

**TECHNICAL APPENDIX**  
**FOR THE**  
**PROPOSED BLACK HILLS CENTER**  
**RAPID CITY, SOUTH DAKOTA**

**APRIL 2010**

**Prepared For:**

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**CBB Job Number 5-10**

























## **2010 No Build (Base) Operating Conditions**

### **Weekday PM Peak Hour Primary Study Intersections**

Lanes, Volumes, Timings  
5: Catron & 5th St

2010 No Build PM Peak

4/26/2010

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	230	0	0	400	80	0	1	0	110	0	150
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Grade (%)		-3%			2%			0%			0%	
Storage Length (ft)	450		450	400		450	200		0	200		0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950		
Satd. Flow (prot)	1702	3403	1791	1747	3319	1485	1765	3353	0	1676	1765	1500
Flt Permitted	0.358									0.615		
Satd. Flow (perm)	641	3403	1791	1747	3319	1485	1765	3353	0	1085	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						87						439
Link Speed (mph)		60			60			30				45
Link Distance (ft)		2300			6259			549				650
Travel Time (s)		26.1			71.1			12.5				9.8
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
Adj. Flow (vph)	87	250	0	0	435	87	0	1	0	120	0	163
Shared Lane Traffic (%)												
Lane Group Flow (vph)	87	250	0	0	435	87	0	1	0	120	0	163
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	12.0	12.0	4.0	12.0	12.0	4.0	7.0		4.0	12.0	12.0
Minimum Split (s)	10.0	31.3	31.3	10.0	30.7	30.7	10.0	30.0		10.0	30.0	30.0
Total Split (s)	20.0	43.0	43.0	10.0	33.0	33.0	10.0	33.0	0.0	14.0	37.0	37.0
Total Split (%)	20.0%	43.0%	43.0%	10.0%	33.0%	33.0%	10.0%	33.0%	0.0%	14.0%	37.0%	37.0%
Maximum Green (s)	14.0	36.0	36.0	4.0	26.6	26.6	4.5	27.5		8.5	31.5	31.5
Yellow Time (s)	4.5	5.8	5.8	4.5	5.2	5.2	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	7.0	7.0	6.0	6.4	6.4	5.5	5.5	4.0	5.5	5.5	5.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
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
Recall Mode	None	None	None	None	None	None	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		17.0	17.0		17.0	17.0		17.0			17.0	17.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effect Green (s)	26.5	28.8			19.0	19.0		8.4		12.8		15.7
Actuated g/C Ratio	0.56	0.61			0.40	0.40		0.18		0.27		0.33
v/c Ratio	0.16	0.12			0.33	0.13		0.00		0.28		0.21
Control Delay	7.6	7.2			17.6	5.8		24.0		18.6		0.6
Queue Delay	0.0	0.0			0.0	0.0		0.0		0.0		0.0
Total Delay	7.6	7.2			17.6	5.8		24.0		18.6		0.6

Lanes, Volumes, Timings  
5: Catron & 5th St

2010 No Build PM Peak

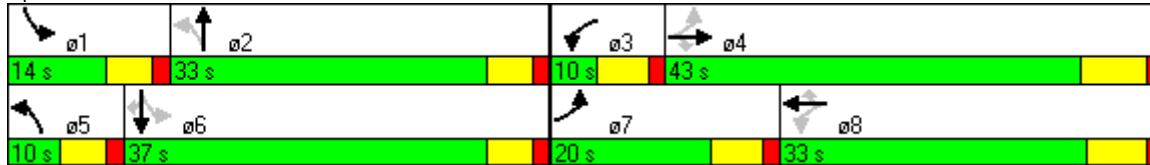
4/26/2010

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	A	A			B	A		C		B		A
Approach Delay		7.3			15.6			24.0				
Approach LOS		A			B			C				
Queue Length 50th (ft)	11	18			57	0		0		28		0
Queue Length 95th (ft)	37	45			122	30		2		74		0
Internal Link Dist (ft)		2220			6179			469			570	
Turn Bay Length (ft)	450					450				200		
Base Capacity (vph)	744	2511			1983	922		2048		473		1150
Starvation Cap Reductn	0	0			0	0		0		0		0
Spillback Cap Reductn	0	0			0	0		0		0		0
Storage Cap Reductn	0	0			0	0		0		0		0
Reduced v/c Ratio	0.12	0.10			0.22	0.09		0.00		0.25		0.14

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	47.4
Natural Cycle:	85
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.33
Intersection Signal Delay:	11.3
Intersection LOS:	B
Intersection Capacity Utilization:	44.4%
ICU Level of Service:	A
Analysis Period (min):	15

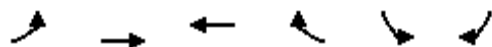
Splits and Phases: 5: Catron & 5th St



### HCM Unsignalized Intersection Capacity Analysis 3: Catron & Black Hills

2010 No Build PM Peak

4/26/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↵	↑↑	↑↑	↵	↵	↵
Volume (veh/h)	15	300	545	5	10	5
Sign Control		Free	Free		Stop	
Grade		-4%	4%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	326	592	5	11	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	598				788	296
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	598				788	296
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				97	99
cM capacity (veh/h)	975				323	700























Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	16	163	163	296	296	5	11	5
Volume Left	16	0	0	0	0	0	11	0
Volume Right	0	0	0	0	0	5	0	5
cSH	975	1700	1700	1700	1700	1700	323	700
Volume to Capacity	0.02	0.10	0.10	0.17	0.17	0.00	0.03	0.01
Queue Length 95th (ft)	1	0	0	0	0	0	3	1
Control Delay (s)	8.8	0.0	0.0	0.0	0.0	0.0	16.5	10.2
Lane LOS	A						C	B
Approach Delay (s)	0.4			0.0			14.4	
Approach LOS							B	

#### Intersection Summary

Average Delay		0.4						
Intersection Capacity Utilization		25.9%		ICU Level of Service			A	
Analysis Period (min)		15						

HCM Unsignalized Intersection Capacity Analysis  
 9: Stumer & 5th St

2010 No Build PM Peak  
 4/26/2010














												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	0	0	5	0	1	1	160	1	1	255	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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)	5	0	0	5	0	1	1	174	1	1	277	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			6									
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								650				
pX, platoon unblocked												
vC, conflicting volume	370	457	139	317	461	88	283			175		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	370	457	139	317	461	88	283			175		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	100	99	100	100	100			100		
cM capacity (veh/h)	561	498	884	611	495	953	1277			1399		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4	
Volume Total	5	0	5	1	1	116	59	1	139	139	5	
Volume Left	5	0	5	0	1	0	0	1	0	0	0	
Volume Right	0	0	0	1	0	0	1	0	0	0	5	
cSH	561	1700	611	953	1277	1700	1700	1399	1700	1700	1700	
Volume to Capacity	0.01	0.00	0.01	0.00	0.00	0.07	0.03	0.00	0.08	0.08	0.00	
Queue Length 95th (ft)	1	0	1	0	0	0	0	0	0	0	0	
Control Delay (s)	11.5	0.0	10.9	8.8	7.8	0.0	0.0	7.6	0.0	0.0	0.0	
Lane LOS	B	A	B	A	A			A				
Approach Delay (s)	11.5		10.6		0.0			0.0				
Approach LOS	B		B									
Intersection Summary												
Average Delay			0.3									
Intersection Capacity Utilization			20.0%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 13: Parkview & 5th St

2010 No Build PM Peak

4/26/2010

							
Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations			 			 	
Volume (veh/h)	15	5	140	25	10	245	
Sign Control	Stop		Free			Free	
Grade	0%		0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	16	5	152	27	11	266	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			None			None	
Median storage (veh)							
Upstream signal (ft)			1234				
pX, platoon unblocked							
vC, conflicting volume	321	90			179		
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	321	90			179		
tC, single (s)	6.8	6.9			4.1		
tC, 2 stage (s)							
tF (s)	3.5	3.3			2.2		
p0 queue free %	97	99			99		
cM capacity (veh/h)	643	950			1394		
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	16	5	101	78	11	133	133
Volume Left	16	0	0	0	11	0	0
Volume Right	0	5	0	27	0	0	0
cSH	643	950	1700	1700	1394	1700	1700
Volume to Capacity	0.03	0.01	0.06	0.05	0.01	0.08	0.08
Queue Length 95th (ft)	2	0	0	0	1	0	0
Control Delay (s)	10.7	8.8	0.0	0.0	7.6	0.0	0.0
Lane LOS	B	A			A		
Approach Delay (s)	10.3		0.0		0.3		
Approach LOS	B						
Intersection Summary							
Average Delay			0.6				
Intersection Capacity Utilization			18.8%		ICU Level of Service		A
Analysis Period (min)			15				

# HCM Unsignalized Intersection Capacity Analysis

## 12: Enchanted Pines & 5th St

2010 No Build PM Peak

4/26/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	45	10	5	140	245	70
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	11	5	152	266	76
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						
vC, conflicting volume	391	171	342			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	391	171	342			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	92	99	100			
cM capacity (veh/h)	583	843	1213			
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	60	5	76	76	178	165
Volume Left	49	5	0	0	0	0
Volume Right	11	0	0	0	0	76
cSH	617	1213	1700	1700	1700	1700
Volume to Capacity	0.10	0.00	0.04	0.04	0.10	0.10
Queue Length 95th (ft)	8	0	0	0	0	0
Control Delay (s)	11.5	8.0	0.0	0.0	0.0	0.0
Lane LOS	B	A				
Approach Delay (s)	11.5	0.3			0.0	
Approach LOS	B					
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			19.5%		ICU Level of Service	A
Analysis Period (min)			15			









# HCM Unsignalized Intersection Capacity Analysis

## 8: Stumer & Black Hills

















2010 No Build PM Peak

4/26/2010

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Sign Control	Stop			Stop	Stop	
Volume (vph)	2	10	1	5	10	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	11	1	5	11	5
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total (vph)	2	11	1	5	11	5
Volume Left (vph)	0	0	1	0	11	0
Volume Right (vph)	0	11	0	0	0	5
Hadj (s)	0.03	-0.67	0.53	0.03	0.53	-0.67
Departure Headway (s)	4.6	3.9	5.1	4.6	5.1	3.9
Degree Utilization, x	0.00	0.01	0.00	0.01	0.02	0.01
Capacity (veh/h)	778	921	703	771	696	921
Control Delay (s)	6.4	5.7	6.9	6.4	7.0	5.7
Approach Delay (s)	5.8		6.5		6.5	
Approach LOS	A		A		A	
Intersection Summary						
Delay			6.3			
HCM Level of Service			A			
Intersection Capacity Utilization			13.3%	ICU Level of Service	A	
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 15: Stumer & Enchantment

2010 No Build PM Peak  
 4/26/2010

















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	2	1	5	2	10	0	30	5	10	45	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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)	8	2	1	5	2	11	0	33	5	11	49	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	121	111	52	111	111	35	54			38		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	121	111	52	111	111	35	54			38		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	100	99	100	99	100			99		
cM capacity (veh/h)	839	773	1016	860	773	1037	1551			1572		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	11	18	38	65								
Volume Left	8	5	0	11								
Volume Right	1	11	5	5								
cSH	840	942	1551	1572								
Volume to Capacity	0.01	0.02	0.00	0.01								
Queue Length 95th (ft)	1	1	0	1								
Control Delay (s)	9.3	8.9	0.0	1.3								
Lane LOS	A	A		A								
Approach Delay (s)	9.3	8.9	0.0	1.3								
Approach LOS	A	A										
<b>Intersection Summary</b>												
Average Delay			2.6									
Intersection Capacity Utilization			20.1%		ICU Level of Service					A		
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 16: Enchanted Pines & Enchantment

2010 No Build PM Peak

4/26/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	10	0	60	10	0	0	0	45	1	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	0	11	0	65	11	0	0	0	49	1	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	11			11			152	152	11	201	152	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	11			11			152	152	11	201	152	11
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			96			100	100	95	100	100	100
cM capacity (veh/h)	1608			1608			790	710	1070	700	710	1070
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	11	76	49	1								
Volume Left	0	65	0	1								
Volume Right	0	0	49	0								
cSH	1608	1608	1070	700								
Volume to Capacity	0.00	0.04	0.05	0.00								
Queue Length 95th (ft)	0	3	4	0								
Control Delay (s)	0.0	6.3	8.5	10.1								
Lane LOS		A	A	B								
Approach Delay (s)	0.0	6.3	8.5	10.1								
Approach LOS			A	B								
<b>Intersection Summary</b>												
Average Delay			6.6									
Intersection Capacity Utilization			20.7%		ICU Level of Service				A			
Analysis Period (min)			15									

## **2010 No Build (Base) Operating Conditions**

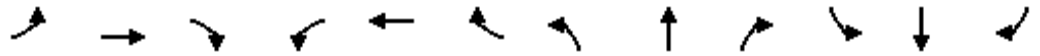
### **Weekday PM Peak Hour Perimeter Study Intersections**

Lanes, Volumes, Timings  
20: Minnesota & 5th St2010 No Build PM Peak  
Black Hills TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	20	20	45	20	125	15	175	35	170	305	50
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	100		0	150		0	300		300	125		0
Storage Lanes	1		0	1		0	1		1	1		0
Taper Length (ft)	25		25	25		25	25		25	25		25
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	0.95
Frt		0.925			0.871				0.850		0.979	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1632	0	1676	1537	0	1676	3353	1500	1676	3283	0
Flt Permitted	0.657			0.524			0.523			0.478		
Satd. Flow (perm)	1159	1632	0	925	1537	0	923	3353	1500	844	3283	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		22			136				38			21
Link Speed (mph)		35			35			45				45
Link Distance (ft)		1080			1107			2181				552
Travel Time (s)		21.0			21.6			33.0				8.4
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
Adj. Flow (vph)	38	22	22	49	22	136	16	190	38	185	332	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	38	44	0	49	158	0	16	190	38	185	386	0
Turn Type	pm+pt			pm+pt			pm+pt		Perm	pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Detector Phase	7	4		3	8		5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	4.0	12.0		4.0	12.0		4.0	12.0	12.0	4.0	12.0	
Minimum Split (s)	10.0	30.0		10.0	30.0		10.0	30.0	30.0	10.0	30.0	
Total Split (s)	12.0	33.0	0.0	12.0	33.0	0.0	11.0	35.0	35.0	20.0	44.0	0.0
Total Split (%)	12.0%	33.0%	0.0%	12.0%	33.0%	0.0%	11.0%	35.0%	35.0%	20.0%	44.0%	0.0%
Maximum Green (s)	6.0	27.0		6.0	27.0		5.0	29.0	29.0	14.0	38.0	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5	1.5	1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None		None	None	None	None	None	
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	
Flash Dont Walk (s)		17.0			17.0			17.0	17.0		17.0	
Pedestrian Calls (#/hr)		0			0			0	0		0	
Act Effect Green (s)	11.4	13.0		12.7	13.0		18.4	13.0	13.0	29.3	29.6	
Actuated g/C Ratio	0.22	0.25		0.24	0.25		0.35	0.25	0.25	0.55	0.56	
v/c Ratio	0.12	0.11		0.15	0.33		0.04	0.23	0.10	0.30	0.21	
Control Delay	16.4	15.1		15.8	9.2		10.9	21.4	9.7	10.8	11.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	16.4	15.1		15.8	9.2		10.9	21.4	9.7	10.8	11.0	
LOS	B	B		B	A		B	C	A	B	B	

Lanes, Volumes, Timings  
20: Minnesota & 5th St

2010 No Build PM Peak  
Black Hills TIS

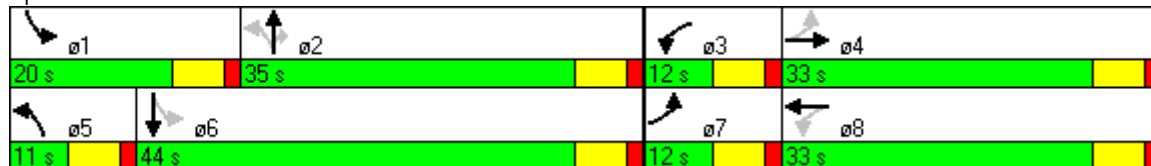


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		15.7			10.7			18.9				10.9
Approach LOS		B			B			B				B
Queue Length 50th (ft)	11	5		12	5		2	24	0	26		26
Queue Length 95th (ft)	28	32		33	53		13	63	22	80		97
Internal Link Dist (ft)		1000			1027			2101				472
Turn Bay Length (ft)	100			150			300		300	125		
Base Capacity (vph)	318	911		334	909		398	1988	905	706		2400
Starvation Cap Reductn	0	0		0	0		0	0	0	0		0
Spillback Cap Reductn	0	0		0	0		0	0	0	0		0
Storage Cap Reductn	0	0		0	0		0	0	0	0		0
Reduced v/c Ratio	0.12	0.05		0.15	0.17		0.04	0.10	0.04	0.26		0.16

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	52.9
Natural Cycle:	80
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.33
Intersection Signal Delay:	13.0
Intersection LOS:	B
Intersection Capacity Utilization:	53.3%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 20: Minnesota & 5th St



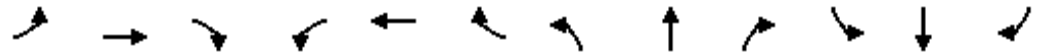
Lanes, Volumes, Timings  
33: Catron & Hwy 16

2010 No Build PM Peak  
Black Hills TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	125	70	195	315	25	90	205	115	60	265	265
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	300		150	300		175	500		1000	500		500
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1765	1500	1676	3353	1500	1676	3353	1500	1676	3353	1500
Flt Permitted	0.546			0.522			0.950			0.950		
Satd. Flow (perm)	964	1765	1500	921	3353	1500	1676	3353	1500	1676	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			76			27			125			288
Link Speed (mph)		45			60			55				55
Link Distance (ft)		1599			7967			1608				7136
Travel Time (s)		24.2			90.5			19.9				88.5
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
Adj. Flow (vph)	114	136	76	212	342	27	98	223	125	65	288	288
Shared Lane Traffic (%)												
Lane Group Flow (vph)	114	136	76	212	342	27	98	223	125	65	288	288
Turn Type	pm+pt		Perm	pm+pt		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	12.0	12.0	4.0	12.0	12.0	4.0	12.0	12.0	4.0	12.0	12.0
Minimum Split (s)	10.0	18.0	18.0	10.0	18.0	18.0	10.0	18.0	18.0	10.0	18.0	18.0
Total Split (s)	17.0	23.0	23.0	22.0	28.0	28.0	20.0	37.0	37.0	18.0	35.0	35.0
Total Split (%)	17.0%	23.0%	23.0%	22.0%	28.0%	28.0%	20.0%	37.0%	37.0%	18.0%	35.0%	35.0%
Maximum Green (s)	11.0	17.0	17.0	16.0	22.0	22.0	14.0	31.0	31.0	12.0	29.0	29.0
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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
Recall Mode	None	Min	Min	None	Min	Min	None	Min	Min	None	Min	Min
Act Effct Green (s)	21.8	13.3	13.3	28.6	19.4	19.4	9.6	17.6	17.6	8.3	13.8	13.8
Actuated g/C Ratio	0.31	0.19	0.19	0.41	0.28	0.28	0.14	0.25	0.25	0.12	0.20	0.20
v/c Ratio	0.29	0.40	0.22	0.42	0.37	0.06	0.42	0.26	0.26	0.32	0.43	0.54
Control Delay	16.5	32.4	9.6	17.1	25.5	10.8	36.3	24.6	7.4	35.9	29.0	8.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.5	32.4	9.6	17.1	25.5	10.8	36.3	24.6	7.4	35.9	29.0	8.3
LOS	B	C	A	B	C	B	D	C	A	D	C	A
Approach Delay		21.5			21.8			22.4			20.4	
Approach LOS		C			C			C			C	
Queue Length 50th (ft)	28	52	0	56	66	0	38	43	0	26	58	0

Lanes, Volumes, Timings  
33: Catron & Hwy 16

2010 No Build PM Peak  
Black Hills TIS

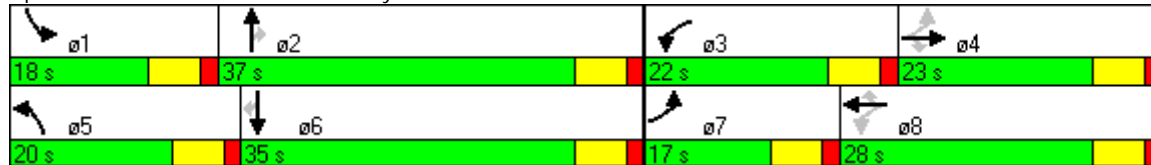


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	70	122	36	125	125	21	97	86	43	72	112	65
Internal Link Dist (ft)		1519			7887			1528			7056	
Turn Bay Length (ft)	300		150	300		175	500		1000	500		500
Base Capacity (vph)	460	449	438	587	1144	530	351	1555	763	301	1454	814
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.30	0.17	0.36	0.30	0.05	0.28	0.14	0.16	0.22	0.20	0.35

Intersection Summary




























Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	69.4
Natural Cycle:	60
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.54
Intersection Signal Delay:	21.4
Intersection LOS:	C
Intersection Capacity Utilization	56.7%
ICU Level of Service	B
Analysis Period (min)	15

Splits and Phases: 33: Catron & Hwy 16



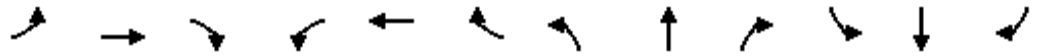


Lanes, Volumes, Timings  
36: Catron & Cambell

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 				 	 		 
Volume (vph)	125	200	75	65	245	170	40	0	50	135	0	245
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	500		0	325		0	250		0	200		0
Storage Lanes	2		0	2		0	1		1	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.97	0.95	0.95	0.97	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.959			0.938				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3252	3215	0	3252	3145	0	1676	0	1500	1676	0	1500
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3252	3215	0	3252	3145	0	1676	0	1500	1676	0	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		59			180				54			266
Link Speed (mph)		60			60			30				30
Link Distance (ft)		6259			1790			1477			2203	
Travel Time (s)		71.1			20.3			33.6			50.1	
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
Adj. Flow (vph)	136	217	82	71	266	185	43	0	54	147	0	266
Shared Lane Traffic (%)												
Lane Group Flow (vph)	136	299	0	71	451	0	43	0	54	147	0	266
Turn Type	Prot			Prot			custom		custom	custom		custom
Protected Phases	7	4		3	8							
Permitted Phases							2		2	6		6
Detector Phase	7	4		3	8		2		2	6		6
Switch Phase												
Minimum Initial (s)	7.0	12.0		7.0	12.0		7.0		7.0	7.0		7.0
Minimum Split (s)	13.0	18.0		13.0	18.0		13.0		13.0	13.0		13.0
Total Split (s)	20.0	39.0	0.0	17.0	36.0	0.0	44.0	0.0	44.0	44.0	0.0	44.0
Total Split (%)	20.0%	39.0%	0.0%	17.0%	36.0%	0.0%	44.0%	0.0%	44.0%	44.0%	0.0%	44.0%
Maximum Green (s)	14.0	33.0		11.0	30.0		38.0		38.0	38.0		38.0
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5		4.5	4.5		4.5
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5		1.5	1.5		1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	4.0	6.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0		3.0	3.0		3.0
Recall Mode	None	Min		None	Min		None		None	None		None
Act Effct Green (s)	8.0	16.2		7.5	13.0		10.1		10.1	10.1		10.1
Actuated g/C Ratio	0.17	0.35		0.16	0.28		0.22		0.22	0.22		0.22
v/c Ratio	0.24	0.26		0.13	0.44		0.12		0.15	0.40		0.50
Control Delay	20.2	11.4		20.4	11.0		16.7		6.8	20.6		6.4
Queue Delay	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Total Delay	20.2	11.4		20.4	11.0		16.7		6.8	20.6		6.4
LOS	C	B		C	B		B		A	C		A
Approach Delay		14.2			12.3							
Approach LOS		B			B							
Queue Length 50th (ft)	17	26		8	31		10		0	35		0

Lanes, Volumes, Timings  
36: Catron & Cambell

2010 No Build PM Peak  
Black Hills TIS

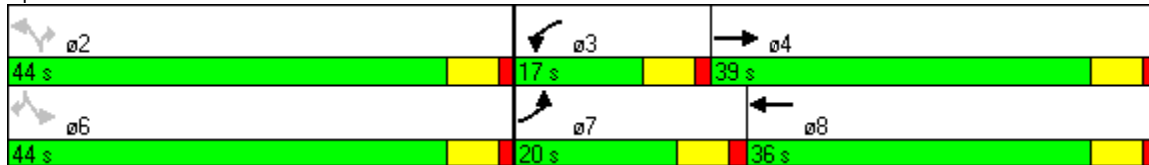


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	42	60		26	75		32		22	83		47
Internal Link Dist (ft)		6179			1710			1397			2123	
Turn Bay Length (ft)	500			325			250			200		
Base Capacity (vph)	1031	2377		810	2195		1367		1233	1367		1272
Starvation Cap Reductn	0	0		0	0		0		0	0		0
Spillback Cap Reductn	0	0		0	0		0		0	0		0
Storage Cap Reductn	0	0		0	0		0		0	0		0
Reduced v/c Ratio	0.13	0.13		0.09	0.21		0.03		0.04	0.11		0.21

Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	46.1
Natural Cycle:	45
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.50
Intersection Signal Delay:	12.5
Intersection LOS:	B
Intersection Capacity Utilization	45.6%
ICU Level of Service	A
Analysis Period (min)	15

Splits and Phases: 36: Catron & Cambell



## **2010 No Build (Base) Operating Conditions**

### **Saturday Midday Peak Hour Primary Study Intersections**

Lanes, Volumes, Timings  
5: Catron & 5th St

2010 No Build Saturday Peak  
Black Hills TIS



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	190	0	0	185	40	0	1	0	35	0	60
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Grade (%)		-3%			2%			0%			0%	
Storage Length (ft)	450		450	400		450	200		0	200		0
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00
Frt						0.850						0.850
Flt Protected	0.950									0.950		
Satd. Flow (prot)	1702	3403	1791	1747	3319	1485	1765	3353	0	1676	1765	1500
Flt Permitted	0.386									0.500		
Satd. Flow (perm)	691	3403	1791	1747	3319	1485	1765	3353	0	882	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						43						648
Link Speed (mph)		60			60			30				45
Link Distance (ft)		2300			6259			549				650
Travel Time (s)		26.1			71.1			12.5				9.8
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
Adj. Flow (vph)	60	207	0	0	201	43	0	1	0	38	0	65
Shared Lane Traffic (%)												
Lane Group Flow (vph)	60	207	0	0	201	43	0	1	0	38	0	65
Turn Type	pm+pt		Perm	pm+pt		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8	2			6		6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	12.0	12.0	4.0	12.0	12.0	4.0	7.0		4.0	12.0	12.0
Minimum Split (s)	10.0	31.3	31.3	10.0	30.7	30.7	10.0	30.0		10.0	30.0	30.0
Total Split (s)	21.0	45.0	45.0	10.0	34.0	34.0	10.0	33.0	0.0	12.0	35.0	35.0
Total Split (%)	21.0%	45.0%	45.0%	10.0%	34.0%	34.0%	10.0%	33.0%	0.0%	12.0%	35.0%	35.0%
Maximum Green (s)	15.0	38.0	38.0	4.0	27.6	27.6	4.5	27.5		6.5	29.5	29.5
Yellow Time (s)	4.5	5.8	5.8	4.5	5.2	5.2	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	7.0	7.0	6.0	6.4	6.4	5.5	5.5	4.0	5.5	5.5	5.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
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
Recall Mode	None	None	None	None	None	None	None	None		None	None	None
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		17.0	17.0		17.0	17.0		17.0			17.0	17.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effect Green (s)	19.6	25.9			18.2	18.2		9.8		10.0		16.5
Actuated g/C Ratio	0.57	0.75			0.53	0.53		0.28		0.29		0.48
v/c Ratio	0.09	0.08			0.11	0.05		0.00		0.09		0.06
Control Delay	6.1	5.3			12.8	7.2		19.0		13.5		0.1
Queue Delay	0.0	0.0			0.0	0.0		0.0		0.0		0.0
Total Delay	6.1	5.3			12.8	7.2		19.0		13.5		0.1

Lanes, Volumes, Timings  
5: Catron & 5th St

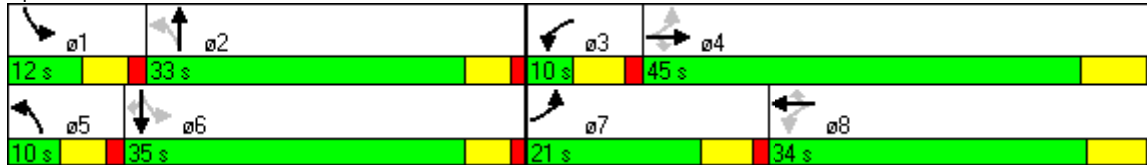
2010 No Build Saturday Peak  
Black Hills TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	A	A			B	A		B		B		A
Approach Delay		5.4			11.8			19.0				
Approach LOS		A			B			B				
Queue Length 50th (ft)	0	0			10	0		0		5		0
Queue Length 95th (ft)	27	36			56	21		2		26		0
Internal Link Dist (ft)		2220			6179			469			570	
Turn Bay Length (ft)	450					450				200		
Base Capacity (vph)	1070	3015			2606	1175		2628		471		1340
Starvation Cap Reductn	0	0			0	0		0		0		0
Spillback Cap Reductn	0	0			0	0		0		0		0
Storage Cap Reductn	0	0			0	0		0		0		0
Reduced v/c Ratio	0.06	0.07			0.08	0.04		0.00		0.08		0.05

Intersection Summary

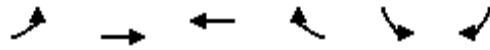
Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	34.4
Natural Cycle:	85
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.11
Intersection Signal Delay:	7.9
Intersection LOS:	A
Intersection Capacity Utilization:	38.8%
ICU Level of Service:	A
Analysis Period (min):	15

Splits and Phases: 5: Catron & 5th St



HCM Unsignalized Intersection Capacity Analysis  
 3: Catron & Black Hills

2010 No Build Saturday Peak  
 Black Hills TIS



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	240	240	5	5	1
Sign Control		Free	Free		Stop	
Grade		-4%	4%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	261	261	5	5	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	266				402	130
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	266				402	130
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				99	100
cM capacity (veh/h)	1295				574	895























Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	5	130	130	130	130	5	5	1
Volume Left	5	0	0	0	0	0	5	0
Volume Right	0	0	0	0	0	5	0	1
cSH	1295	1700	1700	1700	1700	1700	574	895
Volume to Capacity	0.00	0.08	0.08	0.08	0.08	0.00	0.01	0.00
Queue Length 95th (ft)	0	0	0	0	0	0	1	0
Control Delay (s)	7.8	0.0	0.0	0.0	0.0	0.0	11.3	9.0
Lane LOS	A						B	A
Approach Delay (s)	0.2			0.0			11.0	
Approach LOS							B	

Intersection Summary			
Average Delay		0.2	
Intersection Capacity Utilization		17.0%	ICU Level of Service A
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 9: Stumer & 5th St

2010 No Build Saturday Peak  
Black Hills TIS












												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	0	0	1	0	5	5	90	0	5	90	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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)	5	0	0	1	0	5	5	98	0	5	98	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)			6									
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								650				
pX, platoon unblocked												
vC, conflicting volume	174	217	49	168	218	49	99			98		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	174	217	49	168	218	49	99			98		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	100	100	100	99	100			100		
cM capacity (veh/h)	764	675	1009	775	674	1009	1492			1493		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4	
Volume Total	5	0	1	5	5	65	33	5	49	49	1	
Volume Left	5	0	1	0	5	0	0	5	0	0	0	
Volume Right	0	0	0	5	0	0	0	0	0	0	1	
cSH	764	1700	775	1009	1492	1700	1700	1493	1700	1700	1700	
Volume to Capacity	0.01	0.00	0.00	0.01	0.00	0.04	0.02	0.00	0.03	0.03	0.00	
Queue Length 95th (ft)	1	0	0	0	0	0	0	0	0	0	0	
Control Delay (s)	9.7	0.0	9.7	8.6	7.4	0.0	0.0	7.4	0.0	0.0	0.0	
Lane LOS	A	A	A	A	A			A				
Approach Delay (s)	9.7		8.8		0.4			0.4				
Approach LOS	A		A									
Intersection Summary												
Average Delay			0.9									
Intersection Capacity Utilization			20.0%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 13: Parkview & 5th St

2010 No Build Saturday Peak

Black Hills TIS

							
Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Volume (veh/h)	15	10	80	20	5	80	
Sign Control	Stop		Free			Free	
Grade	0%		0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	16	11	87	22	5	87	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			None			None	
Median storage (veh)							
Upstream signal (ft)			1234				
pX, platoon unblocked							
vC, conflicting volume	152	54			109		
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	152	54			109		
tC, single (s)	6.8	6.9			4.1		
tC, 2 stage (s)							
tF (s)	3.5	3.3			2.2		
p0 queue free %	98	99			100		
cM capacity (veh/h)	821	1001			1480		
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	16	11	58	51	5	43	43
Volume Left	16	0	0	0	5	0	0
Volume Right	0	11	0	22	0	0	0
cSH	821	1001	1700	1700	1480	1700	1700
Volume to Capacity	0.02	0.01	0.03	0.03	0.00	0.03	0.03
Queue Length 95th (ft)	2	1	0	0	0	0	0
Control Delay (s)	9.5	8.6	0.0	0.0	7.4	0.0	0.0
Lane LOS	A	A			A		
Approach Delay (s)	9.1		0.0		0.4		
Approach LOS	A						
Intersection Summary							
Average Delay			1.3				
Intersection Capacity Utilization			14.4%		ICU Level of Service		A
Analysis Period (min)			15				



# HCM Unsignalized Intersection Capacity Analysis

## 12: Enchanted Pines & 5th St

2010 No Build Saturday Peak

Black Hills TIS









Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	5	5	85	80	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	5	5	92	87	33
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	160	60	120			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	160	60	120			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	99	100			
cM capacity (veh/h)	812	993	1466			
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	38	5	46	46	58	62
Volume Left	33	5	0	0	0	0
Volume Right	5	0	0	0	0	33
cSH	834	1466	1700	1700	1700	1700
Volume to Capacity	0.05	0.00	0.03	0.03	0.03	0.04
Queue Length 95th (ft)	4	0	0	0	0	0
Control Delay (s)	9.5	7.5	0.0	0.0	0.0	0.0
Lane LOS	A	A				
Approach Delay (s)	9.5	0.4			0.0	
Approach LOS	A					
Intersection Summary						
Average Delay			1.6			
Intersection Capacity Utilization			14.4%		ICU Level of Service	A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 8: Stumer & Black Hills

















2010 No Build Saturday Peak

Black Hills TIS

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Sign Control	Stop			Stop	Stop	
Volume (vph)	2	5	1	5	5	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	5	1	5	5	5
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total (vph)	2	5	1	5	5	5
Volume Left (vph)	0	0	1	0	5	0
Volume Right (vph)	0	5	0	0	0	5
Hadj (s)	0.03	-0.67	0.53	0.03	0.53	-0.67
Departure Headway (s)	4.6	3.9	5.1	4.6	5.1	3.9
Degree Utilization, x	0.00	0.01	0.00	0.01	0.01	0.01
Capacity (veh/h)	781	926	706	775	698	925
Control Delay (s)	6.4	5.7	6.9	6.4	6.9	5.7
Approach Delay (s)	5.9		6.5		6.3	
Approach LOS	A		A		A	
Intersection Summary						
Delay			6.2			
HCM Level of Service			A			
Intersection Capacity Utilization			13.3%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 15: Stumer & Enchantment

2010 No Build Saturday Peak  
 Black Hills TIS

















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (veh/h)	5	1	1	5	1	10	0	20	5	2	25	5	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
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)	5	1	1	5	1	11	0	22	5	2	27	5	
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	70	61	30	60	61	24	33					27	
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	70	61	30	60	61	24	33					27	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1					4.1	
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2					2.2	
p0 queue free %	99	100	100	99	100	99	100					100	
cM capacity (veh/h)	910	828	1045	932	828	1052	1579					1587	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>									
Volume Total	8	17	27	35									
Volume Left	5	5	0	2									
Volume Right	1	11	5	5									
cSH	914	995	1579	1587									
Volume to Capacity	0.01	0.02	0.00	0.00									
Queue Length 95th (ft)	1	1	0	0									
Control Delay (s)	9.0	8.7	0.0	0.5									
Lane LOS	A	A		A									
Approach Delay (s)	9.0	8.7	0.0	0.5									
Approach LOS	A	A											
<b>Intersection Summary</b>													
Average Delay			2.7										
Intersection Capacity Utilization			13.5%	ICU Level of Service	A								
Analysis Period (min)			15										

# HCM Unsignalized Intersection Capacity Analysis

## 16: Enchanted Pines & Enchantment

2010 No Build Saturday Peak

Black Hills TIS

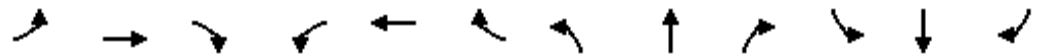
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	5	0	30	5	0	0	0	35	1	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	5	0	33	5	0	0	0	38	1	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	5			5			76	76	5	114	76	5
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	5			5			76	76	5	114	76	5
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			100	100	96	100	100	100
cM capacity (veh/h)	1616			1616			899	798	1078	820	798	1078
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	5	38	38	1								
Volume Left	0	33	0	1								
Volume Right	0	0	38	0								
cSH	1616	1616	1078	820								
Volume to Capacity	0.00	0.02	0.04	0.00								
Queue Length 95th (ft)	0	2	3	0								
Control Delay (s)	0.0	6.3	8.5	9.4								
Lane LOS		A	A	A								
Approach Delay (s)	0.0	6.3	8.5	9.4								
Approach LOS			A	A								
<b>Intersection Summary</b>												
Average Delay			6.9									
Intersection Capacity Utilization			18.7%		ICU Level of Service				A			
Analysis Period (min)			15									

## **2010 Build Operating Conditions**

### **Weekday PM Peak Hour Primary Study Intersections**

Lanes, Volumes, Timings  
5: Catron & 5th St

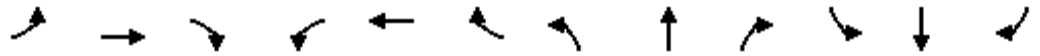
2010 Build PM Peak  
Black Hills TIS



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↖↗	↕	↖	↗	↕	↖	↖	↕		↖↗	↕	↖
Volume (vph)	195	290	1	1	475	330	1	1	1	385	1	260
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Grade (%)		-3%			2%			0%			0%	
Storage Length (ft)	450		450	400		450	200		0	200		0
Storage Lanes	2		1	1		1	1		0	2		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	0.97	1.00	1.00
Frt			0.850			0.850		0.925				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3301	3403	1523	1660	3319	1485	1676	3101	0	3252	1765	1500
Flt Permitted	0.950			0.429						0.950		
Satd. Flow (perm)	3301	3403	1523	749	3319	1485	1765	3101	0	3252	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			1			359		316				283
Link Speed (mph)		60			60			30				45
Link Distance (ft)		2300			6259			549				650
Travel Time (s)		26.1			71.1			12.5				9.8
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
Adj. Flow (vph)	212	315	1	1	516	359	1	1	1	418	1	283
Shared Lane Traffic (%)												
Lane Group Flow (vph)	212	315	1	1	516	359	1	2	0	418	1	283
Turn Type	Prot		Perm	pm+pt		Perm	pm+pt			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4	8		8	2					6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	12.0	12.0	4.0	12.0	12.0	4.0	7.0		4.0	12.0	12.0
Minimum Split (s)	10.0	31.3	31.3	10.0	30.7	30.7	10.0	30.0		10.0	30.0	30.0
Total Split (s)	18.0	42.0	42.0	10.0	34.0	34.0	10.0	16.0	0.0	32.0	38.0	38.0
Total Split (%)	18.0%	42.0%	42.0%	10.0%	34.0%	34.0%	10.0%	16.0%	0.0%	32.0%	38.0%	38.0%
Maximum Green (s)	12.0	35.0	35.0	4.0	27.6	27.6	4.5	10.5		26.5	32.5	32.5
Yellow Time (s)	4.5	5.8	5.8	4.5	5.2	5.2	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	7.0	7.0	6.0	6.4	6.4	5.5	5.5	4.0	5.5	5.5	5.5
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
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
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None		Max	Max	Max
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		17.0	17.0		17.0	17.0		17.0			17.0	17.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effect Green (s)	12.0	51.0	51.0	36.0	35.6	35.6	6.6	7.7		31.3	32.5	32.5
Actuated g/C Ratio	0.12	0.51	0.51	0.36	0.36	0.36	0.07	0.08		0.31	0.32	0.32
v/c Ratio	0.54	0.18	0.00	0.00	0.44	0.47	0.01	0.00		0.41	0.00	0.42
Control Delay	44.8	12.3	11.0	24.0	26.8	5.2	30.0	0.0		19.8	13.0	4.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	44.8	12.3	11.0	24.0	26.8	5.2	30.0	0.0		19.8	13.0	4.5

Lanes, Volumes, Timings  
5: Catron & 5th St

2010 Build PM Peak  
Black Hills TIS

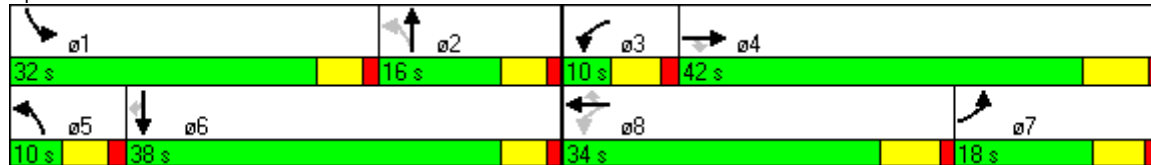


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	B	B	C	C	A	C	A		B	B	A
Approach Delay		25.3			17.9			10.0			13.7	
Approach LOS		C			B			A			B	
Queue Length 50th (ft)	68	43	0	0	125	0	1	0		91	0	0
Queue Length 95th (ft)	106	70	m1	5	202	69	4	0		80	m1	123
Internal Link Dist (ft)		2220			6179			469			570	
Turn Bay Length (ft)	450		450	400		450	200			200		
Base Capacity (vph)	396	1736	777	306	1182	760	112	608		1018	574	679
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.54	0.18	0.00	0.00	0.44	0.47	0.01	0.00		0.41	0.00	0.42

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 70 (70%), Referenced to phase 4:EBT and 8:WBTL, Start of Green  
 Natural Cycle: 85  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.54  
 Intersection Signal Delay: 18.4  
 Intersection LOS: B  
 Intersection Capacity Utilization 52.9%  
 ICU Level of Service A  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

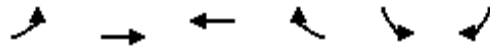
Splits and Phases: 5: Catron & 5th St



### Lanes, Volumes, Timings 3: Catron & Black Hills

2010 Build PM Peak

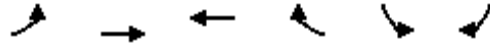
Black Hills TIS



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	425	405	655	80	80	425
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Grade (%)		-4%	4%		0%	
Storage Length (ft)	450			300	100	0
Storage Lanes	1			1	1	1
Taper Length (ft)	25			25	25	25
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1710	3420	3286	1470	1676	1500
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1710	3420	3286	1470	1676	1500
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				87		462
Link Speed (mph)		60	60		25	
Link Distance (ft)		1456	2300		402	
Travel Time (s)		16.5	26.1		11.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	462	440	712	87	87	462
Shared Lane Traffic (%)						
Lane Group Flow (vph)	462	440	712	87	87	462
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	7.0	12.0	12.0	12.0	7.0	7.0
Minimum Split (s)	13.0	19.5	30.4	30.4	13.0	13.0
Total Split (s)	42.0	74.0	32.0	32.0	26.0	26.0
Total Split (%)	42.0%	74.0%	32.0%	32.0%	26.0%	26.0%
Maximum Green (s)	36.0	66.8	25.9	25.9	20.5	20.5
Yellow Time (s)	4.5	6.0	4.9	4.9	4.0	4.0
All-Red Time (s)	1.5	1.2	1.2	1.2	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	7.2	6.1	6.1	5.5	5.5
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?	Yes		Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	C-Max	C-Max	None	None
Walk Time (s)			7.0	7.0		
Flash Dont Walk (s)			17.0	17.0		
Pedestrian Calls (#/hr)			0	0		
Act Effect Green (s)	31.2	75.5	39.4	39.4	11.8	11.8
Actuated g/C Ratio	0.31	0.76	0.39	0.39	0.12	0.12
v/c Ratio	0.87	0.17	0.55	0.14	0.44	0.79
Control Delay	49.2	4.1	14.6	1.8	46.2	14.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.2	4.1	14.6	1.8	46.2	14.5



Lanes, Volumes, Timings  
3: Catron & Black Hills



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
LOS	D	A	B	A	D	B
Approach Delay		27.2	13.2		19.5	
Approach LOS		C	B		B	
Queue Length 50th (ft)	271	31	77	1	53	9
Queue Length 95th (ft)	379	70	#320	7	94	107
Internal Link Dist (ft)		1376	2220		322	
Turn Bay Length (ft)	450			300	100	
Base Capacity (vph)	616	2582	1295	632	344	675
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.17	0.55	0.14	0.25	0.68

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 86 (86%), Referenced to phase 4:EBT and 8:WBT, Start of Green  
 Natural Cycle: 70  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.87  
 Intersection Signal Delay: 20.4  
 Intersection LOS: C  
 Intersection Capacity Utilization 64.5%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 3: Catron & Black Hills



Lanes, Volumes, Timings  
9: Stumer & 5th St

2010 Build PM Peak  
Black Hills TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	300	35	210	10	30	5	280	245	1	5	390	280
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	120		150	100		0	200		0	150		150
Storage Lanes	2		1	1		0	1		0	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	1.00
Fr <sub>t</sub>			0.850		0.980			0.999				0.850
Fl <sub>t</sub> Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3252	1765	1500	1676	1729	0	1676	3350	0	1676	3353	1500
Fl <sub>t</sub> Permitted	0.950			0.732			0.426			0.587		
Satd. Flow (perm)	3252	1765	1500	1292	1729	0	752	3350	0	1036	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			228		5							304
Link Speed (mph)		25			25			45				45
Link Distance (ft)		473			610			650				584
Travel Time (s)		12.9			16.6			9.8				8.8
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
Adj. Flow (vph)	326	38	228	11	33	5	304	266	1	5	424	304
Shared Lane Traffic (%)												
Lane Group Flow (vph)	326	38	228	11	38	0	304	267	0	5	424	304
Turn Type	Prot		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4	8			2			6		6
Detector Phase	7	4	4	3	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	10.0	30.0	30.0	10.0	30.0		10.0	24.0		10.0	28.0	28.0
Total Split (s)	19.0	39.0	39.0	10.0	30.0	0.0	22.0	41.0	0.0	10.0	29.0	29.0
Total Split (%)	19.0%	39.0%	39.0%	10.0%	30.0%	0.0%	22.0%	41.0%	0.0%	10.0%	29.0%	29.0%
Maximum Green (s)	13.5	33.5	33.5	4.5	24.5		16.5	35.5		4.5	23.5	23.5
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	5.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None	None	None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0	7.0		7.0			7.0			7.0	7.0
Flash Dont Walk (s)		17.5	17.5		17.5			11.0			15.0	15.0
Pedestrian Calls (#/hr)		0	0		0			0			0	0
Act Effect Green (s)	13.0	19.5	19.5	9.6	7.5		67.5	65.5		53.8	49.3	49.3
Actuated g/C Ratio	0.13	0.20	0.20	0.10	0.08		0.68	0.66		0.54	0.49	0.49
v/c Ratio	0.77	0.11	0.48	0.08	0.28		0.49	0.12		0.01	0.26	0.34
Control Delay	55.0	32.1	8.3	28.7	44.0		9.8	5.5		9.2	17.6	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	55.0	32.1	8.3	28.7	44.0		9.8	5.5		9.2	17.6	3.6
LOS	D	C	A	C	D		A	A		A	B	A

Lanes, Volumes, Timings  
9: Stumer & 5th St

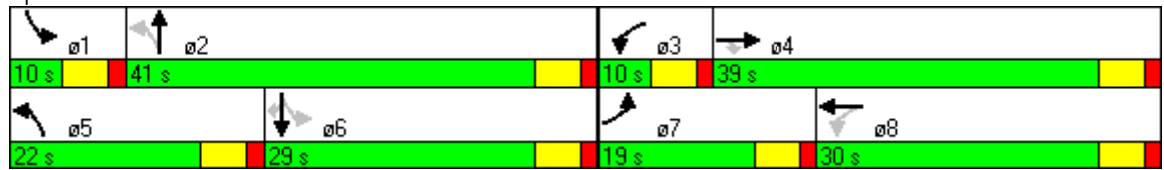


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		35.5			40.5			7.8			11.7	
Approach LOS		D			D			A			B	
Queue Length 50th (ft)	104	18	0	5	20		47	20		1	89	0
Queue Length 95th (ft)	#161	49	63	19	52		105	54		6	138	53
Internal Link Dist (ft)		393			530			570			504	
Turn Bay Length (ft)	120		150	100			200			150		150
Base Capacity (vph)	439	591	654	142	427		660	2195		586	1652	893
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	0
Reduced v/c Ratio	0.74	0.06	0.35	0.08	0.09		0.46	0.12		0.01	0.26	0.34

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 18 (18%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 80  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.77  
 Intersection Signal Delay: 18.6  
 Intersection LOS: B  
 Intersection Capacity Utilization 57.2%  
 ICU Level of Service B  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.




















Splits and Phases: 9: Stumer & 5th St



# HCM Unsignalized Intersection Capacity Analysis

## 13: Parkview & 5th St

2010 Build PM Peak  
Black Hills TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	0	30	50	0	5	45	450	55	15	595	25
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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)	22	0	33	54	0	5	49	489	60	16	647	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						8						
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								584				
pX, platoon unblocked	1.00	1.00		1.00	1.00	1.00				1.00		
vC, conflicting volume	1035	1340	337	1005	1323	274	674			549		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1031	1336	337	1001	1320	268	674			543		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	88	100	95	69	100	99	95			98		
cM capacity (veh/h)	176	141	659	177	145	728	913			1019		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	54	60	49	326	223	16	431	243				
Volume Left	22	54	49	0	0	16	0	0				
Volume Right	33	5	0	0	60	0	0	27				
cSH	314	195	913	1700	1700	1019	1700	1700				
Volume to Capacity	0.17	0.31	0.05	0.19	0.13	0.02	0.25	0.14				
Queue Length 95th (ft)	15	31	4	0	0	1	0	0				
Control Delay (s)	18.9	31.9	9.2	0.0	0.0	8.6	0.0	0.0				
Lane LOS	C	D	A			A						
Approach Delay (s)	18.9	31.9	0.7			0.2						
Approach LOS	C	D										
Intersection Summary												
Average Delay			2.5									
Intersection Capacity Utilization			41.3%	ICU Level of Service							A	
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis  
 12: Enchanted Pines & 5th St



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	55	10	10	465	555	80
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	60	11	11	505	603	87
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	921	345	690			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	921	345	690			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	78	98	99			
cM capacity (veh/h)	266	651	900			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	71	11	253	253	402	288
Volume Left	60	11	0	0	0	0
Volume Right	11	0	0	0	0	87
cSH	293	900	1700	1700	1700	1700
Volume to Capacity	0.24	0.01	0.15	0.15	0.24	0.17
Queue Length 95th (ft)	23	1	0	0	0	0
Control Delay (s)	21.2	9.0	0.0	0.0	0.0	0.0
Lane LOS	C	A				
Approach Delay (s)	21.2	0.2			0.0	
Approach LOS	C					

Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization			29.4%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 42: #1/Future Office & 5th St



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	85	45	430	550	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	92	49	467	598	16
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	938	307	614			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	938	307	614			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	83	87	95			
cM capacity (veh/h)	250	689	961			

















Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	136	49	234	234	399	216
Volume Left	43	49	0	0	0	0
Volume Right	92	0	0	0	0	16
cSH	441	961	1700	1700	1700	1700
Volume to Capacity	0.31	0.05	0.14	0.14	0.23	0.13
Queue Length 95th (ft)	32	4	0	0	0	0
Control Delay (s)	16.8	8.9	0.0	0.0	0.0	0.0
Lane LOS	C	A				
Approach Delay (s)	16.8	0.8			0.0	
Approach LOS	C					

Intersection Summary						
Average Delay			2.1			
Intersection Capacity Utilization			37.7%	ICU Level of Service	A	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 15: Stumer & Enchantment

















2010 Build PM Peak  
Black Hills TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	15	1	30	15	25	0	30	30	25	55	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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)	8	16	1	33	16	27	0	33	33	27	60	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	201	182	62	175	168	49	65			65		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	201	182	62	175	168	49	65			65		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	98	100	96	98	97	100			98		
cM capacity (veh/h)	714	699	1002	762	712	1020	1537			1537		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	25	76	65	92								
Volume Left	8	33	0	27								
Volume Right	1	27	33	5								
cSH	713	824	1537	1537								
Volume to Capacity	0.04	0.09	0.00	0.02								
Queue Length 95th (ft)	3	8	0	1								
Control Delay (s)	10.2	9.8	0.0	2.3								
Lane LOS	B	A		A								
Approach Delay (s)	10.2	9.8	0.0	2.3								
Approach LOS	B	A										
<b>Intersection Summary</b>												
Average Delay			4.7									
Intersection Capacity Utilization			24.6%		ICU Level of Service					A		
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 16: Enchanted Pines & Enchantment

2010 Build PM Peak  
Black Hills TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	10	1	75	10	0	1	5	55	1	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	1	11	1	82	11	0	1	5	60	1	5	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	11			12			190	188	11	250	188	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	11			12			190	188	11	250	188	11
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			95			100	99	94	100	99	100
cM capacity (veh/h)	1608			1607			735	671	1069	634	670	1070
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	13	92	66	7								
Volume Left	1	82	1	1								
Volume Right	1	0	60	0								
cSH	1608	1607	1013	664								
Volume to Capacity	0.00	0.05	0.07	0.01								
Queue Length 95th (ft)	0	4	5	1								
Control Delay (s)	0.6	6.5	8.8	10.5								
Lane LOS	A	A	A	B								
Approach Delay (s)	0.6	6.5	8.8	10.5								
Approach LOS			A	B								
<b>Intersection Summary</b>												
Average Delay			7.1									
Intersection Capacity Utilization			22.3%		ICU Level of Service				A			
Analysis Period (min)			15									
























# HCM Unsignalized Intersection Capacity Analysis

## 8: Stumer & Black Hills

2010 Build PM Peak

Black Hills TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	60	20	395	70	5	40	10	440	10	40	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	1	65	22	429	76	5	43	11	478	11	43	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)									6			
Median type		None			TWLTL							
Median storage (veh)					2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	82			87			1024	1008	65	1249	1027	79
vC1, stage 1 conf vol							67	67		938	938	
vC2, stage 2 conf vol							957	940		312	89	
vCu, unblocked vol	82			87			1024	1008	65	1249	1027	79
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			72			75	95	52	82	81	100
cM capacity (veh/h)	1516			1509			177	237	999	59	233	982
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>EB 3</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>					
Volume Total	1	65	22	429	82	533	54					
Volume Left	1	0	0	429	0	43	11					
Volume Right	0	0	22	0	5	478	0					
cSH	1516	1700	1700	1509	1700	1112	146					
Volume to Capacity	0.00	0.04	0.01	0.28	0.05	0.48	0.37					
Queue Length 95th (ft)	0	0	0	30	0	66	39					
Control Delay (s)	7.4	0.0	0.0	8.3	0.0	13.9	43.4					
Lane LOS	A			A		B	E					
Approach Delay (s)	0.1			7.0		13.9	43.4					
Approach LOS						B	E					
<b>Intersection Summary</b>												
Average Delay			11.2									
Intersection Capacity Utilization			45.9%		ICU Level of Service		A					
Analysis Period (min)			15									

**MOVEMENT SUMMARY**

Site: PM Single Lane

Stumer Road at Black Hills  
 PM Peak  
 Single Lane Roundabout Alternative  
 Roundabout

<b>Movement Performance - Vehicles</b>											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
<b>South</b>		<b>NB Black Hills</b>									
3L	L	44	2.0	0.431	6.2	LOS A	4.3	110.3	0.37	0.70	22.5
8T	T	11	2.0	0.427	0.7	LOS A	4.3	110.3	0.37	0.14	23.6
8R	R	489	2.0	0.432	1.4	LOS A	4.3	110.3	0.37	0.21	23.5
Approach		544	2.0	0.432	1.8	LOS A	4.3	110.3	0.37	0.25	23.4
<b>East</b>		<b>WB Stumer Rd</b>									
1L	L	439	2.0	0.395	6.0	LOS A	3.7	94.8	0.28	0.53	22.2
6T	T	78	2.0	0.395	0.4	LOS A	3.7	94.8	0.28	0.12	23.7
6R	R	6	2.0	0.397	1.2	LOS A	3.7	94.8	0.28	0.18	23.5
Approach		522	2.0	0.395	5.1	LOS A	3.7	94.8	0.28	0.46	22.4
<b>North</b>		<b>SB Black Hills</b>									
7L	L	11	2.0	0.081	9.6	LOS A	0.5	13.9	0.65	0.84	21.8
4T	T	44	2.0	0.080	4.0	LOS A	0.5	13.9	0.65	0.51	22.7
4R	R	1	2.0	0.079	4.8	LOS A	0.5	13.9	0.65	0.50	22.8
Approach		57	2.0	0.080	5.1	LOS A	0.5	13.9	0.65	0.57	22.5
<b>West</b>		<b>EB Stumer Rd</b>									
5L	L	1	2.0	0.101	9.1	LOS A	0.7	18.2	0.62	0.89	22.0
2T	T	67	2.0	0.105	3.5	LOS A	0.7	18.2	0.62	0.49	23.0
2R	R	11	2.0	0.105	4.3	LOS A	0.7	18.2	0.62	0.49	23.0
Approach		79	2.0	0.105	3.7	LOS A	0.7	18.2	0.62	0.49	22.9
All Vehicles		1202	2.0	0.432	3.5	LOS A	4.3	110.3	0.36	0.37	22.9

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.

Roundabout LOS Method: Same as Signalised Intersections.

Roundabout Capacity Model: SIDRA Standard.

**MOVEMENT SUMMARY**Site: **PM Single Lane w/ bypass**

Stumer Road at Black Hills  
 PM Peak  
 Single Lane Roundabout w/Bypass Alternative  
 Roundabout

<b>Movement Performance - Vehicles</b>											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
<b>South</b>		<b>NB Black Hills</b>									
3L	L	44	2.0	0.064	6.3	LOS A	0.4	10.9	0.29	0.55	22.3
8T	T	11	2.0	0.064	0.8	LOS A	0.4	10.9	0.29	0.13	23.7
8R	R	489	2.0	0.363	0.9	LOS A	3.4	86.4	0.32	0.13	23.8
Approach		544	2.0	0.363	1.4	LOS A	3.4	86.4	0.32	0.17	23.6
<b>East</b>		<b>WB Stumer Rd</b>									
1L	L	439	2.0	0.394	6.0	LOS A	3.7	93.2	0.28	0.53	22.3
6T	T	78	2.0	0.395	0.4	LOS A	3.7	93.2	0.28	0.12	23.7
6R	R	6	2.0	0.397	1.2	LOS A	3.7	93.2	0.28	0.18	23.6
Approach		522	2.0	0.394	5.1	LOS A	3.7	93.2	0.28	0.46	22.5
<b>North</b>		<b>SB Black Hills</b>									
7L	L	11	2.0	0.081	9.6	LOS A	0.5	13.9	0.65	0.84	21.8
4T	T	44	2.0	0.080	4.0	LOS A	0.5	13.9	0.65	0.51	22.7
4R	R	1	2.0	0.079	4.8	LOS A	0.5	13.9	0.65	0.50	22.8
Approach		57	2.0	0.080	5.1	LOS A	0.5	13.9	0.65	0.57	22.5
<b>West</b>		<b>EB Stumer Rd</b>									
5L	L	1	2.0	0.101	9.1	LOS A	0.7	18.2	0.62	0.89	22.0
2T	T	67	2.0	0.105	3.5	LOS A	0.7	18.2	0.62	0.49	23.0
2R	R	11	2.0	0.105	4.3	LOS A	0.7	18.2	0.62	0.49	23.0
Approach		79	2.0	0.105	3.7	LOS A	0.7	18.2	0.62	0.49	22.9
All Vehicles		1202	2.0	0.397	3.3	LOS A	3.7	93.2	0.34	0.34	23.0

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.






















Roundabout LOS Method: Same as Signalised Intersections.

Roundabout Capacity Model: SIDRA Standard.

# HCM Unsignalized Intersection Capacity Analysis




















## 4: Stumer & Wal-Mart/Shops

2010 Build PM Peak  
Black Hills TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	70	220	35	70	190	230	40	5	55	250	5	70
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	76	239	38	76	207	250	43	5	60	272	5	76
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												4
Median type		TWLTL			TWLTL							
Median storage (veh)		2			2							
Upstream signal (ft)					1178							
pX, platoon unblocked												
vC, conflicting volume	207			277			810	769	258	812	788	207
vC1, stage 1 conf vol							410	410		359	359	
vC2, stage 2 conf vol							399	359		454	429	
vCu, unblocked vol	207			277			810	769	258	812	788	207
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			94			89	99	92	31	99	91
cM capacity (veh/h)	1365			1286			405	444	780	395	429	834
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>WB 3</b>	<b>NB 1</b>	<b>SB 1</b>					
Volume Total	76	277	76	207	250	109	353					
Volume Left	76	0	76	0	0	43	272					
Volume Right	0	38	0	0	250	60	76					
cSH	1365	1700	1286	1700	1700	554	504					
Volume to Capacity	0.06	0.16	0.06	0.12	0.15	0.20	0.70					
Queue Length 95th (ft)	4	0	5	0	0	18	136					
Control Delay (s)	7.8	0.0	8.0	0.0	0.0	13.1	27.8					
Lane LOS	A		A			B	D					
Approach Delay (s)	1.7		1.1			13.1	27.8					
Approach LOS						B	D					
<b>Intersection Summary</b>												
Average Delay			9.2									
Intersection Capacity Utilization			50.1%		ICU Level of Service		A					
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis  
25: Stumer & Wal-Mart

2010 Build PM Peak  
Black Hills TIS





















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	215	235	45	15	215	70	15	5	20	70	5	215
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	234	255	49	16	234	76	16	5	22	76	5	234
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												3
Median type		TWLTL			TWLTL							
Median storage (veh)		2			2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	310			304			1133	1090	280	1052	1076	272
vC1, stage 1 conf vol							747	747		304	304	
vC2, stage 2 conf vol							386	342		747	772	
vCu, unblocked vol	310			304			1133	1090	280	1052	1076	272
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	81			99			91	98	97	73	98	70
cM capacity (veh/h)	1251			1256			185	293	759	285	300	767
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>						
Volume Total	234	304	16	310	43	315						
Volume Left	234	0	16	0	16	76						
Volume Right	0	49	0	76	22	234						
cSH	1251	1700	1256	1700	321	1035						
Volume to Capacity	0.19	0.18	0.01	0.18	0.14	0.30						
Queue Length 95th (ft)	17	0	1	0	12	32						
Control Delay (s)	8.5	0.0	7.9	0.0	18.0	14.5						
Lane LOS	A		A		C	B						
Approach Delay (s)	3.7		0.4		18.0	14.5						
Approach LOS					C	B						
<b>Intersection Summary</b>												
Average Delay			6.1									
Intersection Capacity Utilization			48.5%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 27: Stumer & Shops

2010 Build PM Peak

Black Hills TIS

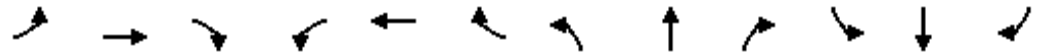
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	45	465	15	20	445	60	5	5	30	50	5	40
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	505	16	22	484	65	5	5	33	54	5	43
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage (veh)		2			2							
Upstream signal (ft)					788							
pX, platoon unblocked												
vC, conflicting volume	549			522			1185	1204	514	1166	1147	484
vC1, stage 1 conf vol							611	611		527	527	
vC2, stage 2 conf vol							573	592		639	620	
vCu, unblocked vol	549			522			1185	1204	514	1166	1147	484
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			98			98	98	94	84	99	93
cM capacity (veh/h)	1021			1045			325	347	561	334	365	583
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>WB 3</b>	<b>NB 1</b>	<b>SB 1</b>					
Volume Total	49	522	22	484	65	43	103					
Volume Left	49	0	22	0	0	5	54					
Volume Right	0	16	0	0	65	33	43					
cSH	1021	1700	1045	1700	1700	480	409					
Volume to Capacity	0.05	0.31	0.02	0.28	0.04	0.09	0.25					
Queue Length 95th (ft)	4	0	2	0	0	7	25					
Control Delay (s)	8.7	0.0	8.5	0.0	0.0	13.2	16.7					
Lane LOS	A		A			B	C					
Approach Delay (s)	0.7		0.3			13.2	16.7					
Approach LOS						B	C					
<b>Intersection Summary</b>												
Average Delay			2.3									
Intersection Capacity Utilization			52.6%		ICU Level of Service		A					
Analysis Period (min)			15									

## **2010 Build Operating Conditions**

### **Weekday PM Peak Hour Perimeter Study Intersections**

Lanes, Volumes, Timings  
20: Minnesota & 5th St

2010 Build PM Peak  
Black Hills TIS



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	20	45	110	20	125	40	415	105	170	535	50
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	100		0	150		0	300		300	125		0
Storage Lanes	1		0	1		0	1		1	1		0
Taper Length (ft)	25		25	25		25	25		25	25		25
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	0.95
Frt		0.896			0.871				0.850		0.987	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1581	0	1676	1537	0	1676	3353	1500	1676	3309	0
Flt Permitted	0.657			0.439			0.410			0.356		
Satd. Flow (perm)	1159	1581	0	775	1537	0	724	3353	1500	628	3309	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		49			136				114			12
Link Speed (mph)		35			35			45				45
Link Distance (ft)		1080			1107			2181				552
Travel Time (s)		21.0			21.6			33.0				8.4
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
Adj. Flow (vph)	38	22	49	120	22	136	43	451	114	185	582	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	38	71	0	120	158	0	43	451	114	185	636	0
Turn Type	pm+pt			pm+pt			pm+pt		Perm	pm+pt		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2		2	6		
Detector Phase	7	4		3	8		5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	4.0	12.0		4.0	12.0		4.0	12.0	12.0	4.0	12.0	
Minimum Split (s)	10.0	30.0		10.0	30.0		10.0	30.0	30.0	10.0	30.0	
Total Split (s)	10.0	30.0	0.0	12.0	32.0	0.0	10.0	33.0	33.0	15.0	38.0	0.0
Total Split (%)	11.1%	33.3%	0.0%	13.3%	35.6%	0.0%	11.1%	36.7%	36.7%	16.7%	42.2%	0.0%
Maximum Green (s)	4.0	24.0		6.0	26.0		4.0	27.0	27.0	9.0	32.0	
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5	4.5	4.5	4.5	4.5	
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5	1.5	1.5	1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0	6.0	4.0
Lead/Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None		None	None		None	None	None	None	None	
Walk Time (s)		7.0			7.0			7.0	7.0		7.0	
Flash Dont Walk (s)		17.0			17.0			17.0	17.0		17.0	
Pedestrian Calls (#/hr)		0			0			0	0		0	
Act Effct Green (s)	10.5	13.2		15.7	16.0		20.2	15.7	15.7	30.8	28.5	
Actuated g/C Ratio	0.18	0.23		0.27	0.28		0.35	0.27	0.27	0.54	0.50	
v/c Ratio	0.15	0.18		0.35	0.30		0.13	0.49	0.23	0.37	0.38	
Control Delay	17.3	13.1		19.3	8.6		11.5	22.1	6.1	12.3	16.1	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	17.3	13.1		19.3	8.6		11.5	22.1	6.1	12.3	16.1	
LOS	B	B		B	A		B	C	A	B	B	



Lanes, Volumes, Timings  
20: Minnesota & 5th St

2010 Build PM Peak  
Black Hills TIS

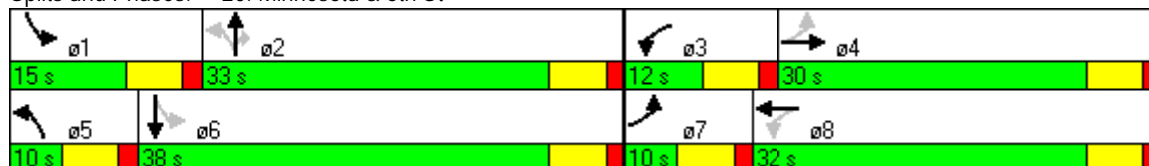


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		14.6			13.2			18.4			15.2	
Approach LOS		B			B			B			B	
Queue Length 50th (ft)	10	7		32	6		9	85	0	43	112	
Queue Length 95th (ft)	30	41		73	54		24	127	34	80	162	
Internal Link Dist (ft)		1000			1027			2101			472	
Turn Bay Length (ft)	100			150			300		300	125		
Base Capacity (vph)	252	759		339	839		329	1747	836	521	2018	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.15	0.09		0.35	0.19		0.13	0.26	0.14	0.36	0.32	

Intersection Summary

Area Type:	Other
Cycle Length:	90
Actuated Cycle Length:	57.1
Natural Cycle:	80
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.49
Intersection Signal Delay:	15.9
Intersection LOS:	B
Intersection Capacity Utilization	58.5%
ICU Level of Service	B
Analysis Period (min)	15

Splits and Phases: 20: Minnesota & 5th St



























### Lanes, Volumes, Timings

#### 33: Catron & Hwy 16

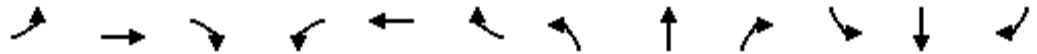
2010 Build PM Peak

Black Hills TIS

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	380	70	410	580	80	90	205	325	110	265	265
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	300		150	300		175	500		1000	500		500
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	1.00	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1765	1500	1676	3353	1500	1676	3353	1500	1676	3353	1500
Flt Permitted	0.413			0.182			0.950			0.950		
Satd. Flow (perm)	729	1765	1500	321	3353	1500	1676	3353	1500	1676	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			59			87			353			288
Link Speed (mph)		45			60			55			55	
Link Distance (ft)		1599			7967			1608			7136	
Travel Time (s)		24.2			90.5			19.9			88.5	
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
Adj. Flow (vph)	114	413	76	446	630	87	98	223	353	120	288	288
Shared Lane Traffic (%)												
Lane Group Flow (vph)	114	413	76	446	630	87	98	223	353	120	288	288
Turn Type	pm+pt		Perm	pm+pt		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8		8			2			6
Detector Phase	7	4	4	3	8	8	5	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	4.0	12.0	12.0	4.0	12.0	12.0	4.0	12.0	12.0	4.0	12.0	12.0
Minimum Split (s)	10.0	18.0	18.0	10.0	18.0	18.0	10.0	18.0	18.0	10.0	18.0	18.0
Total Split (s)	13.0	37.0	37.0	33.0	57.0	57.0	15.0	22.0	22.0	18.0	25.0	25.0
Total Split (%)	11.8%	33.6%	33.6%	30.0%	51.8%	51.8%	13.6%	20.0%	20.0%	16.4%	22.7%	22.7%
Maximum Green (s)	7.0	31.0	31.0	27.0	51.0	51.0	9.0	16.0	16.0	12.0	19.0	19.0
Yellow Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
Act Effct Green (s)	33.6	26.6	26.6	55.6	42.5	42.5	8.7	13.5	13.5	10.8	15.6	15.6
Actuated g/C Ratio	0.34	0.27	0.27	0.57	0.43	0.43	0.09	0.14	0.14	0.11	0.16	0.16
v/c Ratio	0.36	0.86	0.17	0.90	0.43	0.12	0.66	0.48	0.69	0.65	0.54	0.60
Control Delay	16.8	54.2	12.1	43.0	20.2	4.1	68.6	45.2	12.5	62.2	43.8	10.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.8	54.2	12.1	43.0	20.2	4.1	68.6	45.2	12.5	62.2	43.8	10.6
LOS	B	D	B	D	C	A	E	D	B	E	D	B
Approach Delay		41.8			27.8			31.5			33.2	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)	31	257	8	197	139	0	65	75	0	78	96	0

Lanes, Volumes, Timings  
33: Catron & Hwy 16

2010 Build PM Peak  
Black Hills TIS

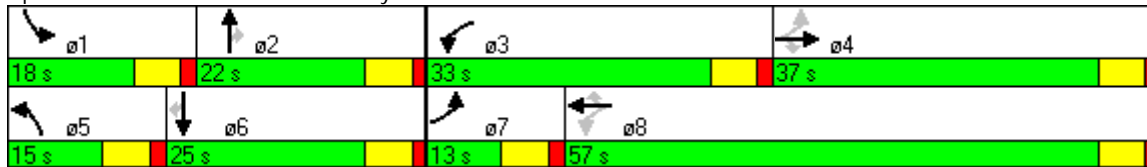


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	61	#435	45	#393	196	27	#152	116	89	#161	142	76
Internal Link Dist (ft)		1519			7887			1528			7056	
Turn Bay Length (ft)	300		150	300		175	500		1000	500		500
Base Capacity (vph)	319	568	523	561	1775	835	157	557	544	209	661	527
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.73	0.15	0.80	0.35	0.10	0.62	0.40	0.65	0.57	0.44	0.55

Intersection Summary

Area Type: Other  
 Cycle Length: 110  
 Actuated Cycle Length: 98.3  
 Natural Cycle: 90  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.90  
 Intersection Signal Delay: 32.5  
 Intersection LOS: C  
 Intersection Capacity Utilization 81.5%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.




























Splits and Phases: 33: Catron & Hwy 16



Lanes, Volumes, Timings  
36: Catron & Cambell

2010 Build PM Peak

Black Hills TIS

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 		 	 				 	 		 
Volume (vph)	275	350	110	65	390	170	75	0	50	135	0	390
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	500		0	325		0	250		0	200		0
Storage Lanes	2		0	2		0	1		1	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.97	0.95	0.95	0.97	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.964			0.954				0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3252	3232	0	3252	3199	0	1676	0	1500	1676	0	1500
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3252	3232	0	3252	3199	0	1676	0	1500	1676	0	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		57			83				54			370
Link Speed (mph)		60			60			30				30
Link Distance (ft)		6259			1790			1477				2203
Travel Time (s)		71.1			20.3			33.6				50.1
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
Adj. Flow (vph)	299	380	120	71	424	185	82	0	54	147	0	424
Shared Lane Traffic (%)												
Lane Group Flow (vph)	299	500	0	71	609	0	82	0	54	147	0	424
Turn Type	Prot			Prot			custom		custom	custom		custom
Protected Phases	7	4		3	8							
Permitted Phases							2		2	6		6
Detector Phase	7	4		3	8		2		2	6		6
Switch Phase												
Minimum Initial (s)	7.0	12.0		7.0	12.0		7.0		7.0	7.0		7.0
Minimum Split (s)	13.0	18.0		13.0	18.0		13.0		13.0	13.0		13.0
Total Split (s)	19.0	33.0	0.0	13.0	27.0	0.0	34.0	0.0	34.0	34.0	0.0	34.0
Total Split (%)	23.8%	41.3%	0.0%	16.3%	33.8%	0.0%	42.5%	0.0%	42.5%	42.5%	0.0%	42.5%
Maximum Green (s)	13.0	27.0		7.0	21.0		28.0		28.0	28.0		28.0
Yellow Time (s)	4.5	4.5		4.5	4.5		4.5		4.5	4.5		4.5
All-Red Time (s)	1.5	1.5		1.5	1.5		1.5		1.5	1.5		1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	4.0	6.0	6.0	4.0	6.0	4.0	6.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0		3.0	3.0		3.0
Recall Mode	None	Min		None	Min		None		None	None		None
Act Effct Green (s)	10.4	25.1		7.2	15.6		11.7		11.7	11.7		11.7
Actuated g/C Ratio	0.18	0.45		0.13	0.28		0.21		0.21	0.21		0.21
v/c Ratio	0.50	0.34		0.17	0.65		0.23		0.15	0.42		0.70
Control Delay	25.4	12.1		27.1	19.8		21.2		7.5	24.1		11.3
Queue Delay	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Total Delay	25.4	12.1		27.1	19.8		21.2		7.5	24.1		11.3
LOS	C	B		C	B		C		A	C		B
Approach Delay		17.1			20.6							
Approach LOS		B			C							
Queue Length 50th (ft)	44	55		10	75		23		0	42		15

Lanes, Volumes, Timings  
36: Catron & Cambell

2010 Build PM Peak  
Black Hills TIS

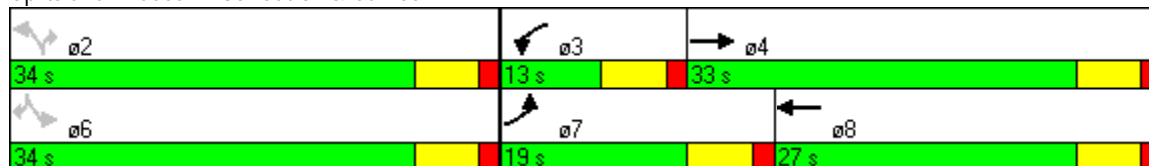


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Queue Length 95th (ft)	101	115		34	161		59		24	97		94
Internal Link Dist (ft)		6179			1710			1397			2123	
Turn Bay Length (ft)	500			325			250			200		
Base Capacity (vph)	776	1632		418	1284		861		797	861		951
Starvation Cap Reductn	0	0		0	0		0		0	0		0
Spillback Cap Reductn	0	0		0	0		0		0	0		0
Storage Cap Reductn	0	0		0	0		0		0	0		0
Reduced v/c Ratio	0.39	0.31		0.17	0.47		0.10		0.07	0.17		0.45

Intersection Summary

Area Type:	Other
Cycle Length:	80
Actuated Cycle Length:	56.3
Natural Cycle:	45
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.70
Intersection Signal Delay:	17.4
Intersection LOS:	B
Intersection Capacity Utilization:	60.3%
ICU Level of Service:	B
Analysis Period (min):	15

Splits and Phases: 36: Catron & Cambell
































## **2010 Build Operating Conditions**

### **Saturday Midday Peak Hour Primary Study Intersections**

Lanes, Volumes, Timings  
5: Catron & 5th St

2010 Build Saturday Peak  
Black Hills TIS

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	 	 			 			 		 	 	
Volume (vph)	180	240	1	1	300	305	1	1	1	325	1	160
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Grade (%)		-3%			2%			0%			0%	
Storage Length (ft)	450		450	400		450	200		0	200		0
Storage Lanes	2		1	1		1	1		0	2		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.97	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	0.97	1.00	1.00
Frt			0.850			0.850		0.925				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3301	3403	1523	1660	3319	1485	1676	3101	0	3252	1765	1500
Flt Permitted	0.950			0.467						0.950		
Satd. Flow (perm)	3301	3403	1523	816	3319	1485	1765	3101	0	3252	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			1			332		400				174
Link Speed (mph)		60			60			30				45
Link Distance (ft)		2300			6259			549				650
Travel Time (s)		26.1			71.1			12.5				9.8
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
Adj. Flow (vph)	196	261	1	1	326	332	1	1	1	353	1	174
Shared Lane Traffic (%)												
Lane Group Flow (vph)	196	261	1	1	326	332	1	2	0	353	1	174
Turn Type	Prot		Perm	pm+pt		Perm	pm+pt			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4	8		8	2					6
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	12.0	12.0	4.0	12.0	12.0	4.0	7.0		4.0	12.0	12.0
Minimum Split (s)	10.0	31.3	31.3	10.0	30.7	30.7	10.0	30.0		10.0	30.0	30.0
Total Split (s)	23.0	50.0	50.0	10.0	37.0	37.0	10.0	16.0	0.0	34.0	40.0	40.0
Total Split (%)	20.9%	45.5%	45.5%	9.1%	33.6%	33.6%	9.1%	14.5%	0.0%	30.9%	36.4%	36.4%
Maximum Green (s)	17.0	43.0	43.0	4.0	30.6	30.6	4.5	10.5		28.5	34.5	34.5
Yellow Time (s)	4.5	5.8	5.8	4.5	5.2	5.2	4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	7.0	7.0	6.0	6.4	6.4	5.5	5.5	4.0	5.5	5.5	5.5
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
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
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None		Max	Max	Max
Walk Time (s)		7.0	7.0		7.0	7.0		7.0			7.0	7.0
Flash Dont Walk (s)		17.0	17.0		17.0	17.0		17.0			17.0	17.0
Pedestrian Calls (#/hr)		0	0		0	0		0			0	0
Act Effect Green (s)	17.0	59.0	59.0	39.0	38.6	38.6	6.6	7.7		33.3	34.5	34.5
Actuated g/C Ratio	0.15	0.54	0.54	0.35	0.35	0.35	0.06	0.07		0.30	0.31	0.31
v/c Ratio	0.38	0.14	0.00	0.00	0.28	0.45	0.01	0.00		0.36	0.00	0.29
Control Delay	44.4	13.1	11.0	26.0	27.3	5.4	34.0	0.0		25.4	22.0	3.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	44.4	13.1	11.0	26.0	27.3	5.4	34.0	0.0		25.4	22.0	3.1

Lanes, Volumes, Timings  
5: Catron & 5th St

2010 Build Saturday Peak  
Black Hills TIS

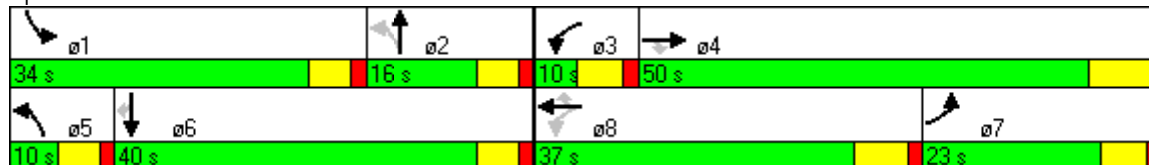


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	B	B	C	C	A	C	A		C	C	A
Approach Delay		26.5			16.2			11.3			18.1	
Approach LOS		C			B			B			B	
Queue Length 50th (ft)	66	51	0	0	83	0	1	0		67	0	0
Queue Length 95th (ft)	103	101	m3	5	138	69	4	0		111	m2	9
Internal Link Dist (ft)		2220			6179			469			570	
Turn Bay Length (ft)	450		450	400		450	200			200		
Base Capacity (vph)	510	1825	818	320	1165	737	103	658		985	554	590
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.38	0.14	0.00	0.00	0.28	0.45	0.01	0.00		0.36	0.00	0.29

Intersection Summary

Area Type: Other  
 Cycle Length: 110  
 Actuated Cycle Length: 110  
 Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBTL, Start of Green  
 Natural Cycle: 85  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.45  
 Intersection Signal Delay: 19.7  
 Intersection LOS: B  
 Intersection Capacity Utilization 46.8%  
 ICU Level of Service A  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

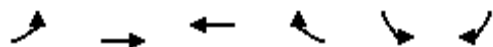
Splits and Phases: 5: Catron & 5th St





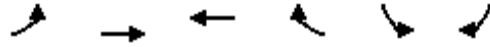
### Lanes, Volumes, Timings 3: Catron & Black Hills

2010 Build Saturday Peak  
Black Hills TIS



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	485	365	325	135	55	450
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Grade (%)		-4%	4%		0%	
Storage Length (ft)	450			300	100	0
Storage Lanes	1			1	1	1
Taper Length (ft)	25			25	25	25
Lane Util. Factor	1.00	0.95	0.95	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1710	3420	3286	1470	1676	1500
Flt Permitted	0.950				0.950	
Satd. Flow (perm)	1710	3420	3286	1470	1676	1500
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				147		489
Link Speed (mph)		60	60		25	
Link Distance (ft)		1456	2300		402	
Travel Time (s)		16.5	26.1		11.0	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	527	397	353	147	60	489
Shared Lane Traffic (%)						
Lane Group Flow (vph)	527	397	353	147	60	489
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6
Detector Phase	7	4	8	8	6	6
Switch Phase						
Minimum Initial (s)	7.0	12.0	12.0	12.0	7.0	7.0
Minimum Split (s)	13.0	19.5	30.4	30.4	13.0	13.0
Total Split (s)	50.0	82.0	32.0	32.0	28.0	28.0
Total Split (%)	45.5%	74.5%	29.1%	29.1%	25.5%	25.5%
Maximum Green (s)	44.0	74.8	25.9	25.9	22.5	22.5
Yellow Time (s)	4.5	6.0	4.9	4.9	4.0	4.0
All-Red Time (s)	1.5	1.2	1.2	1.2	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	7.2	6.1	6.1	5.5	5.5
Lead/Lag	Lead		Lag	Lag		
Lead-Lag Optimize?	Yes		Yes	Yes		
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	C-Max	C-Max	None	None
Walk Time (s)			7.0	7.0		
Flash Dont Walk (s)			17.0	17.0		
Pedestrian Calls (#/hr)			0	0		
Act Effect Green (s)	38.3	85.5	42.2	42.2	11.8	11.8
Actuated g/C Ratio	0.35	0.78	0.38	0.38	0.11	0.11
v/c Ratio	0.88	0.15	0.28	0.22	0.33	0.82
Control Delay	50.7	3.8	12.7	1.5	46.6	15.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.7	3.8	12.7	1.5	46.6	15.5

Lanes, Volumes, Timings  
3: Catron & Black Hills



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
LOS	D	A	B	A	D	B
Approach Delay		30.6	9.4		18.9	
Approach LOS		C	A		B	
Queue Length 50th (ft)	340	26	41	0	41	16
Queue Length 95th (ft)	458	66	69	3	74	109
Internal Link Dist (ft)		1376	2220		322	
Turn Bay Length (ft)	450			300	100	
Base Capacity (vph)	684	2658	1262	655	343	696
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.77	0.15	0.28	0.22	0.17	0.70

Intersection Summary

Area Type: Other  
 Cycle Length: 110  
 Actuated Cycle Length: 110  
 Offset: 10 (9%), Referenced to phase 4:EBT and 8:WBT, Start of Green  
 Natural Cycle: 80  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.88  
 Intersection Signal Delay: 22.0  
 Intersection Capacity Utilization 58.9%  
 Analysis Period (min) 15

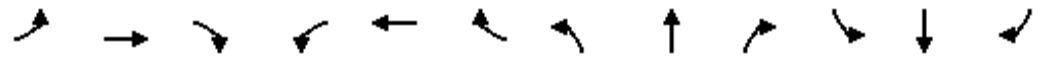
Intersection LOS: C  
 ICU Level of Service B

Splits and Phases: 3: Catron & Black Hills



Lanes, Volumes, Timings  
9: Stumer & 5th St

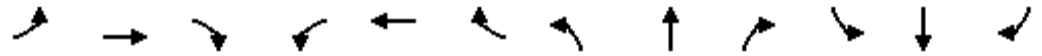
2010 Build Saturday Peak  
Black Hills TIS



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	340	40	230	5	35	10	305	180	0	5	190	320
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	120		150	100		0	200		0	150		150
Storage Lanes	2		1	1		0	1		0	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	1.00
Frt			0.850		0.966							0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3252	1765	1500	1676	1705	0	1676	3353	0	1676	3353	1500
Flt Permitted	0.950			0.729			0.556			0.629		
Satd. Flow (perm)	3252	1765	1500	1286	1705	0	981	3353	0	1110	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			250		11							348
Link Speed (mph)		25			25			45				45
Link Distance (ft)		473			610			650				584
Travel Time (s)		12.9			16.6			9.8				8.8
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
Adj. Flow (vph)	370	43	250	5	38	11	332	196	0	5	207	348
Shared Lane Traffic (%)												
Lane Group Flow (vph)	370	43	250	5	49	0	332	196	0	5	207	348
Turn Type	Prot		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4	8			2			6		6
Detector Phase	7	4	4	3	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	7.0	12.0	12.0	4.0	7.0		7.0	12.0		4.0	12.0	12.0
Minimum Split (s)	13.0	30.0	30.0	10.0	30.0		13.0	30.0		10.0	30.0	30.0
Total Split (s)	24.0	44.0	44.0	10.0	30.0	0.0	24.0	46.0	0.0	10.0	32.0	32.0
Total Split (%)	21.8%	40.0%	40.0%	9.1%	27.3%	0.0%	21.8%	41.8%	0.0%	9.1%	29.1%	29.1%
Maximum Green (s)	18.5	38.5	38.5	4.5	24.5		18.5	40.5		4.5	26.5	26.5
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	5.5
Lead/Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None	None	None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0	7.0		7.0			7.0			7.0	7.0
Flash Dont Walk (s)		17.5	17.5		17.5			11.0			15.0	15.0
Pedestrian Calls (#/hr)		0	0		0			0			0	0
Act Effct Green (s)	16.7	26.1	26.1	11.5	8.4		70.9	68.9		54.9	50.4	50.4
Actuated g/C Ratio	0.15	0.24	0.24	0.10	0.08		0.64	0.63		0.50	0.46	0.46
v/c Ratio	0.75	0.10	0.46	0.03	0.35		0.46	0.09		0.01	0.13	0.40
Control Delay	54.6	31.6	7.1	28.6	45.8		10.7	8.3		11.0	20.2	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	54.6	31.6	7.1	28.6	45.8		10.7	8.3		11.0	20.2	4.1
LOS	D	C	A	C	D		B	A		B	C	A

Lanes, Volumes, Timings  
9: Stumer & 5th St

2010 Build Saturday Peak  
Black Hills TIS

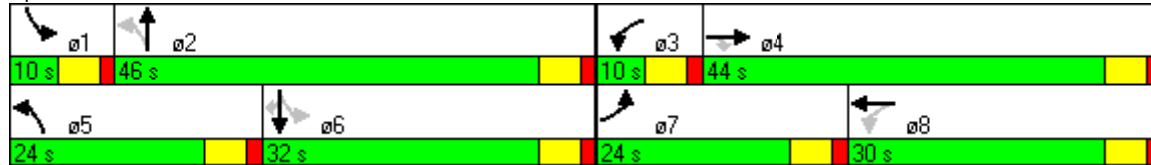


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		35.2			44.2			9.8			10.1	
Approach LOS		D			D			A			B	
Queue Length 50th (ft)	128	22	0	3	26		60	16		1	46	0
Queue Length 95th (ft)	178	55	65	11	63		274	53		7	79	60
Internal Link Dist (ft)		393			530			570			504	
Turn Bay Length (ft)	120		150	100			200			150		150
Base Capacity (vph)	547	618	688	151	388		749	2100		577	1538	876
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	0
Reduced v/c Ratio	0.68	0.07	0.36	0.03	0.13		0.44	0.09		0.01	0.13	0.40

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	67 (61%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	90
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.75
Intersection Signal Delay:	20.3
Intersection LOS:	C
Intersection Capacity Utilization	58.5%
ICU Level of Service	B
Analysis Period (min)	15






















Splits and Phases: 9: Stumer & 5th St



# HCM Unsignalized Intersection Capacity Analysis

## 13: Parkview & 5th St

2010 Build Saturday Peak  
Black Hills TIS












												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	0	15	55	5	15	55	420	55	10	445	25
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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)	11	0	16	60	5	16	60	457	60	11	484	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						8						
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								584				
pX, platoon unblocked												
vC, conflicting volume	870	1155	255	886	1139	258	511			516		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	870	1155	255	886	1139	258	511			516		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	95	100	98	73	97	98	94			99		
cM capacity (veh/h)	223	183	744	222	187	741	1051			1046		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>NB 2</b>	<b>NB 3</b>	<b>SB 1</b>	<b>SB 2</b>	<b>SB 3</b>				
Volume Total	27	82	60	304	212	11	322	188				
Volume Left	11	60	60	0	0	11	0	0				
Volume Right	16	16	0	0	60	0	0	27				
cSH	385	274	1051	1700	1700	1046	1700	1700				
Volume to Capacity	0.07	0.30	0.06	0.18	0.12	0.01	0.19	0.11				
Queue Length 95th (ft)	6	30	5	0	0	1	0	0				
Control Delay (s)	15.1	24.6	8.6	0.0	0.0	8.5	0.0	0.0				
Lane LOS	C	C	A			A						
Approach Delay (s)	15.1	24.6	0.9			0.2						
Approach LOS	C	C										
<b>Intersection Summary</b>												
Average Delay			2.5									
Intersection Capacity Utilization			35.7%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 12: Enchanted Pines & 5th St

2010 Build Saturday Peak

Black Hills TIS












						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	10	10	410	450	40
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	11	11	446	489	43
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	755	266	533			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	755	266	533			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	87	99	99			
cM capacity (veh/h)	341	732	1031			
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	54	11	223	223	326	207
Volume Left	43	11	0	0	0	0
Volume Right	11	0	0	0	0	43
cSH	381	1031	1700	1700	1700	1700
Volume to Capacity	0.14	0.01	0.13	0.13	0.19	0.12
Queue Length 95th (ft)	12	1	0	0	0	0
Control Delay (s)	16.0	8.5	0.0	0.0	0.0	0.0
Lane LOS	C	A				
Approach Delay (s)	16.0	0.2			0.0	
Approach LOS	C					
Intersection Summary						
Average Delay			0.9			
Intersection Capacity Utilization			24.5%		ICU Level of Service	A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 45: Office/Outlot #1 & 5th St

















2010 Build Saturday Peak

Black Hills TIS

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	20	45	45	400	435	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	49	49	435	473	27
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	802	250	500			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	802	250	500			
tC, single (s)	6.8	6.9	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	93	95			
cM capacity (veh/h)	307	750	1060			
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	71	49	217	217	315	185
Volume Left	22	49	0	0	0	0
Volume Right	49	0	0	0	0	27
cSH	519	1060	1700	1700	1700	1700
Volume to Capacity	0.14	0.05	0.13	0.13	0.19	0.11
Queue Length 95th (ft)	12	4	0	0	0	0
Control Delay (s)	13.0	8.6	0.0	0.0	0.0	0.0
Lane LOS	B	A				
Approach Delay (s)	13.0	0.9			0.0	
Approach LOS	B					
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			31.0%		ICU Level of Service	A
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis  
 15: Stumer & Enchantment

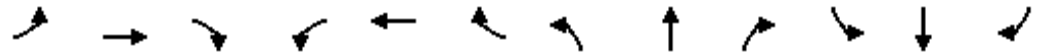
2010 Build Saturday Peak  
 Black Hills TIS

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (veh/h)	5	15	1	35	10	35	1	20	35	15	30	5	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
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)	5	16	1	38	11	38	1	22	38	16	33	5	
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	154	130	35	120	114	41	38					60	
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	154	130	35	120	114	41	38					60	
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1					4.1	
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2					2.2	
p0 queue free %	99	98	100	95	99	96	100					99	
cM capacity (veh/h)	767	752	1037	833	768	1030	1572					1544	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>									
Volume Total	23	87	61	54									
Volume Left	5	38	1	16									
Volume Right	1	38	38	5									
cSH	766	899	1572	1544									
Volume to Capacity	0.03	0.10	0.00	0.01									
Queue Length 95th (ft)	2	8	0	1									
Control Delay (s)	9.8	9.4	0.1	2.3									
Lane LOS	A	A	A	A									
Approach Delay (s)	9.8	9.4	0.1	2.3									
Approach LOS	A	A											
<b>Intersection Summary</b>													
Average Delay			5.2										
Intersection Capacity Utilization			24.8%	ICU Level of Service	A								
Analysis Period (min)			15										



HCM Unsignalized Intersection Capacity Analysis  
 16: Enchanted Pines & Enchantment

2010 Build Saturday Peak  
 Black Hills TIS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	1	10	1	40	10	1	5	1	45	1	1	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	1	11	1	43	11	1	5	1	49	1	1	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	12			12			114	112	11	161	113	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	12			12			114	112	11	161	113	11
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			99	100	95	100	100	100
cM capacity (veh/h)	1607			1607			844	756	1069	750	756	1069

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	13	55	55	3
Volume Left	1	43	5	1
Volume Right	1	1	49	1
cSH	1607	1607	1034	835
Volume to Capacity	0.00	0.03	0.05	0.00
Queue Length 95th (ft)	0	2	4	0
Control Delay (s)	0.6	5.8	8.7	9.3
Lane LOS	A	A	A	A
Approach Delay (s)	0.6	5.8	8.7	9.3
Approach LOS			A	A






















Intersection Summary			
Average Delay		6.6	
Intersection Capacity Utilization	19.8%		ICU Level of Service A
Analysis Period (min)		15	

# HCM Unsignalized Intersection Capacity Analysis

## 8: Stumer & Black Hills

2010 Build Saturday Peak

Black Hills TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	80	15	455	70	0	25	5	550	0	5	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	1	87	16	495	76	0	27	5	598	0	5	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage (veh)		2			2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	76			103			1157	1154	87	1755	1171	76
vC1, stage 1 conf vol							89	89		1065	1065	
vC2, stage 2 conf vol							1068	1065		690	105	
vCu, unblocked vol	76			103			1157	1154	87	1755	1171	76
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			67			84	97	38	100	97	100
cM capacity (veh/h)	1523			1489			169	193	972	19	188	985
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>EB 3</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>NB 2</b>	<b>SB 1</b>				
Volume Total	1	87	16	495	76	33	598	5				
Volume Left	1	0	0	495	0	27	0	0				
Volume Right	0	0	16	0	0	0	598	0				
cSH	1523	1700	1700	1489	1700	173	972	188				
Volume to Capacity	0.00	0.05	0.01	0.33	0.04	0.19	0.62	0.03				
Queue Length 95th (ft)	0	0	0	37	0	17	110	2				
Control Delay (s)	7.4	0.0	0.0	8.6	0.0	30.7	14.4	24.7				
Lane LOS	A			A		D	B	C				
Approach Delay (s)	0.1			7.5		15.3		24.7				
Approach LOS						C		C				
<b>Intersection Summary</b>												
Average Delay				10.7								
Intersection Capacity Utilization			53.7%			ICU Level of Service		A				
Analysis Period (min)			15									

**MOVEMENT SUMMARY**

Site: SAT Single Lane

Stumer Road at Black Hills  
 Saturday Peak  
 Single Lane Roundabout Alternative  
 Roundabout

<b>Movement Performance - Vehicles</b>											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
<b>South</b>		<b>NB Black Hills</b>									
3L	L	28	2.0	0.514	6.4	LOS A	5.9	148.8	0.45	0.70	22.5
8T	T	6	2.0	0.505	0.9	LOS A	5.9	148.8	0.45	0.17	23.3
8R	R	611	2.0	0.519	1.7	LOS A	5.9	148.8	0.45	0.24	23.3
Approach		644	2.0	0.519	1.9	LOS A	5.9	148.8	0.45	0.25	23.2
<b>East</b>		<b>WB Stumer Rd</b>									
1L	L	506	2.0	0.414	5.8	LOS A	4.1	105.4	0.22	0.52	22.3
6T	T	78	2.0	0.414	0.3	LOS A	4.1	105.4	0.22	0.08	24.0
6R	R	1	2.0	0.370	1.0	LOS A	4.1	105.4	0.22	0.14	23.8
Approach		584	2.0	0.414	5.0	LOS A	4.1	105.4	0.22	0.46	22.5
<b>North</b>		<b>SB Black Hills</b>									
7L	L	1	2.0	0.011	9.6	LOS A	0.1	1.9	0.64	0.76	21.7
4T	T	6	2.0	0.011	4.1	LOS A	0.1	1.9	0.64	0.43	22.8
4R	R	1	2.0	0.011	4.9	LOS A	0.1	1.9	0.64	0.42	22.8
Approach		8	2.0	0.011	5.0	LOS A	0.1	1.9	0.64	0.47	22.6
<b>West</b>		<b>EB Stumer Rd</b>									
5L	L	1	2.0	0.139	9.3	LOS A	0.9	23.9	0.63	0.91	21.9
2T	T	89	2.0	0.136	3.8	LOS A	0.9	23.9	0.63	0.52	22.9
2R	R	11	2.0	0.136	4.6	LOS A	0.9	23.9	0.63	0.51	23.0
Approach		101	2.0	0.136	3.9	LOS A	0.9	23.9	0.63	0.52	22.9
All Vehicles		1338	2.0	0.519	3.4	LOS A	5.9	148.8	0.36	0.36	22.9

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (HCM).

Approach LOS values are based on the worst delay for any vehicle movement.

Roundabout LOS Method: Same as Signalised Intersections.

Roundabout Capacity Model: SIDRA Standard.

**MOVEMENT SUMMARY**

Site: SAT Single Lane w/ Bypass

Stumer Road at Black Hills  
 Saturday Peak  
 Single Lane Roundabout w/ Bypass Alternative  
 Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Vehicles veh	Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South		NB Black Hills									
3L	L	28	2.0	0.039	6.4	LOS A	0.3	6.6	0.31	0.54	22.2
8T	T	6	2.0	0.039	0.9	LOS A	0.3	6.6	0.31	0.14	23.6
8R	R	611	2.0	0.460	1.1	LOS A	4.9	123.8	0.40	0.16	23.5
Approach		644	2.0	0.460	1.3	LOS A	4.9	123.8	0.40	0.18	23.5
East		WB Stumer Rd									
1L	L	506	2.0	0.413	5.8	LOS A	4.0	102.1	0.21	0.52	22.3
6T	T	78	2.0	0.414	0.3	LOS A	4.0	102.1	0.21	0.07	24.0
6R	R	1	2.0	0.370	1.0	LOS A	4.0	102.1	0.21	0.14	23.8
Approach		584	2.0	0.413	5.0	LOS A	4.0	102.1	0.21	0.46	22.5
North		SB Black Hills									
7L	L	1	2.0	0.011	9.6	LOS A	0.1	1.9	0.64	0.76	21.7
4T	T	6	2.0	0.011	4.1	LOS A	0.1	1.9	0.64	0.43	22.8
4R	R	1	2.0	0.011	4.9	LOS A	0.1	1.9	0.64	0.42	22.8
Approach		8	2.0	0.011	5.0	LOS A	0.1	1.9	0.64	0.47	22.6
West		EB Stumer Rd									
5L	L	1	2.0	0.139	9.3	LOS A	0.9	23.8	0.63	0.91	21.9
2T	T	89	2.0	0.136	3.8	LOS A	0.9	23.8	0.63	0.52	22.9
2R	R	11	2.0	0.136	4.6	LOS A	0.9	23.8	0.63	0.51	23.0
Approach		101	2.0	0.136	3.9	LOS A	0.9	23.8	0.63	0.52	22.9
All Vehicles		1338	2.0	0.460	3.2	LOS A	4.9	123.8	0.34	0.33	23.0

Level of Service (Aver. Int. Delay): LOS A. Based on average delay for all vehicle movements. LOS Method: Delay (HCM).

Level of Service (Worst Movement): LOS A. LOS Method for individual vehicle movements: Delay (HCM).






















Approach LOS values are based on the worst delay for any vehicle movement.

Roundabout LOS Method: Same as Signalised Intersections.

Roundabout Capacity Model: SIDRA Standard.




















HCM Unsignalized Intersection Capacity Analysis  
 4: Stumer & Wal-Mart/Shops

2010 Build Saturday Peak  
 Black Hills TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	85	230	85	80	205	240	65	5	90	240	5	80
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	92	250	92	87	223	261	71	5	98	261	5	87
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												4
Median type		TWLTL			TWLTL							
Median storage (veh)		2			2							
Upstream signal (ft)					1178							
pX, platoon unblocked												
vC, conflicting volume	223			342			924	878	296	932	924	223
vC1, stage 1 conf vol							481	481		397	397	
vC2, stage 2 conf vol							443	397		535	527	
vCu, unblocked vol	223			342			924	878	296	932	924	223
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	93			93			80	99	87	17	99	89
cM capacity (veh/h)	1346			1217			351	399	743	315	370	817
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>WB 3</b>	<b>NB 1</b>	<b>SB 1</b>					
Volume Total	92	342	87	223	261	174	353					
Volume Left	92	0	87	0	0	71	261					
Volume Right	0	92	0	0	261	98	87					
cSH	1346	1700	1217	1700	1700	502	410					
Volume to Capacity	0.07	0.20	0.07	0.13	0.15	0.35	0.86					
Queue Length 95th (ft)	6	0	6	0	0	38	212					
Control Delay (s)	7.9	0.0	8.2	0.0	0.0	15.9	48.7					
Lane LOS	A		A			C	E					
Approach Delay (s)	1.7		1.2			15.9	48.7					
Approach LOS						C	E					
<b>Intersection Summary</b>												
Average Delay			14.0									
Intersection Capacity Utilization			53.9%		ICU Level of Service		A					
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis  
 25: Stumer & Wal-Mart

2010 Build Saturday Peak  
 Black Hills TIS





















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	215	290	75	40	240	70	30	5	40	70	5	215
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	234	315	82	43	261	76	33	5	43	76	5	234
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												3
Median type		TWLTL			TWLTL							
Median storage (veh)		2			2							
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	337			397			1291	1247	356	1215	1250	299
vC1, stage 1 conf vol							823	823		386	386	
vC2, stage 2 conf vol							467	424		829	864	
vCu, unblocked vol	337			397			1291	1247	356	1215	1250	299
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	81			96			76	98	94	65	98	68
cM capacity (veh/h)	1222			1162			135	253	688	219	244	741
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>NB 1</b>	<b>SB 1</b>						
Volume Total	234	397	43	337	82	315						
Volume Left	234	0	43	0	33	76						
Volume Right	0	82	0	76	43	234						
cSH	1222	1700	1162	1700	250	853						
Volume to Capacity	0.19	0.23	0.04	0.20	0.33	0.37						
Queue Length 95th (ft)	18	0	3	0	34	43						
Control Delay (s)	8.6	0.0	8.2	0.0	26.2	16.9						
Lane LOS	A		A		D	C						
Approach Delay (s)	3.2		0.9		26.2	16.9						
Approach LOS					D	C						
<b>Intersection Summary</b>												
Average Delay			7.0									
Intersection Capacity Utilization			51.7%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 27: Stumer & Shops

2010 Build Saturday Peak

Black Hills TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	485	20	20	475	90	10	5	30	80	5	40
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
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)	60	527	22	22	516	98	11	5	33	87	5	43
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		TWLTL			TWLTL							
Median storage (veh)		2			2							
Upstream signal (ft)								788				
pX, platoon unblocked	0.99						0.99	0.99		0.99	0.99	0.99
vC, conflicting volume	614			549			1264	1315	538	1242	1228	516
vC1, stage 1 conf vol							658	658		560	560	
vC2, stage 2 conf vol							606	658		682	668	
vCu, unblocked vol	608			549			1262	1314	538	1240	1226	510
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)							6.1	5.5		6.1	5.5	
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			98			96	98	94	72	98	92
cM capacity (veh/h)	964			1021			298	314	543	310	341	560
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>EB 2</b>	<b>WB 1</b>	<b>WB 2</b>	<b>WB 3</b>	<b>NB 1</b>	<b>SB 1</b>					
Volume Total	60	549	22	516	98	49	136					
Volume Left	60	0	22	0	0	11	87					
Volume Right	0	22	0	0	98	33	43					
cSH	964	1700	1021	1700	1700	430	363					
Volume to Capacity	0.06	0.32	0.02	0.30	0.06	0.11	0.37					
Queue Length 95th (ft)	5	0	2	0	0	10	42					
Control Delay (s)	9.0	0.0	8.6	0.0	0.0	14.5	20.7					
Lane LOS	A		A			B	C					
Approach Delay (s)	0.9		0.3			14.5	20.7					
Approach LOS						B	C					
<b>Intersection Summary</b>												
Average Delay			3.0									
Intersection Capacity Utilization			55.8%			ICU Level of Service				B		
Analysis Period (min)			15									

## **2030 Build Operating Conditions**

### **Weekday PM Peak Hour Primary Study Intersections**



Lanes, Volumes, Timings  
5: Catron & 5th St

2030 Build PM Peak  
Black Hills TIS

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	395	300	290	775	325	390	240	390	415	305	260
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Grade (%)		-3%			2%			0%				0%
Storage Length (ft)	450		450	400		450	200		0	200		0
Storage Lanes	2		1	2		1	2		0	2		0
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	0.95	0.97	0.95	0.95
Frt			0.850			0.850		0.907				0.931
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3301	3403	1523	3220	3319	1485	3252	3041	0	3252	3122	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3301	3403	1523	3220	3319	1485	3252	3041	0	3252	3122	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			326			353		307			162	
Link Speed (mph)		60			60			30				45
Link Distance (ft)		2300			6259			549				650
Travel Time (s)		26.1			71.1			12.5				9.8
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
Adj. Flow (vph)	223	429	326	315	842	353	424	261	424	451	332	283
Shared Lane Traffic (%)												
Lane Group Flow (vph)	223	429	326	315	842	353	424	685	0	451	615	0
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Detector Phase	7	4	4	3	8	8	5	2		1	6	
Switch Phase												
Minimum Initial (s)	4.0	12.0	12.0	4.0	12.0	12.0	7.0	7.0		12.0	12.0	
Minimum Split (s)	10.0	31.3	31.3	10.0	30.7	30.7	30.0	30.0		30.0	30.0	
Total Split (s)	18.0	36.0	36.0	24.0	42.0	42.0	30.0	30.0	0.0	30.0	30.0	0.0
Total Split (%)	15.0%	30.0%	30.0%	20.0%	35.0%	35.0%	25.0%	25.0%	0.0%	25.0%	25.0%	0.0%
Maximum Green (s)	12.0	29.0	29.0	18.0	35.6	35.6	24.5	24.5		24.5	24.5	
Yellow Time (s)	4.5	5.8	5.8	4.5	5.2	5.2	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5		1.5	1.5	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	7.0	7.0	6.0	6.4	6.4	5.5	5.5	4.0	5.5	5.5	4.0
Lead/Lag	Lag	Lag	Lag	Lead	Lead	Lead	Lead	Lead		Lag	Lag	
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None		Max	Max	
Walk Time (s)		7.0	7.0		7.0	7.0	7.0	7.0		7.0	7.0	
Flash Dont Walk (s)		17.0	17.0		17.0	17.0	17.0	17.0		17.0	17.0	
Pedestrian Calls (#/hr)		0	0		0	0	0	0		0	0	
Act Effect Green (s)	12.0	34.1	34.1	16.1	38.8	38.8	20.5	21.0		24.8	25.3	
Actuated g/C Ratio	0.10	0.28	0.28	0.13	0.32	0.32	0.17	0.18		0.21	0.21	
v/c Ratio	0.68	0.44	0.49	0.73	0.78	0.49	0.76	0.87		0.67	0.78	
Control Delay	52.5	29.0	3.2	60.1	43.7	5.9	56.7	38.8		38.4	29.4	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay	52.5	29.0	3.2	60.1	43.7	5.9	56.7	38.8		38.4	29.4	

Lanes, Volumes, Timings  
5: Catron & 5th St

2030 Build PM Peak  
Black Hills TIS

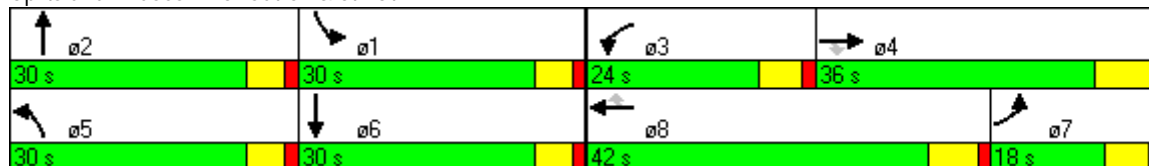


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	D	C	A	E	D	A	E	D		D	C	
Approach Delay		25.7			38.3			45.6			33.2	
Approach LOS		C			D			D			C	
Queue Length 50th (ft)	88	88	0	121	315	0	162	154		171	181	
Queue Length 95th (ft)	123	118	13	169	#411	72	211	225		184	201	
Internal Link Dist (ft)		2220			6179			469			570	
Turn Bay Length (ft)	450		450	400		450	200			200		
Base Capacity (vph)	330	967	666	483	1073	719	664	865		673	787	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	
Reduced v/c Ratio	0.68	0.44	0.49	0.65	0.78	0.49	0.64	0.79		0.67	0.78	

Intersection Summary

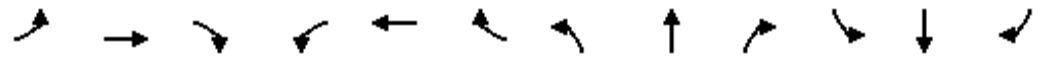
Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Green  
 Natural Cycle: 105  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.87  
 Intersection Signal Delay: 36.2  
 Intersection LOS: D  
 Intersection Capacity Utilization 81.0%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 5: Catron & 5th St



Lanes, Volumes, Timings  
3: Catron & Black Hills

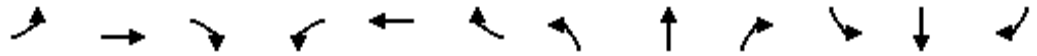
2030 Build PM Peak  
Black Hills TIS



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	415	695	60	60	1285	80	105	25	130	75	25	425
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Grade (%)		-4%			4%			0%				0%
Storage Length (ft)	450		200	200		300	200		0	100		100
Storage Lanes	1		1	1		1	1		0	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.874				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1710	3420	1530	1643	3286	1470	1676	1542	0	1676	1765	1500
Flt Permitted	0.950			0.950			0.441			0.678		
Satd. Flow (perm)	1710	3420	1530	1643	3286	1470	778	1542	0	1196	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			65			79		141				41
Link Speed (mph)		60			60			30				25
Link Distance (ft)		1456			2300			547				402
Travel Time (s)		16.5			26.1			12.4				11.0
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
Adj. Flow (vph)	451	755	65	65	1397	87	114	27	141	82	27	462
Shared Lane Traffic (%)												
Lane Group Flow (vph)	451	755	65	65	1397	87	114	168	0	82	27	462
Turn Type	Prot		Perm	Prot		Perm	pm+pt			pm+pt		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4			8	2			6		6
Detector Phase	7	4	4	3	8	8	5	2		1	6	7
Switch Phase												
Minimum Initial (s)	7.0	12.0	12.0	4.0	12.0	12.0	7.0	7.0		7.0	7.0	7.0
Minimum Split (s)	13.0	19.5	19.5	10.0	30.4	30.4	13.0	13.0		13.0	13.0	13.0
Total Split (s)	34.0	74.0	74.0	16.0	56.0	56.0	13.0	17.0	0.0	13.0	17.0	34.0
Total Split (%)	28.3%	61.7%	61.7%	13.3%	46.7%	46.7%	10.8%	14.2%	0.0%	10.8%	14.2%	28.3%
Maximum Green (s)	28.0	66.8	66.8	10.0	49.9	49.9	7.0	11.0		7.0	11.0	28.0
Yellow Time (s)	4.5	6.0	6.0	4.5	4.9	4.9	4.5	4.5		4.5	4.5	4.5
All-Red Time (s)	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	7.2	7.2	6.0	6.1	6.1	6.0	6.0	4.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
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
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None		None	None	None
Walk Time (s)					7.0	7.0						
Flash Dont Walk (s)					17.0	17.0						
Pedestrian Calls (#/hr)					0	0						
Act Effect Green (s)	28.0	75.2	75.2	8.9	54.8	54.8	15.5	8.7		12.9	8.7	37.5
Actuated g/C Ratio	0.23	0.63	0.63	0.07	0.46	0.46	0.13	0.07		0.11	0.07	0.31
v/c Ratio	1.13	0.35	0.07	0.53	0.93	0.12	0.66	0.69		0.52	0.21	0.93
Control Delay	127.8	13.1	3.1	66.1	36.2	6.0	64.1	28.3		57.1	56.1	63.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	127.8	13.1	3.1	66.1	36.2	6.0	64.1	28.3		57.1	56.1	63.5

Lanes, Volumes, Timings  
3: Catron & Black Hills

2030 Build PM Peak  
Black Hills TIS

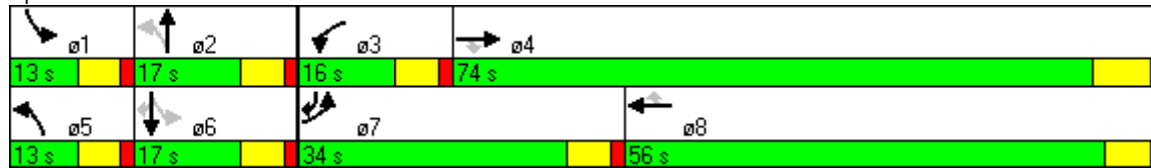


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	F	B	A	E	D	A	E	C		E	E	E
Approach Delay		53.3			35.8			42.8			62.2	
Approach LOS		D			D			D			E	
Queue Length 50th (ft)	~405	155	0	53	610	7	79	20		56	20	301
Queue Length 95th (ft)	#610	211	20	m72	#768	m12	#151	93		m104	m48	#425
Internal Link Dist (ft)		1376			2220			467			322	
Turn Bay Length (ft)	450		200	200		300	200			100		100
Base Capacity (vph)	399	2142	983	138	1501	714	172	269		157	162	497
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	1.13	0.35	0.07	0.47	0.93	0.12	0.66	0.62		0.52	0.17	0.93

Intersection Summary
























Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 117 (98%), Referenced to phase 4:EBT and 8:WBT, Start of Green  
 Natural Cycle: 120  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 1.13  
 Intersection Signal Delay: 46.5 Intersection LOS: D  
 Intersection Capacity Utilization 97.5% ICU Level of Service F  
 Analysis Period (min) 15  
 ~ Volume exceeds capacity, queue is theoretically infinite.  
 Queue shown is maximum after two cycles.  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Catron & Black Hills



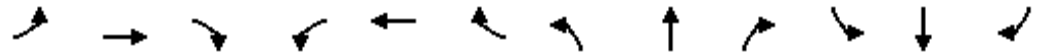
Lanes, Volumes, Timings  
9: Stumer & 5th St

2030 Build PM Peak  
Black Hills TIS

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	310	45	230	115	55	60	295	405	70	35	600	285
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	150		150	100		0	200		0	150		150
Storage Lanes	2		1	1		0	1		0	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	0.97	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	1.00	0.95	1.00
Fr <sub>t</sub>			0.850		0.922			0.978				0.850
Fl <sub>t</sub> Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	3252	1765	1500	1676	1627	0	1676	3279	0	1676	3353	1500
Fl <sub>t</sub> Permitted	0.950						0.295			0.461		
Satd. Flow (perm)	3252	1765	1500	1765	1627	0	521	3279	0	814	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			250		42			20				254
Link Speed (mph)		25			25			45				45
Link Distance (ft)		473			610			650				584
Travel Time (s)		12.9			16.6			9.8				8.8
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
Adj. Flow (vph)	337	49	250	125	60	65	321	440	76	38	652	310
Shared Lane Traffic (%)												
Lane Group Flow (vph)	337	49	250	125	125	0	321	516	0	38	652	310
Turn Type	Prot		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4	8			2			6		6
Detector Phase	7	4	4	3	8		5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
Minimum Split (s)	10.0	30.0	30.0	10.0	30.0		10.0	23.5		10.0	27.5	27.5
Total Split (s)	22.0	38.0	38.0	16.0	32.0	0.0	30.0	56.0	0.0	10.0	36.0	36.0
Total Split (%)	18.3%	31.7%	31.7%	13.3%	26.7%	0.0%	25.0%	46.7%	0.0%	8.3%	30.0%	30.0%
Maximum Green (s)	16.5	32.5	32.5	10.5	26.5		24.5	50.5		4.5	30.5	30.5
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0		4.0	4.0	4.0
All-Red Time (s)	1.5	1.5	1.5	1.5	1.5		1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	4.0	5.5	5.5	4.0	5.5	5.5	5.5
Lead/Lag	Lag	Lag	Lag	Lead	Lead		Lead	Lag		Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes		Yes	Yes		Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		3.0	3.0		3.0	3.0	3.0
Recall Mode	None	None	None	None	None		None	C-Max		None	C-Max	C-Max
Walk Time (s)		7.0	7.0		7.0			7.0			7.0	7.0
Flash Dont Walk (s)		17.5	17.5		17.5			11.0			15.0	15.0
Pedestrian Calls (#/hr)		0	0		0			0			0	0
Act Effct Green (s)	15.7	17.2	17.2	12.5	11.6		76.2	70.2		57.5	53.0	53.0
Actuated g/C Ratio	0.13	0.14	0.14	0.10	0.10		0.64	0.58		0.48	0.44	0.44
v/c Ratio	0.79	0.19	0.58	0.68	0.64		0.64	0.27		0.09	0.44	0.39
Control Delay	64.7	44.9	11.0	70.2	48.5		12.4	8.6		12.5	26.6	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	64.7	44.9	11.0	70.2	48.5		12.4	8.6		12.5	26.6	7.6
LOS	E	D	B	E	D		B	A		B	C	A

Lanes, Volumes, Timings  
9: Stumer & 5th St

2030 Build PM Peak  
Black Hills TIS

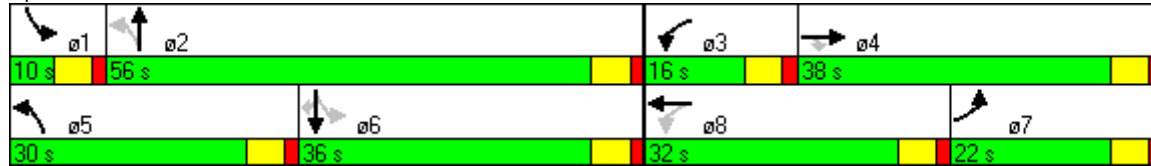


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Approach Delay		42.1			59.3			10.0			20.2	
Approach LOS		D			E			B			C	
Queue Length 50th (ft)	131	34	0	96	62		54	52		10	182	25
Queue Length 95th (ft)	#185	67	71	154	121		m107	151		28	283	106
Internal Link Dist (ft)		393			530			570			504	
Turn Bay Length (ft)	150		150	100			200			150		150
Base Capacity (vph)	447	478	589	188	392		567	1926		422	1480	804
Starvation Cap Reductn	0	0	0	0	0		0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	0
Reduced v/c Ratio	0.75	0.10	0.42	0.66	0.32		0.57	0.27		0.09	0.44	0.39

Intersection Summary

Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 59 (49%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.79  
 Intersection Signal Delay: 25.8  
 Intersection LOS: C  
 Intersection Capacity Utilization 64.5%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.  
 m Volume for 95th percentile queue is metered by upstream signal.




















Splits and Phases: 9: Stumer & 5th St



# HCM Unsignalized Intersection Capacity Analysis

## 13: Parkview & 5th St

2030 Build PM Peak  
Black Hills TIS



















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	20	0	30	70	0	15	45	645	85	20	820	25
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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)	22	0	33	76	0	16	49	701	92	22	891	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)						8						
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)								584				
pX, platoon unblocked	0.95	0.95		0.95	0.95	0.95				0.95		
vC, conflicting volume	1397	1840	459	1367	1807	397	918			793		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1316	1781	459	1285	1747	266	918			682		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	78	100	94	25	100	98	93			97		
cM capacity (veh/h)	100	70	549	102	74	698	739			863		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	54	92	49	467	326	22	594	324				
Volume Left	22	76	49	0	0	22	0	0				
Volume Right	33	16	0	0	92	0	0	27				
cSH	196	123	739	1700	1700	863	1700	1700				
Volume to Capacity	0.28	0.75	0.07	0.27	0.19	0.03	0.35	0.19				
Queue Length 95th (ft)	27	106	5	0	0	2	0	0				
Control Delay (s)	30.2	89.8	10.2	0.0	0.0	9.3	0.0	0.0				
Lane LOS	D	F	B			A						
Approach Delay (s)	30.2	89.8	0.6			0.2						
Approach LOS	D	F										
Intersection Summary												
Average Delay			5.5									
Intersection Capacity Utilization			47.9%	ICU Level of Service	A							
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 12: Enchanted Pines & 5th St

2030 Build PM Peak

Black Hills TIS

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	60	5	10	15	5	10	25	645	20	10	745	90
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
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)	65	5	11	16	5	11	27	701	22	11	810	98
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1299	1658	454	1207	1696	361	908			723		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1299	1658	454	1207	1696	361	908			723		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	39	94	98	87	94	98	96			99		
cM capacity (veh/h)	107	92	553	126	87	635	746			875		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	82	33	27	467	255	11	540	368				
Volume Left	65	16	27	0	0	11	0	0				
Volume Right	11	11	0	0	22	0	0	98				
cSH	119	156	746	1700	1700	875	1700	1700				
Volume to Capacity	0.69	0.21	0.04	0.27	0.15	0.01	0.32	0.22				
Queue Length 95th (ft)	92	19	3	0	0	1	0	0				
Control Delay (s)	84.6	34.1	10.0	0.0	0.0	9.2	0.0	0.0				
Lane LOS	F	D	B			A						
Approach Delay (s)	84.6	34.1	0.4			0.1						
Approach LOS	F	D										
Intersection Summary												
Average Delay			4.7									
Intersection Capacity Utilization			38.3%	ICU Level of Service	A							
Analysis Period (min)			15									



**2030 Build Operating Conditions**
























**Weekday PM Peak Hour**

**Catron Boulevard & Black Hills Boulevard**

**With Potential Eastbound Dual-Lefts**

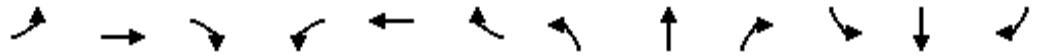
Lanes, Volumes, Timings  
3: Catron & Black Hills

2030 Build PM Peak  
Black Hills TIS

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	415	695	60	60	1285	80	105	25	130	75	25	425
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Grade (%)		-4%			4%			0%			0%	
Storage Length (ft)	450		200	200		300	200		0	100		100
Storage Lanes	2		1	1		1	1		0	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	*0.65	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850		0.874				0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	2223	3420	1530	1643	3286	1470	1676	1542	0	1676	1765	1500
Flt Permitted	0.950			0.950			0.438			0.656		
Satd. Flow (perm)	2223	3420	1530	1643	3286	1470	773	1542	0	1158	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			65			76		141				59
Link Speed (mph)		60			60			30				25
Link Distance (ft)		1456			2300			547				402
Travel Time (s)		16.5			26.1			12.4				11.0
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
Adj. Flow (vph)	451	755	65	65	1397	87	114	27	141	82	27	462
Shared Lane Traffic (%)												
Lane Group Flow (vph)	451	755	65	65	1397	87	114	168	0	82	27	462
Turn Type	Prot		Perm	Prot		Perm	pm+pt			pm+pt		pm+ov
Protected Phases	7	4		3	8		5	2		1	6	7
Permitted Phases			4			8	2			6		6
Detector Phase	7	4	4	3	8	8	5	2		1	6	7
Switch Phase												
Minimum Initial (s)	7.0	12.0	12.0	4.0	12.0	12.0	7.0	7.0		7.0	7.0	7.0
Minimum Split (s)	13.0	19.5	19.5	10.0	30.4	30.4	13.0	13.0		13.0	13.0	13.0
Total Split (s)	34.0	69.0	69.0	18.0	53.0	53.0	15.0	18.0	0.0	15.0	18.0	34.0
Total Split (%)	28.3%	57.5%	57.5%	15.0%	44.2%	44.2%	12.5%	15.0%	0.0%	12.5%	15.0%	28.3%
Maximum Green (s)	28.0	61.8	61.8	12.0	46.9	46.9	9.0	12.0		9.0	12.0	28.0
Yellow Time (s)	4.5	6.0	6.0	4.5	4.9	4.9	4.5	4.5		4.5	4.5	4.5
All-Red Time (s)	1.5	1.2	1.2	1.5	1.2	1.2	1.5	1.5		1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	7.2	7.2	6.0	6.1	6.1	6.0	6.0	4.0	6.0	6.0	6.0
Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lag		Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
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
Recall Mode	None	C-Max	C-Max	None	C-Max	C-Max	None	None		None	None	None
Walk Time (s)					7.0	7.0						
Flash Dont Walk (s)					17.0	17.0						
Pedestrian Calls (#/hr)					0	0						
Act Effect Green (s)	27.6	72.4	72.4	9.6	53.2	53.2	17.5	9.1		14.7	8.9	37.3
Actuated g/C Ratio	0.23	0.60	0.60	0.08	0.44	0.44	0.15	0.08		0.12	0.07	0.31
v/c Ratio	0.88	0.37	0.07	0.49	0.96	0.13	0.57	0.68		0.46	0.21	0.91
Control Delay	64.2	14.8	3.7	60.4	34.8	5.6	54.3	27.1		50.3	54.8	58.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	64.2	14.8	3.7	60.4	34.8	5.6	54.3	27.1		50.3	54.8	58.8

Lanes, Volumes, Timings  
3: Catron & Black Hills

2030 Build PM Peak  
Black Hills TIS



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
LOS	E	B	A	E	C	A	D	C		D	D	E
Approach Delay		31.8			34.2			38.1			57.4	
Approach LOS		C			C			D			E	
Queue Length 50th (ft)	260	163	0	48	592	7	78	20		55	20	289
Queue Length 95th (ft)	#395	234	22	m68	#775	m12	129	92		m100	m47	414
Internal Link Dist (ft)		1376			2220			467			322	
Turn Bay Length (ft)	450		200	200		300	200			100		100
Base Capacity (vph)	519	2064	949	164	1456	694	201	281		185	177	512
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.87	0.37	0.07	0.40	0.96	0.13	0.57	0.60		0.44	0.15	0.90

Intersection Summary

Area Type: Other  
 Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 112 (93%), Referenced to phase 4:EBT and 8:WBT, Start of Green  
 Natural Cycle: 100  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.96  
 Intersection Signal Delay: 37.3  
 Intersection LOS: D  
 Intersection Capacity Utilization 86.5%  
 ICU Level of Service E  
 Analysis Period (min) 15  
 \* User Entered Value  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.  
 m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Catron & Black Hills

