

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

**MARCH 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

Black Hills TIS  
2010 No Build PM Peak

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	225	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
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
Fr <sub>t</sub>						0.850						0.850
Fl <sub>t</sub> Protected	0.950									0.950		
Satd. Flow (prot)	1676	3109	1765	1765	3109	1500	1765	3353	0	1676	1765	1500
Fl <sub>t</sub> Permitted	0.950									0.377		
Satd. Flow (perm)	1676	3109	1765	1765	3109	1500	1765	3353	0	665	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						87						426
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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	114	245	0	0	435	87	0	1	0	120	0	163
Shared Lane Traffic (%)												
Lane Group Flow (vph)	114	245	0	0	435	87	0	1	0	120	0	163
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot		Perm	Prot		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8	2			6		6

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

Black Hills TIS  
2010 No Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	30.0	30.0	10.0	30.0	30.0	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	37.0	37.0	4.0	27.0	27.0	4.0	27.0		8.0	31.0	31.0
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
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
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	4.0	6.0	6.0	6.0
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 Effct Green (s)	9.5	26.7			14.5	14.5		8.8		14.0		14.0
Actuated g/C Ratio	0.18	0.50			0.27	0.27		0.17		0.26		0.26
v/c Ratio	0.38	0.16			0.51	0.18		0.00		0.32		0.23
Control Delay	26.0	7.1			20.7	6.3		26.0		21.1		0.8
Queue Delay	0.0	0.0			0.0	0.0		0.0		0.0		0.0
Total Delay	26.0	7.1			20.7	6.3		26.0		21.1		0.8
LOS	C	A			C	A		C		C		A
Approach Delay		13.1			18.3			26.0				
Approach LOS		B			B			C				
Queue Length 50th (ft)	31	17			61	0		0		30		0
Queue Length 95th (ft)	90	43			130	31		2		81		0
Internal Link Dist (ft)		2220			6179			469				570
Turn Bay Length (ft)	450					450				200		
Base Capacity (vph)	463	2277			1658	841		1788		380		1084
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	0.25	0.11			0.26	0.10		0.00		0.32		0.15

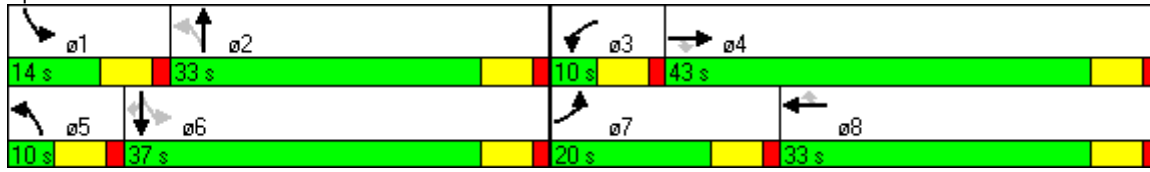
Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	53.3
Natural Cycle:	80
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.51
Intersection Signal Delay:	14.5
Intersection LOS:	B
Intersection Capacity Utilization:	45.9%
ICU Level of Service:	A
Analysis Period (min):	15

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

Black Hills TIS  
 2010 No Build PM Peak

Splits and Phases: 5: Catron & 5th St



# HCM Unsignalized Intersection Capacity Analysis

## 3: Catron & Black Hills

Black Hills TIS  
2010 No Build PM Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↕↕	↕↕	↗	↖	↗
Volume (veh/h)	15	325	545	5	5	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	353	592	5	5	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				802	296
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	598				802	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				98	99
cM capacity (veh/h)	975				316	700

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	16	177	177	296	296	5	5	5
Volume Left	16	0	0	0	0	0	5	0
Volume Right	0	0	0	0	0	5	0	5
cSH	975	1700	1700	1700	1700	1700	316	700
Volume to Capacity	0.02	0.10	0.10	0.17	0.17	0.00	0.02	0.01
Queue Length 95th (ft)	1	0	0	0	0	0	1	1
Control Delay (s)	8.8	0.0	0.0	0.0	0.0	0.0	16.6	10.2
Lane LOS	A						C	B
Approach Delay (s)	0.4			0.0			13.4	
Approach LOS							B	

### Intersection Summary

Average Delay		0.3						
Intersection Capacity Utilization		25.9%		ICU Level of Service			A	
Analysis Period (min)		15						

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

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	185	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	201	1	1	277	5
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	383	484	139	345	489	101	283			202		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	383	484	139	345	489	101	283			202		
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)	548	481	884	585	478	935	1277			1367		
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	134	68	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	548	1700	585	935	1277	1700	1700	1367	1700	1700	1700	
Volume to Capacity	0.01	0.00	0.01	0.00	0.00	0.08	0.04	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)	11.6	0.0	11.2	8.9	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)	11.6		10.8		0.0			0.0				
Approach LOS	B		B									
<b>Intersection Summary</b>												
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

Black Hills TIS  
 2010 No Build PM Peak

Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Volume (veh/h)	15	5	165	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	179	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	348	103			207		
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	348	103			207		
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)	618	932			1362		
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	16	5	120	87	11	133	133
Volume Left	16	0	0	0	11	0	0
Volume Right	0	5	0	27	0	0	0
cSH	618	932	1700	1700	1362	1700	1700
Volume to Capacity	0.03	0.01	0.07	0.05	0.01	0.08	0.08
Queue Length 95th (ft)	2	0	0	0	1	0	0
Control Delay (s)	11.0	8.9	0.0	0.0	7.7	0.0	0.0
Lane LOS	B	A			A		
Approach Delay (s)	10.5		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

Black Hills TIS  
2010 No Build PM Peak









Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	20	10	5	165	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)	22	11	5	179	266	76
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	405	171	342			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	405	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 %	96	99	100			
cM capacity (veh/h)	571	843	1213			
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	33	5	90	90	178	165
Volume Left	22	5	0	0	0	0
Volume Right	11	0	0	0	0	76
cSH	640	1213	1700	1700	1700	1700
Volume to Capacity	0.05	0.00	0.05	0.05	0.10	0.10
Queue Length 95th (ft)	4	0	0	0	0	0
Control Delay (s)	10.9	8.0	0.0	0.0	0.0	0.0
Lane LOS	B	A				
Approach Delay (s)	10.9	0.2	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			19.5%	ICU Level of Service	A	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

















## 8: Stumer & Black Hills

Black Hills TIS  
2010 No Build PM Peak

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Sign Control	Stop			Stop	Stop	
Volume (vph)	2	2	1	5	10	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	2	1	5	11	5
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total (vph)	2	2	1	5	11	5
Volume Left (vph)	0	0	1	0	11	0
Volume Right (vph)	0	2	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	0.00	0.00	0.01	0.02	0.01
Capacity (veh/h)	778	921	703	772	700	927
Control Delay (s)	6.4	5.7	6.9	6.4	6.9	5.7
Approach Delay (s)	6.0		6.5		6.5	
Approach LOS	A		A		A	
Intersection Summary						
Delay 6.4						
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

Black Hills TIS  
 2010 No Build PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	5	1	0	10	0	5	1	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)	0	0	5	1	0	11	0	5	1	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	90	80	52	85	82	6	54			7		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	90	80	52	85	82	6	54			7		
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 %	100	100	99	100	100	99	100			99		
cM capacity (veh/h)	881	805	1016	892	803	1077	1551			1614		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	5	12	7	65								
Volume Left	0	1	0	11								
Volume Right	5	11	1	5								
cSH	1016	1057	1551	1614								
Volume to Capacity	0.01	0.01	0.00	0.01								
Queue Length 95th (ft)	0	1	0	1								
Control Delay (s)	8.6	8.4	0.0	1.2								
Lane LOS	A	A		A								
Approach Delay (s)	8.6	8.4	0.0	1.2								
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

Black Hills TIS  
 2010 No Build PM Peak



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	10	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	11	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	163	152	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	11			11			152	152	11	163	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	99	100	100	100
cM capacity (veh/h)	1608			1608			790	710	1070	769	710	1070

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	11	76	11	1
Volume Left	0	65	0	1
Volume Right	0	0	11	0
cSH	1608	1608	1070	769
Volume to Capacity	0.00	0.04	0.01	0.00
Queue Length 95th (ft)	0	3	1	0
Control Delay (s)	0.0	6.3	8.4	9.7
Lane LOS		A	A	A
Approach Delay (s)	0.0	6.3	8.4	9.7
Approach LOS			A	A

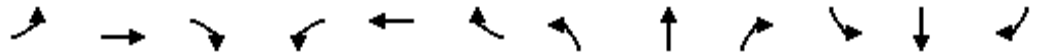
Intersection Summary			
Average Delay		5.9	
Intersection Capacity Utilization	20.7%		ICU Level of Service A
Analysis Period (min)		15	

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

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

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

Black Hills TIS  
2010 No Build PM Peak



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
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12		12		12
Link Offset(ft)		0			0			0		0		0
Crosswalk Width(ft)		16			16			16		16		16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0		0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6		20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
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	

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

Black Hills TIS  
2010 No Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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 Effct 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	
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

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

Black Hills TIS  
 2010 No Build PM Peak

























Splits and Phases: 20: Minnesota & 5th St





Lanes, Volumes, Timings  
33: Catron & Hwy 16

Black Hills TIS  
2010 No Build PM Peak

												
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	1391	1555	3353	1500
Flt Permitted	0.546			0.522			0.950			0.950		
Satd. Flow (perm)	964	1765	1500	921	3353	1500	1676	3353	1391	1555	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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	10%	10%	2%	2%
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
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (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
Detector 1 Queue (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
Detector 1 Delay (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
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
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

Lanes, Volumes, Timings  
33: Catron & Hwy 16

Black Hills TIS  
2010 No Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	17.5	17.5	8.4	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	0.28	0.34	0.43	0.54
Control Delay	16.5	32.4	9.6	17.1	25.5	10.8	36.3	24.7	7.7	36.6	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	24.7	7.7	36.6	29.0	8.3
LOS	B	C	A	B	C	B	D	C	A	D	C	A
Approach Delay		21.5			21.8			22.5			20.5	
Approach LOS		C			C			C			C	
Queue Length 50th (ft)	28	52	0	56	66	0	38	43	0	26	58	0
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	712	279	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	0.18	0.23	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: 21.5

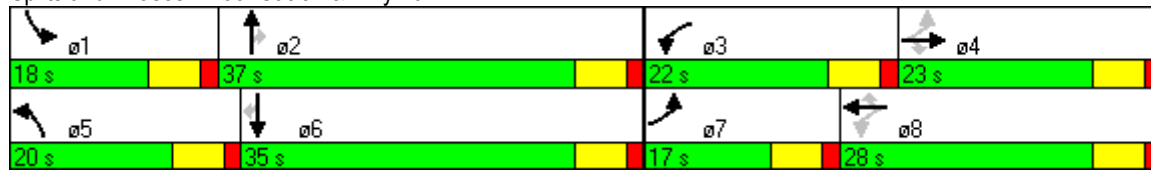
Intersection LOS: C

Intersection Capacity Utilization 56.7%

ICU Level of Service B





















Analysis Period (min) 15

Splits and Phases: 33: Catron & Hwy 16



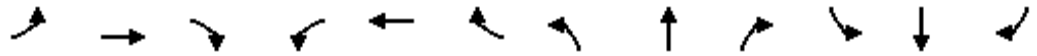
Lanes, Volumes, Timings  
36: Catron & Cambell

Black Hills TIS  
2010 No Build PM Peak

												
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	3042	0	3252	3006	0	1676	0	1500	1676	0	1500
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3252	3042	0	3252	3006	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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
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
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			36			36	
Link Offset(ft)		0			0			0			6	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1		1	1		1
Detector Template	Left	Thru		Left	Thru		Left		Right	Left		Right
Leading Detector (ft)	20	100		20	100		20		20	20		20
Trailing Detector (ft)	0	0		0	0		0		0	0		0
Detector 1 Position(ft)	0	0		0	0		0		0	0		0
Detector 1 Size(ft)	20	6		20	6		20		20	20		20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type	Prot			Prot			custom		custom	custom		custom
Protected Phases	7	4		3	8							
Permitted Phases							2		2	6		6

Lanes, Volumes, Timings  
36: Catron & Cambell

Black Hills TIS  
2010 No Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	16.3		7.5	13.1		10.2		10.2	10.2		10.2
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	0.27		0.13	0.46		0.12		0.15	0.40		0.49
Control Delay	20.3	11.6		20.5	11.2		16.8		6.9	20.6		6.5
Queue Delay	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Total Delay	20.3	11.6		20.5	11.2		16.8		6.9	20.6		6.5
LOS	C	B		C	B		B		A	C		A
Approach Delay		14.3			12.5							
Approach LOS		B			B							
Queue Length 50th (ft)	17	27		8	31		10		0	35		0
Queue Length 95th (ft)	42	61		26	76		32		22	85		47
Internal Link Dist (ft)		6179			1710			1397			2123	
Turn Bay Length (ft)	500			325			250			200		
Base Capacity (vph)	1029	2245		808	2096		1363		1230	1363		1270
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	0.22		0.03		0.04	0.11		0.21

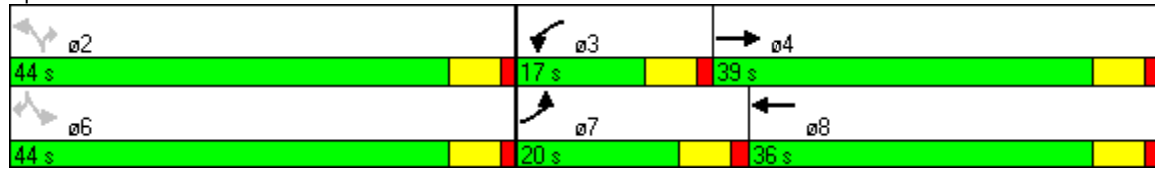
Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	46.2
Natural Cycle:	45
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.49
Intersection Signal Delay:	12.7
Intersection LOS:	B
Intersection Capacity Utilization:	45.6%
ICU Level of Service:	A
Analysis Period (min):	15

Lanes, Volumes, Timings  
36: Catron & Cambell

Black Hills TIS  
2010 No Build PM Peak

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

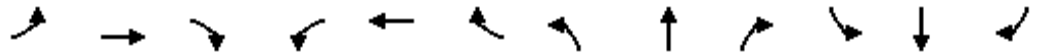
Black Hills TIS  
2010 No Build Saturday Peak

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	185	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
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
Fr <sub>t</sub>								0.850				0.850
Fl <sub>t</sub> Protected	0.950									0.950		
Satd. Flow (prot)	1676	3109	1765	1765	3109	1500	1765	3353	0	1676	1765	1500
Fl <sub>t</sub> Permitted	0.950									0.377		
Satd. Flow (perm)	1676	3109	1765	1765	3109	1500	1765	3353	0	665	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						43						642
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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	76	201	0	0	201	43	0	1	0	38	0	65
Shared Lane Traffic (%)												
Lane Group Flow (vph)	76	201	0	0	201	43	0	1	0	38	0	65
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot		Perm	Prot		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8	2			6		6



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

Black Hills TIS  
2010 No Build Saturday Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	30.0	30.0	10.0	30.0	30.0	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	39.0	39.0	4.0	28.0	28.0	4.0	27.0		6.0	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
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
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	4.0	6.0	6.0	6.0
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 Effct Green (s)	9.6	23.0			16.6	16.6		11.2		11.5		17.5
Actuated g/C Ratio	0.25	0.60			0.43	0.43		0.29		0.30		0.46
v/c Ratio	0.18	0.11			0.15	0.06		0.00		0.09		0.06
Control Delay	19.9	6.5			15.4	7.6		20.0		14.9		0.1
Queue Delay	0.0	0.0			0.0	0.0		0.0		0.0		0.0
Total Delay	19.9	6.5			15.4	7.6		20.0		14.9		0.1
LOS	B	A			B	A		B		B		A
Approach Delay		10.2			14.0			20.0				
Approach LOS		B			B			B				
Queue Length 50th (ft)	20	14			24	0		0		9		0
Queue Length 95th (ft)	56	35			58	21		2		27		0
Internal Link Dist (ft)		2220			6179			469				570
Turn Bay Length (ft)	450					450				200		
Base Capacity (vph)	897	2622			2233	1090		2370		424		1268
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	0.08	0.08			0.09	0.04		0.00		0.09		0.05

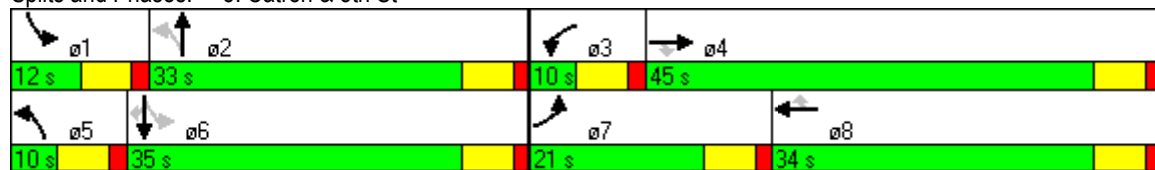
Intersection Summary

Area Type:	Other
Cycle Length:	100
Actuated Cycle Length:	38.4
Natural Cycle:	80
Control Type:	Actuated-Uncoordinated
Maximum v/c Ratio:	0.18
Intersection Signal Delay:	10.9
Intersection LOS:	B
Intersection Capacity Utilization:	39.1%
ICU Level of Service:	A
Analysis Period (min):	15

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

Black Hills TIS  
2010 No Build Saturday Peak

Splits and Phases: 5: Catron & 5th St



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

Black Hills TIS  
2010 No Build Saturday Peak



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	255	240	5	1	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	277	261	5	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	266				410	130
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	266				410	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				100	100
cM capacity (veh/h)	1295				567	895

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	5	139	139	130	130	5	1	1
Volume Left	5	0	0	0	0	0	1	0
Volume Right	0	0	0	0	0	5	0	1
cSH	1295	1700	1700	1700	1700	1700	567	895
Volume to Capacity	0.00	0.08	0.08	0.08	0.08	0.00	0.00	0.00
Queue Length 95th (ft)	0	0	0	0	0	0	0	0
Control Delay (s)	7.8	0.0	0.0	0.0	0.0	0.0	11.4	9.0
Lane LOS	A						B	A
Approach Delay (s)	0.1			0.0			10.2	
Approach LOS							B	























#### Intersection Summary

Average Delay		0.1						
Intersection Capacity Utilization		17.4%		ICU Level of Service			A	
Analysis Period (min)		15						

# HCM Unsignalized Intersection Capacity Analysis

## 9: Stumer & 5th St












Black Hills TIS  
2010 No Build Saturday Peak

												
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	105	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	114	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	182	234	49	185	235	57	99			114		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	182	234	49	185	235	57	99			114		
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)	754	661	1009	755	660	997	1492			1473		
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	76	38	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	754	1700	755	997	1492	1700	1700	1473	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)	9.8	0.0	9.8	8.6	7.4	0.0	0.0	7.5	0.0	0.0	0.0	
Lane LOS	A	A	A	A	A			A				
Approach Delay (s)	9.8		8.8		0.3			0.4				
Approach LOS	A		A									
Intersection Summary												
Average Delay			0.8									
Intersection Capacity Utilization			20.0%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 13: Parkview & 5th St

Black Hills TIS  
2010 No Build Saturday Peak

							
Movement	WBL	WBR	NBT	NBR	SBL	SBT	
Lane Configurations							
Volume (veh/h)	15	10	95	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	103	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	168	62			125		
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	168	62			125		
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)	802	989			1459		
Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	16	11	69	56	5	43	43
Volume Left	16	0	0	0	5	0	0
Volume Right	0	11	0	22	0	0	0
cSH	802	989	1700	1700	1459	1700	1700
Volume to Capacity	0.02	0.01	0.04	0.03	0.00	0.03	0.03
Queue Length 95th (ft)	2	1	0	0	0	0	0
Control Delay (s)	9.6	8.7	0.0	0.0	7.5	0.0	0.0
Lane LOS	A	A			A		
Approach Delay (s)	9.2		0.0		0.4		
Approach LOS	A						
Intersection Summary							
Average Delay			1.2				
Intersection Capacity Utilization			14.4%		ICU Level of Service		A
Analysis Period (min)			15				

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

Black Hills TIS  
 2010 No Build Saturday Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	5	5	100	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)	16	5	5	109	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	168	60	120			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	168	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 %	98	99	100			
cM capacity (veh/h)	802	993	1466			







Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	22	5	54	54	58	62
Volume Left	16	5	0	0	0	0
Volume Right	5	0	0	0	0	33
cSH	843	1466	1700	1700	1700	1700
Volume to Capacity	0.03	0.00	0.03	0.03	0.03	0.04
Queue Length 95th (ft)	2	0	0	0	0	0
Control Delay (s)	9.4	7.5	0.0	0.0	0.0	0.0
Lane LOS	A	A				
Approach Delay (s)	9.4	0.4			0.0	
Approach LOS	A					

Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization			14.4%	ICU Level of Service	A	
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 8: Stumer & Black Hills

















Black Hills TIS  
2010 No Build Saturday Peak

						
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Sign Control	Stop			Stop	Stop	
Volume (vph)	2	1	1	5	5	5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	1	1	5	5	5
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	NB 2
Volume Total (vph)	2	1	1	5	5	5
Volume Left (vph)	0	0	1	0	5	0
Volume Right (vph)	0	1	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	0.00	0.00	0.01	0.01	0.01
Capacity (veh/h)	781	925	706	775	700	928
Control Delay (s)	6.4	5.7	6.9	6.4	6.9	5.7
Approach Delay (s)	6.1		6.5		6.3	
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

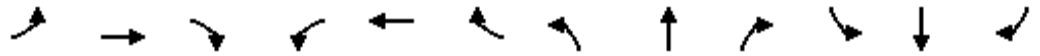
Black Hills TIS  
2010 No Build Saturday Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	5	0	0	2	1	10	0	5	2	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	0	0	2	1	11	0	5	2	2	27	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	52	42	30	41	43	7	33			8		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	52	42	30	41	43	7	33			8		
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	100	100	99	100			100		
cM capacity (veh/h)	935	849	1045	962	847	1076	1579			1613		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	5	14	8	35								
Volume Left	5	2	0	2								
Volume Right	0	11	2	5								
cSH	935	1036	1579	1613								
Volume to Capacity	0.01	0.01	0.00	0.00								
Queue Length 95th (ft)	0	1	0	0								
Control Delay (s)	8.9	8.5	0.0	0.5								
Lane LOS	A	A		A								
Approach Delay (s)	8.9	8.5	0.0	0.5								
Approach LOS	A	A										
<b>Intersection Summary</b>												
Average Delay			3.0									
Intersection Capacity Utilization			13.5%		ICU Level of Service				A			
Analysis Period (min)			15									



HCM Unsignalized Intersection Capacity Analysis  
 16: Enchanted Pines & Enchantment

Black Hills TIS  
 2010 No Build Saturday Peak



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	15	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	16	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	92	76	5
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	5			5			76	76	5	92	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	98	100	100	100
cM capacity (veh/h)	1616			1616			899	798	1078	864	798	1078

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	5	38	16	1
Volume Left	0	33	0	1
Volume Right	0	0	16	0
cSH	1616	1616	1078	864
Volume to Capacity	0.00	0.02	0.02	0.00
Queue Length 95th (ft)	0	2	1	0
Control Delay (s)	0.0	6.3	8.4	9.2
Lane LOS		A	A	A
Approach Delay (s)	0.0	6.3	8.4	9.2
Approach LOS			A	A

Intersection Summary			
Average Delay		6.3	
Intersection Capacity Utilization	18.7%		ICU Level of Service A
Analysis Period (min)		15	

## **2010 Build Operating Conditions**

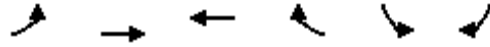
### **Weekday PM Peak Hour Primary Study Intersections**

Lanes, Volumes, Timings  
3: Catron & Black Hills



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	425	430	655	80	75	425
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
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
Fr <sub>t</sub>				0.850		0.850
Fl <sub>t</sub> Protected	0.950				0.950	
Satd. Flow (prot)	1676	3109	3109	1500	1676	1500
Fl <sub>t</sub> Permitted	0.950				0.950	
Satd. Flow (perm)	1676	3109	3109	1500	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
Heavy Vehicles (%)	2%	10%	10%	2%	2%	2%
Adj. Flow (vph)	462	467	712	87	82	462
Shared Lane Traffic (%)						
Lane Group Flow (vph)	462	467	712	87	82	462
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (ft)	20	100	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94	94			
Detector 2 Size(ft)		6	6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6

Lanes, Volumes, Timings  
3: Catron & Black Hills



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
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	18.0	30.0	30.0	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	68.0	26.0	26.0	20.0	20.0
Yellow Time (s)	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
Lost Time Adjust (s)	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
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 Effct Green (s)	31.6	76.5	38.9	38.9	11.5	11.5
Actuated g/C Ratio	0.32	0.76	0.39	0.39	0.12	0.12
v/c Ratio	0.87	0.20	0.59	0.14	0.42	0.79
Control Delay	50.0	4.0	19.9	2.0	48.1	16.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.0	4.0	19.9	2.0	48.1	16.0
LOS	D	A	B	A	D	B
Approach Delay		26.8	17.9		20.8	
Approach LOS		C	B		C	
Queue Length 50th (ft)	270	32	226	0	51	11
Queue Length 95th (ft)	#387	72	#345	m6	m88	101
Internal Link Dist (ft)		1376	2220		322	
Turn Bay Length (ft)	450			300	100	
Base Capacity (vph)	603	2378	1209	637	335	670
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	0.20	0.59	0.14	0.24	0.69

Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 92 (92%), Referenced to phase 4:EBT and 8:WBT, Start of Green  
 Natural Cycle: 75  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.87  
 Intersection Signal Delay: 22.3  
 Intersection LOS: C  
 Intersection Capacity Utilization 64.8%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.

Lanes, Volumes, Timings  
 3: Catron & Black Hills

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

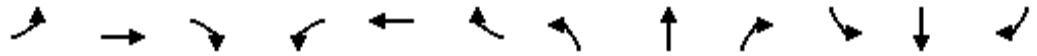


Lanes, Volumes, Timings  
5: Catron & 5th St

Black Hills TIS  
2010 Build PM Peak

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	220	285	0	0	475	330	0	1	0	385	0	260
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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)	1676	3109	1765	1765	3109	1500	1765	3353	0	1676	1765	1500
Flt Permitted	0.950									0.541		
Satd. Flow (perm)	1676	3109	1765	1765	3109	1500	1765	3353	0	955	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						359						663
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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	239	310	0	0	516	359	0	1	0	418	0	283
Shared Lane Traffic (%)												
Lane Group Flow (vph)	239	310	0	0	516	359	0	1	0	418	0	283
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot		Perm	Prot		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8	2			6		6

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



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	30.0	30.0	10.0	30.0	30.0	10.0	30.0		10.0	30.0	30.0
Total Split (s)	25.0	43.0	43.0	10.0	28.0	28.0	10.0	14.0	0.0	33.0	37.0	37.0
Total Split (%)	25.0%	43.0%	43.0%	10.0%	28.0%	28.0%	10.0%	14.0%	0.0%	33.0%	37.0%	37.0%
Maximum Green (s)	19.0	37.0	37.0	4.0	22.0	22.0	4.0	8.0		27.0	31.0	31.0
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
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
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	4.0	6.0	6.0	6.0
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 Effct Green (s)	19.0	55.2			30.2	30.2		7.0		32.8		32.8
Actuated g/C Ratio	0.19	0.55			0.30	0.30		0.07		0.33		0.33
v/c Ratio	0.75	0.18			0.55	0.51		0.00		0.79		0.30
Control Delay	51.8	9.9			32.6	6.2		43.0		34.9		3.4
Queue Delay	0.0	0.0			0.0	0.0		0.0		0.0		0.0
Total Delay	51.8	9.9			32.6	6.2		43.0		34.9		3.4
LOS	D	A			C	A		D		C		A
Approach Delay		28.1			21.8			43.0				
Approach LOS		C			C			D				
Queue Length 50th (ft)	149	35			140	0		0		272		47
Queue Length 95th (ft)	#261	72			220	75		3		337		106
Internal Link Dist (ft)		2220			6179			469				570
Turn Bay Length (ft)	450					450				200		
Base Capacity (vph)	318	1716			939	703		268		531		937
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	0.75	0.18			0.55	0.51		0.00		0.79		0.30

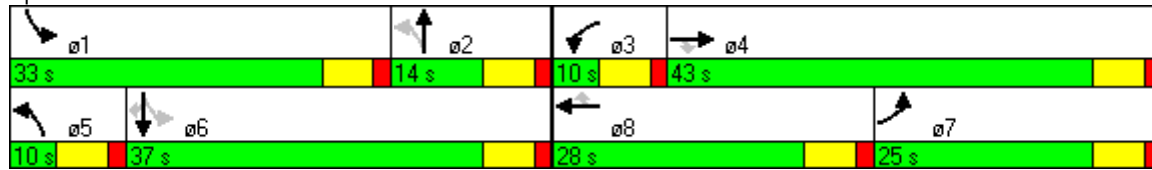
**Intersection Summary**

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 70 (70%), Referenced to phase 4:EBT and 8:WBT, Start of Green  
 Natural Cycle: 90  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.79  
 Intersection Signal Delay: 23.6      Intersection LOS: C  
 Intersection Capacity Utilization 70.9%      ICU Level of Service C  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.

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

Queue shown is maximum after two cycles.

Splits and Phases: 5: Catron & 5th St





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

Black Hills TIS  
2010 Build PM Peak

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	300	40	210	10	30	5	280	270	1	5	390	280
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	1		1	1		0	1		0	1		1
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	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)	1676	1765	1500	1676	1729	0	1676	3350	0	1676	3353	1500
Fl <sub>t</sub> Permitted	0.409			0.729			0.389			0.572		
Satd. Flow (perm)	722	1765	1500	1286	1729	0	686	3350	0	1009	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	43	228	11	33	5	304	293	1	5	424	304
Shared Lane Traffic (%)												
Lane Group Flow (vph)	326	43	228	11	38	0	304	294	0	5	424	304
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Detector Phase	7	4	4	3	8		5	2		1	6	6

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

Black Hills TIS  
2010 Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	30.0		10.0	30.0	30.0
Total Split (s)	28.0	38.0	38.0	10.0	20.0	0.0	21.0	42.0	0.0	10.0	31.0	31.0
Total Split (%)	28.0%	38.0%	38.0%	10.0%	20.0%	0.0%	21.0%	42.0%	0.0%	10.0%	31.0%	31.0%
Maximum Green (s)	22.0	32.0	32.0	4.0	14.0		15.0	36.0		4.0	25.0	25.0
Yellow Time (s)	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
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	4.0	6.0	6.0	4.0	6.0	6.0	6.0
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)		17.0	17.0		17.0			17.0			17.0	17.0
Pedestrian Calls (#/hr)		0	0		0			0			0	0
Act Effct Green (s)	29.7	27.7	27.7	9.1	7.5		58.3	56.3		43.3	39.3	39.3
Actuated g/C Ratio	0.30	0.28	0.28	0.09	0.08		0.58	0.56		0.43	0.39	0.39
v/c Ratio	0.79	0.09	0.39	0.08	0.28		0.57	0.16		0.01	0.32	0.39
Control Delay	43.5	25.1	5.8	24.6	44.0		15.3	7.0		13.8	24.6	4.9
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	43.5	25.1	5.8	24.6	44.0		15.3	7.0		13.8	24.6	4.9
LOS	D	C	A	C	D		B	A		B	C	A
Approach Delay		27.8			39.6			11.2			16.4	
Approach LOS		C			D			B			B	
Queue Length 50th (ft)	165	18	0	5	20		62	27		2	110	0
Queue Length 95th (ft)	242	47	55	16	52		m135	m60		7	161	61
Internal Link Dist (ft)		393			530			570			504	
Turn Bay Length (ft)	150		150	100			200			150		150
Base Capacity (vph)	432	592	655	133	246		549	1887		463	1317	774
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	0.07	0.35	0.08	0.15		0.55	0.16		0.01	0.32	0.39

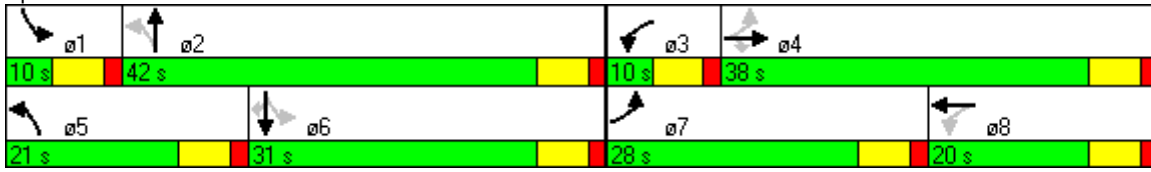
Intersection Summary

Area Type: Other  
 Cycle Length: 100  
 Actuated Cycle Length: 100  
 Offset: 96 (96%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green  
 Natural Cycle: 80  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.79  
 Intersection Signal Delay: 18.8  
 Intersection LOS: B  
 Intersection Capacity Utilization 67.0%  
 ICU Level of Service C  
 Analysis Period (min) 15  
 m Volume for 95th percentile queue is metered by upstream signal.

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




















Black Hills TIS  
 2010 Build PM Peak

Splits and Phases: 9: Stumer & 5th St



HCM Unsignalized Intersection Capacity Analysis  
 13: Parkview & 5th St

Black Hills TIS  
 2010 Build PM Peak

												
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	475	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	516	60	16	647	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked	0.98	0.98		0.98	0.98	0.98				0.98		
vC, conflicting volume	1049	1367	337	1033	1351	288	674			576		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1004	1329	337	987	1313	226	674			520		
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)	180	140	659	177	143	760	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	344	232	16	431	243				
Volume Left	22	54	49	0	0	16	0	0				
Volume Right	33	5	0	0	60	0	0	27				
cSH	320	195	913	1700	1700	1019	1700	1700				
Volume to Capacity	0.17	0.31	0.05	0.20	0.14	0.02	0.25	0.14				
Queue Length 95th (ft)	15	31	4	0	0	1	0	0				
Control Delay (s)	18.6	31.8	9.2	0.0	0.0	8.6	0.0	0.0				
Lane LOS	C	D	A			A						
Approach Delay (s)	18.6	31.8	0.7			0.2						
Approach LOS	C	D										
Intersection Summary												
Average Delay			2.4									
Intersection Capacity Utilization			41.3%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 12: Enchanted Pines & 5th St

Black Hills TIS  
2010 Build PM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	30	10	10	490	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)	33	11	11	533	603	87
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	935	345	690			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	935	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 %	88	98	99			
cM capacity (veh/h)	261	651	900			
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	43	11	266	266	402	288
Volume Left	33	11	0	0	0	0
Volume Right	11	0	0	0	0	87
cSH	307	900	1700	1700	1700	1700
Volume to Capacity	0.14	0.01	0.16	0.16	0.24	0.17
Queue Length 95th (ft)	12	1	0	0	0	0
Control Delay (s)	18.7	9.0	0.0	0.0	0.0	0.0
Lane LOS	C	A				
Approach Delay (s)	18.7	0.2			0.0	
Approach LOS	C					
Intersection Summary						
Average Delay			0.7			
Intersection Capacity Utilization			28.9%		ICU Level of Service	A
Analysis Period (min)			15			

# HCM Unsignalized Intersection Capacity Analysis

## 42: #1/Future Office & 5th St

















Black Hills TIS  
2010 Build PM Peak



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	40	85	45	455	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	495	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	951	307	614			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	951	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 %	82	87	95			
cM capacity (veh/h)	245	689	961			
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	136	49	247	247	399	216
Volume Left	43	49	0	0	0	0
Volume Right	92	0	0	0	0	16
cSH	436	961	1700	1700	1700	1700
Volume to Capacity	0.31	0.05	0.15	0.15	0.23	0.13
Queue Length 95th (ft)	33	4	0	0	0	0
Control Delay (s)	17.0	8.9	0.0	0.0	0.0	0.0
Lane LOS	C	A				
Approach Delay (s)	17.0	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  
 16: Enchanted Pines & Enchantment

















Black Hills TIS  
 2010 Build PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	10	0	75	10	0	0	5	20	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)	0	11	0	82	11	0	0	5	22	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			11			188	185	11	209	185	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	11			11			188	185	11	209	185	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	98	100	99	100
cM capacity (veh/h)	1608			1608			738	674	1070	700	674	1070
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	11	92	27	7								
Volume Left	0	82	0	1								
Volume Right	0	0	22	0								
cSH	1608	1608	957	678								
Volume to Capacity	0.00	0.05	0.03	0.01								
Queue Length 95th (ft)	0	4	2	1								
Control Delay (s)	0.0	6.5	8.9	10.4								
Lane LOS		A	A	B								
Approach Delay (s)	0.0	6.5	8.9	10.4								
Approach LOS			A	B								
<b>Intersection Summary</b>												
Average Delay			6.7									
Intersection Capacity Utilization			21.6%		ICU Level of Service				A			
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 15: Stumer & Enchantment






















Black Hills TIS  
2010 Build PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	15	5	25	15	25	0	5	25	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)	1	16	5	27	16	27	0	5	27	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	171	149	62	149	139	19	65			33		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	171	149	62	149	139	19	65			33		
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 %	100	98	99	97	98	97	100			98		
cM capacity (veh/h)	749	729	1002	790	739	1059	1537			1579		
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	23	71	33	92								
Volume Left	1	27	0	27								
Volume Right	5	27	27	5								
cSH	781	860	1537	1579								
Volume to Capacity	0.03	0.08	0.00	0.02								
Queue Length 95th (ft)	2	7	0	1								
Control Delay (s)	9.7	9.6	0.0	2.2								
Lane LOS	A	A		A								
Approach Delay (s)	9.7	9.6	0.0	2.2								
Approach LOS	A	A										
<b>Intersection Summary</b>												
Average Delay			5.1									
Intersection Capacity Utilization			28.7%		ICU Level of Service					A		
Analysis Period (min)			15									



HCM Unsignalized Intersection Capacity Analysis  
 8: Stumer & Black Hills

Black Hills TIS  
 2010 Build PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	60	10	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)	0	65	11	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			76			1022	1005	65	1247	1014	79
vC1, stage 1 conf vol							65	65		938	938	
vC2, stage 2 conf vol							957	940		310	76	
vCu, unblocked vol	82			76			1022	1005	65	1247	1014	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			76	95	52	82	82	100
cM capacity (veh/h)	1516			1523			179	239	999	59	235	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	0	65	11	429	82	533	54					
Volume Left	0	0	0	429	0	43	11					
Volume Right	0	0	11	0	5	478	0					
cSH	1700	1700	1700	1523	1700	1112	148					
Volume to Capacity	0.00	0.04	0.01	0.28	0.05	0.48	0.37					
Queue Length 95th (ft)	0	0	0	29	0	66	39					
Control Delay (s)	0.0	0.0	0.0	8.3	0.0	13.8	43.0					
Lane LOS				A		B	E					
Approach Delay (s)	0.0			7.0		13.8	43.0					
Approach LOS						B	E					
<b>Intersection Summary</b>												
Average Delay				11.3								
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

Black Hills TIS  
 2010 Build PM Peak

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												
Direction, Lane #												
EB 1 EB 2 WB 1 WB 2 WB 3 NB 1 SB 1												
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												
Intersection Summary												
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

Black Hills TIS  
 2010 Build PM Peak

												
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

Black Hills TIS  
 2010 Build PM Peak



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	0.95						0.95	0.95		0.95	0.95	0.95
vC, conflicting volume	549			522			1185	1204	514	1198	1179	516
vC1, stage 1 conf vol							611	611		560	560	
vC2, stage 2 conf vol							573	592		639	620	
vCu, unblocked vol	494			522			1167	1187	514	1181	1161	460
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	83	98	92
cM capacity (veh/h)	1011			1045			325	344	561	328	357	569

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1
Volume Total	49	522	22	549	43	103
Volume Left	49	0	22	0	5	54
Volume Right	0	16	0	65	33	43
cSH	1011	1700	1045	1700	480	401
Volume to Capacity	0.05	0.31	0.02	0.32	0.09	0.26
Queue Length 95th (ft)	4	0	2	0	7	25
Control Delay (s)	8.7	0.0	8.5	0.0	13.3	17.1
Lane LOS	A		A		B	C
Approach Delay (s)	0.7		0.3		13.3	17.1
Approach LOS					B	C

Intersection Summary		
Average Delay		2.3
Intersection Capacity Utilization	54.4%	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

Black Hills TIS  
2010 Build PM Peak



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
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2	1	1		2
Detector Template	Left	Thru		Left	Thru		Left	Thru	Right	Left		Thru
Leading Detector (ft)	20	100		20	100		20	100	20	20		100
Trailing Detector (ft)	0	0		0	0		0	0	0	0		0
Detector 1 Position(ft)	0	0		0	0		0	0	0	0		0
Detector 1 Size(ft)	20	6		20	6		20	6	20	20		6
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0		0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0		0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0		0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
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



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

Black Hills TIS  
2010 Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	
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	

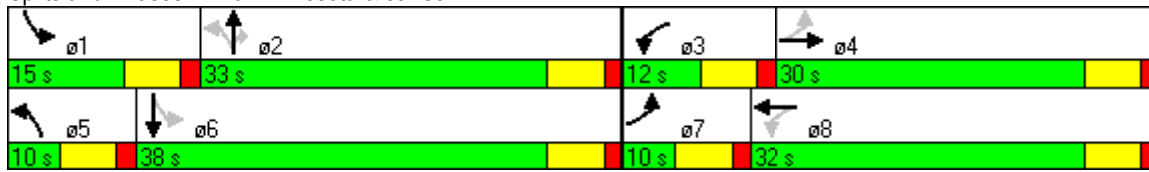
Intersection Summary

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

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

Black Hills TIS  
 2010 Build PM Peak

Splits and Phases: 20: Minnesota & 5th St



Lanes, Volumes, Timings  
33: Catron & Hwy 16

Black Hills TIS  
2010 Build PM Peak

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	1391	1555	3353	1500
Flt Permitted	0.413			0.182			0.950			0.950		
Satd. Flow (perm)	729	1765	1500	321	3353	1500	1676	3353	1391	1555	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
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	10%	10%	2%	2%
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
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (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
Detector 1 Queue (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
Detector 1 Delay (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
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
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

Lanes, Volumes, Timings  
33: Catron & Hwy 16

Black Hills TIS  
2010 Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	26.7	26.7	55.7	42.7	42.7	8.7	13.5	13.5	11.0	15.8	15.8
Actuated g/C Ratio	0.34	0.27	0.27	0.56	0.43	0.43	0.09	0.14	0.14	0.11	0.16	0.16
v/c Ratio	0.36	0.87	0.17	0.90	0.43	0.12	0.66	0.49	0.71	0.69	0.54	0.60
Control Delay	16.9	54.4	12.1	43.2	20.3	4.1	69.0	45.3	13.6	66.1	43.6	10.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.9	54.4	12.1	43.2	20.3	4.1	69.0	45.3	13.6	66.1	43.6	10.5
LOS	B	D	B	D	C	A	E	D	B	E	D	B
Approach Delay		42.0			27.9			32.1			33.8	
Approach LOS		D			C			C			C	
Queue Length 50th (ft)	31	257	8	197	139	0	65	75	0	78	96	0
Queue Length 95th (ft)	61	#435	45	#393	196	27	#152	116	93	#171	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)	318	565	520	559	1767	831	156	554	525	193	658	526
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	0.36	0.10	0.63	0.40	0.67	0.62	0.44	0.55

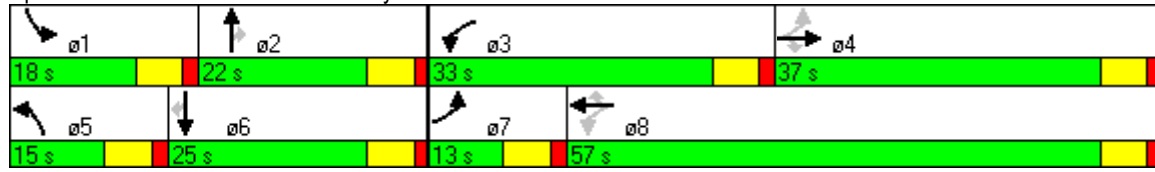
Intersection Summary

Area Type: Other  
 Cycle Length: 110  
 Actuated Cycle Length: 98.6  
 Natural Cycle: 90  
 Control Type: Actuated-Uncoordinated  
 Maximum v/c Ratio: 0.90  
 Intersection Signal Delay: 32.8  
 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.

Lanes, Volumes, Timings  
 33: Catron & Hwy 16




























Black Hills TIS  
 2010 Build PM Peak

Splits and Phases: 33: Catron & Hwy 16



Lanes, Volumes, Timings  
36: Catron & Cambell

Black Hills TIS  
2010 Build PM Peak

												
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	3050	0	3252	3033	0	1676	0	1500	1676	0	1500
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3252	3050	0	3252	3033	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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
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
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			36			36	
Link Offset(ft)		0			0			0			6	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1		1	1		1
Detector Template	Left	Thru		Left	Thru		Left		Right	Left		Right
Leading Detector (ft)	20	100		20	100		20		20	20		20
Trailing Detector (ft)	0	0		0	0		0		0	0		0
Detector 1 Position(ft)	0	0		0	0		0		0	0		0
Detector 1 Size(ft)	20	6		20	6		20		20	20		20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Detector 2 Position(ft)		94			94							
Detector 2 Size(ft)		6			6							
Detector 2 Type		Cl+Ex			Cl+Ex							
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0							
Turn Type	Prot			Prot			custom		custom	custom		custom
Protected Phases	7	4		3	8							
Permitted Phases							2		2	6		6

Lanes, Volumes, Timings  
36: Catron & Cambell

Black Hills TIS  
2010 Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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)	10.5	25.5		7.2	15.9		11.7		11.7	11.7		11.7
Actuated g/C Ratio	0.19	0.45		0.13	0.28		0.21		0.21	0.21		0.21
v/c Ratio	0.50	0.36		0.17	0.67		0.24		0.15	0.42		0.70
Control Delay	25.7	12.3		27.3	20.4		21.4		7.5	24.4		11.4
Queue Delay	0.0	0.0		0.0	0.0		0.0		0.0	0.0		0.0
Total Delay	25.7	12.3		27.3	20.4		21.4		7.5	24.4		11.4
LOS	C	B		C	C		C		A	C		B
Approach Delay		17.3			21.2							
Approach LOS		B			C							
Queue Length 50th (ft)	45	55		10	77		23		0	43		15
Queue Length 95th (ft)	101	117		34	164		59		24	97		94
Internal Link Dist (ft)		6179			1710			1397				2123
Turn Bay Length (ft)	500			325			250			200		
Base Capacity (vph)	770	1536		415	1211		855		791	855		946
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	0.33		0.17	0.50		0.10		0.07	0.17		0.45

#### Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 56.7

Natural Cycle: 45

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 17.7

Intersection LOS: B

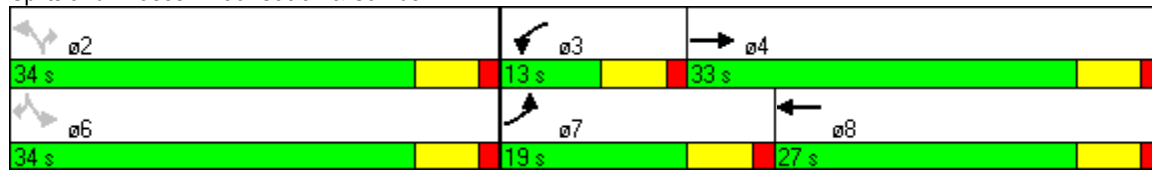
Intersection Capacity Utilization 60.3%

ICU Level of Service B

Analysis Period (min) 15

Lanes, Volumes, Timings  
 36: Catron & Cambell

Splits and Phases: 36: Catron & Cambell





## **2010 Build Operating Conditions**

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

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

Black Hills TIS  
2010 Build Saturday Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	485	380	325	135	50	450
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
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
Fr <sub>t</sub>				0.850		0.850
Fl <sub>t</sub> Protected	0.950				0.950	
Satd. Flow (prot)	1676	3109	3109	1500	1676	1500
Fl <sub>t</sub> Permitted	0.950				0.950	
Satd. Flow (perm)	1676	3109	3109	1500	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
Heavy Vehicles (%)	2%	10%	10%	2%	2%	2%
Adj. Flow (vph)	527	413	353	147	54	489
Shared Lane Traffic (%)						
Lane Group Flow (vph)	527	413	353	147	54	489
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (ft)	20	100	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94	94			
Detector 2 Size(ft)		6	6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Prot			Perm		Perm
Protected Phases	7	4	8		6	
Permitted Phases				8		6

## Lanes, Volumes, Timings

### 3: Catron & Black Hills

Black Hills TIS  
2010 Build Saturday Peak



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
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	18.0	30.0	30.0	13.0	13.0
Total Split (s)	51.0	81.0	30.0	30.0	29.0	29.0
Total Split (%)	46.4%	73.6%	27.3%	27.3%	26.4%	26.4%
Maximum Green (s)	45.0	75.0	24.0	24.0	23.0	23.0
Yellow Time (s)	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
Lost Time Adjust (s)	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
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 Effct Green (s)	39.1	86.2	41.1	41.1	11.8	11.8
Actuated g/C Ratio	0.36	0.78	0.37	0.37	0.11	0.11
v/c Ratio	0.88	0.17	0.30	0.23	0.30	0.82
Control Delay	50.2	3.8	13.5	1.5	46.6	16.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.2	3.8	13.5	1.5	46.6	16.1
LOS	D	A	B	A	D	B
Approach Delay		29.8	10.0		19.2	
Approach LOS		C	A		B	
Queue Length 50th (ft)	339	26	42	0	37	14
Queue Length 95th (ft)	457	70	61	4	m69	117
Internal Link Dist (ft)		1376	2220		322	
Turn Bay Length (ft)	450			300	100	
Base Capacity (vph)	686	2437	1161	652	350	700
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	0.17	0.30	0.23	0.15	0.70

#### Intersection Summary

Area Type: Other

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 8 (7%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.88

Intersection Signal Delay: 21.9

Intersection LOS: C

Intersection Capacity Utilization 59.2%

ICU Level of Service B

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Lanes, Volumes, Timings  
 3: Catron & Black Hills

Splits and Phases: 3: Catron & Black Hills



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

Black Hills TIS  
2010 Build Saturday Peak

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	235	0	0	300	330	0	1	0	325	0	160
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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
Fr <sub>t</sub>						0.850						0.850
Fl <sub>t</sub> Protected	0.950									0.950		
Satd. Flow (prot)	1676	3109	1765	1765	3109	1500	1765	3353	0	1676	1765	1500
Fl <sub>t</sub> Permitted	0.950									0.541		
Satd. Flow (perm)	1676	3109	1765	1765	3109	1500	1765	3353	0	955	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						359						681
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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	212	255	0	0	326	359	0	1	0	353	0	174
Shared Lane Traffic (%)												
Lane Group Flow (vph)	212	255	0	0	326	359	0	1	0	353	0	174
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot		Perm	Prot		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8	2			6		6

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

Black Hills TIS  
2010 Build Saturday Peak



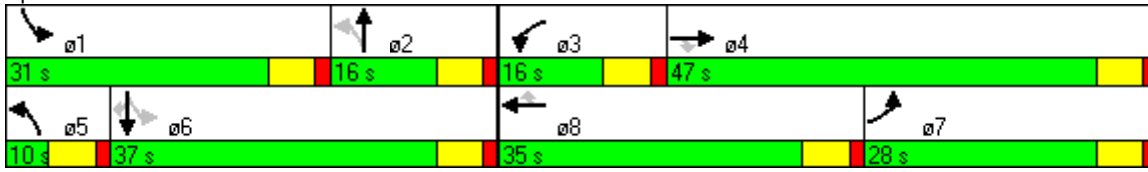
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	3	8	8	5	2		1	6	6
Switch Phase												
Minimum Initial (s)	4.0	12.0	12.0	4.0	12.0	12.0	4.0	7.0		4.0	12.0	12.0
Minimum Split (s)	10.0	30.0	30.0	10.0	30.0	30.0	10.0	30.0		10.0	30.0	30.0
Total Split (s)	28.0	47.0	47.0	16.0	35.0	35.0	10.0	16.0	0.0	31.0	37.0	37.0
Total Split (%)	25.5%	42.7%	42.7%	14.5%	31.8%	31.8%	9.1%	14.5%	0.0%	28.2%	33.6%	33.6%
Maximum Green (s)	22.0	41.0	41.0	10.0	29.0	29.0	4.0	10.0		25.0	31.0	31.0
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
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
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	4.0	6.0	6.0	6.0
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 Effct Green (s)	22.0	65.6			37.6	37.6		7.0		32.4		32.4
Actuated g/C Ratio	0.20	0.60			0.34	0.34		0.06		0.29		0.29
v/c Ratio	0.63	0.14			0.31	0.48		0.00		0.74		0.19
Control Delay	49.4	8.5			28.2	5.4		48.0		37.7		0.6
Queue Delay	0.0	0.0			0.0	0.0		0.0		0.0		0.0
Total Delay	49.4	8.5			28.2	5.4		48.0		37.7		0.6
LOS	D	A			C	A		D		D		A
Approach Delay		27.1			16.2			48.0				
Approach LOS		C			B			D				
Queue Length 50th (ft)	141	43			86	0		0		229		0
Queue Length 95th (ft)	223	37			136	70		3		332		0
Internal Link Dist (ft)		2220			6179			469				570
Turn Bay Length (ft)	450					450				200		
Base Capacity (vph)	335	1854			1062	749		305		476		922
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	0.63	0.14			0.31	0.48		0.00		0.74		0.19

Intersection Summary

Area Type:	Other
Cycle Length:	110
Actuated Cycle Length:	110
Offset:	0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.74
Intersection Signal Delay:	22.2
Intersection LOS:	C
Intersection Capacity Utilization:	62.1%
ICU Level of Service:	B
Analysis Period (min):	15

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

Splits and Phases: 5: Catron & 5th St



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

Black Hills TIS  
2010 Build Saturday Peak

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	195	0	5	190	320
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	300		150	100		0	200		0	150		150
Storage Lanes	1		1	1		0	1		0	1		1
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	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)	1676	1765	1500	1676	1705	0	1676	3353	0	1676	3353	1500
Flt Permitted	0.465			0.729			0.526			0.619		
Satd. Flow (perm)	821	1765	1500	1286	1705	0	928	3353	0	1092	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	212	0	5	207	348
Shared Lane Traffic (%)												
Lane Group Flow (vph)	370	43	250	5	49	0	332	212	0	5	207	348
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Detector Phase	7	4	4	3	8		5	2		1	6	6



# Lanes, Volumes, Timings

## 9: Stumer & 5th St

Black Hills TIS  
2010 Build Saturday Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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)	34.0	45.0	45.0	15.0	26.0	0.0	24.0	40.0	0.0	10.0	26.0	26.0
Total Split (%)	30.9%	40.9%	40.9%	13.6%	23.6%	0.0%	21.8%	36.4%	0.0%	9.1%	23.6%	23.6%
Maximum Green (s)	28.0	39.0	39.0	9.0	20.0		18.0	34.0		4.0	20.0	20.0
Yellow Time (s)	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
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	4.0	6.0	6.0	4.0	6.0	6.0	6.0
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)		17.0	17.0		17.0			17.0			17.0	17.0
Pedestrian Calls (#/hr)		0	0		0			0			0	0
Act Effct Green (s)	38.2	35.8	35.8	12.8	8.4		59.8	57.8		41.8	37.8	37.8
Actuated g/C Ratio	0.35	0.33	0.33	0.12	0.08		0.54	0.53		0.38	0.34	0.34
v/c Ratio	0.76	0.07	0.38	0.03	0.35		0.54	0.12		0.01	0.18	0.47
Control Delay	39.4	24.6	5.2	23.8	45.8		13.4	10.2		16.4	28.8	5.7
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	39.4	24.6	5.2	23.8	45.8		13.4	10.2		16.4	28.8	5.7
LOS	D	C	A	C	D		B	B		B	C	A
Approach Delay		25.6			43.7			12.1			14.4	
Approach LOS		C			D			B			B	
Queue Length 50th (ft)	205	19	0	2	26		79	24		2	57	0
Queue Length 95th (ft)	288	50	58	10	63		151	56		8	93	73
Internal Link Dist (ft)		393			530			570			504	
Turn Bay Length (ft)	300		150	100			200			150		150
Base Capacity (vph)	513	652	712	219	319		627	1761		437	1153	744
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	0.72	0.07	0.35	0.02	0.15		0.53	0.12		0.01	0.18	0.47

### Intersection Summary

Area Type: Other

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 46 (42%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 18.6

Intersection LOS: B

Intersection Capacity Utilization 69.4%

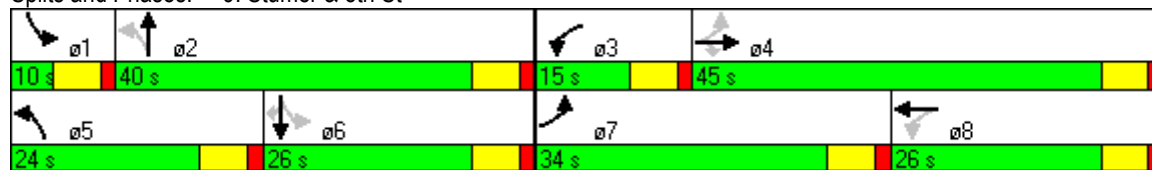
ICU Level of Service C

Analysis Period (min) 15

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

Black Hills TIS  
 2010 Build Saturday Peak






















Splits and Phases: 9: Stumer & 5th St



# HCM Unsignalized Intersection Capacity Analysis

## 13: Parkview & 5th St












Black Hills TIS  
2010 Build Saturday Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	0	15	55	0	15	55	435	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	0	16	60	473	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	0.99	0.99		0.99	0.99	0.99				0.99		
vC, conflicting volume	875	1171	255	902	1155	266	511			533		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	861	1160	255	889	1143	249	511			517		
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	100	98	94			99		
cM capacity (veh/h)	230	180	744	219	184	746	1051			1039		
<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	76	60	315	217	11	322	188				
Volume Left	11	60	60	0	0	11	0	0				
Volume Right	16	16	0	0	60	0	0	27				
cSH	392	279	1051	1700	1700	1039	1700	1700				
Volume to Capacity	0.07	0.27	0.06	0.19	0.13	0.01	0.19	0.11				
Queue Length 95th (ft)	6	27	5	0	0	1	0	0				
Control Delay (s)	14.9	23.7	8.6	0.0	0.0	8.5	0.0	0.0				
Lane LOS	B	C	A			A						
Approach Delay (s)	14.9	23.7	0.9			0.2						
Approach LOS	B	C										
<b>Intersection Summary</b>												
Average Delay			2.3									
Intersection Capacity Utilization			36.1%		ICU Level of Service					A		
Analysis Period (min)			15									

# HCM Unsignalized Intersection Capacity Analysis

## 12: Enchanted Pines & 5th St

Black Hills TIS  
2010 Build Saturday Peak

						
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	25	10	10	425	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)	27	11	11	462	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	764	266	533			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	764	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 %	92	99	99			
cM capacity (veh/h)	337	732	1031			
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	38	11	231	231	326	207
Volume Left	27	11	0	0	0	0
Volume Right	11	0	0	0	0	43
cSH	398	1031	1700	1700	1700	1700
Volume to Capacity	0.10	0.01	0.14	0.14	0.19	0.12
Queue Length 95th (ft)	8	1	0	0	0	0
Control Delay (s)	15.0	8.5	0.0	0.0	0.0	0.0
Lane LOS	B	A				
Approach Delay (s)	15.0	0.2			0.0	
Approach LOS	B					
Intersection Summary						
Average Delay			0.6			
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

Black Hills TIS  
 2010 Build Saturday Peak
























Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	20	45	45	415	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	451	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	810	250	500			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	810	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)	303	750	1060			

Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	71	49	226	226	315	185
Volume Left	22	49	0	0	0	0
Volume Right	49	0	0	0	0	27
cSH	516	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)	13.1	8.6	0.0	0.0	0.0	0.0
Lane LOS	B	A				
Approach Delay (s)	13.1	0.8	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  
 8: Stumer & Black Hills

Black Hills TIS  
 2010 Build Saturday Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	1	80	10	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	11	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			98			1157	1154	87	1755	1165	76
vC1, stage 1 conf vol							89	89		1065	1065	
vC2, stage 2 conf vol							1068	1065		690	100	
vCu, unblocked vol	76			98			1157	1154	87	1755	1165	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			1495			169	194	972	19	189	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	11	495	76	33	598	5				
Volume Left	1	0	0	495	0	27	0	0				
Volume Right	0	0	11	0	0	0	598	0				
cSH	1523	1700	1700	1495	1700	173	972	189				
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	30.6	14.4	24.6				
Lane LOS	A			A		D	B	C				
Approach Delay (s)	0.1			7.4		15.3		24.6				
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

<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	0.039	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
<b>East</b>		<b>WB Stumer Rd</b>									
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
<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	23.8	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  
 16: Enchanted Pines & Enchantment

Black Hills TIS  
 2010 Build Saturday Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	10	0	40	10	0	5	0	25	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	43	11	0	5	0	27	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			109	109	11	136	109	11
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	11			11			109	109	11	136	109	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	97	100	100	100
cM capacity (veh/h)	1608			1608			852	760	1070	797	760	1070
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>								
Volume Total	11	54	33	1								
Volume Left	0	43	5	1								
Volume Right	0	0	27	0								
cSH	1608	1608	1026	797								
Volume to Capacity	0.00	0.03	0.03	0.00								
Queue Length 95th (ft)	0	2	2	0								
Control Delay (s)	0.0	5.9	8.6	9.5								
Lane LOS		A	A	A								
Approach Delay (s)	0.0	5.9	8.6	9.5								
Approach LOS			A	A								
<b>Intersection Summary</b>												
Average Delay			6.2									
Intersection Capacity Utilization			19.6%		ICU Level of Service				A			
Analysis Period (min)			15									






















HCM Unsignalized Intersection Capacity Analysis  
 15: Stumer & Enchantment

Black Hills TIS  
 2010 Build Saturday Peak

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Volume (veh/h)	5	15	0	30	10	35	0	5	30	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	0	33	11	38	0	5	33	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	133	106	35	98	92	22	38					38	
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	133	106	35	98	92	22	38					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	98	100	96	99	96	100					99	
cM capacity (veh/h)	794	776	1037	863	789	1055	1572					1572	
<b>Direction, Lane #</b>	<b>EB 1</b>	<b>WB 1</b>	<b>NB 1</b>	<b>SB 1</b>									
Volume Total	22	82	38	54									
Volume Left	5	33	0	16									
Volume Right	0	38	33	5									
cSH	780	931	1572	1572									
Volume to Capacity	0.03	0.09	0.00	0.01									
Queue Length 95th (ft)	2	7	0	1									
Control Delay (s)	9.7	9.2	0.0	2.2									
Lane LOS	A	A		A									
Approach Delay (s)	9.7	9.2	0.0	2.2									
Approach LOS	A	A											
<b>Intersection Summary</b>													
Average Delay			5.6										
Intersection Capacity Utilization			23.7%	ICU Level of Service	A								
Analysis Period (min)			15										




















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

Black Hills TIS  
 2010 Build Saturday Peak

												
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

Black Hills TIS  
 2010 Build Saturday Peak

												
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

Black Hills TIS  
 2010 Build Saturday Peak

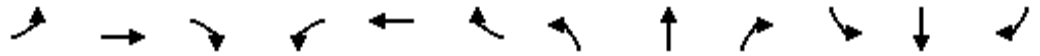
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	55	485	20	20	475	90	10	5	30	80	5	40
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (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	0.91						0.91	0.91		0.91	0.91	0.91
vC, conflicting volume	614			549			1264	1315	538	1291	1277	565
vC1, stage 1 conf vol							658	658		609	609	
vC2, stage 2 conf vol							606	658		682	668	
vCu, unblocked vol	529			549			1241	1298	538	1271	1256	476
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	71	98	92
cM capacity (veh/h)	947			1021			298	310	543	301	329	538
<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	60	549	22	614	49	136						
Volume Left	60	0	22	0	11	87						
Volume Right	0	22	0	98	33	43						
cSH	947	1700	1021	1700	429	352						
Volume to Capacity	0.06	0.32	0.02	0.36	0.11	0.39						
Queue Length 95th (ft)	5	0	2	0	10	44						
Control Delay (s)	9.1	0.0	8.6	0.0	14.5	21.5						
Lane LOS	A		A		B	C						
Approach Delay (s)	0.9		0.3		14.5	21.5						
Approach LOS					B	C						
<b>Intersection Summary</b>												
Average Delay			3.1									
Intersection Capacity Utilization			59.7%		ICU Level of Service				B			
Analysis Period (min)			15									

## **2030 Build Operating Conditions**

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

Lanes, Volumes, Timings  
3: Catron & Black Hills

Black Hills TIS  
2030 Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	410	700	60	60	1205	75	35	5	35	70	5	420
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	450		200	200		300	0		200	100		0
Storage Lanes	1		1	1		1	0		1	0		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
Fr <sub>t</sub>			0.850			0.850			0.850			0.850
Fl <sub>t</sub> Protected	0.950			0.950				0.958			0.955	
Satd. Flow (prot)	1676	3109	1500	1676	3109	1500	0	1691	1500	0	1685	1500
Fl <sub>t</sub> Permitted	0.950			0.950				0.958			0.955	
Satd. Flow (perm)	1676	3109	1500	1676	3109	1500	0	1691	1500	0	1685	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			65			77			38			381
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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	446	761	65	65	1310	82	38	5	38	76	5	457
Shared Lane Traffic (%)												
Lane Group Flow (vph)	446	761	65	65	1310	82	0	43	38	0	81	457
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (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
Detector 1 Queue (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
Detector 1 Delay (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
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6

Lanes, Volumes, Timings  
3: Catron & Black Hills

Black Hills TIS  
2030 Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	6
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	7.0
Minimum Split (s)	13.0	18.0	18.0	10.0	30.0	30.0	13.0	13.0	13.0	13.0	13.0	13.0
Total Split (s)	36.0	74.0	74.0	16.0	54.0	54.0	13.0	13.0	13.0	17.0	17.0	17.0
Total Split (%)	30.0%	61.7%	61.7%	13.3%	45.0%	45.0%	10.8%	10.8%	10.8%	14.2%	14.2%	14.2%
Maximum Green (s)	30.0	68.0	68.0	10.0	48.0	48.0	7.0	7.0	7.0	11.0	11.0	11.0
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 Optimize?	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	C-Max	C-Max	None	C-Max	C-Max	None	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 Effct Green (s)	30.0	74.1	74.1	8.9	50.6	50.6		7.0	7.0		11.0	11.0
Actuated g/C Ratio	0.25	0.62	0.62	0.07	0.42	0.42		0.06	0.06		0.09	0.09
v/c Ratio	1.06	0.40	0.07	0.52	1.00	0.12		0.43	0.31		0.53	0.94
Control Delay	105.5	13.9	3.0	69.2	43.2	1.7		68.6	23.5		64.7	39.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	105.5	13.9	3.0	69.2	43.2	1.7		68.6	23.5		64.7	39.9
LOS	F	B	A	E	D	A		E	C		E	D
Approach Delay		45.5			42.0			47.4			43.6	
Approach LOS		D			D			D			D	
Queue Length 50th (ft)	~381	169	0	50	~600	1		33	0		59	49
Queue Length 95th (ft)	#584	216	20	m66	m#684	m1		72	36		m113	#267
Internal Link Dist (ft)		1376			2220			467			322	
Turn Bay Length (ft)	450		200	200		300			200			
Base Capacity (vph)	419	1920	951	140	1311	677		99	123		154	484
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	1.06	0.40	0.07	0.46	1.00	0.12		0.43	0.31		0.53	0.94

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: 120  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 1.06  
 Intersection Signal Delay: 43.7  
 Intersection LOS: D  
 Intersection Capacity Utilization 85.2%  
 ICU Level of Service E  
 Analysis Period (min) 15

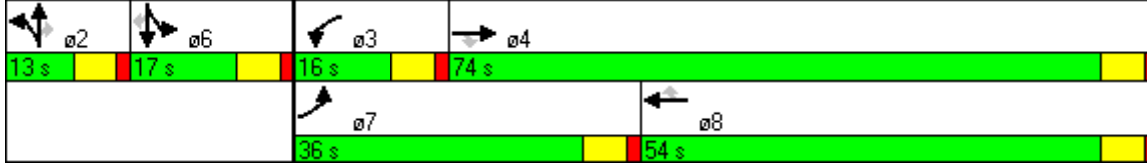
~ Volume exceeds capacity, queue is theoretically infinite.



Lanes, Volumes, Timings  
 3: Catron & Black Hills

- 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  
5: Catron & 5th St

Black Hills TIS  
2030 Build PM Peak

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	485	115	150	860	325	190	90	240	445	165	290
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
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
Fr <sub>t</sub>			0.850			0.850		0.891				0.850
Fl <sub>t</sub> Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	3109	1500	1676	3109	1500	1676	2987	0	1676	1765	1500
Fl <sub>t</sub> Permitted	0.950			0.950			0.644			0.231		
Satd. Flow (perm)	1676	3109	1500	1676	3109	1500	1136	2987	0	408	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			125			353		261				315
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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	223	527	125	163	935	353	207	98	261	484	179	315
Shared Lane Traffic (%)												
Lane Group Flow (vph)	223	527	125	163	935	353	207	359	0	484	179	315
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot		Perm	Prot		Perm	pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8	2			6		6

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

Black Hills TIS  
2030 Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	7.0	7.0		12.0	12.0	12.0
Minimum Split (s)	10.0	30.0	30.0	10.0	30.0	30.0	30.0	30.0		30.0	30.0	30.0
Total Split (s)	24.0	39.0	39.0	28.0	43.0	43.0	20.0	18.0	0.0	35.0	33.0	33.0
Total Split (%)	20.0%	32.5%	32.5%	23.3%	35.8%	35.8%	16.7%	15.0%	0.0%	29.2%	27.5%	27.5%
Maximum Green (s)	18.0	33.0	33.0	22.0	37.0	37.0	14.0	12.0		29.0	27.0	27.0
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
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
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	4.0	6.0	6.0	6.0
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	7.0	7.0
Flash Dont Walk (s)		17.0	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	0
Act Effct Green (s)	18.0	39.0	39.0	16.7	37.7	37.7	24.7	11.3		46.3	27.0	27.0
Actuated g/C Ratio	0.15	0.32	0.32	0.14	0.31	0.31	0.21	0.09		0.39	0.22	0.22
v/c Ratio	0.89	0.52	0.22	0.70	0.96	0.50	0.70	0.69		1.04	0.45	0.54
Control Delay	72.1	25.7	2.5	64.8	61.2	5.8	42.5	22.5		81.6	40.0	16.5
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	72.1	25.7	2.5	64.8	61.2	5.8	42.5	22.5		81.6	40.0	16.5
LOS	E	C	A	E	E	A	D	C		F	D	B
Approach Delay		34.2			48.1			29.8			53.0	
Approach LOS		C			D			C			D	
Queue Length 50th (ft)	173	96	0	122	376	0	110	37		~389	132	99
Queue Length 95th (ft)	#320	122	14	188	#517	70	172	88		#563	205	182
Internal Link Dist (ft)		2220			6179			469			570	
Turn Bay Length (ft)	450		450	400		450	200			200		
Base Capacity (vph)	251	1010	572	307	976	713	303	534		464	397	582
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	0.89	0.52	0.22	0.53	0.96	0.50	0.68	0.67		1.04	0.45	0.54

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: 120  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 1.04  
 Intersection Signal Delay: 43.5  
 Intersection LOS: D  
 Intersection Capacity Utilization 93.9%  
 ICU Level of Service F  
 Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.

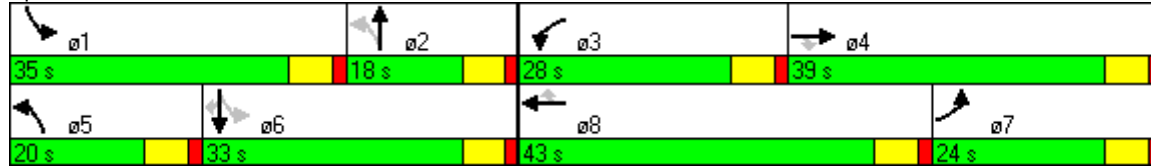
Lanes, Volumes, Timings  
 5: Catron & 5th St

Queue shown is maximum after two cycles.

# 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  
9: Stumer & 5th St

Black Hills TIS  
2030 Build PM Peak

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	255	70	35	520	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	1		1	1		0	1		0	1		1
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	0.95	1.00	0.95	1.00
Fr <sub>t</sub>			0.850		0.922			0.968				0.850
Fl <sub>t</sub> Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1765	1500	1676	1627	0	1676	3246	0	1676	3353	1500
Fl <sub>t</sub> Permitted	0.370			0.725			0.307			0.540		
Satd. Flow (perm)	653	1765	1500	1279	1627	0	542	3246	0	953	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			250		39			35				289
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	277	76	38	565	310
Shared Lane Traffic (%)												
Lane Group Flow (vph)	337	49	250	125	125	0	321	353	0	38	565	310
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Detector Phase	7	4	4	3	8		5	2		1	6	6

# Lanes, Volumes, Timings

## 9: Stumer & 5th St

Black Hills TIS  
2030 Build PM Peak



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
<b>Switch Phase</b>												
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	30.0		10.0	30.0	30.0
Total Split (s)	29.0	42.0	42.0	13.0	26.0	0.0	30.0	55.0	0.0	10.0	35.0	35.0
Total Split (%)	24.2%	35.0%	35.0%	10.8%	21.7%	0.0%	25.0%	45.8%	0.0%	8.3%	29.2%	29.2%
Maximum Green (s)	23.0	36.0	36.0	7.0	20.0		24.0	49.0		4.0	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
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)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0
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)		17.0	17.0		17.0			17.0			17.0	17.0
Pedestrian Calls (#/hr)		0	0		0			0			0	0
Act Effct Green (s)	40.2	27.2	27.2	18.8	11.8		67.8	61.8		47.9	43.9	43.9
Actuated g/C Ratio	0.34	0.23	0.23	0.16	0.10		0.56	0.52		0.40	0.37	0.37
v/c Ratio	0.82	0.12	0.47	0.56	0.64		0.67	0.21		0.09	0.46	0.42
Control Delay	50.1	35.4	7.2	41.7	49.7		26.7	9.6		16.3	32.7	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	50.1	35.4	7.2	41.7	49.7		26.7	9.6		16.3	32.7	7.0
LOS	D	D	A	D	D		C	A		B	C	A
Approach Delay		32.1			45.7			17.7			23.3	
Approach LOS		C			D			B			C	
Queue Length 50th (ft)	214	30	0	69	64		130	47		13	175	11
Queue Length 95th (ft)	#292	60	62	108	124		m217	m78		33	267	90
Internal Link Dist (ft)		393			530			570			504	
Turn Bay Length (ft)	150		150	100			200			150		150
Base Capacity (vph)	415	530	625	224	304		533	1690		405	1227	732
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	0.81	0.09	0.40	0.56	0.41		0.60	0.21		0.09	0.46	0.42

### Intersection Summary

Area Type: Other

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 17 (14%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 80

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 26.3

Intersection LOS: C

Intersection Capacity Utilization 72.2%

ICU Level of Service C

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

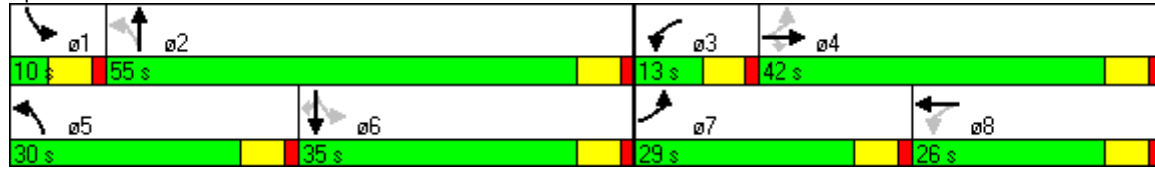
Queue shown is maximum after two cycles.

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

Black Hills TIS  
 2030 Build PM Peak



















m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Stumer & 5th St



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




















Black Hills TIS  
 2030 Build PM Peak

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	35	5	10	15	5	10	25	515	15	10	665	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)	38	5	11	16	5	11	27	560	16	11	723	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								TWLT			TWLT	
Median storage (veh)								2			2	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1106	1389	375	1019	1394	288	750			576		
vC1, stage 1 conf vol	758	758		622	622							
vC2, stage 2 conf vol	348	630		397	772							
vCu, unblocked vol	1106	1389	375	1019	1394	288	750			576		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)	6.5	5.5		6.5	5.5							
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	88	98	98	96	98	98	97			99		
cM capacity (veh/h)	326	321	623	365	311	709	855			993		
<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	54	33	27	373	203	11	482	268				
Volume Left	38	16	27	0	0	11	0	0				
Volume Right	11	11	0	0	16	0	0	27				
cSH	360	421	855	1700	1700	993	1700	1700				
Volume to Capacity	0.15	0.08	0.03	0.22	0.12	0.01	0.28	0.16				
Queue Length 95th (ft)	13	6	2	0	0	1	0	0				
Control Delay (s)	16.8	14.3	9.3	0.0	0.0	8.7	0.0	0.0				
Lane LOS	C	B	A			A						
Approach Delay (s)	16.8	14.3	0.4			0.1						
Approach LOS	C	B										
<b>Intersection Summary</b>												
Average Delay			1.2									
Intersection Capacity Utilization			32.9%		ICU Level of Service			A				
Analysis Period (min)			15									



HCM Unsignalized Intersection Capacity Analysis  
 13: Parkview & 5th St

Black Hills TIS  
 2030 Build PM Peak

												
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	510	70	10	740	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	554	76	11	804	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	0.99	0.99		0.99	0.99	0.99				0.99		
vC, conflicting volume	1215	1568	416	1147	1543	315	832			630		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1197	1554	416	1128	1529	288	832			607		
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 %	83	100	94	46	100	98	94			99		
cM capacity (veh/h)	129	103	586	140	107	701	797			958		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	54	92	49	370	261	11	536	295				
Volume Left	22	76	49	0	0	11	0	0				
Volume Right	33	16	0	0	76	0	0	27				
cSH	243	171	797	1700	1700	958	1700	1700				
Volume to Capacity	0.22	0.54	0.06	0.22	0.15	0.01	0.32	0.17				
Queue Length 95th (ft)	21	69	5	0	0	1	0	0				
Control Delay (s)	24.0	49.1	9.8	0.0	0.0	8.8	0.0	0.0				
Lane LOS	C	E	A			A						
Approach Delay (s)	24.0	49.1	0.7			0.1						
Approach LOS	C	E										
Intersection Summary												
Average Delay			3.8									
Intersection Capacity Utilization			45.5%	ICU Level of Service	A							
Analysis Period (min)			15									

## **2030 Build Operating Conditions**

### **Weekday PM Peak Hour Primary Study Intersections With Potential Dual-Lefts**

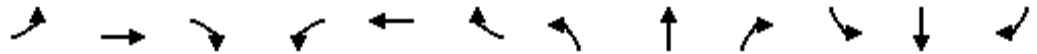
Lanes, Volumes, Timings  
3: Catron & Black Hills



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	410	700	60	60	1205	75	35	5	35	70	5	420
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	450		200	200		300	0		200	100		0
Storage Lanes	2		1	1		1	0		1	0		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	*0.70	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			0.850			0.850
Flt Protected	0.950			0.950				0.958			0.955	
Satd. Flow (prot)	2347	3109	1500	1676	3109	1500	0	1691	1500	0	1685	1500
Flt Permitted	0.950			0.950				0.958			0.955	
Satd. Flow (perm)	2347	3109	1500	1676	3109	1500	0	1691	1500	0	1685	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			65			77			38			362
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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	446	761	65	65	1310	82	38	5	38	76	5	457
Shared Lane Traffic (%)												
Lane Group Flow (vph)	446	761	65	65	1310	82	0	43	38	0	81	457
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (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
Detector 1 Queue (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
Detector 1 Delay (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
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	7	4		3	8		2	2		6	6	
Permitted Phases			4			8			2			6

Lanes, Volumes, Timings  
3: Catron & Black Hills

Black Hills TIS  
2030 Build PM Peak\_Dual Lefts



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Detector Phase	7	4	4	3	8	8	2	2	2	6	6	6
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	7.0
Minimum Split (s)	13.0	18.0	18.0	10.0	30.0	30.0	13.0	13.0	13.0	13.0	13.0	13.0
Total Split (s)	34.0	73.0	73.0	15.0	54.0	54.0	13.0	13.0	13.0	19.0	19.0	19.0
Total Split (%)	28.3%	60.8%	60.8%	12.5%	45.0%	45.0%	10.8%	10.8%	10.8%	15.8%	15.8%	15.8%
Maximum Green (s)	28.0	67.0	67.0	9.0	48.0	48.0	7.0	7.0	7.0	13.0	13.0	13.0
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 Optimize?	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	C-Max	C-Max	None	C-Max	C-Max	None	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 Effct Green (s)	26.1	73.0	73.0	8.3	52.8	52.8		7.0	7.0		12.8	12.8
Actuated g/C Ratio	0.22	0.61	0.61	0.07	0.44	0.44		0.06	0.06		0.11	0.11
v/c Ratio	0.87	0.40	0.07	0.56	0.96	0.12		0.43	0.31		0.45	0.95
Control Delay	63.9	14.6	3.1	73.8	32.3	1.6		68.6	23.5		61.4	44.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Delay	63.9	14.6	3.1	73.8	32.3	1.6		68.6	23.5		61.4	44.1
LOS	E	B	A	E	C	A		E	C		E	D
Approach Delay		31.3			32.4			47.4			46.7	
Approach LOS		C			C			D			D	
Queue Length 50th (ft)	235	173	0	51	~602	1		33	0		60	77
Queue Length 95th (ft)	#343	220	20	m66	m#713	m2		72	36		m114	#290
Internal Link Dist (ft)		1376			2220			467			322	
Turn Bay Length (ft)	450		200	200		300			200			
Base Capacity (vph)	548	1890	937	126	1368	703		99	123		183	485
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	0.81	0.40	0.07	0.52	0.96	0.12		0.43	0.31		0.44	0.94

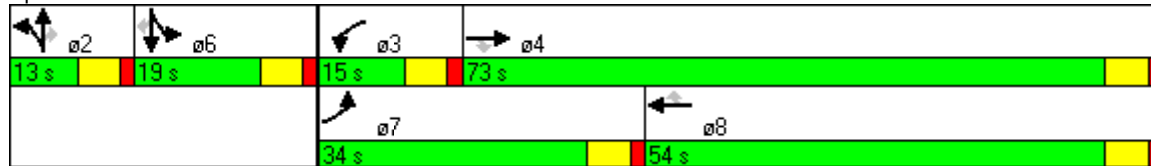
Intersection Summary

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: 110  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.96  
 Intersection Signal Delay: 34.6  
 Intersection Capacity Utilization 83.4%  
 Analysis Period (min) 15  
 \* User Entered Value  
 Intersection LOS: C  
 ICU Level of Service E

























Lanes, Volumes, Timings  
 3: Catron & Black Hills

- ~ 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

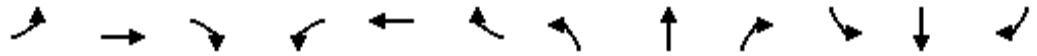


Lanes, Volumes, Timings  
5: Catron & 5th St

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	205	485	115	150	860	325	190	90	240	445	165	290
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	450		450	400		450	200		0	200		0
Storage Lanes	1		1	1		1	1		0	2		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	0.97	1.00	1.00
Fr <sub>t</sub>			0.850			0.850		0.891				0.850
Fl <sub>t</sub> Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	3109	1500	1676	3109	1500	1676	2987	0	3252	1765	1500
Fl <sub>t</sub> Permitted	0.950			0.950			0.644			0.950		
Satd. Flow (perm)	1676	3109	1500	1676	3109	1500	1136	2987	0	3252	1765	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			125			353		261				315
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
Heavy Vehicles (%)	2%	10%	2%	2%	10%	2%	2%	2%	2%	2%	2%	2%
Adj. Flow (vph)	223	527	125	163	935	353	207	98	261	484	179	315
Shared Lane Traffic (%)												
Lane Group Flow (vph)	223	527	125	163	935	353	207	359	0	484	179	315
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		24			24			24				24
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	Prot		Perm	Prot		Perm	pm+pt			Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8	2					6

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

Black Hills TIS  
2030 Build PM Peak\_Dual Lefts



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	7.0	7.0		12.0	12.0	12.0
Minimum Split (s)	10.0	30.0	30.0	10.0	30.0	30.0	30.0	30.0		30.0	30.0	30.0
Total Split (s)	27.0	46.0	46.0	26.0	45.0	45.0	18.0	18.0	0.0	30.0	30.0	30.0
Total Split (%)	22.5%	38.3%	38.3%	21.7%	37.5%	37.5%	15.0%	15.0%	0.0%	25.0%	25.0%	25.0%
Maximum Green (s)	21.0	40.0	40.0	20.0	39.0	39.0	12.0	12.0		24.0	24.0	24.0
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
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
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	4.0	6.0	6.0	6.0
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	7.0	7.0
Flash Dont Walk (s)		17.0	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	0
Act Effct Green (s)	21.0	43.8	43.8	16.2	39.1	39.1	23.8	11.9		24.0	24.0	24.0
Actuated g/C Ratio	0.18	0.36	0.36	0.14	0.33	0.33	0.20	0.10		0.20	0.20	0.20
v/c Ratio	0.76	0.46	0.20	0.72	0.92	0.49	0.74	0.67		0.74	0.51	0.57
Control Delay	52.2	21.3	1.9	67.0	54.5	5.5	49.4	21.8		40.0	37.0	13.4
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	52.2	21.3	1.9	67.0	54.5	5.5	49.4	21.8		40.0	37.0	13.4
LOS	D	C	A	E	D	A	D	C		D	D	B
Approach Delay		26.4			44.0			31.9			30.9	
Approach LOS		C			D			C			C	
Queue Length 50th (ft)	168	83	0	122	366	0	118	37		187	125	99
Queue Length 95th (ft)	#285	107	12	192	#496	68	#205	88		202	207	178
Internal Link Dist (ft)		2220			6179			469			570	
Turn Bay Length (ft)	450		450	400		450	200			200		
Base Capacity (vph)	293	1136	627	279	1012	727	280	534		650	353	552
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	0.76	0.46	0.20	0.58	0.92	0.49	0.74	0.67		0.74	0.51	0.57

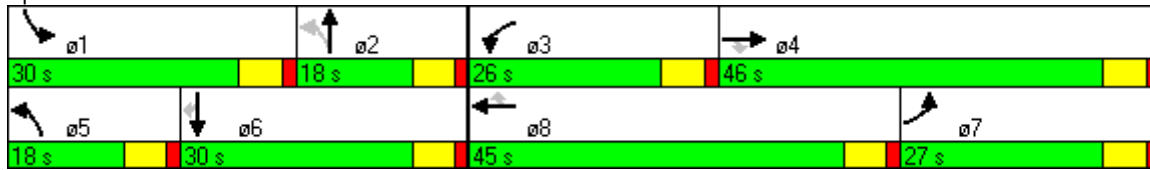
Intersection Summary

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: 120  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.92  
 Intersection Signal Delay: 34.9  
 Intersection LOS: C  
 Intersection Capacity Utilization 81.3%  
 ICU Level of Service D  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.

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

Queue shown is maximum after two cycles.

Splits and Phases: 5: Catron & 5th St





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

Black Hills TIS  
2030 Build PM Peak\_Dual Lefts

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	255	70	35	520	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	1		1	1		0	1		0	1		1
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	0.95	1.00	0.95	1.00
Fr <sub>t</sub>			0.850		0.922			0.968				0.850
Fl <sub>t</sub> Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1676	1765	1500	1676	1627	0	1676	3246	0	1676	3353	1500
Fl <sub>t</sub> Permitted	0.370			0.725			0.307			0.540		
Satd. Flow (perm)	653	1765	1500	1279	1627	0	542	3246	0	953	3353	1500
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			250		39			35				289
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	277	76	38	565	310
Shared Lane Traffic (%)												
Lane Group Flow (vph)	337	49	250	125	125	0	321	353	0	38	565	310
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			24				24
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2		1	2		1	2	1
Detector Template	Left	Thru	Right	Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100		20	100		20	100	20
Trailing Detector (ft)	0	0	0	0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0	0	0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6	20	20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94				94
Detector 2 Size(ft)		6			6			6				6
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0				0.0
Turn Type	pm+pt		Perm	pm+pt			pm+pt			pm+pt		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4		4	8			2			6		6
Detector Phase	7	4	4	3	8		5	2		1	6	6

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



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
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	30.0		10.0	30.0	30.0
Total Split (s)	29.0	42.0	42.0	13.0	26.0	0.0	30.0	55.0	0.0	10.0	35.0	35.0
Total Split (%)	24.2%	35.0%	35.0%	10.8%	21.7%	0.0%	25.0%	45.8%	0.0%	8.3%	29.2%	29.2%
Maximum Green (s)	23.0	36.0	36.0	7.0	20.0		24.0	49.0		4.0	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
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)	6.0	6.0	6.0	6.0	6.0	4.0	6.0	6.0	4.0	6.0	6.0	6.0
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)		17.0	17.0		17.0			17.0			17.0	17.0
Pedestrian Calls (#/hr)		0	0		0			0			0	0
Act Effct Green (s)	40.2	27.2	27.2	18.8	11.8		67.8	61.8		47.9	43.9	43.9
Actuated g/C Ratio	0.34	0.23	0.23	0.16	0.10		0.56	0.52		0.40	0.37	0.37
v/c Ratio	0.82	0.12	0.47	0.56	0.64		0.67	0.21		0.09	0.46	0.42
Control Delay	50.1	35.4	7.2	41.7	49.7		23.6	11.0		16.3	32.7	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	50.1	35.4	7.2	41.7	49.7		23.6	11.0		16.3	32.7	7.0
LOS	D	D	A	D	D		C	B		B	C	A
Approach Delay		32.1			45.7			17.0			23.3	
Approach LOS		C			D			B			C	
Queue Length 50th (ft)	214	30	0	69	64		96	47		13	175	11
Queue Length 95th (ft)	#292	60	62	108	124		m203	m86		33	267	90
Internal Link Dist (ft)		393			530			570			504	
Turn Bay Length (ft)	150		150	100			200			150		150
Base Capacity (vph)	415	530	625	224	304		533	1690		405	1227	732
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	0.81	0.09	0.40	0.56	0.41		0.60	0.21		0.09	0.46	0.42

Intersection Summary	
Area Type:	Other
Cycle Length:	120
Actuated Cycle Length:	120
Offset:	34 (28%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle:	80
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.82
Intersection Signal Delay:	26.1
Intersection LOS:	C
Intersection Capacity Utilization:	72.2%
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.	

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Stumer & 5th St

