



ATTACHMENT D
Level of Service Calculations

HCM Unsignalized Intersection Capacity Analysis

1: Covington Rd. & Miramonte Ave.

12/17/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	92	159	21	23	123	47	13	275	75	94	174	23
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	107	185	24	27	143	55	15	320	87	109	202	27

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	316	224	422	338
Volume Left (vph)	107	27	15	109
Volume Right (vph)	24	55	87	27
Hadj (s)	0.06	-0.09	-0.08	0.05
Departure Headway (s)	7.4	7.6	6.8	7.2
Degree Utilization, x	0.65	0.47	0.80	0.68
Capacity (veh/h)	446	402	500	463
Control Delay (s)	23.0	17.2	32.2	23.9
Approach Delay (s)	23.0	17.2	32.2	23.9
Approach LOS	C	C	D	C

Intersection Summary			
Delay		25.2	
HCM Level of Service		D	
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 2: Eastwood Dr. & Miramonte Ave.

12/17/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	13	0	411	3	3	202
Peak Hour Factor	0.86	0.86	0.86	0.86	0.86	0.86
Hourly flow rate (vph)	15	0	478	3	3	235
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	722	480			481	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	722	480			481	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	100			100	
cM capacity (veh/h)	393	586			1081	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	15	481	238
Volume Left	15	0	3
Volume Right	0	3	0
cSH	393	1700	1081
Volume to Capacity	0.04	0.28	0.00
Queue Length 95th (ft)	3	0	0
Control Delay (s)	14.5	0.0	0.2
Lane LOS	B		A
Approach Delay (s)	14.5	0.0	0.2
Approach LOS	B		

Intersection Summary			
Average Delay			0.3
Intersection Capacity Utilization	31.8%	ICU Level of Service	A
Analysis Period (min)			15

HCM Signalized Intersection Capacity Analysis
3: Covington Rd. & Grant Ave.

12/17/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	
Frbp, ped/bikes	1.00	0.99	1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1652	1458	1652	1739	3178	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1652	1458	1652	1739	3178	
Volume (vph)	210	111	107	748	388	102
Peak-hour factor, PHF	0.78	0.78	0.78	0.78	0.78	0.78
Adj. Flow (vph)	269	142	137	959	497	131
RTOR Reduction (vph)	0	112	0	0	23	0
Lane Group Flow (vph)	269	30	137	959	605	0
Confl. Peds. (#/hr)	4	2	3			3
Confl. Bikes (#/hr)						8
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	11.3	11.3	7.6	30.9	19.3	
Effective Green, g (s)	11.3	11.3	7.6	30.9	19.3	
Actuated g/C Ratio	0.20	0.20	0.13	0.54	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	329	290	221	946	1080	
v/s Ratio Prot	c0.16		0.08	c0.55	0.19	
v/s Ratio Perm		0.02				
v/c Ratio	0.82	0.10	0.62	1.01	0.56	
Uniform Delay, d1	21.8	18.6	23.2	12.9	15.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	14.5	0.2	5.1	32.7	0.7	
Delay (s)	36.3	18.8	28.3	45.7	16.0	
Level of Service	D	B	C	D	B	
Approach Delay (s)	30.2			43.5	16.0	
Approach LOS	C			D	B	
Intersection Summary						
HCM Average Control Delay			32.8		HCM Level of Service	C
HCM Volume to Capacity ratio			0.96			
Actuated Cycle Length (s)			56.8		Sum of lost time (s)	14.6
Intersection Capacity Utilization			58.1%		ICU Level of Service	B
Analysis Period (min)			15			
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis
 1: Covington Rd. & Miramonte Ave.

12/17/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	47	111	40	40	111	46	18	288	33	80	345	66
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	49	116	42	42	116	48	19	300	34	83	359	69

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	206	205	353	511
Volume Left (vph)	49	42	19	83
Volume Right (vph)	42	48	34	69
Hadj (s)	-0.04	-0.07	-0.01	-0.01
Departure Headway (s)	7.3	7.3	6.6	6.2
Degree Utilization, x	0.42	0.41	0.65	0.89
Capacity (veh/h)	454	454	512	511
Control Delay (s)	15.4	15.3	20.8	40.0
Approach Delay (s)	15.4	15.3	20.8	40.0
Approach LOS	C	C	C	E

Intersection Summary			
Delay		26.7	
HCM Level of Service		D	
Intersection Capacity Utilization	70.2%	ICU Level of Service	C
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 2: Eastwood Dr. & Miramonte Ave.

12/17/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔		↔	
Sign Control	Stop		Free		Free	
Grade	0%		0%		0%	
Volume (veh/h)	12	1	350	19	4	425
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	13	1	389	21	4	472
Pedestrians	4		4			
Lane Width (ft)	12.0		10.0			
Walking Speed (ft/s)	4.0		4.0			
Percent Blockage	0		0			
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	889	403			414	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	889	403			414	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	96	100			100	
cM capacity (veh/h)	311	645			1141	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	14	410	477
Volume Left	13	0	4
Volume Right	1	21	0
cSH	324	1700	1141
Volume to Capacity	0.04	0.24	0.00
Queue Length 95th (ft)	3	0	0
Control Delay (s)	16.6	0.0	0.1
Lane LOS	C		A
Approach Delay (s)	16.6	0.0	0.1
Approach LOS	C		

Intersection Summary			
Average Delay		0.3	
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
 3: Covington Rd. & Grant Ave.

12/17/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	
Frbp, ped/bikes	1.00	0.99	1.00	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1652	1458	1652	1739	3221	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1652	1458	1652	1739	3221	
Volume (vph)	118	78	73	472	883	145
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	126	83	78	502	939	154
RTOR Reduction (vph)	0	70	0	0	9	0
Lane Group Flow (vph)	126	13	78	502	1084	0
Conf. Peds. (#/hr)		1	1			2
Conf. Bikes (#/hr)						5
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	12.8	12.8	5.9	53.8	43.9	
Effective Green, g (s)	12.8	12.8	5.9	53.8	43.9	
Actuated g/C Ratio	0.16	0.16	0.07	0.66	0.54	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	259	229	120	1148	1735	
v/s Ratio Prot	c0.08		c0.05	0.29	c0.34	
v/s Ratio Perm		0.01				
v/c Ratio	0.49	0.06	0.65	0.44	0.62	
Uniform Delay, d1	31.4	29.2	36.8	6.6	13.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.4	0.1	11.9	0.3	0.7	
Delay (s)	32.8	29.3	48.7	6.9	13.8	
Level of Service	C	C	D	A	B	
Approach Delay (s)	31.4			12.5	13.8	
Approach LOS	C			B	B	

Intersection Summary

HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	81.5	Sum of lost time (s)	18.9
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 1: Covington Rd. & Miramonte Ave.

12/17/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	122	201	5	20	147	101	4	314	103	93	161	35
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	134	221	5	22	162	111	4	345	113	102	177	38
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	360	295	463	318								
Volume Left (vph)	134	22	4	102								
Volume Right (vph)	5	111	113	38								
Hadj (s)	0.10	-0.18	-0.11	0.03								
Departure Headway (s)	8.3	8.4	7.9	8.4								
Degree Utilization, x	0.83	0.68	1.01	0.74								
Capacity (veh/h)	420	408	463	412								
Control Delay (s)	40.9	27.6	74.0	31.8								
Approach Delay (s)	40.9	27.6	74.0	31.8								
Approach LOS	E	D	F	D								
Intersection Summary												
Delay			46.8									
HCM Level of Service			E									
Intersection Capacity Utilization			85.2%	ICU Level of Service	E							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
2: Eastwood Dr. & Miramonte Ave.

12/17/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	33	1	432	14	12	207
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	34	1	450	15	12	216
Pedestrians	5					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	703	462			470	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	703	462			470	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	91	100			99	
cM capacity (veh/h)	398	597			1088	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	35	465	228
Volume Left	34	0	12
Volume Right	1	15	0
cSH	402	1700	1088
Volume to Capacity	0.09	0.27	0.01
Queue Length 95th (ft)	7	0	1
Control Delay (s)	14.8	0.0	0.6
Lane LOS	B		A
Approach Delay (s)	14.8	0.0	0.6
Approach LOS	B		

Intersection Summary			
Average Delay		0.9	
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
3: Covington Rd. & Grant Ave.

12/17/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	
Frbp, ped/bikes	1.00	1.00	1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1652	1478	1652	1739	3183	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1652	1478	1652	1739	3183	
Volume (vph)	196	121	158	760	446	103
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	245	151	198	950	558	129
RTOR Reduction (vph)	0	118	0	0	20	0
Lane Group Flow (vph)	245	33	198	950	667	0
Conf. Peds. (#/hr)	2		6			6
Conf. Bikes (#/hr)						15
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	14.2	14.2	9.4	35.4	22.0	
Effective Green, g (s)	14.2	14.2	9.4	35.4	22.0	
Actuated g/C Ratio	0.22	0.22	0.15	0.55	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	363	325	240	953	1084	
v/s Ratio Prot	c0.15		0.12	c0.55	0.21	
v/s Ratio Perm		0.02				
v/c Ratio	0.67	0.10	0.82	1.00	0.62	
Uniform Delay, d1	23.1	20.1	26.8	14.5	17.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.9	0.1	20.1	28.2	1.0	
Delay (s)	28.0	20.3	46.9	42.7	18.8	
Level of Service	C	C	D	D	B	
Approach Delay (s)	25.0			43.4	18.8	
Approach LOS	C			D	B	

Intersection Summary			
HCM Average Control Delay	32.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	64.6	Sum of lost time (s)	15.0
Intersection Capacity Utilization	57.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
 1: Covington Rd. & Miramonte Ave.

12/17/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	70	112	26	36	129	60	16	264	27	79	368	50
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	74	119	28	38	137	64	17	281	29	84	391	53

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	221	239	327	529
Volume Left (vph)	74	38	17	84
Volume Right (vph)	28	64	29	53
Hadj (s)	0.03	-0.09	-0.01	0.01
Departure Headway (s)	7.6	7.5	7.0	6.5
Degree Utilization, x	0.47	0.50	0.64	0.96
Capacity (veh/h)	440	457	493	542
Control Delay (s)	17.2	17.6	21.4	54.6
Approach Delay (s)	17.2	17.6	21.4	54.6
Approach LOS	C	C	C	F

Intersection Summary			
Delay		33.4	
HCM Level of Service		D	
Intersection Capacity Utilization	74.5%		ICU Level of Service D
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 2: Eastwood Dr. & Miramonte Ave.

12/17/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔			↔
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	16	2	303	19	0	432
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	2	329	21	0	470
Pedestrians	4					
Lane Width (ft)	12.0					
Walking Speed (ft/s)	4.0					
Percent Blockage	0					
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	813	344			354	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	813	344			354	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	95	100			100	
cM capacity (veh/h)	347	697			1201	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	20	350	470
Volume Left	17	0	0
Volume Right	2	21	0
cSH	367	1700	1201
Volume to Capacity	0.05	0.21	0.00
Queue Length 95th (ft)	4	0	0
Control Delay (s)	15.4	0.0	0.0
Lane LOS	C		
Approach Delay (s)	15.4	0.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay		0.4	
Intersection Capacity Utilization	32.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
 3: Covington Rd. & Grant Ave.

12/17/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	
Frbp, ped/bikes	1.00	0.99	1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.98	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1652	1459	1652	1739	3216	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1652	1459	1652	1739	3216	
Volume (vph)	115	113	101	441	1046	173
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	122	120	107	469	1113	184
RTOR Reduction (vph)	0	101	0	0	10	0
Lane Group Flow (vph)	122	19	107	469	1287	0
Conf. Peds. (#/hr)	4	1	5			5
Conf. Bikes (#/hr)						11
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	12.2	12.2	8.6	48.5	35.9	
Effective Green, g (s)	12.2	12.2	8.6	48.5	35.9	
Actuated g/C Ratio	0.16	0.16	0.11	0.64	0.47	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	264	234	186	1107	1515	
v/s Ratio Prot	c0.07		c0.06	0.27	c0.40	
v/s Ratio Perm		0.01				
v/c Ratio	0.46	0.08	0.58	0.42	0.85	
Uniform Delay, d1	29.0	27.2	32.1	6.9	17.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.3	0.2	4.3	0.3	4.7	
Delay (s)	30.3	27.4	36.3	7.2	22.4	
Level of Service	C	C	D	A	C	
Approach Delay (s)	28.9			12.6	22.4	
Approach LOS	C			B	C	
Intersection Summary						
HCM Average Control Delay		20.5		HCM Level of Service		C
HCM Volume to Capacity ratio		0.72				
Actuated Cycle Length (s)		76.2		Sum of lost time (s)		19.5
Intersection Capacity Utilization		59.0%		ICU Level of Service		B
Analysis Period (min)		15				
c Critical Lane Group						

HCM Unsignalized Intersection Capacity Analysis
 1: Covington Rd. & Miramonte Ave.

12/17/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	87	128	18	17	117	38	6	304	38	46	123	29
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	95	139	20	18	127	41	7	330	41	50	134	32
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	253	187	378	215								
Volume Left (vph)	95	18	7	50								
Volume Right (vph)	20	41	41	32								
Hadj (s)	0.06	-0.08	-0.03	-0.01								
Departure Headway (s)	6.1	6.1	5.7	6.0								
Degree Utilization, x	0.43	0.32	0.59	0.36								
Capacity (veh/h)	534	507	598	531								
Control Delay (s)	13.6	11.9	16.6	12.3								
Approach Delay (s)	13.6	11.9	16.6	12.3								
Approach LOS	B	B	C	B								
Intersection Summary												
Delay			14.1									
HCM Level of Service			B									
Intersection Capacity Utilization			66.1%	ICU Level of Service	C							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 2: Eastwood Dr. & Miramonte Ave.

12/17/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↑			↓
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	40	0	379	16	10	199
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	0	412	17	11	216
Pedestrians			1			
Lane Width (ft)			10.0			
Walking Speed (ft/s)			4.0			
Percent Blockage			0			
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	660	421			429	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	660	421			429	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	100			99	
cM capacity (veh/h)	424	633			1130	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	43	429	227
Volume Left	43	0	11
Volume Right	0	17	0
cSH	424	1700	1130
Volume to Capacity	0.10	0.25	0.01
Queue Length 95th (ft)	9	0	1
Control Delay (s)	14.5	0.0	0.5
Lane LOS	B		A
Approach Delay (s)	14.5	0.0	0.5
Approach LOS	B		

Intersection Summary			
Average Delay		1.1	
Intersection Capacity Utilization		30.9%	ICU Level of Service A
Analysis Period (min)		15	

HCM Signalized Intersection Capacity Analysis
3: Covington Rd. & Grant Ave.

12/17/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	
Frbp, ped/bikes	1.00	0.97	1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1652	1438	1652	1739	3187	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1652	1438	1652	1739	3187	
Volume (vph)	180	127	134	629	481	121
Peak-hour factor, PHF	0.78	0.78	0.78	0.78	0.78	0.78
Adj. Flow (vph)	231	163	172	806	617	155
RTOR Reduction (vph)	0	128	0	0	22	0
Lane Group Flow (vph)	231	35	172	806	750	0
Conf. Peds. (#/hr)		3				
Conf. Bikes (#/hr)		12				6
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	13.9	13.9	9.4	35.5	22.1	
Effective Green, g (s)	13.9	13.9	9.4	35.5	22.1	
Actuated g/C Ratio	0.22	0.22	0.15	0.55	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	357	311	242	960	1095	
v/s Ratio Prot	c0.14		0.10	c0.46	0.24	
v/s Ratio Perm		0.02				
v/c Ratio	0.65	0.11	0.71	0.84	0.68	
Uniform Delay, d1	23.0	20.2	26.2	12.0	18.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.0	0.2	9.4	6.5	1.8	
Delay (s)	27.0	20.4	35.6	18.6	19.9	
Level of Service	C	C	D	B	B	
Approach Delay (s)	24.3			21.6	19.9	
Approach LOS	C			C	B	

Intersection Summary

HCM Average Control Delay	21.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	64.3	Sum of lost time (s)	14.9
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis

1: Covington Rd. & Miramonte Ave.

12/17/2010



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	118	181	10	27	122	125	9	279	62	89	169	32
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	139	213	12	32	144	147	11	328	73	105	199	38

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	364	322	412	341
Volume Left (vph)	139	32	11	105
Volume Right (vph)	12	147	73	38
Hadj (s)	0.09	-0.22	-0.07	0.03
Departure Headway (s)	8.8	8.7	8.4	8.8
Degree Utilization, x	0.89	0.78	0.96	0.84
Capacity (veh/h)	396	399	423	398
Control Delay (s)	50.9	36.5	64.5	43.3
Approach Delay (s)	50.9	36.5	64.5	43.3
Approach LOS	F	E	F	E

Intersection Summary			
Delay		49.8	
HCM Level of Service		E	
Intersection Capacity Utilization	80.8%	ICU Level of Service	D
Analysis Period (min)		15	

HCM Unsignalized Intersection Capacity Analysis
 2: Eastwood Dr. & Miramonte Ave.

12/17/2010



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↔			↔
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Volume (veh/h)	40	0	379	16	10	199
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	0	412	17	11	216
Pedestrians			1			
Lane Width (ft)			10.0			
Walking Speed (ft/s)			4.0			
Percent Blockage			0			
Right turn flare (veh)						
Median type	None					
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	660	421			429	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	660	421			429	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	90	100			99	
cM capacity (veh/h)	424	633			1130	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	43	429	227
Volume Left	43	0	11
Volume Right	0	17	0
cSH	424	1700	1130
Volume to Capacity	0.10	0.25	0.01
Queue Length 95th (ft)	9	0	1
Control Delay (s)	14.5	0.0	0.5
Lane LOS	B		A
Approach Delay (s)	14.5	0.0	0.5
Approach LOS	B		

Intersection Summary			
Average Delay		1.1	
Intersection Capacity Utilization		30.9%	ICU Level of Service A
Analysis Period (min)		15	

HCM Signalized Intersection Capacity Analysis
 3: Covington Rd. & Grant Ave.

12/17/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	10	10	10	10	10	10
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	
Frbp, ped/bikes	1.00	0.97	1.00	1.00	0.99	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	0.85	1.00	1.00	0.97	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1652	1438	1652	1739	3187	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1652	1438	1652	1739	3187	
Volume (vph)	180	127	134	629	481	121
Peak-hour factor, PHF	0.78	0.78	0.78	0.78	0.78	0.78
Adj. Flow (vph)	231	163	172	806	617	155
RTOR Reduction (vph)	0	128	0	0	22	0
Lane Group Flow (vph)	231	35	172	806	750	0
Conf. Peds. (#/hr)		3				
Conf. Bikes (#/hr)		12				6
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	13.9	13.9	9.4	35.5	22.1	
Effective Green, g (s)	13.9	13.9	9.4	35.5	22.1	
Actuated g/C Ratio	0.22	0.22	0.15	0.55	0.34	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	357	311	242	960	1095	
v/s Ratio Prot	c0.14		0.10	c0.46	0.24	
v/s Ratio Perm		0.02				
v/c Ratio	0.65	0.11	0.71	0.84	0.68	
Uniform Delay, d1	23.0	20.2	26.2	12.0	18.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	4.0	0.2	9.4	6.5	1.8	
Delay (s)	27.0	20.4	35.6	18.6	19.9	
Level of Service	C	C	D	B	B	
Approach Delay (s)	24.3			21.6	19.9	
Approach LOS	C			C	B	

Intersection Summary

HCM Average Control Delay	21.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	64.3	Sum of lost time (s)	14.9
Intersection Capacity Utilization	50.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group