
Turn Type	Prot		Prot		Perm		Perm					
Protected Phases	7		4		3		6					
Permitted Phases					2		6					
Actuated Green, G (s)	6.1		25.3		12.3		31.5					
Effective Green, g (s)	6.1		25.3		12.3		31.5					
Actuated g/C Ratio	0.08		0.34		0.17		0.43					
Clearance Time (s)	5.0		5.0		5.0		5.0					
Vehicle Extension (s)	5.0		5.0		5.0		5.0					
Lane Grp Cap (vph)	154		1261		311		1593					
v/s Ratio Prot	0.03		0.26		0.10		0.31					
v/s Ratio Perm					0.21		0.04					
g/C Ratio	0.34		0.74		0.61		0.73					
Uniform Delay, d1	31.9		21.3		28.4		17.5					
Progression Factor	1.00		1.00		1.00		1.00					
Incremental Delay, d2	1.3		2.4		3.6		1.8					
Delay (s)	33.2		23.7		32.0		19.3					
Level of Service	C		C		C		B					
Approach Delay (s)	24.2		21.1		31.8		19.7					
Approach LOS	C		C		C		B					
HCM Average Control Delay	23.4		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.75											
Actuated Cycle Length (s)	73.6		Sum of lost time (s)		15.0							
Intersection Capacity Utilization	80.7%		ICU Level of Service		D							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

3: Ka Uka Blvd & Kam Hwy

9/10/2009



Lane Configurations	↖	↑↑	↗	↖	←	↗↗	↖	↑↑	↗	↗↗	↑↑	↗
Volume (vph)	16	23	4	301	20	269	8	456	303	683	945	8
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	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	1785	2983	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	1785	2983	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	23	4	301	20	269	8	456	303	683	945	8
RTOR Reduction (vph)	0	0	0	0	0	123	0	0	237	0	0	9
Lane Group Flow (vph)	16	23	4	160	161	146	8	456	66	683	945	8
Turn Type	Split		Free	Split		pt+ov	Prot		Perm	Prot		Perm
Protected Phases	4	4		6	6	8.1	5	2		1	0	
Permitted Phases			Free						2			6
Actuated Green, G (s)	3.5	3.5	77.3	13.8	13.8	41.9	4.4	16.9	16.9	23.1	35.6	34.6
Effective Green, g (s)	3.5	3.5	77.3	13.8	13.8	41.9	4.4	16.9	16.9	23.1	35.6	34.6
Actuated C/D Ratio	0.05	0.05	1.00	0.18	0.18	0.54	0.06	0.22	0.22	0.30	0.46	0.45
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)	80	160	1583	316	319	1590	106	814	364	1080	1716	746
v/s Ratio Prot	0.01	0.01		0.09	0.09	0.05	0.03	0.12		0.19	0.25	
v/s Ratio Perm			0.00						0.04			0.00
v/c Ratio	0.20	0.14	0.00	0.51	0.50	0.09	0.08	0.56	0.18	0.63	0.53	0.04
Uniform Delay, d1	35.6	35.5	0.0	28.7	28.7	8.5	34.5	26.9	24.6	23.4	14.9	11.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.4	0.0	1.3	1.3	0.0	0.3	0.9	0.2	1.2	0.3	0.0
Delay (s)	36.8	35.9	0.0	30.0	29.9	8.5	34.8	27.8	24.8	24.6	15.2	11.8
Level of Service	D	D	A	C	C	A	C	C	C	C	B	B
Approach Delay (s)		32.9			20.2			26.7			19.2	
Approach LOS		C			C			C			B	
HCM Average Control Delay			21.5			HCM Level of Service	C					
HCM Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			77.3			Sum of lost time (s)	15.0					
Intersection Capacity Utilization			58.1%			ICU Level of Service	B					
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

3: Ka Uka Blvd & Kam Hwy

9/10/2009



Lane Configurations	↙	↑↑	↗	↙	←	↗	↙	↑↑	↗	↑↑	↗	↙
Volume (vph)	32	45	36	502	32	337	35	674	568	393	592	5
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost Time (s)	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	1.00
Flt Protected	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (prot)	1770	3539	1583	1770	1798	2033	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (perm)	1770	3539	1583	1770	1798	2033	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	45	36	502	32	337	35	674	568	393	592	5
RTOR Reduction (vph)	0	0	0	0	0	243	0	0	395	0	0	30
Lane Group Flow (vph)	32	45	36	291	293	594	35	614	173	393	592	27
Turn Type	Split		Free	Split		pt+ov	Prot		Perm	Prot		Perm
Protected Phases	4	4		6	8	8	5	2		1	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	5.8	5.8	97.2	24.9	24.9	46.8	6.2	29.6	29.6	16.9	40.3	40.3
Effective Green, g (s)	5.8	5.8	97.2	24.9	24.9	46.8	6.2	29.6	29.6	16.9	40.3	39.3
Actuated g/C Ratio	0.06	0.06	1.00	0.26	0.26	0.48	0.06	0.30	0.30	0.17	0.41	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)	5.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	106	211	1583	453	461	1412	119	1134	508	628	1544	674
v/s Ratio Prot	0.02	0.01		0.16	0.16	0.20	0.02	0.22		0.11	0.16	
v/s Ratio Perm			0.02						0.10			0.01
v/c Ratio	0.30	0.24	0.02	0.64	0.64	0.42	0.29	0.72	0.34	0.63	0.88	0.03
Uniform Delay, d1	43.8	43.5	0.0	32.2	32.1	16.4	43.4	30.1	26.2	37.2	19.8	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.5	0.0	3.1	2.9	0.2	1.4	2.2	0.4	2.0	0.2	0.0
Delay (s)	45.4	44.0	0.0	35.3	35.0	16.6	44.8	32.3	26.6	39.2	20.0	17.5
Level of Service	D	D	A	D	C	B	D	C	C	D	B	B
Approach Delay (s)		30.4			24.2			30.3			27.1	
Approach LOS		C			C			C			C	

HCM Average Control Delay	27.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	97.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		
o Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
 19: Waipio Uka & Kam Hwy

9/10/2009

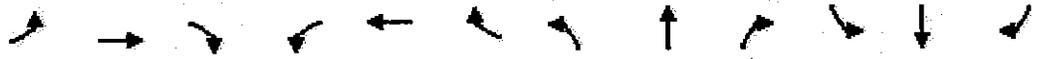


Lane Configurations	↖	↑	↗	↖↗	↔	↖	↗	↖↗	↖	↗	↖↗	↖
Volume (vph)	7	7	9	578	2	43	16	721	567	34	182	7
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (prot)	1770	1863	1863	3614	1880	1880	3725	1867	1863	3725	1667	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	1.00
Satd Flow (perm)	1770	1863	1863	3614	1880	1880	3725	1867	1863	3725	1667	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	7	9	578	2	43	16	721	567	34	182	7
RTOR Reduction (vph)	0	0	0	0	32	0	0	0	338	0	0	1
Lane Group Flow (vph)	7	7	9	578	13	6	16	721	220	34	182	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	76.9	18.8	18.8		5.3	31.0	31.0	6.2	31.9	31.9
Effective Green, g (s)	0.9	0.9	76.9	18.8	18.8		5.3	31.0	31.0	6.2	31.9	31.9
Actuated G/C Ratio	0.01	0.01	1.00	0.24	0.24		0.07	0.40	0.40	0.08	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)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	5.0
Lane Grp Cap (vph)	21	22	1583	884	411		128	1502	672	150	1545	692
v/s Ratio Prot	0.00	0.00		0.16	0.07		0.01	0.19		0.02	0.32	
v/s Ratio Perm			c0.01						0.14			0.00
v/c Ratio	0.05	0.13	0.01	0.65	0.03		0.12	0.48	0.34	0.23	0.77	0.00
Uniform Delay, d1	37.6	37.6	0.0	26.1	22.1		33.6	17.0	15.9	33.1	19.3	13.2
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	0.9	4.0	0.0	1.7	0.0		0.4	0.2	0.3	0.8	2.3	0.0
Delay (s)	38.5	41.6	0.0	27.8	22.1		34.0	17.2	16.2	33.9	21.6	13.2
Level of Service	D	D	A	C	C		C	B	B	C	C	B
Approach Delay (s)		19.6			27.5			17.6			21.9	
Approach LOS		B			C			B			C	
ICU Summary												
HCM Average Control Delay			20.9	HCM Level of Service				C				
HCM Volume to Capacity ratio			0.62									
Actuated Cycle Length (s)			76.9	Sum of lost time (s)				15.0				
Intersection Capacity Utilization			61.7%	ICU Level of Service				B				
Analysis Period (min)			15									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

19: Waipio Uka & Kam Hwy

9/10/2009



Lane Configurations	↙	↑	↗	↖	→	↘	↙	↑↑	↗	↖	↑↑	↗
Volume (vph)	7	16	41	618	17	57	84	1352	833	51	1064	14
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
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	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flow (vph)	1663	1663	1583	3614	1734	1663	3725	1567	1663	3725	1567	1663
Flow Protected	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95
Flow Permitted	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95
Flow (perm)	1770	1863	1583	3614	1734	1863	3725	1567	1863	3725	1567	1863
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	57	84	1352	833	51	1064	14
RTOR Reduction (vph)	0	0	0	0	44	0	0	0	360	0	0	8
Lane Group Flow (vph)	7	16	41	618	30	30	84	1352	473	51	1064	6
Turn Type	Split		Free	Split			Prot		Perm	Prot		Perm
Protected Phases	4	1		6	6		5	2		1	6	6
Permitted Phases			Free						2			6
Actuated Green, g (s)	2.5	2.5	95.3	21.8	21.8		9.2	44.9	44.9	6.1	41.8	41.8
Effective Green, g (s)	2.5	2.5	95.3	21.8	21.8		9.2	44.9	44.9	6.1	41.8	41.8
Actuated v/c Ratio	0.03	0.03	1.00	0.23	0.23		0.18	0.47	0.47	0.06	0.44	0.44
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)	46	49	1583	827	397		180	1755	785	119	1634	731
v/c Ratio Prot	0.00	0.01		0.17	0.02		0.05	0.36		0.03	0.28	
v/s Ratio Perm			0.03						0.28			0.00
v/c Ratio	0.15	0.03	0.05	0.75	0.08		0.47	0.77	0.50	0.48	0.65	0.31
Uniform Delay, d1	45.4	45.6	0.0	34.2	28.8		40.7	20.9	18.6	42.9	21.0	15.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	3.9	0.0	3.7	0.1		1.9	2.2	1.3	2.5	0.9	0.0
Delay (s)	46.9	49.4	0.0	37.9	28.9		42.6	23.1	19.9	45.4	22.0	15.1
Level of Service	D	D	A	D	C		D	C	B	D	C	B
Approach Delay (s)		17.5		36.8			22.6			22.9		
Approach LOS		B		D			C			C		
HCM Average Control Delay			25.0			HCM Level of Service		C				
HCM Volume to Capacity ratio	0.74											
Actuated Cycle Length (s)			95.3			Sum of lost time (s)		20.0				
Intersection Capacity Utilization			74.8%			ICU Level of Service		D				
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

16: Lumiaina St & Kam Hwy

9/10/2009



Lane Configurations	↖	←	↗	↖	↑	↗	↖	↑↑	↗	↖	↑↑	↗	
Volume (vph)	494	17	99	64	73	39	46	75	39	17	160	593	
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	
Imp. per/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	
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	1780	1667	1770	1765		1663	1725	1667	1663	1725	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	1780	1667	1770	1765		1663	1725	1667	1663	1725	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)	494	17	99	64	73	39	46	75	39	17	160	593	
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	23	0	0	0	
Lane Group Flow (vph)	257	254	99	64	96	0	46	75	16	17	160	593	
Confl. Peds. (#/hr)	39												
Turn Type	Split	Free	Free	Split	Free	Prot	Perm	Prot	Free	Free	Free	Free	
Protected Phases	4	4		8	8	5	2		1	6			
Permitted Phases			Free									Free	
Actuated Green, G (s)	19.6	19.6	94.4	10.8	10.8	7.3	38.8	38.8	5.2	36.7	94.4	94.4	
Effective Green, g (s)	19.6	19.6	94.4	10.8	10.8	7.3	38.8	38.8	5.2	36.7	94.4	94.4	
Actuated g/C Ratio	0.21	0.21	1.00	0.11	0.11	0.08	0.41	0.41	0.06	0.39	1.00	1.00	
Clearance Time (s)	5.0	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	3.0	
Lane Group Cap (vph)	368	370	1667	286	202	144	153	685	103	1448	1667	1667	
v/s Ratio Prot	c0.15	0.14		0.04	0.05	0.02	0.21		0.01	c0.31			
v/s Ratio Perm			0.06								0.26		
v/c Ratio	0.70	0.69	0.06	0.32	0.48	0.32	0.51	0.02	0.17	0.80	0.36	0.36	
Uniform Delay, d1	64.7	34.6	0.0	38.4	39.1	41.2	20.7	16.5	42.5	25.6	0.0	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	1.00	
Incremental Delay, d2	5.7	5.2	0.1	0.9	1.8	1.3	0.3	0.0	0.8	3.3	0.0	0.0	
Delay (s)	40.4	39.8	0.1	39.3	40.9	42.5	20.9	16.5	43.3	28.9	0.6	0.6	
Level of Service	D	D	A	D	D	D	C	B	B	C	A	A	
Approach Delay (s)	33.9		40.3			21.9			19.6				
Approach LOS	C		D			C			B				
HCM Average Control Delay	25.8					HCM Level of Service							C
HCM Volume to Capacity ratio	0.63												
Actuated Cycle Length (s)	94.4					Sum of lost time (s)							18.0
Intersection Capacity Utilization	64.7%					ICU Level of Service							C
Analysis Period (min)	15												

c Critical Lane Group

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

9/10/2009



Lane Configurations	↖	↗	↖	↗	↖	↗	↖	↗	↖	↗	↖	↗
Volume (vph)	392	31	134	24	31	51	176	1701	105	28	986	709
Ideal Flow (vphpl)	2000	2000	2000	1900	1900	1900	2000	2000	2000	2000	2000	2000
satd Flow (satd)	5.0	5.0	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
satd Flow (prot)	1770	1783	1667	1770	1689	1863	3725	1667	1863	3725	1667	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	1.00
satd Flow (parr)	1770	1783	1667	1770	1689	1863	3725	1667	1863	3725	1667	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)	392	31	134	24	31	51	176	1701	105	28	986	709
RTOR Reduction (vph)	0	0	0	0	48	0	0	0	37	0	0	0
Lane Group Flow (vph)	282	281	134	24	31	0	176	1701	63	28	986	709
Confl. Peds. (#/hr)	39											
Turn Type	Split		Free		Split		Prot		Permi		Free	
Protected Phases	4	4			8	8	5	2			1	6
Permitted Phases			Free						2		Free	
Actuated Green, G (s)	20.6	20.6	104.9	6.4	6.4	14.9	53.8	53.8	4.1	43.0	104.9	104.9
Effective Green, g (s)	20.6	20.6	104.9	6.4	6.4	14.9	53.8	53.8	4.1	43.0	104.9	104.9
Actuated g/C Ratio	0.20	0.20	1.00	0.06	0.06	0.14	0.51	0.51	0.04	0.41	1.00	1.00
Clearance (Time)	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 (veh)	346	350	1667	196	103	255	1910	855	73	1527	1667	1667
v/s Ratio Prot	c0.16	0.16	0.01		0.02		c0.09	c0.46	0.02		0.26	
v/s Ratio Perm			0.08						0.01		c0.43	
v/c Ratio	0.81	0.80	0.08	0.22	0.33	0.66	0.89	0.08	0.38	0.65	0.43	0.43
Uniform Delay, d1	40.3	40.2	0.9	46.9	47.2	40.6	22.9	13.0	49.2	24.0	0.0	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	1.00
Incremental Delay, d2	13.3	12.5	0.1	1.0	1.9	6.1	5.7	0.0	3.3	0.9	0.8	0.8
Delay (s)	53.6	52.7	0.1	47.9	49.1	48.8	28.6	13.0	52.5	25.8	0.8	0.8
Level of Service	D	D	A	D	D	D	C	B	B	C	A	A
Approach Delay (s)	42.9		48.8		29.5		15.9					
Approach LOS	D		D		C		B					
HCM Volume to Capacity ratio 0.82 Intersection Capacity Utilization 81.9% LOS Level of Service D												

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

30: Lumiauau St & Kam Hwy

9/10/2009



Lane Configurations	↖	↗	↘	↙	↕	↖	↗	↘	↙	↕	↖	
Volume (vph)	17	12	321	173	12	14	30	727	55	3	1308	11
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	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00			1.00	0.95	1.00	1.00	0.95	1.00
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)	1254	1583	1266	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)	17	12	321	173	12	14	30	727	55	3	1308	11
RTOR Reduction (vph)	0	0	78	0	11	0	0	0	27	0	0	6
Lane Group Flow (vph)	0	120	243	173	15	0	30	727	28	3	1308	8
Turn Type	Perm	Perm	Perm				Prot	Perm	Prot		Perm	
Protected Phases		4		8			5	2		1	6	
Permitted Phases	4		4	8					2			6
Actuated Green, G (s)	18.3	18.3	18.3	18.3			6.2	40.0	40.0	4.3	38.1	38.1
Effective Green, g (s)	18.3	18.3	18.3	18.3			6.2	40.0	40.0	4.3	38.1	38.1
Actuated g/C Ratio	0.24	0.24	0.24	0.24			0.68	0.52	0.52	0.66	0.49	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)	319	373	296	404			149	1920	859	103	1829	818
v/s Ratio Prot				0.01			0.02	0.20		0.00	0.35	
v/s Ratio Perm	0.10	0.15	0.14						0.02			0.00
v/c Ratio	0.40	0.35	0.58	0.04			0.26	0.38	0.43	0.03	0.72	0.01
Uniform Delay, d1	25.0	26.8	26.3	22.9			33.4	11.3	9.3	34.7	15.5	10.1
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	4.0	2.9	0.0			0.7	0.1	0.0	0.1	1.4	0.0
Delay (s)	25.8	30.8	29.2	22.9			34.1	11.4	9.3	34.8	16.8	10.1
Level of Service	C	C	C	C			C	B	A	C	B	B
Approach Delay (s)	29.4			28.4				12.1			16.8	
Approach LOS	C			C				B			B	
HCM Average Control Delay	18.3		HCM Level of Service		B							
HCM Volume to Capacity ratio	0.65											
Actuated Cycle Length (s)	77.6		Sum of lost time (s)		15.0							
Intersection Capacity Utilization	76.3%		ICU Level of Service		D							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 30: Lumiauau St & Kam Hwy

9/10/2009



Lane Configurations	←	↖	↗	→	↖	↗	↑↑	↖	↗	↑↑	↖	
Volume (vph)	22	6	69	63	8	10	158	1960	171	11	109	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	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
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	1880	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)	1416	1563	1377	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)	22	6	69	63	8	10	158	1960	171	11	109	28
RTOR Reduction (vph)	0	0	63	0	9	0	0	0	52	0	0	11
Lane Group Flow (vph)	0	28	6	63	9	0	158	1960	119	11	109	17
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases	4						5			1		6
Permitted Phases	4		4	8					2			6
Actuated Green (s)	8.1		8.1	8.1			13.9	64.0	64.0	4.5		54.6
Effective Green, g (s)	8.1		8.1	8.1			13.9	64.0	64.0	4.5		54.6
Actuated g/C Ratio	0.09		0.09	0.09			0.15	0.70	0.70	0.05		0.69
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)	125		140	122	151		283	2603	1165	92		2220
v/s Ratio Prot				0.01			0.08	0.65		0.01		0.80
v/s Ratio Perm	0.02		0.00	0.05					0.07			0.01
v/C Ratio	0.22		0.03	0.52	0.06		0.56	0.75	0.10	0.12		0.50
Uniform Delay, d1	38.8		38.2	39.9	38.3		36.0	8.8	4.5	41.7		10.6
Progression Factor	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00		1.00
Incremental Delay, d2	0.9		0.1	3.7	0.2		2.4	1.3	0.0	0.6		0.2
Delay	39.7		38.3	43.6	38.4		38.4	10.0	4.5	42.2		10.8
Level of Service	D		D	D	D		D	B	A	D		B
Approach Delay (s)	38.7			42.4			11.6			11.0		
Approach LOS	D			D			B			B		
HCM Average Control Delay	12.8		HCM Level of Service		B							
HCM Volume to Capacity ratio	0.73											
Actuated Cycle Length (s)	91.6		Sum of lost time (s)		15.0							
Intersection Capacity Utilization	77.3%		ICU Level of Service		D							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 52: Waipahu St & Kam Hwy

9/10/2009



Lane Configurations	↙	↗	↘	↑↑	↑↑	↖
Volume (vph)	119	618	139	692	1729	90
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Sat. 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
Flt Protected	1.00	0.85	1.00	1.00	1.00	0.85
Sat. Flow (prot)	1863	1667	1863	3725	3725	1667
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Sat. Flow (perm)	1863	1667	1863	3725	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Vol. Flow (vph)	119	618	139	692	1729	90
RTOR Reduction (vph)	0	49	0	0	0	38
Lane Grp Flow (vph)	119	669	139	692	1729	32
Turn Type	pm+ov		Prot	Perm		
Protected Phases	4	5	5	2	6	
Permitted Phases	4			6		
Actuated Green, g (s)	12.1	38.0	25.9	88.3	57.4	57.4
Effective Green, g (s)	12.1	38.0	25.9	88.3	57.4	57.4
Actuated Q/C Ratio	0.31	0.24	0.23	0.80	0.52	0.52
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	649	437	2979	1937	867
v/s Ratio Prot	0.06	0.21	0.07	0.19	0.16	
v/s Ratio Perm	0.14		0.03			
v/s Ratio	0.58	0.88	0.82	0.26	0.89	0.06
Uniform Delay, d1	46.8	34.0	34.9	2.7	23.7	13.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.2	12.7	0.4	0.0	5.7	0.0
Delay (s)	51.0	46.7	35.4	2.8	29.4	13.2
Level of Service	D	D	D	A	C	B
Approach Delay (s)	47.4		28.6			
Approach LOS	D		A C			
Summary						
HCM Average Control Delay	27.7		HCM Level of Service		C	
HCM Volume to Capacity ratio	0.89					
Actuated Cycle Length (s)	110.4		Sum of lost time (s)		10.0	
Intersection Capacity Utilization	90.1%		ICU Level of Service		E	
Analysis Period (min)	15					
Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
 52: Waipahu St & Kam Hwy

9/10/2009



Lane Configurations	↖	↗	←	↑↑	↑↑	↘
Volume (vph)	256	456	292	2097	1059	181
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
Prot	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)	256	456	292	2097	1059	181
RTOR Reduction (vph)	0	20	0	0	0	104
Lane Group Flow (vph)	256	456	292	2097	1059	77
Tum Type		pm+ov	Prot			Perm
Protected Phases	4	5	5	2	5	
Permitted Phases		4				6
Actuated Green, g (s)	18.7	39.7	21.0	66.1	40.1	40.1
Effective Green, g (s)	18.7	39.7	21.0	66.1	40.1	40.1
Actuated g/C Ratio	0.40	0.42	0.22	0.70	0.42	0.42
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extensions	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	367	786	413	2597	1576	705
v/s Ratio Prot	0.14	0.12	0.16	0.55	0.28	
v/s Ratio Perm		0.14				0.05
v/s Ratio	0.70	0.55	0.71	0.78	0.67	0.11
Uniform Delay, d1	35.4	20.9	34.1	9.6	22.0	16.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.7	0.9	5.5	1.6	1.1	0.1
Delay (s)	41.1	21.7	39.5	11.2	23.2	16.6
Level of Service	D	C	D	B	C	B
Approach Delay (s)	28.7			14.8	22.2	
Approach LOS	C			B	C	
HCM Average Control Delay			19.2	HCM Level of Service		B
HCM Volume to Capacity Ratio			0.76			
Actuated Cycle Length (s)			94.8	Sum of lost time (s)	10.0	
Intersection Capacity Utilization			75.3%	ICU Level of Service	D	
Analysis Period (min)	15					
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	3778	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	1511	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	375	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)	3778	1511	375	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1049	420	104	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	4240		1696		421	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.260 Using Equation 0
 FD
 $v = v + (v - v) P = 2357$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	4240	9400	No
Fi F			
v = v - v	2544	9400	No
FO F R			
v	1696	3800	No
R			
v v	941 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is v v > 2700 pc/h?		No	
3 or av34			
Is v v > 1.5 v /2		No	
3 or av34 12			
If yes, v = 2357		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2357	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 10.1$ pc/mi/ln
 R 12 D
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D = 0.581	
	S	
Space mean speed in ramp influence area,	S = 51.6	mph
	R	
Space mean speed in outer lanes,	S = 71.3	mph
	0	
Space mean speed for all vehicles,	S = 58.9	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone:
E-mail:

Fax:

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	7350	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	3994	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	621	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)	7350	3994	621	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2042	1109	173	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	8412		4482		697	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v = v + (v - v) P = 5504$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	8412	9400	No
$v = v - v$	3930	9400	No
v	4482	3800	Yes
v	1454 pc/h	(Equation 25-15 or 25-16)	
Is $v > 2700$ pc/h?		No	
Is $v > 1.5 v / 2$		No	
If yes, $v = 5504$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	5504	4400	Yes

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 37.2$ pc/mi/ln
 R 12 D
 Level of service for ramp-freeway junction areas of influence F

Speed Estimation

Intermediate speed variable,	D = 0.831	
Space mean speed in ramp influence area,	S = 45.9	mph
Space mean speed in outer lanes,	S = 69.5	mph
Space mean speed for all vehicles,	S = 52.0	mph

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	421	1696 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 $P = 0.165$ Using Equation 4
 $v_{12} = v_{FM} (P) = 428$ pc/h
 $v_{12} = 428$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	3015	9400	No
$v_{3 \text{ or } av34}$	1083 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		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, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 7.2$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	$M = 0.233$	
Space mean speed in ramp influence area,	$S_R = 59.6$	mph
Space mean speed in outer lanes,	$S_0 = 64.0$	mph
Space mean speed for all vehicles,	$S = 61.8$	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: PM Peak
 Freeway/Dir of Travel: H-2 Fwy NB On Ramp Loop (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	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	621	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	3994	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3356	621	3994	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	932	173	1109	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	697	4482 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.131 Using Equation 4
 FM
 $v_{12} = v_F \cdot P_{FM} = 502 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	4538	9400	No
FO			
v	1669 pc/h	(Equation 25-4 or 25-5)	
Is v > 2700 pc/h?		No	
Is v > 1.5 v / 2		Yes	
If yes, v = 1536		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1536	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 13.2 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.252	
Space mean speed in ramp influence area,	S = 59.2	mph
Space mean speed in outer lanes,	S = 62.7	mph
Space mean speed for all vehicles,	S = 60.9	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	2642	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	194	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	375	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1700	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2642	194	375	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	734	54	104	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	3024	218	421	pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.191 Using Equation 4
 FM
 $v = v_{12} (P_{FM}) = 576 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	3242	9400	No
FO			
v	1224 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 1209		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1209	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 12.1 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.288	
Space mean speed in ramp influence area,	S = 58.4	mph
Space mean speed in outer lanes,	S = 63.5	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 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	3977	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	444	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	621	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1700	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3977	444	621	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1105	123	173	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	4551	498	697

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.156 Using Equation 4
 FM
 $v = v_{12} (P_{FM}) = 708 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	5049	9400	No
FO			
v	1921 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 1820		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1820	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 18.9 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.312	
Space mean speed in ramp influence area,	S = 57.8	mph
Space mean speed in outer lanes,	S = 61.9	mph
Space mean speed for all vehicles,	S = 60.0	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone:
E-mail:

Fax:

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	4037	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	501	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	1274	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4037	501	1274	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1121	139	354	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	4620		562		1430	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.436 Using Equation 8
 FD
 $v_{12} = v_R + (v_F - v_R) P = 2331 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	4620	9400	No
$v_{FO} = v_F - v_R$	4058	9400	No
v_R	562	2000	No
$v_{3 \text{ or } av34}$	1144 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2331$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2331	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 22.9 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D = 0.479	
Space mean speed in ramp influence area,	S = 54.0	mph
Space mean speed in outer lanes,	S = 70.7	mph
Space mean speed for all vehicles,	S = 61.2	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: 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	3191	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	792	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	1470	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3191	792	1470	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	886	220	408	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	3652		889		1650	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.436 Using Equation 8
 FD
 $v = v + (v - v) P = 2094$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	3652	9400	No
$F_i F$			
$v = v - v$	2763	9400	No
$F_O F R$			
v	889	2000	No
R			
$v v$	779 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is $v v > 2700$ pc/h?		No	
3 or av34			
Is $v v > 1.5 v / 2$		No	
3 or av34 12			
If yes, $v = 2094$		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2094	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v}{12} - 0.009 \frac{L}{D} = 20.9$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D = 0.508	
	S	
Space mean speed in ramp influence area,	S = 53.3	mph
	R	
Space mean speed in outer lanes,	S = 71.3	mph
	O	
Space mean speed for all vehicles,	S = 59.7	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone:
E-mail:

Fax:

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 Loop (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	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	1274	vph	
Length of first accel/decel lane	650	ft	
Length of second accel/decel lane		ft	

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes		
Volume on adjacent Ramp	501	vph	
Position of adjacent Ramp	Upstream		
Type of adjacent Ramp	Off		
Distance to adjacent Ramp	1900	ft	

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3536	1274	501	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	982	354	139	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	1430	562 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.039 Using Equation 4
 FM
 $v_{12} = v_F \cdot P_{FM} = 158 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	5477	9400	No
FO			
v	1944 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is 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, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 24.5 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.358	
	S	
Space mean speed in ramp influence area,	S = 56.8	mph
	R	
Space mean speed in outer lanes,	S = 62.4	mph
	0	
Space mean speed for all vehicles,	S = 59.2	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 SB On Ramp Loop (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	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	1470	vph
Length of first accel/decel lane	650	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	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2399	1470	792	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	666	408	220	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	1650	889	pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.012 Using Equation 4
 FM
 $v_{12} = v_F \cdot P_{FM} = 32 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	4396	9400	No
FO			
v	1357 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v ₁₂ / 2		Yes	
3 or av34	12		
If yes, v = 1098		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1098	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 \frac{v}{R} + 0.0078 \frac{v}{12} - 0.00627 \frac{L}{A} = 22.1 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.336	
Space mean speed in ramp influence area,	S _R = 57.3	mph
Space mean speed in outer lanes,	S _O = 63.8	mph
Space mean speed for all vehicles,	S = 59.6	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	4768	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	1007	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	1232	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4768	1007	1232	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1324	280	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	5457	1130	1383 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.077 Using Equation 4
 FM
 $v_{12} = v_F \cdot P_{FM} = 418 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	6587	9400	No
FO			
v	2519 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v ₁₂ / 2		Yes	
3 or av34			
If yes, v _{12A} = 2182		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	2182	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 25.6 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.371	
Space mean speed in ramp influence area,	S _R = 56.5	mph
Space mean speed in outer lanes,	S ₀ = 60.9	mph
Space mean speed for all vehicles,	S = 58.6	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	3849	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	798	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	1450	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3849	798	1450	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1069	222	403	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	4405	896	1627 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.106$ Using Equation 4
 FM
 $v_{12} = v_{12} \cdot (P_{12}) = 466$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	5301	9400	No
FO			
v v	1969 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 = 1762		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

v	Actual	Max Desirable	Violation?
12A	1762	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 20.7$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.319	
Space mean speed in ramp influence area,	S = 57.7	mph
Space mean speed in outer lanes,	S = 62.0	mph
Space mean speed for all vehicles,	S = 59.8	mph

HCS+: Basic Freeway Segments Release 5.4

Phone:
E-mail:

Fax:

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	5775	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1604	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	1652	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	1652	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	67.9	mi/h
Number of lanes, N	4	
Density, D	24.3	pc/mi/ln
Level of service, LOS	C	

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	4647	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1291	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	1330	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	1330	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	19.4	pc/mi/ln
Level of service, LOS	C	

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	4810	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	1467	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	1274	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4810	1467	1274	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1336	408	354	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	5505	1646	1430 pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 25-2 or 25-3)}$$

$$EQ$$

$$P = 0.012 \text{ Using Equation 4}$$

$$FM$$

$$v = v (P) = 66 \text{ pc/h}$$

$$12 \quad F \quad FM$$

Capacity Checks

	Actual	Maximum	LOS F?
v	7151	9400	No
FO			
v	2719 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		Yes	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 2202		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	2202	4600	No
12A			

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.6 \text{ pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M = 0.447	
	S	
Space mean speed in ramp influence area,	S = 54.7	mph
	R	
Space mean speed in outer lanes,	S = 60.9	mph
	0	
Space mean speed for all vehicles,	S = 57.4	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: 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	3869	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	1404	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	1470	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3869	1404	1470	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1075	390	408	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	4428	1576	1650 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.021 Using Equation 4
 FM
 $v_{12} = v_F (P_{FM}) = 92 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6004	9400	No
$v_{3 \text{ or } av34}$	2168 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		Yes	
If yes, $v_{12A} = 1771$		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1771	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 25.7 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.374	
Space mean speed in ramp influence area,	S _R = 56.4	mph
Space mean speed in outer lanes,	S _O = 62.0	mph
Space mean speed for all vehicles,	S _A = 58.7	mph

Phone:
E-mail:

Fax:

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	6277	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1744	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	1796	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, flD	0.0	mi/h
Number of lanes adjustment, flN	1.5	mi/h
Free-flow speed, FFS	68.5	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1796	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	66.7	mi/h
Number of lanes, N	4	
Density, D	26.9	pc/mi/ln
Level of service, LOS	D	

HCS+: Basic Freeway Segments Release 5.4

Phone:
E-mail:

Fax:

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	5273	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1465	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	1509	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	1509	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	68.4	mi/h
Number of lanes, N	4	
Density, D	22.1	pc/mi/ln
Level of service, LOS	C	

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	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4810	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	1467	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	1274	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4810	1467	1274	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1336	408	354	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	5505	1646	1430 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.012 Using Equation 4
 FM
 $v_{12} = v_F (P_{FM}) = 50 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	5830	9400	No
FO			
v	2067 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 1673		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1673	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 25.5 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.371	
Space mean speed in ramp influence area,	S = 56.5	mph
Space mean speed in outer lanes,	S = 62.3	mph
Space mean speed for all vehicles,	S = 58.8	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: 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	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3869	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	1404	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	1470	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3869	1404	1470	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1075	390	408	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	4428	1576	1650 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.021 Using Equation 4
 FM
 $v_{12} = v_{F} (P_{FM}) = 72 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	5030	9400	No
FO			
v	1691 pc/h	(Equation 25-4 or 25-5)	
Is v > 2700 pc/h?			No
Is v > 1.5 v / 2			Yes
If yes, v = 1381		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1381	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 22.7 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.339	
Space mean speed in ramp influence area,	S = 57.2	mph
Space mean speed in outer lanes,	S = 63.1	mph
Space mean speed for all vehicles,	S = 59.5	mph

Phone:
E-mail:

Fax:

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	3778	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1049	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	1081	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	1081	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	15.8	pc/mi/ln
Level of service, LOS	B	

Phone:
E-mail:

Fax:

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	7350	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2042	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	2103	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	2103	pc/h/ln
Free-flow speed, FFS	68.5	mi/h
Average passenger-car speed, S	61.7	mi/h
Number of lanes, N	4	
Density, D	34.1	pc/mi/ln
Level of service, LOS	D	

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	2836	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	788	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	811	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	811	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	11.8	pc/mi/ln
Level of service, LOS	B	

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	4421	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1228	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	1265	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	1265	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	18.5	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 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	6277	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1744	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	1197	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	6	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1197	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	17.1	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 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	5273	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1465	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	1006	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	6	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1006	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	14.4	pc/mi/ln
Level of service, LOS	B	

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	4037	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1121	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	1155	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	1155	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	16.9	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	3191	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	886	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	913	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	913	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	

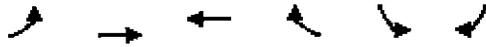
APPENDIX J

**CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2016 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT
KOA RIDGE MAKAI AND WAIAWA DEVELOPMENTS
(WITH ADDITIONAL IMPROVEMENTS)**

HCM Signalized Intersection Capacity Analysis

25: Ka Uka Blvd &

5/13/2010



Lane Configurations	TT	TT	TTT	TT	TT	TT
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	0.97	0.95	0.91			0.88
Frt	1.00	1.00	0.98			0.85
Frt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3614	3725	5256			2933
Frt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3614	3725	5256			2933
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
RTOR Restriction (vph)	0	0	0	0	0	0
Turn Type	Prot					Over
Protected Phases	7	4	8			7
Permitted Phases						
Actuated Green, G (s)	23.3	64.6	31.3			23.3
Effective Green, g (s)	23.3	64.6	31.3			23.3
Actuated g/C Ratio	0.36	1.00	0.48			0.36
Clearance Time (s)	5.0	5.0	5.0			5.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	1304	3725	2547			1058
v/s Ratio Prot	0.10	0.05	0.30			0.24
v/s Ratio Perm						
v/c Ratio	0.29	0.05	0.62			0.65
Uniform Delay, d1	14.7	0.0	12.3			17.3
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.1	0.0	0.5			1.5
Delay (s)	14.9	0.0	12.8			18.7
Level of Service	B	A	B			B
Approach Delay (s)		10.0	12.8		18.7	
Approach LOS		A	B		B	
Intersection Summary						
HCM Average Control Delay		14.0		HCM Level of Service		B
HCM Volume to Capacity ratio		0.64				
Actuated Cycle Length (s)		64.6		Sum of lost time (s)		10.0
Intersection Capacity Utilization		67.8%		ICU Level of Service		C
Analysis Period (min)		15				
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

25: Ka Uka Blvd &

5/13/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖↗	↑↑	↑↑↔			↖↗
Volume (vph)	621	543	1644	444	0	1912
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	0.97	0.95	0.91			0.88
Flt	1.00	1.00	0.97			0.85
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3614	3725	5182			2933
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3614	3725	5182			2933
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	621	543	1644	444	0	1912
RTOR Reduction (vph)	0	0	49	0	0	490
Lane Group Flow (vph)	621	543	2039	0	0	1422
Turn Type	Split			Over		
Protected Phases	4	4	8			4
Permitted Phases						
Actuated Green, G (s)	51.0	51.0	39.0			51.0
Effective Green, g (s)	51.0	51.0	39.0			51.0
Actuated g/C Ratio	0.51	0.51	0.39			0.51
Clearance Time (s)	5.0	5.0	5.0			5.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	1843	1900	2021			1496
v/s Ratio Prot	0.17	0.15	0.39			0.48
v/s Ratio Perm						
v/c Ratio	0.34	0.29	1.01			0.95
Uniform Delay, d1	14.5	14.1	30.5			23.3
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.1	0.1	22.2			13.3
Delay (s)	14.6	14.1	52.7			36.6
Level of Service	B	B	D			D
Approach Delay (s)		14.4	52.7		36.6	
Approach LOS		B	D		D	

Intersection Summary			
HCM Average Control Delay	38.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	111.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
 5: Ka Uka Blvd & H-2 Off (SB)

9/10/2009



Lane Configurations	↑↑↑			↖ ↗		↑↑↑		↖		↗		↑		↖	
Volume (vph)	0	1579	54	180	833	0	29	0	239	0	380	99	158	244	
Ideal Flow (vphpl)	2000	2000	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		5.0		5.0	
Lane Util. Factor	0.91			0.97		0.91		1.00		1.00		0.97		1.00	
Flt Protected	1.00			0.95		1.00		0.95		1.00		0.95		1.00	
Satd. Flow (prot)	5326			3614		5353		1863		1667		3614		1961	
Flt Permitted	1.00			0.95		1.00		0.95		1.00		0.95		1.00	
Satd. Flow (perm)	5326			3614		5353		1863		1667		3614		1961	
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	1.00	1.00	
Adj. Flow (vph)	0	1579	54	180	833	0	29	0	239	0	380	99	158	244	
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	0	91	0	0	0	143	
Lane Group Flow (vph)	0	1629	0	180	833	0	29	0	239	99	158	0	0	0	
Turn Type	Prot			Prot		Prot		custom		Prot		Perm		Perm	
Protected Phases	4			6		6		2		7		6		6	
Permitted Phases								3						6	
Actuated Green, G (s)	31.5			8.7		48.2		2.6		22.3		4.4		17.4	
Effective Green, g (s)	34.5			8.7		48.2		2.6		22.3		4.4		17.4	
Actuated v/c Ratio	0.41			0.10		0.56		0.03		0.27		0.05		0.20	
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)	2208			378		3101		58		567		191		410	
v/s Ratio Prot	0.34			0.05		0.16		0.02		0.07		0.03		0.08	
v/s Ratio Perm										0.07				0.06	
v/c Ratio	0.74			0.48		0.27		0.50		0.42		0.52		0.39	
Uniform Delay, d1	20.5			35.1		8.7		39.7		25.1		38.4		28.3	
Progression Factor	1.00			1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	1.3			0.9		0.0		6.6		0.5		2.4		0.6	
Delay (s)	21.9			36.1		8.7		46.3		25.6		40.7		28.9	
Level of Service	C			D		A		D		C		D		C	
Approach Delay (s)	21.9			36.1		8.7		46.3		25.6		40.7		28.9	
Approach LOS	C			B		C		C		C		C		C	

HCM Average Control Delay	21.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	83.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.2%	IGD 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)

9/10/2009



Lane Configurations	↑↑↑		↙ ↘		↑↑↑		↙ ↘		↑		↙ ↘	
Volume (vph)	0	1740	77	298	1795	0	81	0	525	397	192	293
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		5.0	
Lane Util. Factor	0.91		0.97		0.91		1.00		1.00		0.97	
Flt	0.99		1.00		1.00		1.00		0.85		1.00	
Flt Protected	1.00		0.95		1.00		0.95		1.00		0.95	
Satd. Flow (prot)	5318		3614		5353		1863		1667		3614	
Flt Permitted	1.00		0.95		1.00		0.95		1.00		0.95	
Satd. Flow (perm)	5318		3614		5353		1863		1667		3614	
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	1740	77	298	1795	0	81	0	525	397	192	293
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	136	0	0	32
Lane Grp Flow (vph)	0	1783	0	298	1795	0	81	0	390	397	192	261
Turn Type	Prot			Prot			custom		Prot		Prot	
Protected Phases	4		3		8		5		2		1	
Permitted Phases	3											
Actuated Green, G (s)	41.6		12.9		59.5		6.9		37.9		13.1	
Effective Green, g (s)	41.6		12.9		59.5		6.9		35.9		13.1	
Actuated G/C Ratio	0.37		0.11		0.53		0.06		0.32		0.12	
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)	1965		414		2829		114		620		420	
v/s Ratio Prot	0.34		0.06		0.34		0.04		0.16		0.08	
v/s Ratio Perm	0.10											
v/c Ratio	0.91		0.72		0.63		0.71		0.63		0.73	
Uniform Delay, d1	33.7		48.1		18.8		51.9		32.7		48.0	
Progression Factor	1.00											
Incremental Delay, d2	6.5		5.9		0.5		18.8		2.0		6.4	
Delay (s)	40.2		54.0		19.3		70.6		34.7		54.5	
Level of Service	D		D		B		E		C		D	
Approach Delay (s)	40.2		24.2				39.5		43.1			
Approach LOS	D		C				D		D			
HCM Average Control Delay	34.2		HCM Level of Service				C					
HCM Volume to Capacity ratio	0.81											
Actuated Cycle Length (s)	112.6		Sum of lost time (s)				21.0					
Intersection Capacity Utilization	85.6%		ICU Level of Service				E					
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Ka Uka Blvd & Spine Rd

9/10/2009



Lane Configurations	↖	↕	↗	↖	↕	↗	↖	↕	↗	↖	↕	↗
Volume (vph)	94	959	73	150	609	344	0	0	142	532	0	145
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Los/time (s)	5.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.86	1.00	0.85	1.00
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (prot)	1863	3686	1863	3725	1667	1667	1611	1611	3433	1583	1583	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (perm)	1863	3686	1863	3725	1667	1667	1611	1611	3433	1583	1583	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)	94	959	73	150	609	344	0	0	142	532	0	145
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	0	0	110	0
Lane Grp Flow (vph)	94	1026	0	150	609	344	0	0	142	532	35	0
Turn Type	Prot		Prot		Free		Free		Free	Prot		
Protected Phases	7	4	3	8						1	6	
Permitted Phases					Free		Free		Free			
Actuated Green, G (s)	9.0	27.7	10.5	30.2	71.5	71.5	71.5	71.5	17.3	17.3	17.3	17.3
Effective Green, g (s)	9.0	26.7	10.5	29.2	71.5	71.5	71.5	71.5	17.3	17.3	17.3	17.3
Actuated v/c Ratio	0.13	0.37	0.15	0.41	1.00	1.00	1.00	1.00	0.24	0.24	0.24	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)	235	1376	274	1521	1667	1667	1611	831	383	383		
v/s Ratio Prot	0.05	0.28	0.08	0.15					0.15	0.02		
v/s Ratio Perm					c0.21		0.09					
v/c Ratio	0.40	0.75	0.55	0.40	0.21	0.21	0.09	0.64	0.09	0.09		
Uniform Delay, d1	28.8	19.5	28.3	15.0	0.0	0.0	0.0	24.3	21.0	21.0		
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	1.1	2.2	2.2	0.2	0.3	0.3	0.1	1.7	0.1	0.1		
Delay (s)	29.9	21.7	30.5	15.1	0.3	0.3	0.1	26.0	21.1	21.1		
Level of Service	C	C	C	B	A	A	A	C	C	C		
Approach Delay (s)		22.4		12.6			0.1		25.0			
Approach LOS		C		B			A		C			
HCM Average Control Delay	18.4		HCM Level of Service		B							
HCM Volume to Capacity ratio	0.68											
Actuated Cycle Length (s)	71.5		Sum of lost time (s)		17.0							
Intersection Capacity Utilization	64.6%		ICU Level of Service		C							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 31: Ka Uka Blvd & Spine Rd

9/10/2009



Lane Configurations	←		←		←		←		←		←	
Volume (vph)	221	737	140	200	1153	815	0	0	345	701	0	190
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	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	1.00	1.00	0.97	1.00	1.00	1.00
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (prot)	1863	3636	1863	3725	1667	1667	1667	1667	1611	3433	1667	1667
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (perm)	1863	3636	1863	3725	1667	1667	1667	1667	1611	3433	1667	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
Vol Flow (vph)	221	737	140	200	1153	815	0	0	345	701	0	190
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	139	0
Lane Group Flow (vph)	221	864	10	200	1153	815	0	0	345	701	51	0
Turn Type	Prot		Prot		Free		Free		Prot		Prot	
Protected Phases	7		4		3		8		1		6	
Permitted Phases					Free		Free					
Actuated Green, G (s)	17.0		37.6		14.9		36.5		95.1		25.6	
Effective Green, g (s)	17.0		37.6		14.9		36.5		95.1		25.6	
Actuated v/s Ratio	0.18		0.40		0.16		0.38		1.00		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)	333		1438		292		1430		1667		426	
v/s Ratio Prot	0.12		0.24		0.11		0.31		0.21		0.08	
v/s Ratio Perm					c0.49		c0.49		0.21			
v/c Ratio	0.66		0.60		0.68		0.81		0.49		0.12	
Uniform Delay, d1	36.4		22.8		37.9		26.1		0.0		31.9	
Preemption Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	4.9		0.7		6.5		3.4		1.0		0.3	
Delay (s)	41.3		23.5		44.4		29.6		1.0		32.2	
Level of Service	D		C		D		C		A		D	
Approach Delay (s)	27.1		27.1		20.2		20.2		0.3		33.6	
Approach LOS	C		C		C		C		A		C	
Summary of Signal Timing												
HCM Average Control Delay	23.0		23.0		23.0		23.0		23.0		23.0	
HCM Volume to Capacity Ratio	0.77		0.77		0.77		0.77		0.77		0.77	
Actuated Cycle Length (s)	95.1		95.1		95.1		95.1		95.1		95.1	
Intersection Capacity Utilization	75.2%		75.2%		75.2%		75.2%		75.2%		75.2%	
Analysis Period (min)	15		15		15		15		15		15	
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

35: Ukee (E) & Ka Uka Blvd

9/10/2009



Phase	North	South	East	West	North	South	East	West	North	South	East	West
Lane Configurations	↕		↕		↖		↗		↖		↗	
Volume (vph)	15	3	2	41	15	21	8	1092	69	87	584	37
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	
Fit Protected	0.99		0.96		1.00		0.99		1.00		0.98	
Fit Permitted	0.96		0.97		0.95		1.00		0.95		1.00	
Sat. Flow (prot)	1771		1748		1863		3692		1963		3653	
Fit Permitted	0.76		0.82		0.40		1.00		0.23		1.00	
Sat. Flow (perm)	1398		1476		778		3692		444		3653	
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	21	8	1092	69	87	584	37
RTOR Reduction (vph)	0	2	0	0	17	0	0	4	0	0	12	0
Lane Group Flow (vph)	0	38	0	0	60	0	8	1157	0	87	659	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		2		6		6	
Permitted Phases	4		8		2		2		6		6	
Actuated Green, G (s)	4.6		4.6		34.4		34.4		34.4		34.4	
Effective Green, g (s)	4.6		4.6		34.4		34.4		34.4		34.4	
Actuated G/C Ratio	0.09		0.09		0.70		0.70		0.70		0.70	
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)	131		139		546		2592		312		2565	
v/s Ratio Prot	0.01		0.04		0.01		0.01		0.20		0.18	
v/s Ratio Perm	0.01		0.04		0.01		0.01		0.20		0.18	
Uniform Delay, d1	20.4		21.0		2.2		3.2		2.7		2.7	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.5		2.1		0.0		0.1		0.5		0.1	
D3e (s)	20.9		23.1		2.2		3.3		3.2		2.7	
Level of Service	C		C		A		A		A		A	
Approach Delay (s)	20.9		23.1		3.3		3.3		2.8		2.8	
Approach LOS	C		C		A		A		A		A	
Intersection Summary												
HCM Average Control Delay	4.0				HCM Level of Service				A			
HCM Volume to Capacity ratio	0.44				Sum of lost time (s)				10.0			
Actuated Cycle Length (s)	49.0				ICU Level of Service				A			
Intersection Capacity Utilization	62.3%				Analysis Period (min)				15			
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 35: Ukee (E) & Ka Uka Blvd

9/10/2009



Lane Configurations	↕		↕		↗		↖		↗		↖	
Volume (vph)	47	11	14	121	13	64	7	988	54	62	1205	70
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	
Flt Protected	0.97		0.97		0.97		0.99		1.00		0.99	
Flt Permitted	0.97		0.97		0.95		1.00		0.95		1.00	
Satd. Flow (perm)	1757		1729		1863		3697		1863		3695	
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	988	54	62	1205	70
RTOR Reduction (vph)	0	11	0	0	21	0	0	4	0	0	4	0
Lane Group Flow (vph)	0	61	0	0	177	0	7	1038	10	63	1271	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		2		6		6	
Permitted Phases	4		8		2		2		6		6	
Actuated Green, G (s)	13.4		13.4		35.8		35.8		35.8		35.8	
Effective Green, g (s)	13.4		13.4		35.8		35.8		35.8		35.8	
Actuated L/C Ratio	0.23		0.23		0.60		0.60		0.60		0.60	
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)	313		311		194		2236		278		2234	
v/s Ratio Prot	0.04		0.13		0.02		0.28		0.14		0.34	
v/s Ratio Perm	0.04		0.13		0.02		0.28		0.14		0.34	
Uniform Delay, d1	18.5		20.3		4.7		6.4		5.4		7.0	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.3		2.4		0.1		0.2		0.4		0.3	
Delay (s)	18.8		22.7		4.8		6.6		5.8		7.4	
Level of Service	B		C		A		A		A		A	
Approach Delay (s)	18.8		22.7		4.8		6.6		5.8		7.4	
Approach LOS	B		C		A		A		A		A	
HCM Average Control Delay	8.5		HCM Level of Service		A							
HCM Volume to Capacity ratio	0.57											
Actuated Cycle Length (s)	59.2		Sum of lost time (s)		10.0							
Intersection Capacity Utilization	62.6%		ICU Level of Service		B							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Waipio Uka & Ka Uka Blvd

9/10/2009



Lane Configurations	↔		↔		↖		↗		↖		↗	
Volume (vph)	46	12	23	91	19	96	68	1031	101	64	532	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	
Flt Protected	0.96		0.94		1.00		0.99		1.00		0.99	
Flt Permitted	0.97		0.98		0.95		1.00		0.95		1.00	
Satd Flow (prot)	1739		1709		1863		1876		1863		1897	
Satd Flow (perm)	1449		1435		1666		1675		1487		1697	
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)	46	12	23	91	19	96	68	1031	101	64	532	29
RTOR Reduction (vph)	0	17	0	0	39	0	0	9	0	0	5	0
Lane Group Flow (vph)	0	58	0	0	167	0	58	1123	0	64	556	0
Turn Type	Perm											
Protected Phases	4		8		2		6					
Permitted Phases	4		8		2		6					
Actuated Green, G (s)	11.1		11.1		25.3		25.3		25.3		25.3	
Effective Green, g (s)	11.1		11.1		25.3		25.3		25.3		25.3	
Actuated g/C Ratio	0.24		0.24		0.55		0.55		0.55		0.55	
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)	346		343		472		2004		211		2016	
v/s Ratio Prot	0.04		0.12		0.07		0.17					
v/s Ratio Perm	0.04		0.12		0.07		0.17					
v/c Ratio	0.17		0.49		0.12		0.56		0.30		0.28	
Uniform Delay, d1	14.0		15.2		5.1		6.9		5.7		5.6	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.2		1.1		0.1		0.4		0.8		0.1	
Delay (s)	14.2		16.9		5.3		7.3		6.6		5.7	
Level of Service	B		B		A		A		A		A	
Approach Delay (s)	14.2		16.9		7.2		7.2		5.8		5.8	
Approach LOS	B		B		A		A		A		A	
HCM Average Control Delay	7.9		7.9		5.1		5.1		5.7		5.6	
HCM Level of Service	B		B		A		A		A		A	
HCM Volume to Capacity ratio	0.54		0.54		0.12		0.56		0.30		0.28	
Actuated Cycle Length (s)	46.4		46.4		46.4		46.4		46.4		46.4	
Sum of lost time (s)	10.0		10.0		10.0		10.0		10.0		10.0	
Intersection Capacity Utilization	59.0%		59.0%		10.0%		10.0%		10.0%		10.0%	
ICU Level of Service	B		B		A		A		A		A	
Analysis Period (min)	15		15		15		15		15		15	
Critical Lane Group	Thru											

HCM Signalized Intersection Capacity Analysis

4: Waipio Uka & Ka Uka Blvd

9/10/2009



Lane Configurations	↕		↕		↖ ↗		↖ ↗		↖ ↗		↖ ↗	
Volume (vph)	94	38	34	138	26	43	41	910	92	115	1184	41
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	
Flt Protected	0.97		0.97		0.95		1.00		0.95		1.00	
Satd Flow (prot)	1761		1752		1863		3674		1863		3707	
Flt Permitted	0.75		0.74		0.16		1.00		0.24		1.00	
Satd Flow (perm)	1359		1345		318		3674		465		3707	
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	910	92	115	1184	41
RTOR Reduction (vph)	0	11	0	0	11	0	0	10	0	0	3	0
Lane Group Flow (vph)	0	155	0	0	196	0	41	992	0	115	1222	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		2		6		6	
Permitted Phases	4		8		2		2		6		6	
Actuated Green, G (s)	14.1		14.1		29.1		29.1		29.1		29.1	
Effective Green, g (s)	14.1		14.1		29.1		29.1		29.1		29.1	
Actuated G/C Ratio	0.27		0.27		0.55		0.55		0.55		0.55	
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)	360		356		174		2010		254		2028	
v/s Ratio Prot	0.11		0.15		0.13		0.27		0.25		0.35	
v/s Ratio Perm	0.11		0.15		0.13		0.27		0.25		0.35	
v/c Ratio	0.43		0.55		0.24		0.49		0.45		0.60	
Uniform Delay, d1	16.2		16.8		6.3		7.5		7.3		8.1	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.8		1.8		0.7		0.2		1.3		0.5	
Delay (s)	17.0		18.7		7.0		7.7		8.6		8.6	
Level of Service	B		B		A		A		A		A	
Approach Delay (s)	17.0		16.7		7.6		7.6		8.6		8.6	
Approach LOS	B		B		A		A		A		A	
PERFORMANCE SUMMARY												
HCM Average Control Delay	9.5		HCM Level of Service		A							
HCM Volume to Capacity ratio	0.39											
Actuated Cycle Length (s)	53.2		Sum of lost time (s)		10.0							
Intersection Capacity Utilization	63.3%		ICU Level of Service		B							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

37: Ka Uka Blvd & Ukee (W)

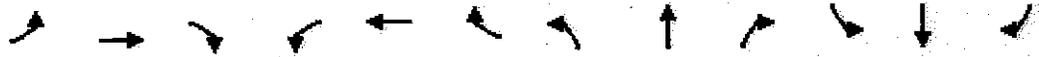
9/10/2009



Lane Configurations	↙ ↑↑		↙ ↑↑		↙ ↑↑		↙ ↑↑		↙ ↑↑		↙ ↑↑	
Volume (vph)	58	867	85	139	498	8	83	12	319	8	7	0
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	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	0.95	1.00	0.95	1.00	0.95	1.00	0.95
Flt Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.99	0.99	0.99	0.99	0.99	0.99
Satd Flow (prot)	1863	3675	1863	3717	1863	3717	1652	1652	1652	1652	1652	1652
Flt Permitted	0.95	1.00	0.95	1.00	0.95	1.00	0.93	0.93	0.93	0.93	0.93	0.93
Satd Flow (perm)	1863	3675	1863	3717	1863	3717	1547	1547	1547	1547	1547	1547
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	867	85	139	498	8	83	12	319	8	7	0
RTOR Reduction (vph)	0	8	0	0	1	0	0	157	0	0	5	0
Lane Grp Flow (vph)	58	938	0	139	503	0	0	257	0	0	12	0
Turn Type	Prot		Prot		Perm		Perm		Perm		Perm	
Protected Phases	7		4		3		8		2		6	
Permitted Phases							2				6	
Actuated Green, G (s)	6.9		24.4		10.3		27.8		16.3		16.3	
Effective Green, g (s)	6.9		24.4		10.3		27.8		16.3		16.3	
Actuated g/C Ratio	0.10		0.37		0.16		0.42		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)	195		1359		291		1566		382		411	
v/s Ratio Prot	0.63		0.26		0.07		0.14					
v/s Ratio Perm									c0.17		0.01	
v/c Ratio	0.30		0.69		0.48		0.32		0.67		0.03	
Uniform Delay, d1	27.3		17.6		25.4		12.8		22.4		18.8	
Preemption Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.9		1.5		1.2		0.1		4.6		0.0	
Delay (s)	28.2		19.1		26.6		12.9		27.1		18.9	
Level of Service	C		B		C		B		C		B	
Approach Delay (s)			19.7				15.9		27.1		18.9	
Approach LOS			B				B		C		B	
HCM Average Control Delay			20.0				HCM Level of Service				B	
HCM Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			66.0				Sum of lost time (s)				20.0	
Intersection Capacity Utilization			76.8%				ICU Level of Service				D	
Analysis Period (min)			15									
c Critical Lane Group												

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

9/10/2009



Lane Configurations	←		↑		→		↓		←		↑		→		↓	
Volume (vph)	53	849	99	191	1157	7	149	19	180	11	22	168				
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				
Fit Protected	1.00	0.98		1.00	1.00			0.95				0.98				
Fit Permitted	0.95	1.00		0.95	1.00			0.98				1.00				
Satd Flow (prot)	1863	3667		1863	3722			1896				1654				
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	1.00	1.00	1.00	1.00
Adj. Flow (vph)	53	849	99	191	1157	7	149	19	180	11	22	168				
RTOR Reduction (vph)	0	9	0	0	1	0	0	48	0	0	77	0				
Lane Group Flow (vph)	53	939	0	191	1163	0	0	390	0	0	67	0				
Turn Type	Prot		Prot		Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	7		4		8		2		2		6		6		6	
Permitted Phases							2		2		6		6		6	
Actuated Green, G (s)	6.1		25.3		12.3		31.5		21.0		21.0		21.0		21.0	
Effective Green, g (s)	6.1		25.3		12.3		31.5		21.0		21.0		21.0		21.0	
Actuated v/c Ratio	0.08		0.34		0.17		0.43		0.29		0.29		0.29		0.29	
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		1261		311		1593		398		460		460		460	
v/s Ratio Prot	0.08		0.26		0.10		0.31									
v/s Ratio Perm									c0.21		0.04		0.04		0.04	
v/c Ratio	0.34		0.74		0.61		0.73		0.75		0.75		0.75		0.75	
Uniform Delay, d1	31.9		21.3		28.4		17.5		23.9		19.6		19.6		19.6	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	1.3		2.4		3.6		1.8		7.9		0.1		0.1		0.1	
Delay (s)	33.2		23.7		32.0		19.3		31.8		19.7		19.7		19.7	
Level of Service	C		C		C		B		C		B		B		B	
Approach Delay (s)			24.2				21.1		31.8		19.7					
Approach LOS			C				C		C		B					
HCM Average Control Delay			23.4				HCM Level of Service				C					
HCM Volume to Capacity ratio			0.73													
Actuated Cycle Length (s)			73.6				Sum of lost time (s)				15.0					
Intersection Capacity Utilization			80.7%				ICD Level of Service				D					
Analysis Period (min)			15													
Critical Lane Group																

HCM Signalized Intersection Capacity Analysis

3: Ka Uka Blvd & Kam Hwy

9/10/2009



Lane Configurations	↖	↗	↘	↙	←	→	↖	↗	↘	↙	←	→
Volume (vph)	16	23	4	301	20	269	8	456	30	883	913	7
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	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (prot)	1770	3530	1583	1770	1785	2933	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (perm)	1770	3530	1583	1770	1785	2933	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	23	4	301	20	269	8	456	30	883	913	7
RTOR Reduction (vph)	0	0	0	0	0	123	0	0	237	0	0	9
Lane Group Flow (vph)	16	23	4	160	161	146	8	456	66	883	913	8
Turn Type	Split		Free	Split		pt+ov	Prot		Perm	Prot		Perm
Protected Phases	3	4		8	8	8	5	2		1	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	3.5	3.5	77.3	13.8	13.8	41.9	4.4	16.9	16.9	23.1	35.6	34.6
Effective Green, g (s)	3.5	3.5	77.3	13.8	13.8	41.9	4.4	16.9	16.9	23.1	35.6	34.6
Actuated v/s Ratio	0.05	0.05	1.00	0.18	0.18	0.54	0.06	0.22	0.22	0.00	0.46	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)	80	160	1583	316	319	1590	106	814	364	1080	1716	746
v/s Ratio Prot	0.01	0.01		0.09	0.09	0.05	0.00	0.12		0.19	0.25	
v/s Ratio Perm			0.00						0.04			0.00
v/s Ratio	0.20	0.14	0.00	0.31	0.50	0.09	0.08	0.56	0.18	0.63	0.53	0.01
Uniform Delay, d1	35.6	35.5	0.0	28.7	28.7	8.5	34.5	26.9	24.6	23.4	14.9	11.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.4	0.0	1.3	1.3	0.0	0.3	0.9	0.2	1.2	0.3	0.0
Delays (s)	36.8	35.9	0.0	30.0	29.9	8.5	34.8	27.8	24.8	24.6	15.2	11.8
Level of Service	D	D	A	C	C	A	C	C	C	C	B	B
Approach Delay (s)		32.9			20.2			26.7			19.2	
Approach LOS		C			C			C			B	
HCM Average Control Delay			21.5	HCM Level of Service			C					
HCM Volume/Capacity ratio			0.52									
Actuated Cycle Length (s)			77.3	Sum of lost time (s)			15.0					
Intersection Capacity Utilization			58.1%	IGD Level of Service			B					
Analysis Period (min)			15									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

3: Ka Uka Blvd & Kam Hwy

9/10/2009



Lane Configurations	↖	↑↑	↗	↖	↑	↗	↖	↑↑	↗	↖↗	↑↑	↗
Volume (vph)	82	45	36	502	82	837	35	814	568	393	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	5.0	5.0	5.0	5.0	5.0	5.0	5.0	6.0
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	1798	2933	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	1798	2933	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
Ideal Flow (vph)	82	45	36	502	82	837	35	814	568	393	592	51
RTOR Reduction (vph)	0	0	0	0	0	243	0	0	395	0	0	30
Lane Group Flow (vph)	82	45	36	281	293	594	35	814	173	393	592	21
Turn Type	Split		Free	Split		pt+ov	Prot		Perm	Prot		Perm
Protected Phases	4			6		8	5		2			8
Permitted Phases			Free						2			6
Actuated Green, G (s)	5.8	5.8	97.2	24.9	24.9	46.8	6.2	29.6	29.6	16.9	40.3	40.3
Effective Green, g (s)	5.8	5.8	97.2	24.9	24.9	46.8	6.2	29.6	29.6	16.9	40.3	39.3
Actuated g/C Ratio	0.06	0.06	1.09	0.26	0.25	0.48	0.06	0.30	0.30	0.17	0.41	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)	106	211	1583	453	461	1412	119	1134	508	628	1544	674
v/s Ratio Prot	0.02	0.01		0.16	0.16	0.20	0.02	0.22		0.11		0.16
v/s Ratio Perm			0.02						0.10			0.01
v/s Ratio	0.30	0.21	0.02	0.64	0.64	0.42	0.29	0.72	0.34	0.63	0.38	0.03
Uniform Delay, d1	43.8	43.5	0.0	32.2	32.1	16.4	43.4	30.1	26.2	37.2	19.8	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.5	0.0	3.1	2.9	0.2	1.4	2.2	0.4	2.0	0.2	0.0
Delay (s)	45.4	44.0	0.0	35.3	35.0	16.6	44.8	32.3	26.6	39.2	20.0	17.5
Level of Service	D	D	A	D	C	B	D	C	C	D	B	B
Approach Delay (s)		30.4			24.2			30.9			27.1	
Approach LOS		C			C			C			C	

HCM Average Control Delay	27.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	97.2	Sum of lost time (s)	20.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		
Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
 19: Waipio Uka & Kam Hwy

9/10/2009



Lane Configurations	↙	↑	↘	↙↘	↑	↙	↘	↙↘	↑	↙	↘	↙↘
Volume (vph)	4	4	9	578	2	43	16	721	567	34	182	1
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	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00
PHF	1.00	1.00	0.85	1.00	0.86	1.00	1.00	0.85	1.00	1.00	0.93	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (prot)	1770	1863	1583	3614	1680	1863	3725	1667	1863	3725	1667	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	1.00
Satd Flow (perm)	1770	1863	1583	3614	1680	1863	3725	1667	1863	3725	1667	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)	4	4	9	578	2	43	16	721	567	34	182	1
RTOR Reduction (vph)	0	0	0	0	32	0	0	0	338	0	0	1
Lane Group Flow (vph)	4	4	9	579	13	0	16	721	229	34	182	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	76.9	18.8	18.8		5.3	31.0	31.0	6.2	31.9	31.9
Effective Green, g (s)	0.9	0.9	76.9	18.8	18.8		5.3	31.0	31.0	6.2	31.9	31.9
Actuated G/C Ratio	0.01	0.01	1.00	0.24	0.24		0.07	0.40	0.40	0.08	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)	5.0	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	884	411		128	1502	672	150	1545	692
v/s Ratio Prot	0.40	0.40		0.16	0.01		0.01	0.19		0.02	0.32	
v/s Ratio Perm			c0.01						0.14			0.00
v/c Ratio	0.05	0.18	0.01	0.65	0.03		0.12	0.48	0.34	0.23	0.77	0.00
Uniform Delay, d1	37.6	37.6	0.0	26.1	22.1		33.6	17.0	15.9	33.1	19.3	13.2
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	0.9	4.0	0.0	1.7	0.0		0.4	0.2	0.3	0.8	2.3	0.0
Delay (s)	38.5	41.6	0.0	27.9	22.1		34.1	17.2	16.2	33.9	21.6	13.2
Level of Service	D	D	A	C	C		C	B	B	C	C	B
Approach Delay (s)		14.6			27.5			17.0			21.9	
Approach LOS		B			C			B			C	

HCM Average Control Delay	20.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	76.9	Sum of lost time (s)	15.0
Intersection Capacity Utilization	61.7%	ICU Level of Service	B
Analysis Period (min)	15		
o Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

19: Waipio Uka & Kam Hwy

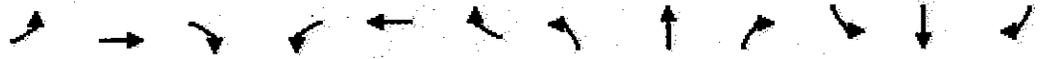
9/10/2009



Lane Configurations	↙	↑	↘	↙↘	↔	↙	↑↑	↘	↙	↑↑	↘	
Volume (vph)	7	16	41	618	17	57	84	1352	833	51	1064	7
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	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	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3614	1734	1863	3725	1667	1863	3725	1667	1667
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	3614	1734	1863	3725	1667	1863	3725	1667	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	57	84	1352	833	51	1064	7
RTOR Reduction (vph)	0	0	0	0	44	0	0	0	360	0	0	8
Lane Group Flow (vph)	7	16	41	618	30	10	84	1352	473	51	1064	6
Turn Type	Split		Free	Split			Prot		Perm	Prot		Perm
Protected Phases	4	4		6	6		5	2		1	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	2.5	2.5	95.3	21.8	21.8		9.2	44.9	44.9	6.1	41.8	41.8
Effective Green, g (s)	2.5	2.5	95.3	21.8	21.8		9.2	44.9	44.9	6.1	41.8	41.8
Actuated G/C Ratio	0.03	0.03	1.00	0.23	0.23		0.10	0.47	0.47	0.06	0.44	0.44
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)	46	49	1583	827	397		180	1755	785	119	1634	731
v/s Ratio Prot	0.00	0.03		0.17	0.02		0.05	0.06		0.03	0.29	
v/s Ratio Perm			0.03						0.28			0.00
v/c Ratio	0.15	0.33	0.03	0.75	0.08		0.47	0.77	0.59	0.43	0.65	0.04
Uniform Delay, d1	45.4	45.6	0.0	34.2	28.8		40.7	20.9	18.6	42.9	21.0	15.1
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.5	3.9	0.0	3.7	0.1		1.9	2.2	1.3	2.5	0.9	0.0
Delay (s)	46.9	49.4	0.0	37.9	28.9		42.6	23.1	19.9	45.4	22.0	15.1
Level of Service	D	D	A	D	C		D	C	B	D	C	B
Approach Delay (s)		17.8			36.9			22.6			22.9	
Approach LOS		B			D			C			C	
HCM Average Control Delay			25.0	HCM Level of Service				C				
HCM Volume to Capacity ratio			0.74									
Actuated Cycle Length (s)			95.3	Sum of lost time (s)				20.0				
Intersection Capacity Utilization			74.8%	ICD Level of Service				D				
Analysis Period (min)			15									
Critical Lane Group												

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

9/10/2009

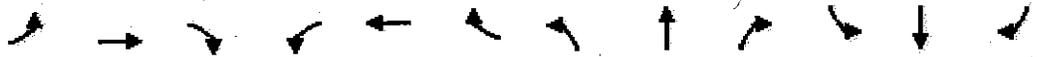


Lane Configurations	↙	←	↗	↘	→	↖	↑↑	↗	↘	↑↑	↖	
Volume (vph)	494	17	93	64	73	39	46	75	39	17	160	593
Ideal Flow (vphpl)	2000	2000	2000	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost Time (s)	5.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95
Flt. Ped/Bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt. Protected	0.95	0.96	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95
Safe Flow (prot)	1770	1780	1667	1770	1765	1863	3725	1667	1863	3725	1667	1863
Flt. Permitted	0.95	0.96	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95
Safe Flow (perm)	1770	1780	1667	1770	1765	1863	3725	1667	1863	3725	1667	1863
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	75	39	17	160	593
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	75	16	17	160	593
Confl. Peds. (#/hr)	39											
Phase 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)	19.6	19.6	94.4	10.8	10.8	7.3	38.8	38.8	5.2	36.7	94.4	
Effective Green, g (s)	19.6	19.6	94.4	10.6	10.6	7.3	38.8	38.8	5.2	36.7	94.4	
Actuated g/C Ratio	0.21	0.21	1.00	0.11	0.11	0.08	0.41	0.41	0.06	0.39	1.00	
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	
Stage Group Cap (vph)	368	370	1667	203	202	174	1531	685	103	1443	1667	
v/s Ratio Prot	c0.15	0.14		0.04	0.05	0.02	0.21		0.01	c0.31		
v/s Ratio Perm			0.06					0.01			0.36	
v/c Ratio	0.70	0.69	0.06	0.32	0.48	0.32	0.51	0.02	0.17	0.80	0.36	
Platform Delay (s)	34.7	34.6	0.0	30.4	39.1	41.2	20.7	16.5	42.5	25.6	0.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	5.7	5.2	0.1	0.9	1.8	1.3	0.3	0.0	6.8	3.3	0.6	
Delay (s)	40.4	39.8	0.1	39.3	40.9	42.5	20.9	16.5	43.3	28.9	0.6	
Level of Service	D	D	A	D	D	D	C	B	D	C	A	
Approach Delay (s)	33.9		40.3			21.9			19.6			
Approach LOS	C		D			G			B			
HCM Average Control Delay	23.8		HCM Level of Service			C						
HCM Volume to Capacity ratio	0.63											
Actuated Cycle Length (s)	94.4		Sum of lost time (s)			10.0						
Intersection Capacity Utilization	64.7%		ICU Level of Service			C						
Analysis Period (min)	15											

c Critical Lane Group

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

9/10/2009



Lane Configurations	↙	↖	↗	↘	↙	↖	↗	↘	↙	↖	↗	↘
Volume (vph)	582	31	134	24	31	51	176	1701	105	28	986	709
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
Flt. ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
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		1663	3725	1667	1663	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		1663	3725	1667	1663	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)	582	31	134	24	31	51	176	1701	105	28	986	709
RTOR Reduction (vph)	0	0	0	0	48	0	0	0	37	0	0	0
Lane Group Flow (vph)	282	281	134	24	24	0	176	1701	66	28	986	709
Confl. Peds. (#/hr)	39											
Phases	Split	Free	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)	20.6	20.6	104.9	6.4	6.4	14.9	53.8	53.8	4.1	43.0	104.9	
Effective Green, g (s)	20.6	20.6	104.9	6.4	6.4	14.9	53.8	53.8	4.1	43.0	104.9	
Actuated g/C Ratio	0.20	0.20	1.00	0.06	0.06	0.14	0.51	0.51	0.04	0.41	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)	348	350	1667	108	109	265	1916	635	73	1527	1667	
v/s Ratio Prot	c0.16	0.16		0.01	0.02	c0.09	c0.46		0.02	0.26		
v/c Ratio Perm			0.08					0.04			c0.46	
v/c Ratio	0.81	0.80	0.08	0.22	0.33	0.66	0.89	0.08	0.38	0.65	0.43	
Uniform Delay, d1	46.3	40.2	0.0	46.9	47.2	42.6	23.9	13.0	49.2	24.8	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	18.3	12.5	0.1	1.0	1.9	6.1	5.7	0.0	3.3	0.9	0.8	
Delay (s)	53.6	52.7	0.1	47.9	49.1	48.8	28.6	13.0	52.5	25.8	0.8	
Level of Service	D	D	A	D	D	D	C	B	D	C	A	
Approach Delay (s)	42.9		48.8			29.5		15.9				
Approach LOS	D		D			C		B				
HCM Average Control Delay	26.9		HCM Level of Service			C						
HCM Volume to Capacity ratio	0.82											
Actuated Cycle Length (s)	104.9		Sum of lost time (s)			15.0						
Intersection Capacity Utilization	81.9%		ICU Level of Service			D						
Analysis Period (min)	15											

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

30: Lumiauu St & Kam Hwy

9/10/2009



Lane Configurations	←	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Volume (vph)	117	12	321	173	12	14	30	727	55	3	1308	11
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	5.0	5.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
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	1883	1776	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	727	55	3	1308	11
RTOR Reduction (vph)	0	0	78	0	11	0	0	0	27	0	0	6
Lane Group Flow (vph)	0	129	243	178	15	0	30	727	28	3	1308	5
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases		1			5		5	2		1		6
Permitted Phases	4		4	8					2			6
Actuated Green, G (s)	18.3	18.3	18.3	18.3			6.2	40.0	40.0	4.3	38.1	38.1
Effective Green, g (s)	18.3	18.3	18.3	18.3			6.2	40.0	40.0	4.3	38.1	38.1
Actuated v/c Ratio	0.24	0.24	0.24	0.24			0.08	0.52	0.52	0.06	0.49	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)	319	373	296	404			149	1920	859	103	1829	818
v/s Ratio Prot				0.01			0.02	0.20		0.08	0.35	
v/s Ratio Perm	0.10	0.15	0.14						0.02			0.00
w/c Ratio	0.40	0.35	0.38	0.01			0.20	0.88	0.03	0.03	0.72	0.01
Uniform Delay, d1	25.0	26.8	26.3	22.9			33.4	11.3	9.3	34.7	15.5	10.1
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	4.0	2.9	0.0			0.7	0.1	0.0	0.1	1.4	0.0
Delay (s)	25.8	30.8	29.2	22.9			34.1	11.4	9.3	34.8	16.6	10.1
Level of Service	C	C	C	C			C	B	A	C	B	B
Approach Delay (s)	29.4			28.4			12.1				16.6	
Approach LOS	C			C			B				B	
HCM Average Control Delay	18.3		HCM Level of Service		B							
HCM Volume to Capacity ratio	0.65											
Actuated Cycle Length (s)	77.6		Sum of lost time (s)		15.0							
Intersection Capacity Utilization	76.3%		ICU Level of Service		D							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 30: Lumiauu St & Kam Hwy

9/10/2009



Lane Configurations	←	↖	↗	→	←	↖	↗	→	←	↖	↗	→
Volume (vph)	22	6	69	63	9	10	158	1960	177	11	1109	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	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00
Flt Protected	0.96	1.00	0.95	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (prot)	1792	1583	1770	1708	1863	1863	3725	1867	1863	3725	1867	1667
Flt Permitted	0.76	1.00	0.74	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (perm)	1416	583	1377	1708	1863	1863	3725	1867	1863	3725	1867	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
RTOR Reduction (vph)	0	0	63	0	9	0	0	0	52	0	0	11
RTOR Reduction (%)	0	0	33	0	9	0	0	0	29	0	0	39
Turn Type	Perm	Perm	Perm	Perm	Prot	Perm	Prot	Perm	Prot	Perm	Prot	Perm
Protected Phases	4	4	8	8	5	2	1	5	6	6	6	6
Permitted Phases	4	4	8	8	2	2	2	2	2	2	2	2
Actuated Green, G (s)	8.1	8.1	8.1	8.1	13.9	64.0	64.0	4.5	54.6	54.6	54.6	54.6
Effective Green, g (s)	8.1	8.1	8.1	8.1	13.9	64.0	64.0	4.5	54.6	54.6	54.6	54.6
Actuated v/c Ratio	0.09	0.09	0.09	0.09	0.15	0.70	0.70	0.05	0.60	0.60	0.60	0.60
Clearance Time (s)	5.0	5.0	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	3.0	3.0
Lane Grp Cap (vph)	125	140	122	151	283	2603	1165	92	2220	994	994	994
v/s Ratio Prot	0.02	0.00	0.05	0.05	0.08	0.53	0.01	0.30	0.01	0.30	0.30	0.30
v/s Ratio Perm	0.02	0.00	0.05	0.05	0.08	0.53	0.01	0.30	0.01	0.30	0.30	0.30
v/c Ratio	0.22	0.09	0.52	0.06	0.56	0.75	0.10	0.12	0.50	0.12	0.50	0.12
Uniform Delay, d1	38.8	38.2	39.9	38.3	36.0	8.8	4.5	41.7	10.6	7.5	7.5	7.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.1	3.7	0.2	2.4	1.3	0.0	0.6	0.2	0.0	0.0	0.0
Delay (s)	39.7	38.3	43.5	38.4	38.4	10.0	4.5	42.2	10.8	7.5	7.5	7.5
Level of Service	D	D	D	D	D	B	A	D	B	A	A	A
Approach Delay (s)	38.7	38.3	42.4	38.4	38.4	11.6	4.5	42.2	11.0	7.5	7.5	7.5
Approach LOS	D	D	D	D	D	B	A	D	B	A	A	A
HCM Average Control Delay	12.8			HCM Level of Service			B					
HCM Volume to Capacity ratio	0.73											
Actuated Cycle Length (s)	91.6			Sum of lost time (s)			15.0					
Intersection Capacity Utilization	77.5%			ICU Level of Service			D					
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 52: Waipahu St & Kam Hwy

9/10/2009



Lane Configurations	↙	↗	↖	↑↑	↑↑	↘
Volume (vph)	119	618	139	692	1729	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
Flt Protected	1.00	0.85	1.00	1.00	1.00	0.85
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1868	1667	1868	3725	3725	1667
Satd. Flow (perm)	1868	1667	1868	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	692	1729	90
RTOR Reduction (vph)	0	49	0	0	0	38
Lane Group Flow (vph)	170	569	139	692	1729	52
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	12.1	38.0	25.9	88.3	57.4	57.4
Effective Green, g (s)	12.1	38.0	25.9	88.3	57.4	57.4
Actuated g/C Ratio	0.41	0.94	0.23	0.80	0.52	0.52
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	649	437	2979	1937	867
v/s Ratio Prot	0.06	0.21	0.07	0.19	0.46	
v/s Ratio Perm		0.14				0.03
v/c Ratio	0.58	0.88	0.32	0.23	0.89	0.06
Uniform Delay, d1	46.8	34.0	34.9	2.7	23.7	13.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.2	12.7	0.4	0.0	5.7	0.0
Delay (s)	51.0	46.7	35.4	2.7	29.4	13.2
Level of Service	D	D	D	A	C	B
Approach Delay (s)	47.4			8.2	28.6	
Approach LOS	D			A	C	
HCM Average Control Delay	27.7		HCM Level of Service		C	
HCM Volume to Capacity ratio	0.89					
Actuated Cycle Length (s)	110.4		Sum of lost time (s)		10.0	
Intersection Capacity Utilization	90.1%		ICU Level of Service		E	
Analysis Period (min)	15					
Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
 52: Waipahu St & Kam Hwy

9/10/2009



Lane Configurations	↙	↗	←	↑↑	↑↑	↘
Volume (vph)	256	436	292	2037	1059	181
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
Flt Protected	1.00	0.95	1.00	1.00	1.00	0.95
Satd. Flow (prot)	1863	1667	1863	3725	3725	1867
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)	256	436	292	2037	1059	181
RTOR Reduction (vph)	0	20	0	0	0	104
Lane Group Flow (vph)	256	436	292	2037	1059	77
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	18.7	39.7	21.0	66.1	40.1	40.1
Effective Green, g (s)	18.7	39.7	21.0	66.1	40.1	40.1
Actuated G/C Ratio	0.20	0.42	0.22	0.70	0.42	0.42
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)	367	786	413	2597	1576	705
v/s Ratio Prot	0.14	0.12	0.16	0.55	0.28	
v/s Ratio Perm		0.14				0.05
v/c Ratio	0.70	0.55	0.71	0.78	0.67	0.11
Uniform Delay, d1	35.4	20.9	34.1	9.6	22.0	16.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.7	0.9	5.5	1.6	1.1	0.1
Delay (s)	41.1	21.7	39.5	11.2	23.2	16.6
Level of Service	D	C	D	B	C	B
Approach Delay (s)	28.7			14.8	22.2	
Approach LOS	C			B	C	
HCM Average Control Delay	19.2		HCM Level of Service		B	
HCM Volume to Capacity ratio	0.76					
Actuated Cycle Length (s)	94.8		Sum of lost time (s)		10.0	
Intersection Capacity Utilization	75.3%		ICU Level of Service		D	
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	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3778	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	922	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	800	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	375	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)	3778	922	375	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1049	256	104	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	4240		1035		421	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.260 Using Equation 0
 FD
 $v = v + (v - v) P = 1758$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	3816	9400	No
$F_i F$			
$v = v - v$	2781	9400	No
$F_O F R$			
v	1035	3800	No
R			
$v v$	1029 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is $v v > 2700$ pc/h?		No	
3 or av34			
Is $v v > 1.5 v / 2$		No	
3 or av34 12			
If yes, $v = 1758$		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	1758	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = -2.2$ pc/mi/ln
 R 12 D
 Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D = 0.521	
	S	
Space mean speed in ramp influence area,	S = 53.0	mph
	R	
Space mean speed in outer lanes,	S = 71.2	mph
	O	
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 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	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7350	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	2718	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	800	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	621	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)	7350	2718	621	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	2042	755	173	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	8412		3050		697	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v_{12} = v_R + (v_F - v_R) P = 4007$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_F = v_{12}$	6730	9400	No
$v_{FO} = v_F - v_R$	3680	9400	No
v_R	3050	3800	No
$v_{3} = v_{av34}$	1361 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3} > 2700$ pc/h?		No	
Is $v_{3} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 4007$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	4007	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v_{12}}{R} - 0.009 \frac{L}{D} = 17.1$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	D = 0.702	
Space mean speed in ramp influence area,	S = 48.8	mph
Space mean speed in outer lanes,	S = 69.9	mph
Space mean speed for all vehicles,	S = 55.6	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 Loop (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	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	375	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1511	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2267	375	1511	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	630	104	420	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	421	1696 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.165 Using Equation 4
 FM
 $v_{12} = v_F (P_{FM}) = 428 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	3015	9400	No
FO			
v v	1083 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	= 1037	(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1037	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 7.2 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M = 0.233	
	S	
Space mean speed in ramp influence area,	S = 59.6	mph
	R	
Space mean speed in outer lanes,	S = 64.0	mph
	0	
Space mean speed for all vehicles,	S = 61.8	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: PM Peak
 Freeway/Dir of Travel: H-2 Fwy NB On Ramp Loop (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	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	621	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	3994	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3356	621	3994	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	932	173	1109	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	697	4482 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.131$ Using Equation 4
 FM
 $v_{12} = v_{12} (P_{FM}) = 502$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4538	9400	No
$v_{3 \text{ or } av34}$	1669 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12}$?		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, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 13.2$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	$M = 0.252$	
Space mean speed in ramp influence area,	$S_R = 59.2$	mph
Space mean speed in outer lanes,	$S_0 = 62.7$	mph
Space mean speed for all vehicles,	$S = 60.9$	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	2642	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	194	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	375	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1700	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2642	194	375	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	734	54	104	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	3024	218	421 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.191 Using Equation 4
 FM
 $v_{12} = v_F (P_{FM}) = 576 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v FO	3242	9400	No
v 3 or av34	1224 pc/h	(Equation 25-4 or 25-5)	
Is v 3 or av34	> 2700 pc/h?	No	
Is v 3 or av34	> 1.5 v / 2	Yes	
If yes, v 12A	= 1209	(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v 12A	1209	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 12.1 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.288	
Space mean speed in ramp influence area,	S = 58.4	mph
Space mean speed in outer lanes,	S = 63.5	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 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	3977	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	444	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	621	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1700	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3977	444	621	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1105	123	173	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	4551	498	697	pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
EQ
P = 0.156 Using Equation 4
FM
 $v = v (P) = 708$ pc/h
12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	5049	9400	No
FO			
v v	1921 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 = 1820		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1820	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 18.9$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.312	
	S	
Space mean speed in ramp influence area,	S = 57.8	mph
	R	
Space mean speed in outer lanes,	S = 61.9	mph
	0	
Space mean speed for all vehicles,	S = 60.0	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	4037	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	501	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	1274	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4037	501	1274	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1121	139	354	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	4620		562		1430	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.436 Using Equation 8
 FD
 $v_{12} = v_R + (v_F - v_R) P = 2331$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	4620	9400	No
$v_{12} = v_{12} - v_{12}$	4058	9400	No
v_{12}	562	2000	No
v_{12}	1144 pc/h	(Equation 25-15 or 25-16)	
Is $v_{12} > 2700$ pc/h?		No	
Is $v_{12} > 1.5 v_{12} / 2$		No	
If yes, $v_{12} = 2331$		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2331	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_{12} = 22.9$ pc/mi/ln
 R 12 D
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D = 0.479	
	S	
Space mean speed in ramp influence area,	S = 54.0	mph
	R	
Space mean speed in outer lanes,	S = 70.7	mph
	O	
Space mean speed for all vehicles,	S = 61.2	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: 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	3191	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	792	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	1470	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3191	792	1470	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	886	220	408	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	3652		889		1650	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.436 Using Equation 8
 FD
 $v_{12} = v_R + (v_F - v_R) P = 2094$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	3652	9400	No
$v_{FO} = v_F - v_R$	2763	9400	No
v_R	889	2000	No
$v_{3} = v_{av34}$	779 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3} > 2700$ pc/h?		No	
Is $v_{3} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2094$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2094	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0085 v_{12} - 0.009 L_D = 20.9$ pc/mi/ln
 R 12 D
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D = 0.508	
Space mean speed in ramp influence area,	S = 53.3	mph
Space mean speed in outer lanes,	S = 71.3	mph
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: AM Peak
 Freeway/Dir of Travel: H-2 Fwy SB On Ramp Loop (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	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	1274	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	501	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3536	1274	501	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	982	354	139	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	1430	562 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.039$ Using Equation 4
 FM
 $\dot{v} = v (P) = 158$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	5477	9400	No
FO			
v	1944 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is 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, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 24.5$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.358	
	S	
Space mean speed in ramp influence area,	S = 56.8	mph
	R	
Space mean speed in outer lanes,	S = 62.4	mph
	0	
Space mean speed for all vehicles,	S = 59.2	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 SB On Ramp Loop (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	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	1470	vph
Length of first accel/decel lane	650	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	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2399	1470	792	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	666	408	220	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	1650	889 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.012$ Using Equation 4
 FM
 $v = v (P) = 32$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	4396	9400	No
FO			
v	1357 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v /2		Yes	
3 or av34	12		
If yes, v = 1098		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1098	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v + 0.0078 v - 0.00627 L = 22.1$ pc/mi/ln
 R R 12 A C
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.336	
	S	
Space mean speed in ramp influence area,	S = 57.3	mph
	R	
Space mean speed in outer lanes,	S = 63.8	mph
	0	
Space mean speed for all vehicles,	S = 59.6	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	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4810	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	1467	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	1274	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4810	1467	1274	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1336	408	354	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	5505	1646	1430 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.012 Using Equation 4
 FM
 $v_{12} = v_F (P_{FM}) = 50 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5830	9400	No
$v_{3 \text{ or } av34}$	2067 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		Yes	
If yes, $v_{12A} = 1673$		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1673	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 25.5 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.371	
Space mean speed in ramp influence area,	S _R = 56.5	mph
Space mean speed in outer lanes,	S _O = 62.3	mph
Space mean speed for all vehicles,	S = 58.8	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: 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	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3869	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	1404	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	1470	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3869	1404	1470	vph
Peak-hour factor, PHF	0.90	0.90	0.90	
Peak 15-min volume, v15	1075	390	408	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	4428	1576	1650 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
EQ
P = 0.021 Using Equation 4
FM
 $v_{12} = v_F (P_{FM}) = 72 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	5030	9400	No
FO			
v	1691 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 1381		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1381	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 22.7 \text{ pc/mi/ln}$
Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.339	
	S	
Space mean speed in ramp influence area,	S = 57.2	mph
	R	
Space mean speed in outer lanes,	S = 63.1	mph
	0	
Space mean speed for all vehicles,	S = 59.5	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	3778	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1049	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	865	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	5	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	865	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	5	
Density, D	12.4	pc/mi/ln
Level of service, LOS	B	

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	7350	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	2042	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	1682	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	5	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1682	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	68.9	mi/h
Number of lanes, N	5	
Density, D	24.4	pc/mi/ln
Level of service, LOS	C	

Phone:
E-mail:

Fax:

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	2836	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	788	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	811	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	811	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	11.8	pc/mi/ln
Level of service, LOS	B	

Phone:
E-mail:

Fax:

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	4421	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1228	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	1265	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	1265	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	18.5	pc/mi/ln
Level of service, LOS	C	

Phone:
E-mail:

Fax:

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	6277	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1744	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	1197	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	6	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1197	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	17.1	pc/mi/ln
Level of service, LOS	B	

Phone:
E-mail:

Fax:

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	5273	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1465	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	1006	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	6	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1006	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	14.4	pc/mi/ln
Level of service, LOS	B	

Phone:
E-mail:

Fax:

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	4037	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	1121	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	1155	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	1155	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	16.9	pc/mi/ln
Level of service, LOS	B	

Phone:
E-mail:

Fax:

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	3191	veh/h
Peak-hour factor, PHF	0.90	
Peak 15-min volume, v15	886	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	913	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	913	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	

APPENDIX K

**CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2025 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT
KOA RIDGE MAKAI AND WAIAWA DEVELOPMENTS
(WITHOUT ADDITIONAL IMPROVEMENTS)**

HCM Signalized Intersection Capacity Analysis

25: Ka Uka Blvd &

6/9/2010

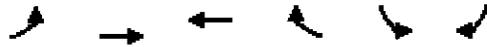


Movement	EBL	EBT	WBT	WBIF	SBT	SEB
Lane Configurations	↗↘	↑↑	↑↑↑			↑↑
Volume (vph)	507	256	2314	310	0	1316
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	0.97	0.95	0.91			0.88
Fit	1.00	1.00	0.98			0.85
Fit Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3614	3725	5258			2933
Fit Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3614	3725	5258			2933
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	507	256	2314	310	0	1316
RTOR Reduction (vph)	0	0	17	0	0	241
Lane Group Flow (vph)	507	256	2607	0	0	1075
Turn Type	Split			Over		
Protected Phases	4	4	8			4
Permitted Phases						
Actuated Green, G (s)	39.4	39.4	50.0			39.4
Effective Green, g (s)	39.4	39.4	50.0			39.4
Actuated g/C Ratio	0.40	0.40	0.50			0.40
Clearance Time (s)	5.0	5.0	5.0			5.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	1433	1477	2645			1163
v/s Ratio Prot	0.14	0.07	0.50			0.37
v/s Ratio Perm						
v/c Ratio	0.35	0.17	0.99			0.92
Uniform Delay, d1	21.1	19.4	24.3			28.6
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.2	0.1	14.2			12.1
Delay (s)	21.2	19.5	38.5			40.7
Level of Service	C	B	D			D
Approach Delay (s)		20.6	38.5		40.7	
Approach LOS		C	D		D	
Intersection Summary						
HCM Average Control Delay			36.2		HCM Level of Service	D
HCM Volume to Capacity ratio			0.96			
Actuated Cycle Length (s)			99.4		Sum of lost time (s)	10.0
Intersection Capacity Utilization			101.1%		ICU Level of Service	G
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

25: Ka Uka Blvd &

6/9/2010



Movement	EBL	EBT	WB	WBR	SBL	SBR
Lane Configurations	↘↘	↑↑	↑↑↑			↗↗
Volume (vph)	745	809	2144	536	0	2846
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	0.97	0.95	0.91			0.88
Flt	1.00	1.00	0.97			0.85
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3614	3725	5192			2933
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3614	3725	5192			2933
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	745	809	2144	536	0	2846
RTOR Reduction (vph)	0	0	43	0	0	611
Lane Group Flow (vph)	745	809	2637	0	0	2235
Turn Type	Split			Over		
Protected Phases	4	4	8			4
Permitted Phases						
Actuated Green, G (s)	53.0	53.0	37.0			53.0
Effective Green, g (s)	53.0	53.0	37.0			53.0
Actuated g/C Ratio	0.53	0.53	0.37			0.53
Clearance Time (s)	5.0	5.0	5.0			5.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	1915	1974	1921			1554
v/s Ratio Prot	0.21	0.22	0.51			0.76
v/s Ratio Perm						
v/c Ratio	0.39	0.41	1.37			1.44
Uniform Delay, d1	13.9	14.1	31.5			23.5
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.1	0.1	171.0			200.9
Delay (s)	14.0	14.2	202.5			224.4
Level of Service	B	B	F			F
Approach Delay (s)		14.2	202.5		224.4	
Approach LOS		B	F		F	
Intersection Summary						
HCM Average Control Delay			170.0		HCM Level of Service	F
HCM Volume to Capacity ratio			1.41			
Actuated Cycle Length (s)			100.0		Sum of lost time (s)	10.0
Intersection Capacity Utilization			158.6%		ICU Level of Service	H
Analysis Period (min)			15			
c Critical Lane Group						

HCM Signalized Intersection Capacity Analysis
 5: Ka Uka Blvd & H-2 Off (SB)

9/11/2009



Lane Configurations	↑↑↑			↖↗		↑↑↑		↖		↗		↑		↖	
Volume (vph)	0	2184	56	184	1396	0	30	0	236	131	158	262	314		
Ideal Flow (vphpl)	2000	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	6.0	5.0	5.0	6.0		
Lane Util. Factor		0.91		0.97	0.91		1.00		1.00	0.97	1.00	1.00	1.00		
Flt Protected		1.00		1.00	1.00		1.00		0.85	1.00	1.00	1.00	0.85		
Satd Flow (prot)		5333		3614	5353		1863		1667	3614	1961	1667	1667		
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00	1.00		
Satd Flow (perm)		5333		3614	5353		1863		1667	3614	1961	1667	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	1.00		
Adj Flow (vph)	0	2184	56	184	1396	0	30	0	236	131	158	262	314		
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	95	0	0	0	52		
Lane Group Flow (vph)	0	2237	6	184	1396	0	30	0	236	131	158	262	314		
Turn Type				Prot		Prot		custom		Prot		Perm			
Protected Phases		4		3	3		5		2	1		6			
Permitted Phases									3				6		
Actuated Green, G (s)		45.0		7.0	57.0		2.3		23.5	6.0		22.2	22.2		
Effective Green, g (s)		45.0		7.0	57.0		2.3		23.5	6.0		22.2	21.2		
Actuated d/C Ratio		0.47		0.07	0.69		0.02		0.23	0.06		0.23	0.22		
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)		2487		262	3162		44		510	225		451	366		
v/s Ratio Prot		0.42		0.05	0.26		0.02		0.09	0.04		0.06			
v/s Ratio Perm									0.06				c0.16		
v/c Ratio		0.90		0.70	0.44		0.68		0.46	0.58		0.35	0.72		
Uniform Delay, d1		23.7		43.7	10.9		46.7		31.1	44.0		31.1	34.9		
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00		1.00	1.00		
Incremental Delay, d2		4.8		8.2	0.1		35.7		0.7	3.8		0.5	6.5		
Delay (s)		28.5		52.0	11.0		82.4		31.8	47.8		31.6	41.4		
Level of Service		C		D	B		F		C	D		C	D		
Approach Delay (s)		28.5			15.8				36.0			40.2			
Approach LOS		C			B				D			D			
HCM Average Control Delay				26.3											
HCM Level of Service													C		
HCM Volume to Capacity ratio				0.84											
Actuated Cycle Length (s)				96.5								21.0			
Sum of lost time (s)															
Intersection Capacity Utilization				77.6%									D		
ICU Level of Service															
Analysis Period (min)				15											
Critical Lane Group															

HCM Signalized Intersection Capacity Analysis

5: Ka Uka Blvd & H-2 Off (SB)

9/15/2009



	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB	
Lane Configurations	↑↑↑			↑↑↑			↑		↑	↑↑		
Volume (vph)	0	2652	79	281	2796	0	84	0	530	423	192	
Ideal Flow (vphpl)	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	
Lane Util. Factor		0.91		0.97	0.91		1.00		1.00	0.97	1.00	
Flt Protected		1.00		0.95	1.00		0.95		1.00	0.95	1.00	
Satd. Flow (prot)		5339		3614	5353		1863		1667	3614	1961	
Flt Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	
Satd. Flow (perm)		5339		3614	5353		1863		1667	3614	1961	
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	
Adj. Flow (vph)	0	2652	79	281	2796	0	84	0	530	423	192	
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	153	0	0	
Lane Group Flow (vph)	0	2728	0	281	2796	0	84	0	377	423	192	
Turn Type				Prot			Prot		custom	Prot		
Protected Phases		4		3	8		5		2	1	6	
Permitted Phases									3			
Actuated Green, G (s)		55.0		9.0	69.0		6.0		30.0	15.0	30.0	
Effective Green, g (s)		55.0		9.0	69.0		6.0		28.0	15.0	29.0	
Actuated g/C Ratio		0.46		0.08	0.57		0.05		0.23	0.12	0.25	
Clearance Time (s)		5.0		5.0	5.0		5.0		5.0	5.0	5.0	
Vehicle Extension (s)		2.0		3.0	3.0		3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)		2443		271	3078		93		472	452	490	
v/s Ratio Prot		0.51		0.08	0.52		0.05		0.13	0.12	0.10	
v/s Ratio Perm									0.09			
v/c Ratio		1.12		1.04	0.91		0.90		0.80	0.94	0.89	
Uniform Delay, d1		32.5		55.5	22.7		56.7		43.3	52.0	37.4	
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00	1.00	
Incremental Delay, d2		58.8		64.6	4.4		62.4		9.1	26.8	0.5	
Delay (s)		91.3		120.1	27.1		119.1		52.4	78.8	37.9	
Level of Service		F		F	C		F		D	E	D	
Approach Delay (s)		91.3			35.6			61.6			83.2	
Approach LOS		F			D			E			F	
Summary												
HCM Average Control Delay		64.8			HCM Level of Service			E				
HCM Volume to Capacity ratio		1.12			Sum of lost time (s)			21.0				
Actuated Cycle Length (s)		120.0			ICD Level of Service			G				
Intersection Capacity Utilization		166.3%			Analysis Period (min)			15				
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Ka Uka Blvd & Spine Rd

9/11/2009



Lane Configurations	←		↑		→		←		↑		→	
Volume (vph)	103	1038	73	151	770	814	0	0	143	1428	0	161
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost Time (s)	5.0	6.0		6.0	6.0	4.0			6.0	5.0		5.0
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00			1.00	0.97		1.00
Flt Protected	0.95	1.00		0.95	1.00	1.00			1.00	0.95		1.00
Satd. Flow (prot)	1863	3689		1863	3725	1667			1611	3433		1583
Flt Permitted	0.95	1.00		0.95	1.00	1.00			1.00	0.95		1.00
Satd. Flow (perm)	1863	3689		1863	3725	1667			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)	103	1038	73	151	770	814	0	0	143	1428	0	161
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	91	0
Lane Grp Flow (vph)	103	1106	0	151	770	814	0	0	143	1428	70	0
Turn Type	Prot		Prot		Free		Free		Free		Prot	
Protected Phases	7		4		8		8		1		9	
Permitted Phases					Free		Free					
Actuated Green, G (s)	9.2		31.0		10.0		31.0		99.2		43.2	
Effective Green, g (s)	9.2		30.0		9.0		30.8		99.2		43.2	
Actuated g/C Ratio	0.09		0.30		0.09		0.31		1.00		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)	173		1116		169		1157		1667		689	
v/s Ratio Prot	0.06		0.30		0.08		0.21		0.09		0.04	
v/s Ratio Perm					c0.49		c0.49		0.09			
v/c Ratio	0.60		0.99		0.89		0.67		0.49		0.09	
Uniform Delay, d1	43.2		34.5		44.6		29.7		0.0		27.1	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	5.4		24.7		40.1		1.5		1.0		0.1	
Delay (s)	48.6		59.2		84.7		31.2		1.0		16.6	
Level of Service	D		E		F		C		A		D	
Approach Delay (s)			58.0				21.7		0.1		38.5	
Approach LOS			E				C		A		D	
HCM Average Control Delay			36.2			HCM Level of Service			D			
HCM Volume to Capacity ratio			0.97									
Actuated Cycle Length (s)			99.2			Sum of lost time (s)			17.0			
Intersection Capacity Utilization			92.3%			ICU Level of Service			F			
Analysis Period (min)			15									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Ka Uka Blvd & Spine Rd

9/15/2009



Approach	EB	EBT	EBP	WBL	WB	WBR	NBT	NBP	SB	SBT	SEB	
Lane Configurations	↖	↕		↖	↕	↗			↗	↕	↖	
Volume (vph)	239	904	140	201	1273	1667	0	0	347	1472	0	
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	
Total Lost time (s)	5.0	6.0		6.0	6.0	6.0			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	
Flt Protected	1.00	0.98		1.00	1.00	0.95			0.96	1.00	0.95	
Flt Permitted	0.95	1.00		0.95	1.00	1.00			1.00	0.95	1.00	
Satd Flow (prot)	1863	1651		1863	1667	1667			1611	1472	1583	
Satd Flow (perm)	1863	1651		1863	1667	1667			1611	1472	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	
Adj Flow (vph)	239	904	140	201	1273	1667	0	0	347	1472	0	
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	0	0	122	
Lane Grp Flow (vph)	239	1084	0	201	1273	1667	0	0	347	1472	82	
Turn Type	Prot			Prot		Free			Free	Prot		
Protected Phases	7	4		3	8				1	6		
Permitted Phases						Free			Free			
Actuated Green, G (s)	15.0	40.5		16.5	42.0	120.0			120.0	48.0	48.0	
Effective Green, g (s)	15.0	39.5		15.5	41.0	120.0			120.0	48.0	48.0	
Actuated v/c Ratio	0.12	0.33		0.13	0.34	1.00			1.00	0.40	0.40	
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)	233	1202		241	1273	1667			1611	1373	633	
v/s Ratio Prot	0.13	0.28		0.11	0.34				0.43	0.05		
v/s Ratio Perm						c1.10			0.22			
v/c Ratio	1.03	0.86		0.83	1.00	1.10			0.22	1.07	0.13	
Uniform Delay, d1	52.5	37.7		51.0	39.5	60.0			0.0	36.0	22.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00			1.00	1.00	1.00	
Incremental Delay, d2	65.8	6.5		21.3	26.2	54.8			0.3	46.2	0.1	
Delays (s)	118.3	44.1		72.3	65.7	114.8			0.3	82.2	22.9	
Level of Service	F	D		E	E	F			A	F	C	
Approach Delay (s)		58.0			93.3			0.3			74.9	
Approach LOS		E			F			A			E	
Analysis Summary												
HCM Average Control Delay	76.9			HCM Level of Service			E					
HCM Volume to Capacity ratio	1.10											
Actuated Cycle Length (s)	120.0			Sum of lost time (s)			0.0					
Intersection Capacity Utilization	101.5%			ICU Level of Service			G					
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

35: Ukee (E) & Ka Uka Blvd

9/11/2009



Lane Configurations	↕		↕		↖ ↗		↖ ↗		↖ ↗		↖ ↗	
Volume (vph)	15	3	2	41	15	21	8	182	69	91	746	81
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	
Flt Protected	0.99		0.96		1.00		0.99		1.00		0.99	
Satd Flow (prot)	1771		1748		1863		3695		1863		3671	
Satd Flow (perm)	1342		1476		664		3695		386		3671	
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	21	8	182	69	91	746	81
RTOR Reduction (vph)	0	2	0	0	17	0	0	5	0	0	9	0
Lane Grp Flow (vph)	0	18	0	0	60	0	8	246	0	93	813	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		6		2		2		6		6	
Permitted Phases	4		8		2		2		6		6	
Actuated Green, G (s)	6.2		6.2		36.9		36.9		36.9		36.9	
Effective Green, g (s)	6.2		6.2		36.9		36.9		36.9		36.9	
Actuated G/C Ratio	0.12		0.12		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)	157		172		461		2568		268		2551	
v/s Ratio Prot	0.01		0.04		0.01		0.24		0.01		0.22	
v/s Ratio Perm	0.01		0.04		0.01		0.24		0.01		0.24	
v/c Ratio	0.12		0.35		0.02		0.49		0.34		0.32	
Uniform Delay, d1	21.0		21.6		2.5		3.7		3.2		3.2	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.3		1.2		0.0		0.1		0.8		0.1	
Delay (s)	21.3		22.8		2.5		3.9		4.0		3.3	
Level of Service	C		C		A		A		A		A	
Approach Delay (s)	21.3		22.8		3.9		3.9		3.3		3.3	
Approach LOS	C		C		A		A		A		A	
Summary												
HCM Average Control Delay	4.4				HCM Level of Service				A			
HCM Volume to Capacity ratio	0.47											
Actuated Cycle Length (s)	53.1				Sum of lost time (s)				10.0			
Intersection Capacity Utilization	54.9%				ICU Level of Service				A			
Analysis Period (min)	15											
o Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 35: Ukee (E) & Ka Uka Blvd

9/15/2009



	EBL	EBT	EBF	WBL	WBT	WBF	NBL	NBT	NBF	SBL	SBT	SBF
Lane Configurations	↕			↕			↖	↗		↖	↗	
Volume (vph)	49	11	14	121	13	68	7	169	54	65	133	74
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	
Flt Protected	0.97			0.97			0.95	1.00		0.95	1.00	
Satd Flow (prot)	1757			1726			1853	1701		1863	1696	
Flt Permitted	0.74			0.77			0.14	1.00		0.18	1.00	
Satd Flow (perm)	1351			1376			256	1701		357	1696	
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)	49	11	14	121	13	68	7	169	54	65	133	74
RTOR Reduction (vph)	0	10	0	0	22	0	0	3	0	0	4	0
Lane Group Flow (vph)	0	64	0	0	180	0	7	1220	0	65	1402	0
Turn Type	Perm			Perm			Perm		Perm			
Protected Phases	4			8			2		6			
Permitted Phases	4			8			2		6			
Actuated Green, G (s)	14.0			14.0			40.7	40.7		40.7	40.7	
Effective Green, g (s)	14.0			14.0			40.7	40.7		40.7	40.7	
Actuated g/C Ratio	0.22			0.22			0.63	0.63		0.63	0.63	
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)	292			298			167	2328		225	2325	
v/s Ratio Prot							0.83		0.88			
v/s Ratio Perm	0.05			0.13			0.03		0.18			
w/c Ratio	0.22			0.60			0.04	0.52		0.29	0.60	
Uniform Delay, d1	20.9			22.9			4.6	6.6		5.4	7.2	
Progression Factor	1.00			1.00			1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4			3.4			0.1	0.2		0.7	0.4	
Delay (s)	21.2			26.3			4.7	6.9		6.2	7.6	
Level of Service	C			C			A	A		A	A	
Approach Delay (s)	21.2			26.3			5.8		7.6			
Approach LOS	C			C			A		A			
Key Report Summary												
HCM Average Control Delay	8.9			HCM Level of Service			A					
HCM Volume to Capacity ratio	0.60											
Actuated Cycle Length (s)	64.7			Sum of lost time (s)			10.0					
Intersection Capacity Utilization	66.1%			ICU Level of Service			C					
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Waipio Uka & Ka Uka Blvd

9/11/2009



Lane Configurations	↕		↕		↖ ↗		↖ ↗		↖ ↗		↖ ↗	
Volume (vph)	41	12	23	91	19	96	58	1115	101	68	686	31
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	
Flt Protected	0.97		0.98		0.98		0.95		1.00		0.95	
Satd Flow (prot)	1740		1707		1663		1679		1663		1701	
Flt Permitted	0.80		0.82		0.37		1.00		0.17		1.00	
Satd Flow (perm)	1433		1436		725		3679		342		3701	
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)	41	12	23	91	19	96	58	1115	101	68	686	31
RTOR Reduction (vph)	0	18	0	0	38	0	0	8	0	0	4	0
Lane Group Flow (vph)	0	58	0	0	170	0	58	1208	0	68	713	0
Turn Type	Perm											
Protected Phases	4		8		8		2		2		6	
Permitted Phases	4		8		2		2		6		6	
Actuated Green, G (s)	11.4		11.4		27.8		27.8		27.8		27.8	
Effective Green, g (s)	11.4		11.4		27.8		27.8		27.8		27.8	
Actuated G/C Ratio	0.23		0.23		0.57		0.57		0.57		0.57	
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)	332		333		410		2079		193		2091	
v/s Ratio Prot	0.04		0.12		0.08		0.38		0.19		0.19	
v/s Ratio Perm	0.04		0.12		0.08		0.20		0.20		0.20	
v/c Ratio	0.18		0.51		0.14		0.58		0.35		0.94	
Uniform Delay, d1	15.1		16.5		5.1		6.9		5.8		5.8	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.3		1.3		0.2		0.4		1.1		0.1	
Delay (s)	15.4		17.8		5.2		7.3		6.9		5.9	
Level of Service	B		B		A		A		A		A	
Approach Delay (s)	15.4		17.8		7.2		7.2		6.0		6.0	
Approach LOS	B		B		A		A		A		A	
HCM Average Control Delay	8.0		8.0		8.0		8.0		8.0		8.0	
HCM Level of Service	A		A		A		A		A		A	
HCM Volume to Capacity ratio	0.56		0.56		0.56		0.56		0.56		0.56	
Actuated Cycle Length (s)	49.2		49.2		49.2		49.2		49.2		49.2	
Sum of lost time (s)	10.0		10.0		10.0		10.0		10.0		10.0	
Intersection Capacity Utilization	62.3%		62.3%		62.3%		62.3%		62.3%		62.3%	
ICU Level of Service	B		B		B		B		B		B	
Analysis Period (min)	15		15		15		15		15		15	
Critical Lane Group	↕		↕		↖ ↗		↖ ↗		↖ ↗		↖ ↗	

HCM Signalized Intersection Capacity Analysis

4: Waipio Uka & Ka Uka Blvd

9/15/2009



	EBL	EBF	EBP	EB	WBP	WB	NBP	NB	SBP	SB	SB	
Lane Configurations	↕			↕	↕		↕	↕	↕		↕	
Volume (vph)	99	38	34	138	26	45	41	1080	92	119	1306	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	
Total Lost Time (s)	5.0			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		0.95	
Fit Protected	0.97			0.97	1.00		0.99	1.00	1.00		1.00	
Satd. Flow (prot)	1762			1751	1863		3632	3632	3632		3708	
Fit Permitted	0.74			0.73	0.14		1.00	1.00	0.19		1.00	
Satd. Flow (perm)	1346			1326	267		3632	3632	364		3708	
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	
Adj. Flow (vph)	99	38	34	138	26	45	41	1080	92	119	1306	
RTOR Reduction (vph)	0	11	0	0	11	0	0	8	0	0	3	
Lane Grp Flow (vph)	0	161	0	0	198	0	41	1164	0	119	1345	
Turn Type	Perm			Perm	Perm		Perm	Perm	Perm		Perm	
Protected Phases	4			8	8		2	2	6		6	
Permitted Phases	4			8	2		2	2	6		6	
Actuated Green, G (s)	14.6			14.6	33.8		33.8	33.8	33.8		33.8	
Effective Green, g (s)	14.6			14.6	33.8		33.8	33.8	33.8		33.8	
Actuated g/C Ratio	0.25			0.25	0.58		0.58	0.58	0.58		0.58	
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)	337			332	155		2131	2131	211		2146	
v/s Ratio Prot	0.12			0.15	0.15		0.32	0.32	0.33		0.33	
v/s Ratio Perm	0.12			0.15	0.15		0.15	0.15	0.33		0.33	
v/c Ratio	0.48			0.60	0.26		0.55	0.55	0.56		0.63	
Uniform Delay, d1	18.6			19.3	6.1		7.6	7.6	7.7		8.1	
Progression Factor	1.00			1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	1.1			2.9	0.9		0.3	0.3	3.4		0.6	
Delay (s)	19.7			22.2	7.0		7.9	7.9	11.1		8.7	
Level of Service	B			C	A		A	A	B		A	
Approach Delay (s)	19.7			22.2	7.8		7.8	7.8	8.9		8.9	
Approach LOS	B			C	A		A	A	A		A	
Summary												
HCM Average Control Delay	10.0			HCM Level of Service				A				
HCM Volume to Capacity ratio	0.62											
Actuated Cycle Length (s)	58.4			Sum of lost time (s)				10.0				
Intersection Capacity Utilization	66.4%			ICU Level of Service				C				
Analysis Period (min)	15											
Critical Lane Group												

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

9/11/2009



Lane Configurations	←		↑		→		↓		←		↓	
Volume (vph)	58	931	85	145	642	9	83	12	326	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	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	0.95	1.00	0.95	1.00	0.95	1.00	0.95
Flt Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.99	0.99	0.99	0.99	0.99	0.99
Satd Flow (prot)	1863	3679	1863	3718	1863	3718	1549	1549	1549	1549	1549	1549
Flt Permitted	0.95	1.00	0.95	1.00	0.95	1.00	0.93	0.93	0.93	0.93	0.93	0.93
Satd Flow (perm)	1863	3679	1863	3718	1863	3718	1549	1549	1549	1549	1549	1549
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	931	85	145	642	9	83	12	326	3	7	7
RTOR Reduction (vph)	0	7	0	0	1	0	0	158	0	0	5	0
Lane Grp Flow (vph)	58	1009	0	145	650	0	0	263	0	0	12	0
Turn Type	Prot		Prot		Perm		Perm		Perm		Perm	
Protected Phases	7	4	3	3			2	2			6	6
Permitted Phases							2				6	
Actuated Green, G (s)	6.9	26.2	10.5	29.8	10.5	29.8	16.9	16.9	16.9	16.9	16.9	16.9
Effective Green, g (s)	6.9	26.2	10.5	29.8	10.5	29.8	16.9	16.9	16.9	16.9	16.9	16.9
Actuated g/C Ratio	0.10	0.98	0.15	0.43	0.15	0.43	0.25	0.25	0.25	0.25	0.25	0.25
Clearance Time (s)	5.0	5.0	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	3.0	3.0
Lane Grp Cap (vph)	187	1405	285	1615	285	1615	382	382	382	382	409	409
v/s Ratio Prot	0.03	0.27	0.08	0.17	0.08	0.17						
v/s Ratio Perm							0.17	0.17	0.17	0.17	0.01	0.01
v/c Ratio	0.31	0.72	0.51	0.40	0.51	0.40	0.69	0.69	0.69	0.69	0.03	0.03
Uniform Delay, d1	28.6	18.1	26.7	13.3	26.7	13.3	23.5	23.5	23.5	23.5	19.6	19.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	1.8	1.4	0.2	1.4	0.2	5.1	5.1	5.1	5.1	0.0	0.0
Delays (s)	29.6	19.6	28.1	13.6	28.1	13.6	28.6	28.6	28.6	28.6	19.6	19.6
Level of Service	C	B	C	B	C	B	C	C	C	C	B	B
Approach Delay (s)		20.4		16.1		16.1	28.6	28.6	28.6	28.6	19.6	19.6
Approach LOS		C		B		B	C	C	C	C	B	B
HCM Average Control Delay	20.4		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.73											
Actuated Cycle Length (s)	68.6		Sum of lost time (s)		20.0							
Intersection Capacity Utilization	79.1%		ICU Level of Service		D							
Analysis Period (min)	15											
Critical Lane Group												

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

9/15/2009



	EBL	EBT	EBR	NBL	NBT	NBR	WBL	WBT	WBR	SBL	SBT	SBR
Lane Configurations	←	↑↑		←	↑↑					↑	↘	↙
Volume (vph)	53	1009	99	198	1271	7	149	19	189	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	
Flt Protected	0.95	1.00		0.95	1.00			0.98			1.00	
Satd. Flow (prot)	1863	3676		1863	3722			1694			1664	
Flt Permitted	0.95	1.00		0.95	1.00			0.80			0.97	
Satd. Flow (perm)	1863	3676		1863	3722			1389			1616	
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	1009	99	198	1271	7	149	19	189	11	22	108
RTOR Reduction (vph)	0	8	0	0	1	0	0	50	0	0	78	0
Lane Group Flow (vph)	53	1100	0	198	1277	0	0	307	0	0	65	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	29.0		11.9	36.8			21.7			21.7	
Effective Green, g (s)	4.1	29.0		11.9	36.8			21.7			21.7	
Actuated g/C Ratio	0.05	0.37		0.15	0.47			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)	98	1374		286	1765			388			452	
v/s Ratio Prot	0.06	0.39		0.11	0.34							
v/s Ratio Perm								0.22			0.04	
v/c Ratio	0.54	0.80		0.69	0.72			0.79			0.14	
Uniform Delay, d1	35.8	21.7		31.1	16.3			25.9			21.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	6.0	3.5		7.1	1.5			10.6			0.1	
Delay (s)	41.8	25.2		38.2	17.8			36.4			21.1	
Level of Service	D	C		D	B			D			C	
Approach Delay (s)		25.9			20.6			36.4			21.1	
Approach LOS		C			C			D			C	
Key Results Summary												
HCM Average Control Delay	24.4		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.85		Sum of lost time (s)		20.0							
Actuated Cycle Length (s)	77.6		ICU Level of Service		E							
Intersection Capacity Utilization	65.8%		Analysis Period (min)		15							
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 3: Ka Uka Blvd & Kam Hwy

9/11/2009



Lane Configurations	↖	↕	↗	↖	↕	↗	↖	↕	↗	↖	↕	↗
Volume (vph)	16	25	4	363	27	346	8	475	326	734	953	17
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000
Satd Flow time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	1.00
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (prot)	1770	3539	1583	1770	1786	2933	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (perm)	1770	3539	1583	1770	1786	2933	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	25	4	363	27	346	8	475	326	734	953	17
RTOR Reduction (vph)	0	0	0	0	0	154	0	0	255	0	0	9
Lane Grp Flow (vph)	16	25	4	196	191	191	8	475	71	734	953	8
Turn Type	Split		Free	Split		pt+ov	Prot		Perm	Prot		Perm
Protected Phases	4	4		6	6	6.1	5	2		1		6
Permitted Phases			Free						2			6
Actuated Green, G (s)	9.5	9.5	82.9	16.1	16.1	46.3	4.4	18.1	18.1	25.2	38.9	36.9
Effective Green, g (s)	3.5	3.5	82.9	16.1	16.1	46.3	4.4	18.1	18.1	25.2	38.9	37.9
Actuated g/C Ratio	0.04	0.04	1.00	0.19	0.19	0.56	0.05	0.22	0.22	0.30	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)	75	149	1583	344	347	1638	99	813	364	1099	1748	762
v/s Ratio Prot	0.04	0.04		0.19	0.19	0.07	0.00	0.13		0.20	0.26	
v/s Ratio Perm			0.00						0.04			0.00
v/c Ratio	0.21	0.17	0.00	0.57	0.56	0.12	0.08	0.58	0.20	0.67	0.55	0.04
Uniform Delay, d1	38.4	38.3	0.0	30.3	30.2	8.7	37.3	29.0	26.5	25.2	15.7	12.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.5	0.0	2.2	2.0	0.0	0.4	1.1	0.3	1.6	0.3	0.0
Delay (s)	39.8	38.8	0.0	32.5	32.1	8.7	37.7	30.1	26.7	26.7	16.0	12.3
Level of Service	D	D	A	C	C	A	D	C	C	C	B	B
Approach Delay (s)		35.7			21.2			28.8			20.6	
Approach LOS		D			C			C			C	
HCM Average Control Delay			23.0			HCM Level of Service	C					
HCM Volume to Capacity ratio			0.56									
Actuated Cycle Length (s)			82.9			Sum of lost time (s)	15.0					
Intersection Capacity Utilization			61.8%			ICU Level of Service	B					
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

3: Ka Uka Blvd & Kam Hwy

9/15/2009



Lane Group	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Lane Configurations	↙	↑↑	↗	↙	←	↗	↙	↑↑	↗	↙↗	↑↑	↗
Volume (vph)	32	53	36	542	37	915	35	350	650	467	617	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	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	1798	2933	1863	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	1798	2933	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	53	36	542	37	915	35	350	650	467	617	51
RTOR Reduction (vph)	0	0	0	0	0	238	0	0	453	0	0	29
Lane Group Flow (vph)	32	53	36	314	315	677	35	350	497	467	617	22
Turn Type	Split		Free	Split		pt+ov	Prot	Perm		Prot	Perm	
Protected Phases	4	4		8	8	8.1	5	2		4	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	5.9	5.9	101.7	25.7	25.7	50.0	6.1	30.8	30.8	19.3	44.0	44.0
Effective Green, g (s)	5.9	5.9	101.7	25.7	25.7	50.0	6.1	30.8	30.8	19.3	44.0	43.0
Actuated g/C Ratio	0.06	0.06	1.00	0.25	0.25	0.49	0.06	0.30	0.30	0.19	0.43	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)	103	205	1583	447	454	1442	112	1128	505	686	1612	705
v/s Ratio Prot	0.02	0.01		0.18	0.18	0.23	0.02	0.23		0.15	0.17	
v/s Ratio Perm			0.02						0.12			0.01
g/c Ratio	0.31	0.26	0.02	0.70	0.69	0.47	0.31	0.75	0.99	0.68	0.33	0.03
Uniform Delay, d1	45.9	45.8	0.0	34.5	34.4	17.1	45.8	32.0	28.0	38.3	19.6	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	1.00
Incremental Delay, d2	1.7	0.7	0.0	5.0	4.6	0.2	1.6	2.9	0.5	2.8	0.2	0.0
Delay (s)	47.7	46.5	0.0	39.5	39.0	17.3	47.4	34.9	28.5	41.1	19.8	17.2
Level of Service	D	D	A	D	D	B	D	C	C	D	B	B
Approach Delay (s)	33.0			26.2			32.5			28.4		
Approach LOS	C			C			C			C		
Intersection Summary												
HCM Average Control Delay	29.2		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.69											
Actuated Cycle Length (s)	101.7		Sum of lost time (s)		20.0							
Intersection Capacity Utilization	70.6%		ICU Level of Service		B							
Analysis Period (min)	15											
C - Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

19: Waipio Uka & Kam Hwy

9/11/2009



Lane Configurations	↖	↑	↗	↖↗	↔	↖	↖↗	↗	↖	↖↗	↗	
Volume (vph)	1	1	9	578	2	44	16	762	567	35	1282	
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	
Total Lost time (s)	5.0	5.0	4.8	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	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd Flow (prot)	1770	1863	1583	3614	1679		1863	3725	1667	1863	3725	
Flt Permitted	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd Flow (perm)	1770	1863	1583	3614	1679		1863	3725	1667	1863	3725	
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	
Adj. Flow (vph)	1	1	9	578	2	44	16	762	567	35	1282	
RTOR Reduction (vph)	0	0	0	0	33	0	0	0	327	0	0	
Lane Group Flow (vph)	1	1	9	578	16	0	16	762	246	35	1282	
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	80.8	19.5	19.5	5.3	34.2	34.2	6.2	35.1	35.1	
Effective Green, g (s)	0.9	0.9	80.8	19.5	19.5	5.3	34.2	34.2	6.2	35.1	35.1	
Actuated v/c Ratio	0.01	0.01	0.01	0.24	0.24	0.07	0.42	0.42	0.08	0.43	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)	20	21	1583	872	405	122	1577	706	143	1618	724	
v/s Ratio Prot	0.00	0.00		0.16	0.01	0.01	0.20		0.02	0.34		
v/s Ratio Perm			c0.01					0.14			0.00	
v/c Ratio	0.05	0.19	0.01	0.66	0.63	0.13	0.48	0.37	0.24	0.79	0.69	
Uniform Delay, d1	39.5	39.6	0.0	27.7	23.4	35.6	16.9	15.7	35.1	19.7	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	1.0	4.4	0.0	1.9	0.0	0.5	0.2	0.3	0.9	2.7	0.0	
Delay (s)	40.6	44.0	0.0	29.6	23.5	36.1	17.1	16.0	36.0	22.5	12.9	
Level of Service	D	D	A	C	C	D	B	B	D	C	B	
Approach Delay (s)		15.7			29.1		16.9			22.8		
Approach LOS		B			C		B			C		
HCM Average Control Delay			21.6	HCM Level of Service				C				
HCM Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			80.8	Sum of lost time (s)				15.0				
Intersection Capacity Utilization			64.3%	ICU Level of Service				C				
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

19: Waipio Uka & Kam Hwy

9/15/2009



Category	EB	NB	SB	WB	EB	NB	SB	WB	EB	NB	SB	WB	
Lane Configurations	↖	↑	↗	↖↗	↑	↖	↗	↖↗	↑↑	↖	↗	↑↑	↖
Volume (vph)	7	16	41	618	17	59	84	1467	833	52	1128	7	
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	2000	2000	2000	2000	2000	2000	
Oper. Cycle Time (s)	5.0	5.0	5.0	5.0	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	0.95	1.00	1.00	0.95	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1593	3614	1732	1863	1667	1863	1725	1667	1863	1667	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1593	3614	1732	1863	1667	1863	1725	1667	1863	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	1467	833	52	1128	7	
RTOR Reduction (vph)	0	0	0	0	46	0	0	0	328	0	0	7	
Lane Group Flow (vph)	7	16	41	618	30	0	84	1467	505	52	1128	7	
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)	2.6	2.6	99.3	21.7	21.7	9.2	48.9	48.9	6.1	45.8	45.8	45.8	
Effective Green, g (s)	2.6	2.6	99.3	21.7	21.7	9.2	48.9	48.9	6.1	45.8	45.8	45.8	
Actuated g/C Ratio	0.03	0.03	1.00	0.22	0.22	0.09	0.49	0.49	0.06	0.46	0.46	0.46	
Clearance Time (s)	5.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	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	3.0	
Lane Grp Cap (vph)	46	49	1583	790	378	173	1834	821	114	1718	769		
v/s Ratio Prot	0.03	0.03	0.17		0.02	0.05	0.39		0.03	0.39			
v/s Ratio Perm			0.03						0.30		0.00		
g/C Ratio	0.15	0.33	0.03	0.78	0.08	0.49	0.80	0.61	0.46	0.66	0.01		
Uniform Delay, d1	47.3	47.5	0.0	36.6	30.9	42.8	21.1	18.3	45.0	20.7	14.5		
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	5.1	0.1	2.1	2.5	1.4	2.9	0.9	0.0		
Delay (s)	48.8	51.4	0.0	41.6	30.9	44.9	23.6	19.7	47.9	21.6	14.5		
Level of Service	D	D	A	D	C	D	C	B	D	C	B		
Approach Delay (s)	18.2		40.5		23.0		22.6						
Approach LOS	B		D		C		C						
Summary Statistics													
HCM Average Control Delay	25.6		HCM Level of Service		C								
HCM Volume to Capacity ratio	0.77												
Actuated Cycle Length (s)	99.3		Sum of lost time (s)		20.0								
Intersection Capacity Utilization	77.8%		ICU Level of Service		D								
Analysis Period (min)	15												
c Critical Lane Group													

HCM Signalized Intersection Capacity Analysis

16: Lumina St & Kam Hwy

9/11/2009



Lane Configurations	←	←	←	←	←	←	←	←	←	←	←	←
Volume (vph)	496	17	93	64	73	39	46	816	39	17	1252	60
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		6.0	5.0	3.0	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
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
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	1780	1667	1770	1765		1663	3725	1667	1663	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	1780	1667	1770	1765		1663	3725	1667	1663	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
Vol. Flow (vph)	496	17	93	64	73	39	46	816	39	17	1252	60
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	23	0	0	0
Lane Group Flow (vph)	256	255	93	64	96	0	46	816	16	17	1252	60
Confl. Peds. (#/hr)	39											
Phase 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)	19.5	19.5	96.0	10.8	10.8		6.1	40.5	40.5	5.2	39.6	96.0
Effective Green, g (s)	19.5	19.5	96.0	10.8	10.8		6.1	40.5	40.5	5.2	39.6	96.0
Actuated g/C Ratio	0.20	0.20	1.00	0.11	0.11		0.06	0.42	0.42	0.05	0.41	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)	360	362	1667	199	109		118	1571	703	101	1537	1667
v/s Ratio Prot	c0.15	0.14		0.04	0.05		0.02	0.22		0.01		c0.36
v/c Ratio Perm			0.06						0.01			0.36
v/c Ratio	0.72	0.70	0.06	0.32	0.48		0.39	0.52	0.02	0.17	0.81	0.36
Uniform Delay, d1	35.7	35.6	0.0	39.2	40.0		43.2	20.5	16.2	43.5	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	6.7	6.1	0.0	0.9	1.6		2.1	0.3	0.0	0.8	3.4	0.0
Delay (s)	42.3	41.7	0.1	40.2	41.8		45.3	20.8	16.2	44.1	28.4	0.6
Level of Service	D	D	A	D	D		D	C	B	D	C	A
Approach Delay (s)	35.6		41.2			21.9		19.6				
Approach LOS	D		D			C		B				
HCM Average Control Delay	24.0		HCM Level of Service			C						
HCM Volume to Capacity ratio	0.65											
Actuated Cycle Length (s)	96.0		Sum of lost time (s)			10.0						
Intersection Capacity Utilization	64.8%		ICU Level of Service			C						
Analysis Period (min)	15											

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

16: Lumiaina St & Kam Hwy

9/15/2009



Category	EB	EB	EB	WB	WB	WB	SB	SB	SB	SB	SB	SB
Lane Configurations	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖	↖
Volume (vph)	541	31	194	24	31	52	176	1824	105	28	1044	774
Ideal Flow (vphpl)	2000	2000	2000	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Loss time (s)	5.0	5.0	4.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00
Flpb, ped/bike	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd Flow (prot)	1770	1783	1667	1770	1688	1663	3725	1667	1663	3725	1667	1667
Flt Permitted	0.95	0.96	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd Flow (perm)	1770	1783	1667	1770	1688	1663	3725	1667	1663	3725	1667	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)	541	31	134	24	31	52	176	1824	105	28	1044	774
RTOR Reduction (vph)	0	0	0	0	49	0	0	0	33	0	0	0
Lane Group Flow (vph)	287	285	134	24	34	0	176	1824	72	28	1044	774
Confl. Peds. (#/hr)	39											
Con Type	Split		Free	Split			Prot		Perm	Prot		Free
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			Free						Free			Free
Actuated Green, G (s)	21.5	21.5	107.7	6.6	6.6		14.8	54.6	54.6	5.0	44.8	107.7
Effective Green, g (s)	21.5	21.5	107.7	6.6	6.6		14.8	54.6	54.6	5.0	44.8	107.7
Actuated g/C Ratio	0.20	0.20	1.00	0.06	0.06		0.14	0.51	0.51	0.05	0.42	1.00
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)	353	356	1667	108	103		256	1888	646	36	1549	1667
v/s Ratio Prot	c0.16	0.16		0.01	0.02		c0.09	c0.49		0.02	0.28	
v/s Ratio Perm			0.08						0.04			c0.43
v/c Ratio	0.81	0.80	0.08	0.22	0.33		0.69	0.97	0.09	0.33	0.67	0.43
Uniform Delay, d1	41.2	41.1	0.0	48.1	48.4		44.2	25.7	13.7	49.7	26.5	0.0
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	13.3	12.2	0.1	1.0	1.9		7.5	13.5	0.0	2.2	1.2	0.8
Delay (s)	54.5	53.2	0.1	49.2	50.3		51.7	39.2	13.7	51.9	26.7	0.8
Level of Service	D	D	A	D	D		D	D	B	D	C	A
Approach Delay (s)	43.7		50.1			38.9			16.7			
Approach LOS	D		D			D			B			
Intersection Summary												
HCM Average Control Delay			31.5			HCM Level of Service		E				
HCM Volume to Capacity ratio			0.87									
Actuated Cycle Length (s)			107.7			Sum of lost time (s)		15.0				
Intersection Capacity Utilization			85.4%			ICU Level of Service		E				
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

30: Lumiauau St & Kam Hwy

9/11/2009



Lane Configurations	←	↖	↗	→	←	↖	↗	→	←	↖	↗	→
Volume (vph)	118	12	321	173	12	14	30	766	55	3	1408	11
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	5.0	5.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
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	1255	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)	118	12	321	173	12	14	30	766	55	3	1408	11
RTOR Reduction (vph)	0	0	72	0	11	0	0	0	26	0	0	5
Lane Group Flow (vph)	0	130	249	173	15	0	30	766	29	3	1408	6
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases		4		6			5	2		1		6
Permitted Phases	4		4	8					2			6
Actuated Green, G (s)	19.4	19.4	19.4	19.4	19.4		6.3	44.6	44.6	4.3	42.6	42.6
Effective Green, g (s)	19.4	19.4	19.4	19.4	19.4		6.3	44.6	44.6	4.3	42.6	42.6
Actuated v/c Ratio	0.23	0.23	0.23	0.23	0.23		0.08	0.54	0.54	0.05	0.51	0.51
Clearance Time (s)	5.0	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	3.0
Lane Grp Cap (vph)		315	369	292	399		141	1994	893	96	1905	853
v/s Ratio Prot					0.01		0.02	0.21		0.00	0.38	
v/s Ratio Perm	0.10	0.16	0.14						0.02			0.00
v/c Ratio	0.41	0.67	0.59	0.04			0.24	0.68	0.03	0.03	0.74	0.74
Uniform Delay, d1	27.1	29.1	28.4	24.7			36.2	11.3	9.2	37.5	16.0	10.0
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	4.8	3.2	0.0			0.8	0.1	0.0	0.1	1.5	0.0
Delay (s)	28.0	33.9	31.6	24.7			36.9	11.4	9.2	37.7	17.5	10.0
Level of Service		C	C	C	C		D	B	A	D	B	A
Approach Delay (s)		32.2		30.7				12.2			17.5	
Approach LOS		C		C				B			B	
HCM Average Control Delay		19.1										
HCM Volume to Capacity ratio		0.67										
Actuated Cycle Length (s)		83.3										
Intersection Capacity Utilization		78.9%										
Analysis Period (min)		15										
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

30: Lumiauau St & Kam Hwy

9/15/2009



	EFL	EFB	EFB	WFL	WBT	WBR	NBL	NBT	NBF	SBL	SBT	SEB	
Lane Configurations		←	←	←	←	←	←	←	←	←	←	←	
Volume (vph)	22	6	69	69	8	10	158	2094	173	11	1173	28	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	2000	2000	2000	2000	2000	2000	
Total LOS Time (s)	5.0	5.0	5.0	5.0	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	1.00	1.00	1.00	0.95	1.00	1.00	1.00	0.95	1.00	
Flt	1.00	0.85	1.00	0.92	1.00	1.00	0.85	1.00	0.85	1.00	1.00	0.85	
Flt Protected	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	
Satd Flow (prot)	1792	1583	1776	1708	1708	1863	3725	1667	1863	3725	1667	1667	
Flt Permitted	0.76	1.00	0.74	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	
Satd Flow (perm)	1416	1583	1377	1708	1708	1863	3725	1667	1863	3725	1667	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)	22	6	69	69	8	10	158	2094	173	11	1173	28	
RTOR Reduction (vph)	0	0	63	0	9	0	0	0	49	0	0	11	
Lane Group Flow (vph)	0	28	6	69	9	0	158	2094	122	11	1173	17	
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm	
Protected Phases		4			8		5	2		1	6		
Permitted Phases	4		4	8					2			6	
Actuated Green, G (s)		8.3	8.3	8.3	8.3		14.0	69.7	69.7	4.4	60.1	60.1	
Effective Green, g (s)		8.3	8.3	8.3	8.3		14.0	69.7	69.7	4.4	60.1	60.1	
Actuated g/C Ratio		0.09	0.09	0.09	0.09		0.14	0.72	0.72	0.05	0.62	0.62	
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)		121	135	117	146		268	2666	1193	84	2298	1029	
v/s Ratio Prot					0.01		0.08	0.56		0.01	0.31		
v/s Ratio Perm		0.02	0.00	c0.05					0.07			0.01	
v/c Ratio		0.23	0.04	0.54	0.06		0.59	0.79	0.10	0.13	0.51	0.02	
Uniform Delay, d1		41.6	40.9	42.7	41.0		39.0	9.0	4.3	44.7	10.4	7.2	
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		1.0	0.1	4.7	0.2		3.3	1.6	0.0	0.7	0.2	0.0	
Delay (s)		42.6	41.0	47.4	41.1		42.3	10.6	4.3	45.4	10.6	7.2	
Level of Service		D	D	D	D		D	B	A	D	B	A	
Approach Delay (s)		41.6			46.0			12.2			10.9		
Approach LOS		D			D			B			B		
Summary													
HCM Average Control Delay		13.2		HCM Level of Service				B					
HCM Volume to Capacity ratio		0.77											
Actuated Cycle Length (s)		97.4				Sum of lost time (s)				15.0			
Intersection Capacity Utilization		81.0%		ICU Level of Service				D					
Analysis Period (min)		15											
Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 52: Waipahu St & Kam Hwy

9/11/2009



Lane Configurations	↙	↖	↗	↑↑	↑↑	↘
Volume (vph)	119	618	139	730	1845	91
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
Flt Protected	1.00	0.85	1.00	1.00	1.00	0.85
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1863	1667	1863	3725	3725	1667
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	730	1845	91
RTOR Reduction (vph)	0	50	0	0	0	36
Lane Group Flow (vph)	119	568	139	730	1845	65
Turn Type	pm+ov		Prot	Perm		
Protected Phases	4	5	5	2	6	
Permitted Phases				4	6	
Actuated Green, G (s)	12.2	37.3	25.1	91.1	61.0	61.0
Effective Green, g (s)	12.2	37.3	25.1	91.1	61.0	61.0
Actuated %C Ratio	0.11	0.33	0.22	0.80	0.61	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)	201	622	413	2995	2006	898
v/s Ratio Prot	0.06	0.20	0.07	0.26	0.50	
v/s Ratio Perm	0.14		0.03			
v/s Ratio	0.59	0.91	0.34	0.24	0.92	0.06
Uniform Delay, d1	48.2	36.4	37.1	2.7	23.9	12.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	17.8	0.5	0.0	7.3	0.0
Delay (s)	52.8	54.3	37.6	2.7	31.2	12.5
Level of Service	D	D	D	A	C	B
Approach Delay (s)	54.0		8.3			30.4
Approach LOS	D		A			C
HCM Average Control Delay	29.9		HCM Level of Service			C
HCM Volume to Capacity ratio	0.92					
Actuated Cycle Length (s)	113.3		Sum of lost time (s)			10.0
Intersection Capacity Utilization	93.1%		ICU Level of Service			F
Analysis Period (min)	15					
Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

52: Waipahu St & Kam Hwy

9/15/2009



	EBL	EBR	NBL	NBT	SBL	SBR
Lane Configurations	←	→	←	↑↑	↑↑	→
Volume (vph)	259	456	292	2172	1120	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
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)	259	456	292	2172	1120	182
RTOR Reduction (vph)	0	17	0	0	0	101
Lane Group Flow (vph)	259	439	292	2172	1120	81
Turn Type	pm+ov		Prot		Perm	
Protected Phases	4	5	5	2	6	
Permitted Phases					6	
Isolated Green, G (s)	19.6	41.4	21.8	71.8	45.0	45.0
Effective Green, g (s)	19.6	41.4	21.8	71.8	45.0	45.0
Isolated v/c Ratio	0.19	0.41	0.21	0.71	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)	360	763	401	2638	1653	740
v/s Ratio Prot	0.14	0.12	0.16	0.58	0.30	
v/s Ratio Perm	0.14				0.05	
v/c Ratio	0.72	0.58	0.73	0.62	0.68	0.11
Uniform Delay, d1	38.3	23.2	37.0	10.4	22.4	16.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.7	1.1	6.5	2.2	1.1	0.1
Delay (s)	45.1	24.3	43.5	12.6	23.5	16.6
Level of Service	D	C	D	B	C	B
Approach Delay (s)	31.8		16.2		22.6	
Approach LOS	C		B		C	
HCM Average Control Delay	20.6		HCM Level of Service		C	
HCM Volume to Capacity ratio	0.80		Sum of lost time (s)		10.0	
Actuated Cycle Length (s)	101.4		ICU Level of Service		D	
Intersection Capacity Utilization	79.0%		Analysis Period (min)		15	
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 2025 With Project
 Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4516	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	1274	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	800	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	507	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)	4516	1274	507	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1188	335	133	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	4896		1354		539	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v_{12} = v_R + (v_F - v_R) P = 2148$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{Fi}$	4407	9400	No
$v = v_{FO} - v_{FR}$	3053	9400	No
v_R	1354	3800	No
$v_{3 \text{ or } av34}$	1129 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2148$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2148	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L = 1.1$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	D = 0.550	
Space mean speed in ramp influence area,	S = 52.4	mph
Space mean speed in outer lanes,	S = 70.8	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 2025 With Project
Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	9224	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	3826	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	800	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	745	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)	9224	3826	745	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	2427	1007	196	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	10001		4068		792	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v = v + (v - v) P = 5091$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	8001	9400	No
Fi F			
v = v - v	3933	9400	No
FO F R			
v	4068	3800	Yes
R			
v v	1455 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is v v > 2700 pc/h?		No	
3 or av34			
Is v v > 1.5 v /2		No	
3 or av34 12			
If yes, v = 5091		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	5091	4400	Yes
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v}{R} - 0.009 \frac{L}{D} = 26.4$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	D = 0.794	
	S	
Space mean speed in ramp influence area,	S = 46.7	mph
	R	
Space mean speed in outer lanes,	S = 69.5	mph
	0	
Space mean speed for all vehicles,	S = 53.1	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: AM Peak
Freeway/Dir of Travel: H-2 Fwy NB On Ramp Loop (EB)
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2025 With Project
Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2365	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	507	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	2151	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2365	507	2151	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	622	133	566	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	2564	539	2287 pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 25-2 or 25-3)}$$

$$EQ$$

$$P = 0.150 \text{ Using Equation 4}$$

$$FM$$

$$v_{12} = v_F (P_{FM}) = 386 \text{ pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v	3103	9400	No
FO			
v	1089 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 1025		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1025	4600	No
12A			

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 8.0 \text{ pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M = 0.235	
	S	
Space mean speed in ramp influence area,	S = 59.6	mph
	R	
Space mean speed in outer lanes,	S = 64.0	mph
	O	
Space mean speed for all vehicles,	S = 61.7	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 NB On Ramp Loop (EB)
 Junction: H-2 Fwy/Ka Uka Blvd
 Jurisdiction:
 Analysis Year: Year 2025 With Project
 Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3501	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	745	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	5723	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3501	745	5723	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	921	196	1506	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		3796	792	6084 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
EQ
P = 0.119 Using Equation 4
FM
 $v_{12} = v_F \cdot P_{FM} = 451 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	4588	9400	No
FO			
v	1672 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 1518		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1518	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 13.7 \text{ pc/mi/ln}$
Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.255	
	S	
Space mean speed in ramp influence area,	S = 59.1	mph
	R	
Space mean speed in outer lanes,	S = 62.7	mph
	O	
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 NB On Ramp (WB)
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2025 With Project
Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2872	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	310	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	507	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1700	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2872	310	507	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	756	82	133	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	3114	330	539 pcp/h

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.177 Using Equation 4
 FM
 $v_{12} = v_{F \text{ FM}} = 550 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v FO	3444	9400	No
v v 3 or av34	1282 pc/h	(Equation 25-4 or 25-5)	
Is v v > 2700 pc/h?		No	
Is v v > 1.5 v /2 3 or av34 12		Yes	
If yes, v = 1245 12A		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v 12A	1245	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 \frac{v}{R} + 0.0078 \frac{v}{12} - 0.00627 \frac{L}{A} = 13.2 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.291	
Space mean speed in ramp influence area,	S = 58.3	mph
Space mean speed in outer lanes,	S = 63.4	mph
Space mean speed for all vehicles,	S = 61.0	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 2025 With Project
Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4246	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	536	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	745	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1700	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4246	536	745	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1117	141	196	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	4604	570	792 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.147 Using Equation 4
 FM
 $v = v_{12} (P) = 675 \text{ pc/h}$
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	5174	9400	No
FO			
v v	1964 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 = 1841		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1841	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 19.6 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.315	
	S	
Space mean speed in ramp influence area,	S = 57.7	mph
	R	
Space mean speed in outer lanes,	S = 61.8	mph
	0	
Space mean speed for all vehicles,	S = 59.9	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 2025 With Project
Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4292	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	603	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	2030	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4292	603	2030	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1129	159	534	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	4653		641		2158	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.436 Using Equation 8
FD
 $v = v_{12} + (v_R - v_F) P = 2390$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	4653	9400	No
$v = v_{12} - v_{FO}$	4012	9400	No
v_R	641	2000	No
$v_{3 \text{ or } 12}$	1131 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } 12} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } 12} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2390$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2390	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 23.5$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D = 0.486	
Space mean speed in ramp influence area,	S = 53.8	mph
Space mean speed in outer lanes,	S = 70.8	mph
Space mean speed for all vehicles,	S = 60.9	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 2025 With Project
 Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3554	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	1051	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	1884	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3554	1051	1884	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	935	277	496	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	3853		1117		2003	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.436 Using Equation 8
FD
 $v = v + (v - v) P = .2310$ pc/h
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	3853	9400	No
F_i F			
$v = v - v$	2736	9400	No
F_O F R			
v	1117	2000	No
R			
v v	771 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is v v > 2700 pc/h?		No	
3 or av34			
Is v v > 1.5 v /2		No	
3 or av34 12			
If yes, v = 2310		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2310	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v - 0.009 L = 22.8$ pc/mi/ln
R 12 D
Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D = 0.529	
	S	
Space mean speed in ramp influence area,	S = 52.8	mph
	R	
Space mean speed in outer lanes,	S = 71.3	mph
	O	
Space mean speed for all vehicles,	S = 59.0	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 Loop (WB)
 Junction: H-2 Fwy/Ka Uka Blvd
 Jurisdiction:
 Analysis Year: Year 2025 With Project
 Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3689	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	2030	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	603	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3689	2030	603	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	971	534	159	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	4000	2158	641

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = -0.052$ Using Equation 4
 FM
 $v = v_{12} (P_{FM}) = -207$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	6158	9400	No
FO			
v v	2103 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 = 1600		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1600	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 29.7$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M = 0.443	
Space mean speed in ramp influence area,	S = 54.8	mph
Space mean speed in outer lanes,	S = 62.5	mph
Space mean speed for all vehicles,	S = 57.6	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 Loop (WB)
 Junction: H-2 Fwy/Ka Uka Blvd
 Jurisdiction:
 Analysis Year: Year 2025 With Project
 Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2503	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	1884	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1051	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2503	1884	1051	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	659	496	277	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	2714	2003	1117 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = -0.033$ Using Equation 4
 FM
 $v_{12} = v_F (P_{FM}) = -87$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	4717	9400	No
$v_{3 \text{ or } av34}$	1400 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		Yes	
If yes, $v_{12A} = 1085$		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1085	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 24.6$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	$M = 0.361$	
Space mean speed in ramp influence area,	$S_R = 56.7$	mph
Space mean speed in outer lanes,	$S_0 = 63.9$	mph
Space mean speed for all vehicles,	$S = 59.0$	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 2025 With Project
Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4387	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	2105	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	1884	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4387	2105	1884	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1154	554	496	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	4756	2238	2003 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = -0.062$ Using Equation 4
 FM
 $v = v (P) = -229$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	5948	9400	No
FO			
v v	1969 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 = 1484		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1484	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 \frac{v}{R} + 0.0078 \frac{v}{R} - 0.00627 \frac{L}{A} = 28.3$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M = 0.425	
	S	
Space mean speed in ramp influence area,	S = 55.2	mph
	R	
Space mean speed in outer lanes,	S = 62.8	mph
	O	
Space mean speed for all vehicles,	S = 57.8	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 2025 With Project
Description: 15/15/15 - No Pineapple Road

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5719	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	2285	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	2030	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5719	2285	2030	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1505	601	534	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	6201	2429	2158 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = -0.086 Using Equation 4
 FM
 $v = v (P) = -403 \text{ pc/h}$
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v	7142	9400	No
FO			
v	2558 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v /2		Yes	
3 or av34	12		
If yes, v = 1885		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1885	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 32.9 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	M = 0.555	
	S	
Space mean speed in ramp influence area,	S = 52.2	mph
	R	
Space mean speed in outer lanes,	S = 61.7	mph
	O	
Space mean speed for all vehicles,	S = 55.6	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 2025 With Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	4516	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1129	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	930	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	5	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	930	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	5	
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 2025 With Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	9224	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	2306	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	1900	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	5	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h
	Urban Freeway	

LOS and Performance Measures

Flow rate, vp	1900	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	66.6	mi/h
Number of lanes, N	5	
Density, D	28.5	pc/mi/ln
Level of service, LOS	D	

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 2025 With Project
 Description: North of Ka Uka Blvd - 15/15/15 - No Pineapple Road

Flow Inputs and Adjustments

Volume, V	3182	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	796	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	819	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	819	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 2025 With Project
Description: North of Ka Uka Blvd - 15/15/15 - No Pineapple Road

Flow Inputs and Adjustments

Volume, V	4782	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1196	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	1231	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	1231	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	18.0-	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: AM Peak
Freeway/Direction: H-2 Fwy SB
From/To:
Jurisdiction:
Analysis Year: Year 2025 With Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	8005	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	2002	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	1374	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	6	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1374	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	19.6	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: PM Peak
Freeway/Direction: H-2 Fwy SB
From/To:
Jurisdiction:
Analysis Year: Year 2025 With Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	6493	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1624	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	1115	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	6	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1115	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	15.9	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 2025 With Project
Description: North of Ka Uka Blvd - 15/15/15 - No Pineapple Road

Flow Inputs and Adjustments

Volume, V	4292	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1073	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	1105	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, flD	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	1105	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	16.1	pc/mi/ln
Level of service, LOS	B	

Phone:
E-mail:

Fax:

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 2025 With Project
 Description: North of Ka Uka Blvd - 15/15/15 - No Pineapple Road

Flow Inputs and Adjustments

Volume, V	3554	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	889	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	915	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	915	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	13.4	pc/mi/ln
Level of service, LOS	B	

APPENDIX L

**CAPACITY ANALYSIS CALCULATIONS
PROJECTED YEAR 2025 PEAK HOUR TRAFFIC
ANALYSIS WITH PROJECT
KOA RIDGE MAKAI AND WAIAWA DEVELOPMENTS
(WITH ADDITIONAL IMPROVEMENTS)**

HCM Signalized Intersection Capacity Analysis
 25: Ka Uka Blvd &

5/13/2010

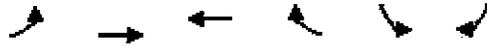


Lane Configuration	FF	FF	FF	FF	FF	FF
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	0.97	0.95	0.91			0.88
Frt	1.00	1.00	0.98			0.85
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3614	3725	5258			2933
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3614	3725	5258			2933
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	388	256	2314	310	0	909
RTOR Reduction (vph)	0	0	16	0	0	282
Lane Group Flow (vph)	388	256	2608	0	0	627
Turn Type	Split			Over		
Protected Phases	4	4	8			4
Permitted Phases						
Actuated Green, G (s)	27.4	27.4	55.4			27.4
Effective Green, g (s)	27.4	27.4	55.4			27.4
Actuated g/C Ratio	0.30	0.30	0.60			0.30
Clearance Time (s)	5.0	5.0	5.0			5.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	1067	1100	3139			866
v/s Ratio Prot	0.11	0.07	c0.50			c0.21
v/s Ratio Perm						
v/c Ratio	0.36	0.23	0.83			0.72
Uniform Delay, d1	25.8	24.7	15.0			29.3
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.2	0.1	2.0			3.0
Delay (s)	26.0	24.9	16.9			32.3
Level of Service	C	C	B			C
Approach Delay (s)		25.6	16.9		32.3	
Approach LOS		C	B		C	

Intersection Summary			
HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	92.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		
c - Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
 25: Ka Uka Blvd &

5/13/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	←	↑	←	→	←	↑
Volume (vph)	643	809	2144	536	0	1965
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	5.0			5.0
Lane Util. Factor	0.97	0.95	0.91			0.88
Flt	1.00	1.00	0.97			0.85
Flt Protected	0.95	1.00	1.00			1.00
Satd. Flow (prot)	3614	3725	5192			2933
Flt Permitted	0.95	1.00	1.00			1.00
Satd. Flow (perm)	3614	3725	5192			2933
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	643	809	2144	536	0	1965
RTOR Reduction (vph)	0	0	43	0	0	767
Lane Group Flow (vph)	643	809	2637	0	0	1198
Turn Type	Split			Over		
Protected Phases	4	4	8			4
Permitted Phases						
Actuated Green, G (s)	41.0	41.0	49.0			41.0
Effective Green, g (s)	41.0	41.0	49.0			41.0
Actuated g/C Ratio	0.41	0.41	0.49			0.41
Clearance Time (s)	5.0	5.0	5.0			5.0
Vehicle Extension (s)	3.0	3.0	3.0			3.0
Lane Grp Cap (vph)	1482	1527	2544			1203
v/s Ratio Prot	0.18	0.22	0.51			0.41
v/s Ratio Perm						
v/c Ratio	0.43	0.53	1.04			1.00
Uniform Delay, d1	21.2	22.2	25.5			29.4
Progression Factor	1.00	1.00	1.00			1.00
Incremental Delay, d2	0.2	0.3	28.1			24.8
Delay (s)	21.4	22.6	53.6			54.2
Level of Service	C	C	D			D
Approach Delay (s)		22.0	53.6		54.2	
Approach LOS		C	D		D	

Intersection Summary			
HCM Average Control Delay	46.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	124.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
 5: Ka Uka Blvd & H-2 Off (SB)

9/11/2009



Lane Configurations	↑↑↑			↔		↑↑↑			↔		↑↑↑	
Volume (vph)	0	1658	56	184	989	0	30	0	331	131	158	252
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	5.0	5.0	5.0
Lane Util. Factor		0.91		0.97	0.91		1.00		1.00	0.97	1.00	1.00
Fit Protected		1.00		1.00	1.00		1.00		0.85	1.00	1.00	0.85
Satd Flow (prot)		5327		3614	5353		1863		1667	3614	1961	1667
Fit Permitted		1.00		0.95	1.00		0.95		1.00	0.95	1.00	1.00
Satd Flow (perm)		5327		3614	5353		1863		1667	3614	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	1658	56	184	989	0	30	0	331	131	158	252
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	91	0	0	103
Lane Group Flow (vph)	0	1710	0	184	989	0	30	0	240	131	158	149
Turn Type				Prot		Prot		custom	Prot		Perm	
Protected Phases		4		3	8	5		2	1		6	
Permitted Phases								3			6	
Actuated Green, G (s)		36.5		8.6	50.1		2.8		26.1	6.9		21.6
Effective Green, g (s)		36.5		8.6	50.1		2.8		24.1	6.9		20.6
Actuated g/C Ratio		0.41		0.10	0.56		0.03		0.27	0.08		0.23
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)		2172		347	2996		58		561	279		473
v/s Ratio Prot		0.32		0.05	0.18		0.02		0.08	0.04		0.08
v/s Ratio Perm									0.06			c0.09
g/C Ratio		0.79		0.53	0.53		0.52		0.43	0.47		0.33
Uniform Delay, d1		23.1		38.5	10.6		42.7		27.0	39.5		28.0
Progression Factor		1.00		1.00	1.00		1.00		1.00	1.00		1.00
Incremental Delay, d2		2.0		1.6	0.1		7.6		0.5	1.2		0.4
Delay (s)		25.1		40.1	10.7		50.3		27.5	40.8		28.4
Level of Service		C		D	B		D		C	D		C
Approach Delay (s)		25.1			15.3			29.4				32.0
Approach LOS		C			B			C				C
HCM Average Control Delay		23.5										
HCM Volume to Capacity ratio		0.72										
Actuated Cycle Length (s)		89.5							27.0			
Intersection Capacity Utilization		68.0%										
ICU Level of Service												
Analysis Period (min)		15										
c - Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

5: Ka Uka Blvd & H-2 Off (SB)

9/11/2009



Lane Configurations	↑↑↑			↖↖			↑↑↑			↗↗		
Volume (vph)	0	1883	79	281	1915	0	84	0	530	423	192	301
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		
Lane Util. Factor	0.91			0.97			0.91			1.00		
Flt Protected	1.00			0.95			1.00			0.95		
Flt Permitted	1.00			0.95			1.00			0.95		
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	1883	79	281	1915	0	84	0	530	423	192	301
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	145	0	0	24
Lane Grp Flow (vph)	0	1958	0	281	1915	0	84	0	385	423	192	277
Turn Type	Prot			Prot			custom			Prot		
Protected Phases	1			3			5			2		
Permitted Phases										3		
Actuated green, g (s)	44.2			13.4			62.6			7.8		
Effective Green, g (s)	44.2			13.4			62.6			7.8		
Actuated g/C Ratio	0.38			0.12			0.54			0.07		
Clearance Time (s)	5.0			5.0			5.0			5.0		
Vehicle Extension (s)	3.0			3.0			3.0			3.0		
Lane Grp Cap (vph)	2038			420			2904			126		
v/s Ratio Prot	0.37			0.08			0.36			0.05		
v/s Ratio Perm										0.11		
v/c Ratio	0.96			0.67			0.66			0.67		
Uniform Delay, d1	34.8			48.9			18.8			52.5		
Progression Factor	1.00			1.00			1.00			1.00		
Incremental Delay, d2	12.1			4.0			0.6			12.5		
Delay (s)	46.8			52.9			19.4			65.1		
Level of Service	D			D			B			E		
Approach Delay (s)	46.8			23.6			44.8			46.6		
Approach LOS	D			C			D			D		
HCM Average Control Delay	37.6			HCM Level of Service			D					
HCM Volume to Capacity ratio	0.83			Sum of lost time (s)			16.0					
Actuated Cycle Length (s)	115.4			ICU Level of Service			F					
Intersection Capacity Utilization	92.2%			Analysis Period (min)			15					
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Ka Uka Blvd & Spine Rd

9/11/2009



Lane Configurations	↙ ↘		↙ ↘		↙ ↘		↙ ↘		↙ ↘		↙ ↘	
Volume (vph)	103	1038	73	151	770	345	0	0	143	534	0	161
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0		6.0	5.0	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	
Flt	1.00	0.99		1.00	1.00	0.95			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)	1863	3689		1863	3725	1667			1611	3433	1583	
Flt Permitted	0.95	1.00		0.95	1.00	1.00			1.00	0.95	1.00	
Satd Flow (perm)	1863	3689		1863	3725	1667			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)	103	1038	73	151	770	345	0	0	143	534	0	161
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	122	0
Lane Group Flow (vph)	103	1106	0	151	770	345	0	0	143	534	39	0
Turn Type	Prot		Prot		Free		Free		Prot		Prot	
Protected Phases	7	4		3	8				1		6	
Permitted Phases					Free		Free					
Actuated Green, G (s)	9.2	30.2		11.7	32.7	74.8			74.8	17.9	17.9	
Effective Green, g (s)	9.2	29.2		10.7	31.7	74.8			74.8	17.9	17.9	
Actuated g/C Ratio	0.12	0.39		0.14	0.42	1.00			1.00	0.24	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)	229	1440		266	1579	1667			1611	822	379	
v/s Ratio Prot	0.06	0.30		0.08	0.21				0.16	0.02		
v/s Ratio Perm					0.21		0.09					
v/c Ratio	0.45	0.77		0.57	0.49	0.21			0.09	0.65	0.10	
Uniform Delay, d1	30.5	19.8		29.9	15.7	0.0			0.0	25.6	22.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00			1.00	1.00	1.00	
Incremental Delay, d2	1.4	2.5		2.8	0.2	0.3			0.1	1.8	0.1	
Delay (s)	31.9	22.4		32.7	15.9	0.3			0.1	27.4	22.3	
Level of Service	C	C		C	B	A			A	C	C	
Approach Delay (s)	23.2				13.6		0.1				26.2	
Approach LOS	C				B		A				C	
HCM Average Control Delay	19.2				HCM Level of Service		B					
HCM Volume to Capacity ratio	0.70											
Actuated Cycle Length (s)	74.8				Sum of lost time (s)		17.0					
Intersection Capacity Utilization	66.8%				ICU Level of Service		C					
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

31: Ka Uka Blvd & Spine Rd

9/11/2009



Lane Configurations	↙	↕	↘	↙	↕	↘	↙	↕	↘	↙	↕	↘
Volume (vph)	239	904	140	201	1278	818	0	0	347	703	0	204
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.0	5.0	6.0	4.0	5.0	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	0.86	1.00	0.85	1.00	0.85	1.00
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1863	3651	1863	3725	1667	1667	1611	3493	1583	1583	1583	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00	1.00	0.95	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1863	3651	1863	3725	1667	1667	1511	3493	1583	1583	1583	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)	239	904	140	201	1278	818	0	0	347	703	0	204
RTOR Reduction (vph)	0	10	0	0	0	0	0	0	0	0	151	0
Lane Group Flow (vph)	239	1024	0	201	1278	818	0	0	347	703	50	0
Turn Type	Prot		Prot		Free		Free		Free	Prot		
Protected Phases	7	4	3	8						1	6	
Permitted Phases					Free		Free		Free			
Actuated Green, G (s)	17.9	42.3	16.6	42.0	101.4		101.4		26.5	26.5		
Effective Green, g (s)	17.9	42.3	15.6	41.0	101.4		101.4		26.5	26.5		
Actuated g/C Ratio	0.18	0.42	0.15	0.40	1.00		1.00		0.26	0.26		
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)	329	1523	287	1506	1667		1611		897	414		
v/s Ratio Prot	0.13	0.28	0.11	0.34					0.20	0.03		
v/s Ratio Perm					c0.49		0.22					
v/c Ratio	0.73	0.68	0.70	0.85	0.48		0.22		0.78	0.13		
Uniform Delay, d1	39.4	24.0	40.7	27.4	0.0		0.0		34.8	28.6		
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00		
Incremental Delay, d2	7.8	1.2	7.5	4.7	1.0		0.3		4.5	0.1		
Delay (s)	47.2	25.2	48.2	32.1	1.0		0.3		39.3	28.6		
Level of Service	D	C	D	C	A		A		D	C		
Approach Delay (s)		29.3		22.4			0.3			36.9		
Approach LOS		C		C			A			D		
HCM Average Control Delay		25.4										
HCM Level of Service										C		
HCM Volume to Capacity ratio		0.81										
Actuated Cycle Length (s)		101.4								16.0		
Sum of lost time (s)												
Intersection Capacity Utilization		79.8%										
ICU Level of Service										D		
Analysis Period (min)		15										
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

35: Ukee (E) & Ka Uka Blvd

9/11/2009



Lane Configurations	↕		↕		↗ ↘		↕		↗ ↘		↕	
Volume (vph)	15	3	2	41	15	21	8	1182	69	91	746	81
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	
Fit	0.99		0.96		1.00		0.99		1.00		0.99	
Fit Protected	0.96		0.97		0.95		1.00		0.95		1.00	
Satd. Flow (prot)	1771		1748		1863		3695		1863		3671	
Fit Permitted	0.73		0.82		0.34		1.00		0.20		1.00	
Satd. Flow (perm)	1342		1476		664		3695		386		3671	
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	21	8	1182	69	91	746	81
RTOR Reduction (vph)	0	2	0	0	17	0	0	5	0	0	9	0
Lane Group Flow (vph)	0	18	0	0	60	0	6	1246	0	91	818	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		2		6		6	
Permitted Phases	4		8		2		2		6		6	
Actuated Green, G (s)	6.2		6.2		36.9		36.9		36.9		36.9	
Effective Green, g (s)	6.2		6.2		36.9		36.9		36.9		36.9	
Actuated G/C Ratio	0.12		0.12		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)	157		172		461		2568		268		2551	
v/s Ratio Prot					0.34		0.34		0.22		0.22	
v/s Ratio Perm	0.01		c0.04		0.01		0.01		0.24		0.24	
v/c Ratio	0.12		0.33		0.02		0.49		0.34		0.32	
Uniform Delay, d1	21.0		21.6		2.5		3.7		3.2		3.2	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.3		1.2		0.0		0.1		0.8		0.1	
Delay (s)	21.3		22.8		2.5		3.9		4.0		3.3	
Level of Service	C		C		A		A		A		A	
Approach Delay (s)	21.3		22.8		3.9		3.9		4.0		3.3	
Approach LOS	C		C		A		A		A		A	
HCM Average Control Delay	4.4		HCM Level of Service		A		A		A		A	
HCM Volume to Capacity ratio	0.47		Sum of lost time (s)		10.0		10.0		10.0		10.0	
Actuated Cycle Length (s)	53.1		ICU Level of Service		A		A		A		A	
Intersection Capacity Utilization	54.9%		Analysis Period (min)		15		15		15		15	
Analysis Period (min)	15		Critical Lane Group									

HCM Signalized Intersection Capacity Analysis

35: Ukee (E) & Ka Uka Blvd

9/11/2009



Lane Configurations	↕		↕		↙		↘		↙		↘	
Volume (vph)	49	11	14	121	13	68	7	1169	54	65	1333	73
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	
Flt Protected	0.97		0.97		0.95		1.00		0.95		1.00	
Satd Flow (prot)	1757		1726		1863		3701		1863		3696	
Flt Permitted	0.74		0.77		0.14		1.00		0.18		1.00	
Satd Flow (perm)	1351		1376		266		3701		357		3696	
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)	49	11	14	121	13	68	7	1169	54	65	1333	73
RTOR Reduction (vph)	0	10	0	0	22	0	0	3	0	0	4	0
Lane Group Flow (vph)	0	64	0	0	180	0	7	1226	0	65	1402	0
Turn Type	Perm											
Protected Phases	4		8		2		6		4		6	
Permitted Phases	4		8		2		6		4		6	
Actuated Green, G (s)	14.0		14.0		40.7		40.7		40.7		40.7	
Effective Green, g (s)	14.0		14.0		40.7		40.7		40.7		40.7	
Actuated c/c Ratio	0.22		0.22		0.63		0.63		0.63		0.63	
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)	292		298		167		2328		225		2325	
v/s Ratio Prot	0.05		0.13		0.03		0.33		0.18		0.38	
v/s Ratio Perm	0.05		0.13		0.03		0.33		0.18		0.38	
c/c Ratio	0.22		0.60		0.04		0.52		0.29		0.60	
Uniform Delay, d1	20.9		22.9		4.6		6.6		5.4		7.2	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.4		3.4		0.1		0.2		0.7		0.4	
Delay (s)	21.2		26.3		4.7		6.8		6.2		7.6	
Level of Service	C		C		A		A		A		A	
Approach Delay (s)	21.2		26.3		4.7		6.8		6.2		7.6	
Approach LOS	C		C		A		A		A		A	
HCM Average Control Delay 8.9 HCM Level of Service A												
HCM Volume to Capacity ratio 0.60												
Actuated Cycle Length (s) 64.7 Sum of lost time (s) 10.0												
Intersection Capacity Utilization 66.1% (CU) Level of Service C												
Analysis Period (min) 15												
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

4: Waipio Uka & Ka Uka Blvd

9/11/2009



Lane Configurations	←			←			↑		↑		↑		
Volume (vph)	41	12	23	91	19	98	58	1115	101	68	686	31	
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		
Lane Util. Factor	1.00			1.00			1.00	0.95	1.00	0.95			
Fit Protected	0.97			0.98			0.95	1.00	0.95	1.00			
Satd Flow (prot)	1740			1707			1863	3679	1863	3701			
Fit Permitted	0.80			0.82			0.37	1.00	0.17	1.00			
Satd Flow (perm)	1433			1436			725	3679	342	3701			
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)	41	12	23	91	19	98	58	1115	101	68	686	31	
RTOR Reduction (vph)	0	18	0	0	38	0	0	8	0	0	4	0	
Lane Group Flow (vph)	0	58	0	0	170	0	58	1208	0	168	713	0	
Turn Type	Perm			Perm			Perm		Perm				
Protected Phases	4			8			2		6				
Permitted Phases	4			8			2		6				
Activated Green, G (s)	11.4			11.4			27.8		27.8				
Effective Green, g (s)	11.4			11.4			27.8		27.8				
Activated g/C Ratio	0.23			0.23			0.57		0.57				
Clearance Time (s)	5.0			5.0			5.0		5.0				
Vehicle Extension (s)	3.0			3.0			3.0		3.0				
Lane Grp Cap (vph)	332			333			410		2079		193		2091
v/s Ratio Prot							0.33		0.39				
v/s Ratio Perm	0.04			0.12			0.08		0.20				
g/C Ratio	0.18			0.51			0.14		0.58		0.35		0.34
Uniform Delay, d1	15.1			16.5			5.1		6.9		5.8		5.8
Progression Factor	1.00			1.00			1.00		1.00		1.00		1.00
Incremental Delay, d2	0.3			1.3			0.2		0.4		1.1		0.1
Delay (s)	15.4			17.8			5.2		7.3		6.9		5.9
Level of Service	B			B			A		A		A		A
Approach Delay (s)	15.4			17.8			7.2		6.0				
Approach LOS	B			B			A		A				
HCM Average Control Delay	8.0			HCM Level of Service			A						
HCM Volume to Capacity ratio	0.56												
Actuated Cycle Length (s)	49.2			Sum of lost time (s)			10.0						
Intersection Capacity Utilization	62.3%			ICU Level of Service			B						
Analysis Period (min)	15												
Critical Lane Group													

HCM Signalized Intersection Capacity Analysis
 4: Waipio Uka & Ka Uka Blvd

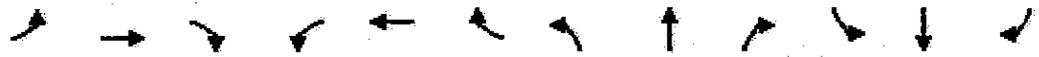
9/11/2009



Lane Configurations	↔		↔		↙ ↑		↙ ↑		↙ ↑		↙ ↑	
Volume (vph)	99	38	34	138	26	45	41	1080	92	119	1306	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	
Flt Protected	0.97		0.97		0.97		0.99		1.00		1.00	
Satd Flow (prot)	1762		1761		1863		3682		1863		3708	
Flt Permitted	0.74		0.73		0.14		1.00		0.19		1.00	
Satd Flow (perm)	1346		1326		267		3692		364		3708	
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)	99	38	34	138	26	45	41	1080	92	119	1306	42
RTOR Reduction (vph)	0	11	0	0	11	0	0	8	0	0	3	0
Lane Group Flow (vph)	0	161	0	0	198	0	41	1164	0	119	1345	0
Turn Type	Perm		Perm		Perm		Perm		Perm		Perm	
Protected Phases	4		8		2		2		6		6	
Permitted Phases	4		8		2		2		6		6	
Actuated Green, G (s)	14.6		14.6		33.8		33.8		33.8		33.8	
Effective Green, g (s)	14.6		14.6		33.8		33.8		33.8		33.8	
Actuated g/C Ratio	0.25		0.25		0.58		0.58		0.58		0.58	
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)	337		332		155		2131		211		2146	
v/s Ratio Prot	0.12		0.15		0.15		0.32		0.33		0.36	
v/s Ratio Perm	0.12		0.15		0.15		0.33		0.33		0.36	
w/C Ratio	0.48		0.60		0.26		0.55		0.56		0.63	
Uniform Delay, d1	18.6		19.3		6.1		7.6		7.7		8.1	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	1.1		2.9		0.9		0.3		3.4		0.6	
Delay (s)	19.7		22.2		7.0		7.9		11.1		8.7	
Level of Service	B		C		A		A		B		A	
Approach Delay (s)	19.7		22.2		7.3		7.9		8.9		8.9	
Approach LOS	B		C		A		A		A		A	
HCM Average Control Delay	10.0		10.0		HCM Level of Service		A		A		A	
HCM Volume to Capacity ratio	0.62		0.62		0.62		0.62		0.62		0.62	
Actuated Cycle Length (s)	58.4		58.4		Sum of lost time (s)		10.0		10.0		10.0	
Intersection Capacity Utilization	66.4%		66.4%		ICU Level of Service		C		C		C	
Analysis Period (min)	15		15		15		15		15		15	
c Critical Lane Group	c		c		c		c		c		c	

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

9/11/2009



Lane Configurations	←		←		←		←		←		←	
	←	←	←	←	←	←	←	←	←	←	←	←
Volume (vph)	58	931	85	145	642	9	83	12	326	9	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	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	0.99	1.00	0.99	1.00	1.00	1.00
Fit Protected	0.95	1.00	0.95	1.00	0.95	1.00	0.99	1.00	0.99	1.00	1.00	1.00
Satd. Flow (prot)	1863	3679	1863	3718	1863	3718	1863	3718	1863	3718	1863	3718
Fit Permitted	0.95	1.00	0.95	1.00	0.95	1.00	0.93	1.00	0.93	1.00	1.00	1.00
Satd. Flow (perm)	1863	3679	1863	3718	1863	3718	1549	1.00	1549	1.00	1662	1662
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	931	85	145	642	9	83	12	326	9	7	7
RTOR Reduction (vph)	0	7	0	0	1	0	0	158	0	0	5	0
Lane Grp Flow (vph)	58	1009	0	145	650	0	0	263	0	0	12	0
Turn Type	Prot		Prot		Perm		Perm		Perm		Perm	
Protected Phases	7		4		3		6		2		5	
Permitted Phases							2				6	
Actuated Green, G (s)	6.9		26.2		10.5		29.8		16.9		16.9	
Effective Green, g (s)	6.9		26.2		10.5		29.8		16.9		16.9	
Actuated g/C Ratio	0.10		0.38		0.15		0.43		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)	187		1405		285		1615		382		409	
v/s Ratio Prot	0.03		0.27		0.08		0.17		0.17		0.17	
v/s Ratio Perm									0.17		0.01	
v/c Ratio	0.31		0.72		0.51		0.40		0.69		0.03	
Uniform Delay, d1	28.6		18.1		26.7		13.3		23.5		19.6	
Progression Factor	1.00		1.00		1.00		1.00		1.00		1.00	
Incremental Delay, d2	0.9		1.8		1.4		0.2		5.1		0.0	
Delay (s)	29.5		19.9		28.1		13.5		28.6		19.6	
Level of Service	C		B		C		B		C		B	
Approach Delay (s)			20.4				16.1		28.6		19.6	
Approach LOS			C				B		C		B	

HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	68.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	79.1%	ICU Level of Service	D
Analysis Period (min)	15		
Critical Lane Group			

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

9/11/2009

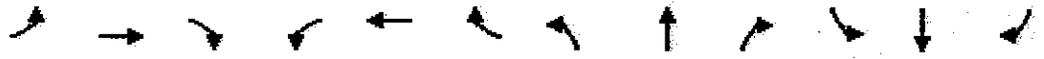


Lane Configurations	←		↑		→		↓		←		↑	
Volume (vph)	53	1009	95	198	1277	7	149	19	189	11	22	108
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0			3.0				5.0	
Lane Util. Factor	1.00	0.95	1.00	0.95			1.00				1.00	
Fit Protected	0.95	1.00	0.95	1.00			0.98				1.00	
Satd. Flow (prot)	1863	3676	1863	3722			1894				1864	
Fit Permitted	0.95	1.00	0.95	1.00			0.80				0.97	
Satd. Flow (perm)	1863	3676	1863	3722			1389				1616	
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	1009	95	198	1277	7	149	19	189	11	22	108
RTOR Reduction (vph)	0	8	0	0	1	0	0	50	0	0	78	0
Lane Group Flow (vph)	53	1100	0	198	1277	0	0	807	0	0	63	0
Turn Type	Prot		Prot		Perm		Perm		Perm		Perm	
Protected Phases	7	4	3	8			2				6	
Permitted Phases							2				6	
Actuated Green, G (s)	4.1	29.0		11.9	36.8			21.7			21.7	
Effective Green, g (s)	4.1	29.0		11.9	36.8			21.7			21.7	
Actuated g/C Ratio	0.06	0.37		0.15	0.47			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)	98	1374		286	1765			388			452	
v/s Ratio Prot	0.08	0.30		0.11	0.31							
v/s Ratio Perm								0.22			0.04	
v/c Ratio	0.54	0.60		0.69	0.72			0.79			0.14	
Uniform Delay, d1	35.8	21.7		31.1	16.3			25.9			21.0	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	6.0	3.5		7.1	1.5			10.6			0.1	
Delay (s)	41.8	26.2		38.2	17.8			36.4			21.1	
Level of Service	D	C		D	B			D			C	
Approach Delay (s)		25.9			20.6			36.4			21.1	
Approach LOS		C			C			D			C	
HCM Average Control Delay	24.4		HCM Level of Service		C							
HCM Volume to Capacity ratio	0.85											
Actuated Cycle Length (s)	77.6		Sum of lost time (s)		20.0							
Intersection Capacity Utilization	85.8%		ICU Level of Service		E							
Analysis Period (min)	15											
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

3: Ka Uka Blvd & Kam Hwy

9/11/2009



Lane Configurations	↖	↗	↘	↙	↕	↖	↗	↘	↙	↕	↖	↗
Volume (vph)	16	25	4	363	27	348	8	475	326	734	953	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	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	1.00
Flt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (prot)	1770	3539	1583	1770	1786	2933	1868	3725	1667	3614	3725	1667
Flt Permitted	0.95	1.00	1.00	0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd Flow (perm)	1770	3539	1583	1770	1786	2933	1868	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	25	4	363	27	348	8	475	326	734	953	17
RTOR Reduction (vph)	0	0	0	0	0	154	0	0	255	0	0	9
Lane Grp Flow (vph)	16	25	4	196	194	194	8	475	71	734	953	8
Turn Type	Split		Free	Split		pt+ov	Prot		Perm	Prot		Perm
Protected Phases	4	4		8	8	3.1	5	2		1	6	
Permitted Phases			Free						2			6
Actuated Green, G (s)	3.5	3.5	82.9	16.1	16.1	46.3	4.4	18.1	18.1	25.2	38.9	37.9
Effective Green, g (s)	3.5	3.5	82.9	16.1	16.1	46.3	4.4	18.1	18.1	25.2	38.9	37.9
Actuated g/C Ratio	0.04	0.04	1.00	0.19	0.19	0.56	0.05	0.22	0.22	0.30	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)	75	149	1583	344	347	1638	99	813	364	1099	1748	762
v/s Ratio Prot	0.01	0.01		0.11	0.11	0.07	0.00	0.13		0.20	0.26	
v/s Ratio Perm			0.00						0.04			0.00
v/c Ratio	0.21	0.17	0.00	0.57	0.56	0.12	0.08	0.58	0.20	0.67	0.55	0.01
Uniform Delay, d1	38.4	38.3	0.0	30.3	30.2	8.7	37.3	29.0	26.5	25.2	15.7	12.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.5	0.0	2.2	2.0	0.0	0.4	1.1	0.3	1.6	0.3	0.0
Delay (s)	39.8	38.8	0.0	32.4	32.1	8.7	37.7	30.1	26.7	26.7	16.0	12.3
Level of Service	D	D	A	C	C	A	D	C	C	C	B	B
Approach Delay (s)		35.7			21.2			28.8			20.6	
Approach LOS		D			C			C			C	
HCM Average Control Delay			23.0			HCM Level of Service			C			
HCM Volume to Capacity ratio			0.56			Sum of lost time (s)			15.0			
Actuated Cycle Length (s)			82.9			ICU Level of Service			B			
Intersection Capacity Utilization			61.8%			Analysis Period (min)			15			
c - Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

3: Ka Uka Blvd & Kam Hwy

9/11/2009



Lane Configurations	↖	↗	↘	↙	↕	↖	↗	↘	↙	↕	↖	↗	↘	↙
Volume (vph)	32	53	36	542	87	915	35	850	650	467	617	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	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0		6.0
Lane Util. Factor	1.00	0.95	1.00	0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	1.00		
β	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		
β _{Prot}	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00		
Sat. Flow (prot)	1770	3539	1583	1770	1798	2933	1863	3725	1667	3614	3725	1667		
β _{Perm}	0.95	1.00	1.00	0.95	0.97	1.00	0.95	1.00	1.00	0.95	1.00	1.00		
Sat. Flow (perm)	1770	3539	1583	1770	1798	2933	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	53	36	542	87	915	35	850	650	467	617	51		
RTOR Reduction (vph)	0	0	0	0	0	238	0	0	453	0	0	29		
Lane Group Flow (vph)	32	53	36	314	315	677	35	850	197	467	617	22		
Turn Type	Split		Free	Split		pt+ov	Prot		Perm	Prot		Perm		
Protected Phases	4	4		8	8	6	5	2		1		6		
Permitted Phases			Free						2				6	
Actuated Green, G (s)	5.9	5.9	101.7	25.7	25.7	50.0	6.1	30.8	30.8	19.3	44.0	40.0		
Effective Green, g (s)	5.9	5.9	101.7	25.7	25.7	50.0	6.1	30.8	30.8	19.3	44.0	43.0		
Green Ratio	0.06	0.06	1.00	0.25	0.25	0.49	0.06	0.30	0.30	0.19	0.49	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	3.0		3.0	3.0	3.0	3.0	3.0	3.0		
Lane Grp Cap (vph)	103	205	1583	447	454	1442	112	1128	505	686	1612	705		
v/s Ratio Prot	0.02	0.01		0.16	0.16	0.23	0.02	0.23		0.15	0.17			
v/s Ratio Perm			0.02						0.12			0.01		
β Ratio	0.31	0.26	0.02	0.70	0.69	0.47	0.31	0.75	0.39	0.68	0.38	0.03		
Uniform Delay, d1	45.9	45.8	0.0	34.5	34.4	17.1	45.8	32.0	28.0	38.3	19.6	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	1.00		
Incremental Delay, d2	1.7	0.7	0.0	5.0	4.6	0.2	1.6	2.9	0.5	2.8	0.2	0.0		
Delays (s)	47.7	46.5	0.0	39.5	39.0	17.3	47.4	34.9	28.5	41.1	19.8	17.2		
Level of Service	D	D	A	D	D	B	D	C	C	D	B	B		
Approach Delay (s)		33.0			26.2			32.5			26.4			
Approach LOS		C			C			C			C			

HCM Average Control Delay	29.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	101.7	Sum of lost time (s)	20.0
Intersection Capacity Utilization	70.6%	ICU Level of Service	C
Analysis Period (min)	15		
Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
 19: Waipio Uka & Kam Hwy

9/11/2009



Lane Configurations	↖	↑	↗	↖↗	↔	↖	↑↑	↗	↖	↑↑	↗	
Volume (vph)	1	4	9	578	2	44	16	762	567	35	1282	
Ideal Flow (vphpl)	1900	1900	1900	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	1.00	0.95	
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	1679	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	1679	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	
Adj Flow (vph)	1	4	9	578	2	44	16	762	567	35	1282	
RTOR Reduction (vph)	0	0	0	0	33	0	0	0	327	0	0	
Lane Group Flow (vph)	1	4	9	578	13	0	16	762	240	35	1282	
Turn Type	Split		Free	Split		Prot		Perm	Prot		Perm	
Protected Phases	4	1		6	6	5	2		1	6		
Permitted Phases			Free					2			6	
Actuated Green, G (s)	0.9	0.9	80.8	19.5	19.5	5.3	34.2	34.2	6.2	35.1	35.1	
Effective Green, g (s)	0.9	0.9	80.8	19.5	19.5	5.3	34.2	34.2	6.2	35.1	35.1	
Actuated g/C Ratio	0.01	0.01	1.00	0.24	0.24	0.07	0.42	0.42	0.08	0.43	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)	20	21	1583	872	405	122	1577	706	143	1618	724	
v/s Ratio Prot	0.00	0.00		0.16	0.01	0.01	0.20		0.02	0.34		
v/s Ratio Perm			c0.01					0.14			0.00	
v/c Ratio	0.05	0.19	0.01	0.66	0.03	0.13	0.48	0.34	0.24	0.79	0.00	
Uniform Delay, d1	39.5	39.6	0.0	27.7	23.4	35.6	16.9	15.7	35.1	19.7	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	1.0	4.4	0.0	1.9	0.0	0.5	0.2	0.3	0.9	2.7	0.0	
Delay (s)	40.6	44.0	0.0	29.6	23.5	36.1	17.1	16.0	36.0	22.5	12.9	
Level of Service	D	D	A	C	C	D	B	B	D	C	B	
Approach Delay (s)		19.5			29.1		16.9			22.8		
Approach LOS		B			C		B			C		
HCM Average Control Delay			21.6	HCM Level of Service				C				
HCM Volume to Capacity ratio			0.64									
Actuated Cycle Length (s)			80.8	Sum of lost time (s)				15.0				
Intersection Capacity Utilization			64.3%	ICU Level of Service				C				
Analysis Period (min)			15									
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
 19: Waipio Uka & Kam Hwy

9/11/2009



	←	↑	↗	↘	→	←	↑	↗	↘	→	←	↑	↗	↘	→
Lane Configurations	↗	↑	↗	↘	→	↗	↑↑	↗	↘	↑↑	↗	↑↑	↗	↘	→
Volume (vph)	7	16	41	618	17	59	84	1467	833	52	1128	7	16	41	618
Ideal Flow (vphpl)	1900	1900	1900	2000	2000	2000	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	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.97	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (prot)	1770	1863	1583	3614	1732	1863	3725	1667	1863	3725	1667	1863	3725	1667	1863
Flt Permitted	0.95	1.00	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (perm)	1770	1863	1583	3614	1732	1863	3725	1667	1863	3725	1667	1863	3725	1667	1863
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	1.00	1.00	1.00
Adj Flow (vph)	7	16	41	618	17	59	84	1467	833	52	1128	7	16	41	618
RTOR Reduction (vph)	0	0	0	0	46	0	0	0	328	0	0	0	0	0	7
Lane Group Flow (vph)	7	16	41	618	30	0	84	1467	505	52	1128	7	16	41	618
Turn Type	Split		Free	Split			Prot		Perm		Prot		Perm		Perm
Protected Phases	4	4		6	6		5	2		1	6				
Permitted Phases			Free						2						6
Actuated Green, G (s)	2.6	2.6	99.3	21.7	21.7		9.2	48.9	48.9	6.1	45.8				45.8
Effective Green, g (s)	2.6	2.6	99.3	21.7	21.7		9.2	48.9	48.9	6.1	45.8				45.8
Actuated g/C Ratio	0.03	0.03	1.00	0.22	0.22		0.09	0.49	0.49	0.06	0.46				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)	46	49	1583	790	378		173	1834	821	114	1718				769
v/s Ratio Prot	0.00	0.00		0.17	0.02		0.05	0.39		0.03	0.30				0.00
v/s Ratio Perm			0.03						0.30						0.00
v/c Ratio	0.15	0.33	0.93	0.78	0.06		0.49	0.80	0.61	0.46	0.66				0.01
Uniform Delay, d1	47.3	47.5	0.0	36.6	30.9		42.8	21.1	18.3	45.0	20.7				14.5
Regression 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	5.1	0.1		2.1	2.5	1.4	2.9	0.9				0.0
Delay (s)	48.8	51.4	0.0	41.6	30.9		44.9	23.6	19.7	47.9	21.6				14.5
Level of Service	D	D	A	D	C		D	C	B	D	C				B
Approach Delay (s)		18.2			40.5			23.0			22.6				
Approach LOS		B			D			C			C				
HCM Average Control Delay			25.6			HCM Level of Service			C						
HCM Volume to Capacity ratio			0.77												
Actuated Cycle Length (s)			99.3			Sum of lost time (s)			20.0						
Intersection Capacity Utilization			77.8%			ICU Level of Service			D						
Analysis Period (min)			15												
Critical Lane Group															

HCM Signalized Intersection Capacity Analysis

16: Lumiaina St & Kam Hwy

9/11/2009

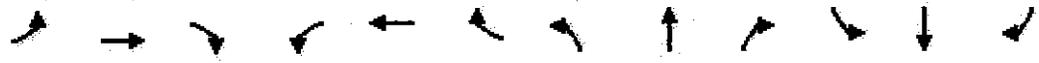


Lane Configurations	←		←		←		←		←		←	
Volume (vph)	496	17	93	64	73	39	46	816	39	17	1252	601
Ideal Flow (vphpl)	2000	2000	2000	1900	1900	1900	2000	2000	2000	2000	2000	2000
Total Lost time (s)	5.0	5.0	4.0	5.0	5.0		5.0	5.0	5.0	5.0	5.0	4.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
Emp. ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
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	1780	1967	1770	1765		1863	3725	1967	1863	3725	1967
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	1780	1967	1770	1765		1863	3725	1967	1863	3725	1967
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)	496	17	93	64	73	39	46	816	39	17	1252	601
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	23	0	0	0
Lane Group Flow (vph)	358	255	93	64	96	0	46	616	16	17	1252	601
Conf. Peds. (#/hr)	39											
Turn Type	Split		Free		Split		Prot		Perm		Prot	
Protected Phases	4	4	8		8		5	2	2		1	6
Permitted Phases			Free						2		Free	
Actuated Green, G (s)	19.5	19.5	96.0	10.8	10.8		6.1	40.5	40.5	5.2	39.6	96.0
Effective Green, g (s)	19.5	19.5	96.0	10.8	10.8		6.1	40.5	40.5	5.2	39.6	96.0
Actuated g/C Ratio	0.20	0.20	1.00	0.11	0.11		0.06	0.42	0.42	0.05	0.41	1.00
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)	360	362	1667	199	199		118	1571	705	101	1587	1667
v/s Ratio Prot	c0.15	0.14	0.04		0.05		0.02	0.22	0.01		c0.34	
v/s Ratio Perm			0.06						0.01		c0.36	
v/c Ratio	0.72	0.70	0.06	0.32	0.48		0.39	0.52	0.02	0.17	0.81	0.36
Uniform Delay, d1	35.7	35.6	0.1	39.2	40.0		43.2	20.5	16.2	43.3	25.0	0.6
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	6.7	6.1	0.1	0.9	1.8		2.1	0.3	0.0	0.8	3.4	0.6
Delay (s)	42.3	41.7	0.1	40.2	41.8		45.3	20.8	16.2	44.1	28.4	0.6
Level of Service	D	D	A	D	D		D	C	B	D	C	A
Approach Delay (s)	35.6		41.2				21.9				19.6	
Approach LOS	D		D				C				B	
HCM Average Control Delay	24.0		HCM Level of Service				C					
HCM Volume to Capacity ratio	0.65											
Actuated Cycle Length (s)	96.0		Sum of lost time (s)				10.0					
Intersection Capacity Utilization	64.8%		ICU Level of Service				C					
Analysis Period (min)	15											

c Critical Lane Group

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

9/11/2009



Lane Configurations	↙	↖	↗	↘	↙	↖	↗	↘	↙	↖	↗	↘
Volume (vph)	541	31	134	24	31	52	176	1824	105	28	1044	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	5.0	4.0
Lane Util. Factor	0.95	0.95	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Flt Protected	0.95	0.96	1.00	0.95	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1770	1783	1667	1770	1688	1667	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	1.00
Satd. Flow (perm)	1770	1783	1667	1770	1688	1667	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)	541	31	134	24	31	52	176	1824	105	28	1044	714
RTOR Reduction (vph)	0	0	0	0	49	0	0	0	33	0	0	0
Lane Group Flow (vph)	287	285	134	24	34	6	176	1824	72	28	1044	714
Confl. Peds. (#/hr)	39											
Turn Type	Split	Free	Free	Split	Split	Prot	Perm	Prot	Perm	Prot	Free	Free
Protected Phases	4	4		8	8	5	2			1	6	
Permitted Phases			Free						2			Free
Actuated Green, G (s)	21.5	21.5	107.7	6.6	6.6	14.8	54.6	54.6	5.0	44.8	107.7	107.7
Effective Green, g (s)	21.5	21.5	107.7	6.6	6.6	14.8	54.6	54.6	5.0	44.8	107.7	107.7
Actuated g/C Ratio	0.20	0.20	1.00	0.06	0.06	0.14	0.51	0.51	0.05	0.42	1.00	1.00
Clearance Time (s)	5.0	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	3.0
Lane Grp Sat (vph)	353	356	1667	108	108	256	1888	845	86	1549	1667	1667
v/s Ratio Prot	c0.16	0.16		0.01	0.02	c0.09	c0.49			0.02	0.28	
v/s Ratio Perm			0.08						0.04			0.49
v/c Ratio	0.81	0.80	0.08	0.22	0.33	0.69	0.97	0.09	0.33	0.67	0.43	0.43
Uniform Delay, d1	41.2	41.1	0.0	48.1	48.4	44.2	25.7	13.7	49.7	29.5	0.0	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	1.00
Incremental Delay, d2	13.3	12.2	0.1	1.0	1.9	7.5	13.5	0.0	2.2	1.2	0.8	0.8
Delay (s)	54.5	53.2	0.1	49.2	50.3	51.7	39.2	13.7	51.9	26.7	0.8	0.8
Level of Service	D	D	A	D	D	D	D	E	D	C	A	A
Approach Delay (s)	43.7		50.1				38.9			16.7		
Approach LOS	D		D				D			B		

HCM Volume to Capacity ratio		0.87
Intersection Capacity Utilization		85.4%
ICU Level of Service		E

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis

30: Lumiauu St & Kam Hwy

9/11/2009



Lane Configurations	←	↖	↗	→	←	↖	↗	→	←	↖	↗	→
Volume (vph)	118	12	321	173	12	14	30	766	55	3	1408	11
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	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Fit Protected	0.96	1.00	0.95	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	1663	1663	3725	1667	1663	3725	1667	1667
Fit Permitted	0.73	1.00	0.67	1.00	0.95	1.00	1.00	1.00	0.95	1.00	1.00	1.00
Satd Flow (perm)	1354	1383	1255	1712	1663	3725	1667	1663	3725	1667	1667	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)	118	12	321	173	12	14	30	766	55	3	1408	11
RTOR Reduction (vph)	0	0	72	0	11	0	0	0	26	0	0	5
Lane Group Flow (vph)	0	130	249	173	15	0	30	766	29	3	1408	6
Turn Type	Perm	Perm	Perm	Prot								
Protected Phases	4		8	5	2		1	5				
Permitted Phases	4	4	8				2					6
Actuated Green, G (s)	19.4	19.4	19.4	19.4	6.3	44.6	44.6	4.3	42.6	42.6		
Effective Green, g (s)	19.4	19.4	19.4	19.4	6.3	44.6	44.6	4.3	42.6	42.6		
Actuated g/G Ratio	0.23	0.23	0.23	0.23	0.08	0.54	0.54	0.05	0.51	0.51		
Clearance Time (s)	5.0	5.0	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	3.0	3.0
Lane Grp Cap (vph)	315	369	292	399	141	1994	893	96	1905	853		
v/s Ratio Prot				0.01	0.02	0.21		0.00	0.38			
v/s Ratio Perm	0.10	0.16	0.14				0.02				0.00	
v/c Ratio	0.41	0.67	0.59	0.04	0.21	0.38	0.05	0.03	0.74	0.01		
Uniform Delay, d1	27.1	29.1	28.4	24.7	36.2	11.3	9.2	37.5	16.0	10.0		
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	4.8	3.2	0.0	0.8	0.1	0.0	0.1	1.5	0.0		
Delay (s)	26.0	33.9	31.6	24.6	36.9	11.4	9.2	37.7	17.5	10.0		
Level of Service	C	C	C	C	D	B	A	D	B	A		
Approach Delay (s)	32.2			30.7			12.2		17.5			
Approach LOS	C			C			B		B			

HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	83.3	Sum of lost time (s)	15.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
 30: Lumiauu St & Kam Hwy

9/11/2009



Lane Configurations	←	↖	↗	→	←	↖	↗	→	←	↖	↗	→
Volume (vph)	22	6	69	63	8	10	158	2094	171	11	1173	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	5.0	5.0	5.0	5.0
Lane Util. Factor		1.00	1.00	1.00	1.00		1.00	0.95	1.00	1.00	0.95	1.00
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)		1416	1583	1377	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)	22	6	69	63	8	10	158	2094	171	11	1173	28
RTOR Reduction (vph)	0	0	63	0	9	0	0	0	49	0	0	11
Lane Group Flow (vph)	0	28	16	63	9	0	158	2094	122	11	1173	17
Turn Type	Perm		Perm	Perm			Prot		Perm	Prot		Perm
Protected Phases		4			8		3	2		1	8	
Permitted Phases	4		4		8				2			6
Actuated Green, g (s)		8.3	8.3	8.3	8.3		14.0	69.7	69.7	4.4	60.1	60.1
Effective Green, g (s)		8.3	8.3	8.3	8.3		14.0	69.7	69.7	4.4	60.1	60.1
Actuated g/C Ratio		0.09	0.09	0.09	0.09		0.14	0.72	0.72	0.05	0.62	0.62
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)		121	135	117	146		268	2666	1193	84	2298	1029
v/s Ratio Prot					0.01		0.08	0.56		0.01	0.31	
v/s Ratio Perm		0.02	0.00	c0.05					0.07			0.01
v/c Ratio		0.23	0.04	0.54	0.06		0.59	0.79	0.10	0.13	0.51	0.02
Uniform Delay, d1		41.6	40.9	42.7	41.0		39.0	9.0	4.3	44.7	10.4	7.2
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		1.0	0.1	4.7	0.2		3.3	1.6	0.0	0.7	0.2	0.0
Delay (s)		42.6	41.0	47.4	41.1		42.3	10.6	4.3	45.4	10.6	7.2
Level of Service		D	D	D	D		D	B	A	D	B	A
Approach Delay (s)		41.5			46.0		42.2				40.9	
Approach LOS		D			D		B				B	
HCM Average Control Delay		13.2		HCM Level of Service				B				
HCM Volume to Capacity ratio		0.77										
Actuated Cycle Length (s)		97.4		Sum of lost time (s)				15.0				
Intersection Capacity Utilization		81.0%		ICU Level of Service				D				
Analysis Period (min)		15										
Critical Lane Group												

HCM Signalized Intersection Capacity Analysis

52: Waipahu St & Kam Hwy

9/11/2009

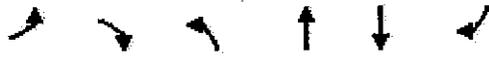


Lane Configurations	↖	↗	↖	↑↑	↑↑	↗
Volume (vph)	119	618	139	730	1845	91
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	1.00
φ	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1863	1667	1863	3725	3725	1667
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1868	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	730	1845	91
RTOR Reduction (vph)	0	50	0	0	0	36
Lane Group Flow (vph)	119	568	139	730	1845	55
Turn Type	pm+ov		Prot		Perm	
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	12.2	37.3	25.1	91.1	61.0	61.0
Effective Green, g (s)	12.2	37.3	25.1	91.1	61.0	61.0
Actuated g/C Ratio	0.11	0.33	0.22	0.80	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)	201	622	413	2995	2006	898
v/s Ratio Prot	0.06	0.20	0.07	0.20	0.50	
v/s Ratio Perm		0.14				0.03
v/C Ratio	0.59	0.91	0.34	0.24	0.92	0.06
Uniform Delay, d1	48.2	36.4	37.1	2.7	23.9	12.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.6	17.8	0.5	0.0	7.3	0.0
Delay (s)	52.8	54.3	37.6	2.7	31.2	12.5
Level of Service	D	D	D	A	C	B
Approach Delay (s)	54.0		8.3		30.3	
Approach LOS	D		A		C	
HCM Average Control Delay	29.9		HCM Level of Service		C	
HCM Volume to Capacity ratio	0.92					
Actuated Cycle Length (s)	113.3		Sum of lost time (s)		10.0	
Intersection Capacity Utilization	93.1%		ICU Level of Service		E	
Analysis Period (min)	15					
Critical Lane Group						

HCM Signalized Intersection Capacity Analysis

52: Waipahu St & Kam Hwy

9/11/2009



Lane Configurations	↖	↗	↙	↑↑	↑↑	↘
Volume (vph)	259	436	292	2172	1120	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
Flt Protected	1.00	0.85	1.00	1.00	1.00	0.85
Satd. Flow (prot)	1868	1667	1868	3725	3725	1667
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	1868	1667	1868	3725	3725	1667
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	259	436	292	2172	1120	182
RTOR Reduction (vph)	0	17	0	0	0	101
Lane Group Flow (vph)	259	436	292	2172	1120	81
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5	2	6	
Permitted Phases		4				6
Actuated Green, G (s)	19.6	41.4	21.8	71.8	45.0	45.0
Effective Green, g (s)	19.6	41.4	21.8	71.8	45.0	45.0
Actuated g/C Ratio	0.19	0.41	0.21	0.71	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)	360	763	401	2638	1653	740
v/s Ratio Prot	0.14	0.12	0.16	0.56	0.30	
v/s Ratio Perm		0.14				0.05
v/c Ratio	0.72	0.58	0.73	0.82	0.68	0.11
Uniform Delay, d1	38.3	23.2	37.0	10.4	22.4	16.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.7	1.1	6.5	2.2	1.1	0.1
Delay (s)	45.1	24.3	43.5	12.6	23.5	16.5
Level of Service	D	C	D	B	C	B
Approach Delay (s)	31.8			16.2	22.6	
Approach LOS	C			B	C	
HCM Average Control Delay	20.6		HCM Level of Service		C	
HCM Volume to Capacity ratio	0.90					
Actuated Cycle Length (s)	101.4		Sum of lost time (s)		10.0	
Intersection Capacity Utilization	79.0%		ICU Level of Service		D	
Analysis Period (min)	15					
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 2025 With Project
Description: 15/15/15

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4516	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	1138	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	800	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	388	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)	4516	1138	388	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1188	299	102	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	4896		1210		413	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.260 Using Equation 0
 FD
 $v_{12} = v_R + (v_F - v_R) P = 2041 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{Fi}$	4407	9400	No
$v = v_{FO} - v_F$	3197	9400	No
v_R	1210	3800	No
$v_{3 \text{ or } av34}$	1183 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700 \text{ pc/h?}$		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2041$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2041	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v}{R} - 0.009 \frac{L}{D} = 0.2 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	D = 0.537	
Space mean speed in ramp influence area,	S = 52.7	mph
Space mean speed in outer lanes,	S = 70.6	mph
Space mean speed for all vehicles,	S = 61.0	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 2025 With Project
Description: 15/15/15/

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	9224	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	3532	vph
Length of first accel/decel lane	800	ft
Length of second accel/decel lane	800	ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent ramp	644	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)	9224	3532	644	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	2427	929	169	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	10001		3755		685	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.260 Using Equation 0

FD

$v = v + (v - v) P = 4859$ pc/h

12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	8001	9400	No
F_i F			
$v = v - v$	4246	9400	No
F_O F R			
v	3755	3800	No
R			
v v	1571 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is v v > 2700 pc/h?		No	
3 or av34			
Is v v > 1.5 v /2		No	
3 or av34 12			
If yes, v = 4859		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	4859	4400	Yes
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v}{12} - 0.009 \frac{L}{D} = 24.4$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	D = 0.766	
	S	
Space mean speed in ramp influence area,	S = 47.4	mph
	R	
Space mean speed in outer lanes,	S = 69.1	mph
	O	
Space mean speed for all vehicles,	S = 54.0	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 Loop (EB)
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2025 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	2772	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	388	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	1744	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2772	388	1744	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	729	102	459	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	3005	413	1854 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.166 Using Equation 4
 FM
 $v_{12} = v_F \cdot P_{FM} = 499 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	3418	9400	No
FO			
v	1253 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 1202		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1202	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 \frac{v}{R} + 0.0078 \frac{v}{12} - 0.00627 \frac{L}{A} = 8.5 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence A

Speed Estimation

Intermediate speed variable,	M = 0.236	
	S	
Space mean speed in ramp influence area,	S = 59.6	mph
	R	
Space mean speed in outer lanes,	S = 63.6	mph
	O	
Space mean speed for all vehicles,	S = 61.6	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 Loop (EB)
 Junction: H-2 Fwy/Ka Uka Blvd
 Jurisdiction:
 Analysis Year: Year 2025 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	4382	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	644	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	4842	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1300	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4382	644	4842	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1153	169	1274	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	4751	685	5148 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.132 Using Equation 4
 FM
 $v_{12} = v_F (P_{FM}) = 628 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	5436	9400	No
FO			
v v	2061 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 = 1900		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1900	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 15.9 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.268	
	S	
Space mean speed in ramp influence area,	S = 58.8	mph
	R	
Space mean speed in outer lanes,	S = 61.7	mph
	0	
Space mean speed for all vehicles,	S = 60.3	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 2025 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	3160	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	310	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	388	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1700	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3160	310	388	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	832	82	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		3426	330	413 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)

EQ

P = 0.177 Using Equation 4

FM

$v_{12} = v_F (P_{FM}) = 605 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	3756	9400	No
FO			
v	1410 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v / 2		Yes	
3 or av34	12		
If yes, v = 1370		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1370	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 14.2 \text{ pc/mi/ln}$

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

Speed Estimation

Intermediate speed variable,	M = 0.293	
	S	
Space mean speed in ramp influence area,	S = 58.3	mph
	R	
Space mean speed in outer lanes,	S = 63.1	mph
	O	
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: PM Peak
Freeway/Dir of Travel: H-2 Fwy NB On Ramp (WB)
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2025 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	5026	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	536	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	644	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1700	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5026	536	644	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1323	141	169	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	5449	570	685 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.147$ Using Equation 4
 FM
 $v_{12} = v_{FM} (P) = 799$ pc/h
 12 F FM

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6019	9400	No
$v_{3 \text{ or } av34}$	2325 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		Yes	
If yes, $v_{12A} = 2179$		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2179	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 22.3$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	$M = 0.333$	
Space mean speed in ramp influence area,	$S_R = 57.3$	mph
Space mean speed in outer lanes,	$S_0 = 60.9$	mph
Space mean speed for all vehicles,	$S = 59.2$	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst:
Agency/Co.:
Date performed: 9/11/2009
Analysis time period: AM Peak
Freeway/Dir of Travel: H2 NB Off-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2025 w/ project
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3470	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	407	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3470	407		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	913	107		v
Trucks and buses	2	2		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		

Grade	0.00	%	0.00	%	%
Length	0.00	mi	0.00	mi	mi
Trucks and buses PCE, ET	2.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		
Driver population factor, fP	1.00		1.00		
Flow rate, vp	3762		433		pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.436 Using Equation 8
 FD
 $v_{12} = v_R + (v_F - v_R) P = 1884$ pc/h
 12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	3762	9400	No
$v_{Fi} = v_F - v_{FO}$	3329	9400	No
v_R	433	2000	No
$v_{3 or av34}$	939 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 or av34} > 2700$ pc/h?		No	
Is $v_{3 or av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 1884$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1884	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 16.0$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D = 0.467	
Space mean speed in ramp influence area,	S = 54.3	mph
Space mean speed in outer lanes,	S = 71.3	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:
 Agency/Co.:
 Date performed: 9/11/2009
 Analysis time period: PM Peak
 Freeway/Dir of Travel: H2 NB Off-Ramp
 Junction: Pineapple Road
 Jurisdiction:
 Analysis Year: Year 2025 w/ project
 Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5563	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	881	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	5563	881	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	1464	232	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade	0.00	%	0.00	%	%
Length	0.00	mi	0.00	mi	mi
Trucks and buses PCE, ET	2.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		
Heavy vehicle adjustment, fHV	0.971		0.990		
Driver population factor, fP	1.00		1.00		
Flow rate, vp	6031		937		pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.436 Using Equation 8
FD
 $v = v + (v - v) P = 3158 \text{ pc/h}$
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
$v = v$	6031	9400	No
Fi F			
$v = v - v$	5094	9400	No
FO F R			
v	937	2000	No
R			
v v	1436 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is v v > 2700 pc/h?		No	
3 or av34			
Is v v > 1.5 v /2		No	
3 or av34 12			
If yes, v = 3158		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	3158	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v}{R} - 0.009 \frac{L}{D} = 26.9 \text{ pc/mi/ln}$
Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	D = 0.512	
	S	
Space mean speed in ramp influence area,	S = 53.2	mph
	R	
Space mean speed in outer lanes,	S = 69.6	mph
	0	
Space mean speed for all vehicles,	S = 59.9	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: CL
Agency/Co.:
Date performed: 9/23/2009
Analysis time period: AM Peak
Freeway/Dir of Travel: H2 NB On-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2025
Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3063	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	119	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	3063	119	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	806	31	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade Length	% mi	% mi	% mi
Trucks and buses PCE, ET	2.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3321	127	pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.202 Using Equation 4
 FM
 $v_{12} = v_F \cdot P_{FM} = 671 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v	3448	9400	No
FO			
v	1325 pc/h	(Equation 25-4 or 25-5)	
3 or av34			
Is v > 2700 pc/h?		No	
3 or av34			
Is v > 1.5 v ₁₂ / 2		Yes	
3 or av34			
If yes, v = 1328		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1328	4600	No
12A			

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 13.6 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	M = 0.303	
Space mean speed in ramp influence area,	S = 58.0	mph
Space mean speed in outer lanes,	S = 63.2	mph
Space mean speed for all vehicles,	S = 60.9	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst: CL
Agency/Co.:
Date performed: 9/23/2009
Analysis time period: PM Peak
Freeway/Dir of Travel: H2 NB On-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2025
Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4682	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	102	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	4682	102	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	1232	27	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade Length	% mi	% mi	% mi
Trucks and buses PCE, ET	2.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5076	108	pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.204$ Using Equation 4
 FM
 $v_{12} = v_F (P) = 1037$ pc/h
 FM

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5184	9400	No
$v_{3 \text{ or } av34}$	2019 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		Yes	
If yes, $v_{12A} = 2030$		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2030	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 19.0$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	$M = 0.319$	
Space mean speed in ramp influence area,	$S_R = 57.7$	mph
Space mean speed in outer lanes,	$S_0 = 61.3$	mph
Space mean speed for all vehicles,	$S = 59.8$	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 2025 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	5006	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	542	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	2030	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5006	542	2030	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1317	143	534	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	5428		576		2158	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ
P = 0.436 Using Equation 8

FD
v = v + (v - v) P = 2691 pc/h
12 R F R FD

Capacity Checks

	Actual	Maximum	LOS F?
v = v	5428	9400	No
Fi F			
v = v - v	4852	9400	No
FO F R			
v	576	2000	No
R			
v v	1368 pc/h	(Equation 25-15 or 25-16)	
3 or av34			
Is v v > 2700 pc/h?		No	
3 or av34			
Is v v > 1.5 v /2		No	
3 or av34 12			
If yes, v = 2691		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v	2691	4400	No
12			

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 \frac{v}{R} - 0.009 \frac{L}{D} = 26.0$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	D = 0.480	
	S	
Space mean speed in ramp influence area,	S = 54.0	mph
	R	
Space mean speed in outer lanes,	S = 69.9	mph
	0	
Space mean speed for all vehicles,	S = 61.0	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 2025 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	4086	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	916	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	1884	vph
Position of adjacent ramp	Downstream	
Type of adjacent ramp	On	
Distance to adjacent ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4086	916	1884	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1075	241	496	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	4430		974		2003	pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)

EQ

P = 0.436 Using Equation 8

FD

$v_{12} = v_R + (v_F - v_R) P = 2481$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	4430	9400	No
$v_{Fi} = v_F - v_R$	3456	9400	No
v_R	974	2000	No
$v_{3 or av34}$	974 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 or av34} > 2700$ pc/h?		No	
Is $v_{3 or av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 2481$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2481	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L_D = 24.2$ pc/mi/ln

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

Speed Estimation

Intermediate speed variable,	D = 0.516	
Space mean speed in ramp influence area,	S = 53.1	mph
Space mean speed in outer lanes,	S = 71.3	mph
Space mean speed for all vehicles,	S = 59.8	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 Loop (WB)
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2025 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	4464	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	2030	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	542	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4464	2030	542	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1175	534	143	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		4840	2158	576 pcph

Estimation of V12 Merge Areas

$$L = \text{(Equation 25-2 or 25-3)}$$

$$EQ$$

$$P = -0.052 \text{ Using Equation 4}$$

$$FM$$

$$v = v \left(\frac{P}{F} \right) = -250 \text{ pc/h}$$

$$12 \quad F \quad FM$$

Capacity Checks

	Actual	Maximum	LOS F?
v	6998	9400	No
FO			
v v	2545 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 = 1936		(Equation 25-8)	
12A			

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v	1936	4600	No
12A			

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 \frac{v}{R} + 0.0078 \frac{v}{R} - 0.00627 \frac{L}{A} = 32.3 \text{ pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M = 0.509	
	S	
Space mean speed in ramp influence area,	S = 53.3	mph
	R	
Space mean speed in outer lanes,	S = 61.6	mph
	O	
Space mean speed for all vehicles,	S = 56.4	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: PM Peak
Freeway/Dir of Travel: H-2 Fwy SB On Ramp Loop (WB)
Junction: H-2 Fwy/Ka Uka Blvd
Jurisdiction:
Analysis Year: Year 2025 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	3170	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	1884	vph
Length of first accel/decel lane	650	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	Yes	
Volume on adjacent Ramp	916	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	Off	
Distance to adjacent Ramp	1900	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	3170	1884	916	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	834	496	241	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	3437	2003	974

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = -0.033$ Using Equation 4
 FM
 $v_{12} = v_{F} (P_{FM}) = -111$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5440	9400	No
$v_{3 \text{ or } av34}$	1774 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		Yes	
If yes, $v_{12A} = 1374$		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	1374	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 26.8$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	$M = 0.390$	
Space mean speed in ramp influence area,	$S_R = 56.0$	mph
Space mean speed in outer lanes,	$S_0 = 63.1$	mph
Space mean speed for all vehicles,	$S = 58.5$	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 2025 With Project
Description: 15/15/15

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6494	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	1510	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	2030	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6494	1510	2030	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1709	397	534	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	7041	1605	2158 pcph

Estimation of V12 Merge Areas

$L =$ (Equation 25-2 or 25-3)
 EQ
 $P = 0.017$ Using Equation 4
 FM
 $v_{12} = v_{F \cdot FM} = 88$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6745	9400	No
$v_{3 \text{ or } av34}$	2526 pc/h	(Equation 25-4 or 25-5)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		Yes	
If yes, $v_{12A} = 2056$		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2056	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 \frac{v}{R} + 0.0078 \frac{v}{R} - 0.00627 \frac{L}{A} = 28.2$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence D

Speed Estimation

Intermediate speed variable,	$M = 0.415$	
Space mean speed in ramp influence area,	$S_R = 55.4$	mph
Space mean speed in outer lanes,	$S_0 = 61.2$	mph
Space mean speed for all vehicles,	$S = 58.0$	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 2025 With Project
Description: 15/15/15

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5054	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	1438	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	1884	vph
Position of adjacent Ramp	Upstream	
Type of adjacent Ramp	On	
Distance to adjacent Ramp	1600	ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5054	1438	1884	vph
Peak-hour factor, PHF	0.95	0.95	0.95	
Peak 15-min volume, v15	1330	378	496	
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	5480	1529	2003 pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.027 Using Equation 4
 FM
 $v_{12} = v_F(P_{FM}) = 114 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	5804	9400	No
v _{3 or av34}	2080 pc/h	(Equation 25-4 or 25-5)	
Is v _{3 or av34} > 2700 pc/h?		No	
Is v _{3 or av34} > 1.5 v ₁₂ / 2		Yes	
If yes, v _{12A} = 1710		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{12A}	1710	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 24.9 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.363	
Space mean speed in ramp influence area,	S _R = 56.6	mph
Space mean speed in outer lanes,	S ₀ = 62.2	mph
Space mean speed for all vehicles,	S = 59.0	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: CL
Agency/Co.:
Date performed: 9/23/2009
Analysis time period: AM Peak
Freeway/Dir of Travel: H2 SB Off-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2025
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4293	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	62	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4293	62		vph
Peak-hour factor, PHF	0.95	0.95		
Peak 15-min volume, v15	1130	16		v
Trucks and buses	0	0		%
Recreational vehicles	0	0		%
Terrain type:	Rolling	Level		

Grade	0.00	%	0.00	%	%
Length	0.00	mi	0.00	mi	mi
Trucks and buses PCE, ET	2.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		
Heavy vehicle adjustment, fHV	1.000		1.000		
Driver population factor, fP	1.00		1.00		
Flow rate, vp	4519		65		pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
EQ
P = 0.436 Using Equation 8
FD
 $v_{12} = v_R + (v_F - v_R) P = 2007$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v_{12} = v_{12}$	4519	9400	No
$v_{12} = v_{12} - v_{12}$	4454	9400	No
v_{12}	65	2000	No
v_{12}	1256 pc/h	(Equation 25-15 or 25-16)	
Is $v_{12} > 2700$ pc/h?		No	
Is $v_{12} > 1.5 v_{12} / 2$		No	
If yes, $v_{12} = 2007$		(Equation 25-18)	
12A			

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	2007	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L = 17.0$ pc/mi/ln
Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D = 0.434	
Space mean speed in ramp influence area,	S = 55.0	mph
Space mean speed in outer lanes,	S = 70.3	mph
Space mean speed for all vehicles,	S = 62.6	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Diverge Analysis

Analyst: CL
Agency/Co.:
Date performed: 9/23/2009
Analysis time period: PM Peak
Freeway/Dir of Travel: H2 SB Off-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2025
Description:

Freeway Data

Type of analysis	Diverge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3554	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	135	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent ramp		vph
Position of adjacent ramp		
Type of adjacent ramp		
Distance to adjacent ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	3554	135	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	935	36	v
Trucks and buses	0	0	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade	0.00	%	0.00	%	%
Length	0.00	mi	0.00	mi	mi
Trucks and buses PCE, ET	2.5		1.5		
Recreational vehicle PCE, ER	2.0		1.2		
Heavy vehicle adjustment, fHV	1.000		1.000		
Driver population factor, fP	1.00		1.00		
Flow rate, vp	3741		142		pcph

Estimation of V12 Diverge Areas

L = (Equation 25-8 or 25-9)
 EQ
 P = 0.436 Using Equation 8
 FD
 $v_{12} = v_R + (v_F - v_R) P = 1711$ pc/h

Capacity Checks

	Actual	Maximum	LOS F?
$v = v_{12}$	3741	9400	No
$v_{F1} = v_F - v_R$	3599	9400	No
v_R	142	2000	No
$v_{3 \text{ or } av34}$	1015 pc/h	(Equation 25-15 or 25-16)	
Is $v_{3 \text{ or } av34} > 2700$ pc/h?		No	
Is $v_{3 \text{ or } av34} > 1.5 v_{12} / 2$		No	
If yes, $v_{12A} = 1711$		(Equation 25-18)	

Flow Entering Diverge Influence Area

	Actual	Max Desirable	Violation?
v_{12}	1711	4400	No

Level of Service Determination (if not F)

Density, $D = 4.252 + 0.0086 v_{12} - 0.009 L = 14.5$ pc/mi/ln
 Level of service for ramp-freeway junction areas of influence B

Speed Estimation

Intermediate speed variable,	D = 0.441	
Space mean speed in ramp influence area,	S = 54.9	mph
Space mean speed in outer lanes,	S = 71.2	mph
Space mean speed for all vehicles,	S = 62.7	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst:
Agency/Co.:
Date performed: 9/11/2009
Analysis time period: AM Peak
Freeway/Dir of Travel: H2 SB On-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2025 With Project
Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4231	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	775	vph
Length of first accel/decel lane	500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	4231	775	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	1113	204	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade Length	% mi	% mi	% mi
Trucks and buses PCE, ET	2.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	4587	824	pcph

Estimation of V12 Merge Areas

L = (Equation 25-2 or 25-3)
 EQ
 P = 0.115 Using Equation 4
 FM
 $v_{12} = v_F (P_{FM}) = 527 \text{ pc/h}$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	5411	9400	No
v _{3 or av34}	2030 pc/h	(Equation 25-4 or 25-5)	
Is v _{3 or av34} > 2700 pc/h?		No	
Is v _{3 or av34} > 1.5 v ₁₂ / 2		Yes	
If yes, v _{12A} = 1834		(Equation 25-8)	

Flow Entering Merge Influence Area

v _{12A}	Actual	Max Desirable	Violation?
v _{12A}	1834	4600	No

Level of Service Determination (if not F)

Density, $D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 22.7 \text{ pc/mi/ln}$
 Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable,	M = 0.342	
Space mean speed in ramp influence area,	S _R = 57.1	mph
Space mean speed in outer lanes,	S ₀ = 61.8	mph
Space mean speed for all vehicles,	S = 59.4	mph

HCS+: Ramps and Ramp Junctions Release 5.4

Phone: Fax:
E-mail:

Merge Analysis

Analyst:
Agency/Co.:
Date performed: 9/11/2009
Analysis time period: PM Peak
Freeway/Dir of Travel: H2 SB On-Ramp
Junction: Pineapple Road
Jurisdiction:
Analysis Year: Year 2025 With Project
Description:

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3419	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	667	vph
Length of first accel/decel lane	1500	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp
Volume, V (vph)	3419	667	vph
Peak-hour factor, PHF	0.95	0.95	
Peak 15-min volume, v15	900	176	v
Trucks and buses	2	2	%
Recreational vehicles	0	0	%
Terrain type:	Rolling	Level	

Grade Length	% mi	% mi	% mi
Trucks and buses PCE, ET	2.5	1.5	
Recreational vehicle PCE, ER	2.0	1.2	
Heavy vehicle adjustment, fHV	0.971	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3707	709	pcph

Estimation of V12 Merge Areas

$$L = \frac{EQ}{P} \quad (\text{Equation 25-2 or 25-3})$$

$$P = 0.129 \quad \text{Using Equation 4}$$

$$v = v_{12} \left(\frac{P}{FM} \right) = 479 \quad \text{pc/h}$$

Capacity Checks

	Actual	Maximum	LOS F?
v _{FO}	4416	9400	No
v _{3 or av34}	1614 pc/h	(Equation 25-4 or 25-5)	
Is v _{3 or av34} > 2700 pc/h?		No	
Is v _{3 or av34} > 1.5 v ₁₂ / 2		Yes	
If yes, v _{12A} = 1482		(Equation 25-8)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v _{12A}	1482	4600	No

Level of Service Determination (if not F)

$$\text{Density, } D = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A = 12.8 \quad \text{pc/mi/ln}$$

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

Speed Estimation

Intermediate speed variable,	M = 0.251	
Space mean speed in ramp influence area,	S _R = 59.2	mph
Space mean speed in outer lanes,	S ₀ = 62.8	mph
Space mean speed for all vehicles,	S = 61.0	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 2025 With Project
Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	4516	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1129	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	930	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	5	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	930	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	5	
Density, D	13.3	pc/mi/ln
Level of service, LOS	B	

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 2025 With Project
 Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	9224	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	2306	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	1900	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	5	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1900	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	66.6	mi/h
Number of lanes, N	5	
Density, D	28.5	pc/mi/ln
Level of service, LOS	D	

Phone:
E-mail:

Fax:

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 2025 With Project
 Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	3470	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	868	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	894	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	894	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	13.1	pc/mi/ln
Level of service, LOS	B	

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 2025 With Project
 Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	5563	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1391	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	1432	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	1432	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	20.9	pc/mi/ln
Level of service, LOS	C	

Phone:
E-mail:

Fax:

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 2025 With Project
 Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	8005	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	2002	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	1374	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	6	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1374	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	19.6	pc/mi/ln
Level of service, LOS	C	

Phone:
E-mail:

Fax:

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 2025 With Project
 Description: South of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	6493	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1624	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	1115	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	6	
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	0.0	mi/h
Free-flow speed, FFS	70.0	mi/h

Urban Freeway

LOS and Performance Measures

Flow rate, vp	1115	pc/h/ln
Free-flow speed, FFS	70.0	mi/h
Average passenger-car speed, S	70.0	mi/h
Number of lanes, N	6	
Density, D	15.9	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 2025 With Project
Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	5006	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1252	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	1289	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	1289	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	18.8	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 2025 With Project
Description: North of Ka Uka Blvd - 15/15/15

Flow Inputs and Adjustments

Volume, V	4086	veh/h
Peak-hour factor, PHF	1.00	
Peak 15-min volume, v15	1022	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	1052	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	1052	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	15.4	pc/mi/ln
Level of service, LOS	B	

APPENDIX M

**WAIPIO INTERCHANGE
NORTHBOUND OFF-RAMP ALTERNATIVES ANALYSIS**

2-11-10

Waipio Interchange Northbound Off-Ramp Alternatives Analysis

Major improvements are being proposed to the H-2 Waipio Interchange to accommodate the proposed Koa Ridge Makai, Castle & Cooke Waiawa, and the Waiawa Ridge Development projects. During the afternoon peak hour of traffic, over 5,000 vehicles are projected to be using the northbound off-ramp to the Waipio Interchange when the planned developments are fully built out. In response to concerns expressed by the DOT, alternative ramp configurations were evaluated to determine the most beneficial and cost-effective means of accommodating the traffic volumes.

The Waipio Interchange provides east-west mobility and access to the Waipio business and residential developments west of the Interstate H-2 Freeway, and Mililani Memorial Park and Waiawa Correctional Facility to the east. Ka Uka Boulevard, a predominantly two-way, four-lane divided City and County of Honolulu collector roadway intersects with the northbound on and off ramp junction of the Waipio Interchange. At the signalized intersection, the northbound off-ramp approach services an exclusive left-turn lane and a shared left-turn, through, and right-turn lane. The westbound Ka Uka Boulevard intersection approach provides a through lane and an exclusive right-turn lane. The eastbound Ka Uka Boulevard approach provides an exclusive left-turn lane and an exclusive through movement lane. A planned eastward extension of Ka Uka Boulevard across Panakauahi Gulch is to be developed by the Waiawa Ridge Development.

The land area to accommodate a future Southbound Loop On-Ramp is already set aside on the west side of the Waipio Interchange. For the northbound off-ramp, a similar accommodation has not been made, possibly due to the proximity of the Panakauahi Gulch to the east of the Interchange. As such, a number of ramp configurations and options are available to accommodate the northbound traffic from the H-2 Freeway.

The following ramp alternatives for northbound vehicles were evaluated and are depicted in the attached Figure 1:

1. NB Flyover Ramp A (Yellow):
 2. NB Flyover Ramp B (Magenta)
 3. NB Flyover Ramp C (Red)
 4. NB Flyover Ramp D (Blue)
 5. NB Flyover Ramp E (Lt. Blue)
 6. NB Loop Off-Ramp (Green)
 7. NB Loop On-Ramp (Purple)
 8. Modified NB Loop Off-Ramp (Orange)
-
1. Northbound Flyover Ramp A (Yellow)
Alternative No. 1 is a northbound flyover ramp which extends from northbound H-2 to westbound Ka Uka Boulevard. This alternative is intended to achieve a touchdown to grade at or near the existing Ka Uka bridge. Extensive bridge structures would be required as the alignment extends well into the middle of Panakauahi Gulch from just beyond the diverge ramp. There are potential view concerns from Waiawa Ridge with the elevated bridge structures and the need to obtain approval from land owner Waiawa Ridge Development, LLC. This alternative is estimated to cost \$61 million.

2. NB Flyover Ramp B (Magenta)
Alternative No. 2 is a similar flyover ramp which extends from northbound H-2 to westbound Ka Uka Boulevard. The flyover ramp crosses over the Ka Uka Boulevard extension through Panakauahi Gulch and returns to westbound Ka Uka Boulevard just beyond the freeway overpass. Extensive bridge structures within Panakauahi Gulch would be required as well as a separate crossing of H-2 north of the Ka Uka Boulevard bridge. There are similar view and ownership concerns as Alternative 1. This alternative is estimated to cost \$69 million.
3. NB Flyover Ramp C (Red)
Alternative No. 3 is another flyover ramp extending from northbound H-2 to westbound Ka Uka Boulevard. Similar to Alternative No. 2, this flyover ramp crosses over the Ka Uka Boulevard extension through Panakauahi Gulch and returns to westbound Ka Uka Boulevard beyond the freeway overpass. Extensive bridge structures within Panakauahi Gulch would be required. There is a separate crossing of H-2 north of the Ka Uka Boulevard bridge as well as a crossing over the southbound on-ramp, with touchdown on Ka Uka Boulevard past Moaniani Street. The major concern with this alternative is the bypassing of Moaniani Street which provides access to major businesses including Costco and the Tony Group Autoplex. This alternative is estimated to cost \$93 million.
4. NB Flyover Ramp D (Blue)
Alternative No. 4 is a northbound flyover ramp which extends parallel to and just east of the H-2 freeway to westbound Ka Uka Boulevard. Panakauahi Gulch is avoided. A separate crossing of the H-2 freeway is needed and touchdown of the ramp structure to Ka Uka Boulevard would extend past Moaniani Street. As with Alternative No. 3, the major concern with this alternative is bypassing Moaniani Street which provides access to major businesses including Costco and the Tony Group Autoplex. This alternative is estimated to cost \$64 million.
5. NB Flyover Ramp E (Lt. Blue)
Alternative No. 5 is a flyover ramp which follows the existing northbound off-ramp alignment, crosses over the Ka Uka Boulevard, and returns to westbound Ka Uka Boulevard via an extended ramp crossing the H-2 beyond the southbound on-ramp, crossing the southbound off-ramp, with touchdown on Ka Uka Boulevard beyond Moaniani Street. As with Alternative Nos. 3 and 4, the major concern with this alternative is bypassing Moaniani Street which provides access to major businesses including Costco and the Tony Group Autoplex. This alternative is estimated to cost \$81 million.

A variation to this alternative (not shown) is for the off-ramp to connect and lead directly into the Koa Ridge site. This alternative is rejected as previous consultation with the Federal Highways Administration staff indicated that a ramp benefitting only one landowner would be very difficult to justify (meeting with Pat Phung, FHWA, 7/27/09).

6. NB Loop Off-Ramp (Green)
Alternative No. 6 is a northbound loop off-ramp to westbound Ka Uka Boulevard. The loop ramp would extend well into Panakauahi Gulch north of the Ka Uka Boulevard extension. The existing northbound on-ramp would need to be relocated to the east of the loop off-ramp. Extensive bridge structures would be required for

both the loop off-ramp and the relocated northbound on-ramp. This alternative is estimated to cost \$90 million.

7. NB Loop On-Ramp (Purple)

Alternative No. 7 is a northbound on-ramp to the H-2 freeway from eastbound Ka Uka Boulevard. This alternative eliminates the need for a left turn movement from eastbound Ka Uka Boulevard to northbound H-2. The northbound off-ramp would need to be relocated to the east (aligned with the Mililani cemetery access road) and widened to provide for three left turn lanes to westbound Ka Uka Boulevard and two right-turn lanes onto eastbound Ka Uka Boulevard. This alternative is estimated to cost \$52 million.

8. Modified NB Loop Off-Ramp (Orange)

Alternative No. 8 is a northbound loop off-ramp to westbound Ka Uka Boulevard, similar to Alternative No. 6 but modified to provide for a smaller loop radius based on a reduced design speed. To accommodate the reduced design speed of 25 mph, a longer deceleration lane is needed on the H-2 Freeway. The northbound on-ramp would need to be relocated to the east of the loop off-ramp. This relocated on-ramp could be appended to the loop off-ramp structure. The cemetery road access would need to be relocated. This alternative is estimated to cost \$57 million.

Table 1 presents a matrix evaluating the above alternatives relative to safety, traffic, community and planning issues, and constructability. Based on the evaluation matrix, Alternative No. 8 providing for a Modified Northbound Loop Off-Ramp is the recommended alternative.