

TRAFFIC SIGNAL
WARRANT ANALYSIS
SUPPLEMENT

MONTGOMERY COUNTY
3RD DISTRICT
POLICE STATION

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Introduction

This report is a supplement to the Traffic Signal Warrant Analysis for the Montgomery County 3rd District Police Station that was submitted to SHA in June 2009. The full traffic signal warrant analysis was for the intersection of MD 650 and Heartfields Drive/Quaint Acres Drive. The purpose of this supplement is to briefly summarize the previous study and SHA's comments, update SHA on this project, and then to address SHA's comment that wanted further analysis for a signal analysis with a full median closure at the MD 650 / Milestone Drive intersection. Any background information that is not mentioned or addressed in this supplement can be found in the June 2009 study.

Brief Summary

A full traffic signal warrant analysis was conducted for the intersection of MD 650 and Heartfields Drive/Quaint Acres Drive in White Oak, MD. This study was done based on a suggestion from SHA that responded to a Traffic Impact Study for the relocation of the Montgomery County 3rd District Police Station that was submitted in January 2009. In the response letter dated March 26, 2009, SHA made the following comment: "If desired, the applicant should explore the feasibility and traffic warrants of a potential full signal at the MD 650/Heartfields Drive intersection." The County discussed the idea of a full signal to both the police department and the existing community and got full support from all parties for a signal warrant analysis.

The full signal warrant analysis was completed in June 2009 and delivered to SHA. The study showed that based on the existing traffic volumes, a signal could be warranted under the MUTCD warrants:

- Warrant 2 – Four-Hour Vehicular Volume
- Warrant 3 – Peak Hour Vehicular Volume
- Warrant 4 – Pedestrian Volume
- Warrant 6 – Coordinated Signal System
- Warrant 8 – Roadway Network

For the fully built condition of an added police station and housing units, Warrant 1, which is the Eight-Hour Vehicular Volume, would also be met for a full traffic signal.

The study could not evaluate Warrant 7 which is crash experience, since SHA does not make crash data available anymore. However the study did indicate several safety concerns:

- Below standard vertical sight distance to the south of the intersection
- Pedestrians afraid to cross due to confusing signal system
- Red light running at the current signal due to driver confusion of the unconventional signal and/or the infrequency of a red light
- Illegal left turns from Heartfields Drive to SB MD 650 and Quaint Acres Drive to NB MD 650 (when left turn prohibition is turned on)

- Lefts turns from the side roads (both legal and illegal) waiting in the median with the vehicle sticking out into the MD 650 thru lane
- Speeding on MD 650 at the intersection
- Traffic cutting through the White Oak Library to avoid the intersection due to safety concerns

Synchro analyses were conducted based on existing conditions with and without a signal at the study intersection. The Synchro analyses showed that MD 650 thru traffic has a delay level of service (LOS) of A in all directions for all conditions. Both Quaint Acres Drive and Heartfields Drive traffic would have delays reduced at a full traffic signal when considering the added time necessary for drivers wishing to make a left turn by making a right and then u-turn maneuver at the next available median break.

In response to the traffic signal warrant analysis study delivered to SHA, SHA responded in a letter dated September 8, 2009 the following: “Although SHA concurs in principle with the findings of the Traffic Signal Warrant Study, SHA would like some additional information included in the study before a decision is made regarding a full color traffic signal at the MD 650 at Heartfields Drive/Quaint Acres Drive intersection. Specifically, SHA would like the study to include the potential median closure at the MD 650 at Milestone Drive intersection (except for emergency vehicles).... After the follow-up analyses is submitted and reviewed by SHA, a final decision on the need for a full color signalized MD 650 at Heartfields Drive/Quaint Acres Drive intersection will be made by SHA.”

This document is the supplement to the previous traffic signal warrant analysis that addresses SHA’s request to study the median closure on MD 650 at Milestone Drive (except for emergency vehicles).

Updates on the Project

Before going through the analysis, there are a couple of important updates that SHA should be aware of:

- 1) Several crashes have occurred at the intersection of MD 650 and Quaint Acres Drive/Heartfields Drive intersection since the June 2009 report. One of these crashes occurred last month on the morning of January 8, 2010, where the traffic signal was in the pedestrian phase, i.e. the vehicular signals were all red. A driver in an SUV, not realizing that the signal was red, skidded to the sidewalk to avoid the stopped cars in front and instead hit an 11-year old child who happened to be the child of the president for the Quaint Acres Citizen’s Association. The child spent the whole day in the emergency room before being released with what seemed to be just “minor” injuries.
- 2) The June 2009 report incorrectly indicated that there were three access points to the neighborhood on the Quaint Acres Drive side of MD 650. There are in fact only two access points, Milestone Drive and Quaint Acres Drive. Tanley Drive does not connect to this neighborhood. Although this does not affect any of the traffic analysis previously done, it does show the added difficulties for residents in this neighborhood to make a left

turn to go northbound on MD 650. A full traffic signal would help even more for these movements.

- 3) The June 2009 study showed an analysis based on existing conditions as well as fully built conditions that assumed a police station and 180 condominium units. Since the June 2009 study was conducted, the residential component of the project has been removed. In this supplement, the proposed condition is only for the added police station and not the residential component.

Analysis

The analysis in this supplement is all based on conditions where the median is closed at the intersection of MD 650 and Milestone Drive, thus diverting all the left turns from MD 650 in either direction to a new location. For the purpose of this study, a conservative assumption was made that all the left turns were moved on MD 650 from the Milestone Drive intersection to a new fully signalized intersection at Heartfields Drive/Quaint Acres Drive.

Figure 1 shows the new traffic volumes for the existing and proposed scenarios. Both scenarios incorporate the median closure at MD 650 at Milestone Drive. The first scenario is existing volumes with the adjusted left turn traffic. The second scenario is the proposed condition with the new 3rd District Police Station. As noted above, the residential component from the previous study is no longer being evaluated.

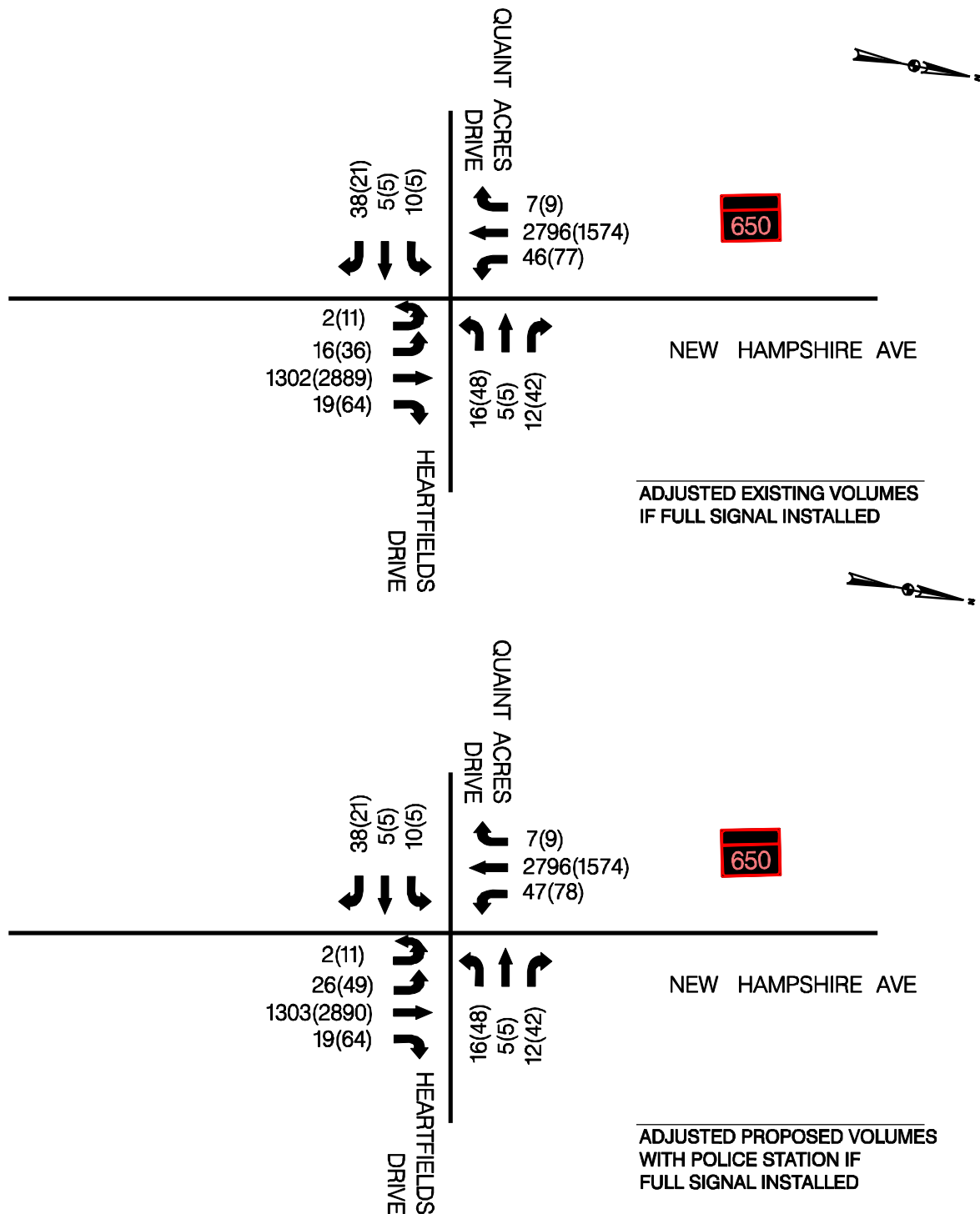
Figure 2 shows where the volumes were added compared to the existing volumes that are also shown in Figure 5 of the June 2009 study. For the police station traffic, the same assumption was made as the previous study that all traffic both to and from the police station would use Milestone Drive if possible. Since left turns from southbound MD 650 would not be possible at Milestone Drive with a median closure, these volumes were moved to Heartfields Drive.

One other minor difference to note is that in the previous study, the traffic volumes for the illegal movements were not changed with a proposed full traffic signal. Since full turning movements would be allowed at a full traffic signal, the volumes for those previously illegal movements were slightly increased for this probable effect.

For the existing and proposed conditions, Synchro simulations were conducted for three possible signal phasing; a two-phased signal, a three-phased signal where SB lefts from MD 650 has a lead protected phase, and a three-phased signal where both NB and SB lefts from MD 650 have a protected phase. All left turns are permissive after the exclusive phase ends. The simulations were optimized at a 150 second signal cycle. This may not be the optimal cycle length but was chosen based on the half-signal on MD 650 at the US 29 ramp having the same cycle length.

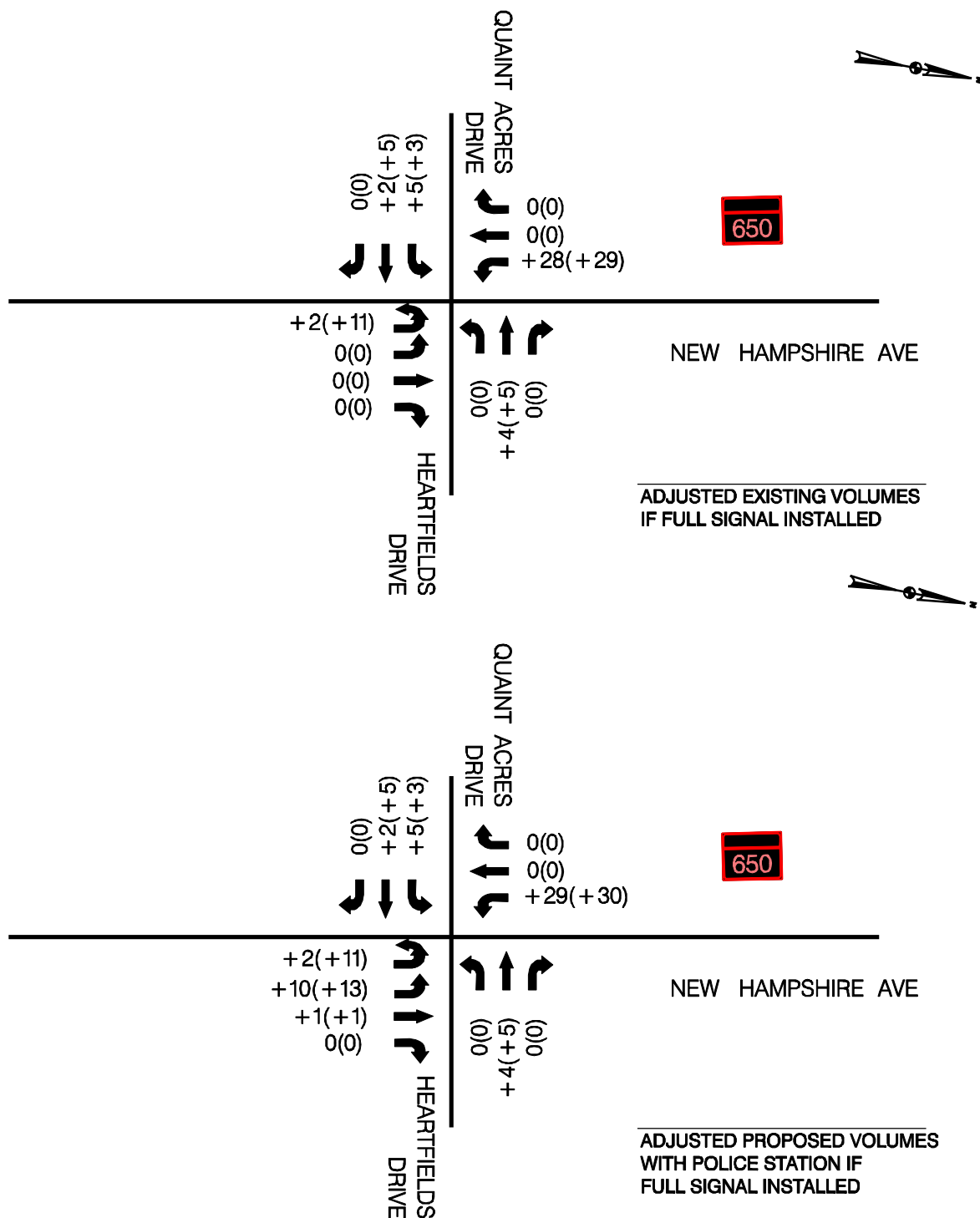
Adjusted Existing Analysis

A summary of the results for the simulation at the study intersection of MD 650 and Heartfields Drive/Quaint Acres Drive can be seen in the following tables for the existing conditions with the adjustment for the median closure on MD 650 at Milestone Drive. The Synchro reports can be found in the Appendix.



NOT TO SCALE

FIGURE 1
EXISTING AND PROPOSED VOLUMES WITH
MEDIAN CLOSURE AT MILESTONE DRIVE



NOT TO SCALE

FIGURE 2
CHANGES IN VOLUMES COMPARED
TO EXISTING CONDITIONS

TWO PHASE SIGNAL							
		AM			PM		
		Delay (sec/veh)	LOS	95th Percentile Queue (ft)	Delay (sec/veh)	LOS	95th Percentile Queue (ft)
New Hampshire Ave Northbound	L/U-Turn	22.8	C	51	5.3	A	26
	T/R	2.3	A	118	5.5	A	524
	Approach	2.5	A		5.5	A	
New Hampshire Ave Southbound	L	3.2	A	20	388.9	F	195
	T/R	4.6	A	432	2.7	A	161
	Approach	4.6	A		20.6	C	
Heartfields Drive Westbound	L/T	68.9	E	50	76.8	E	95
	R	66.2	E	23	69.8	E	81
	Approach	67.9	E		73.5	E	
Quaint Acres Drive Eastbound	L/T/R	75.2	E	97	66.1	E	38
Overall Intersection		5.3	A		12.4	B	

Table 1: Synchro Analysis Summary for Adjusted Existing Volumes at a Two-Phased Signal

THREE PHASE SIGNAL (SBL Protected/Permissive)							
		AM			PM		
		Delay (sec/veh)	LOS	95th Percentile Queue (ft)	Delay (sec/veh)	LOS	95th Percentile Queue (ft)
New Hampshire Ave Northbound	L/U-Turn	25.4	C	52	9.3	A	43
	T/R	5.0	A	192	14.0	B	889
	Approach	5.3	A		14.0	B	
New Hampshire Ave Southbound	L	2.5	A	15	45.8	D	93
	T/R	4.6	A	432	2.8	A	163
	Approach	4.6	A		4.8	A	
Heartfields Drive Westbound	L/T	69.1	E	50	80.7	F	102
	R	66.3	E	23	65.4	E	41
	Approach	68.0	E		73.9	E	
Quaint Acres Drive Eastbound	L/T/R	74.9	E	96	66.1	E	44
Overall Intersection		5.1	A		12.3	B	

Table 2: Synchro Analysis Summary for Adjusted Existing Volumes at a Three-Phased Signal with southbound lefts having a phase

THREE PHASE SIGNAL (NBL & SBL Protected/Permissive)							
		AM			PM		
		Delay (sec/veh)	LOS	95th Percentile Queue (ft)	Delay (sec/veh)	LOS	95th Percentile Queue (ft)
New Hampshire Ave Northbound	L/U-Turn	9.8	A	6	4.2	A	16
	T/R	4.4	A	174	14.0	B	889
	Approach	4.5	A		13.9	B	
New Hampshire Ave Southbound	L	2.4	A	12	44.1	D	92
	T/R	7.9	A	619	5.8	A	244
	Approach	7.8	A		7.6	A	
Heartfields Drive Westbound	L/T	72.7	E	52	80.7	F	102
	R	68.3	E	23	65.4	E	41
	Approach	71.1	E		73.9	E	
Quaint Acres Drive Eastbound	L/T/R	71.0	E	63	66.1	E	44
Overall Intersection		8.0	A		13.2	B	

Table 3: Synchro Analysis Summary for Adjusted Existing Volumes at a Three-Phased Signal with southbound and northbound lefts having a shared phase

The June 2009 study showed that the overall intersection delay for the current conditions would be 4.8 sec/veh in the AM and 7.6 sec/veh in the PM. These delays are both considered to be at LOS A. This compares to a LOS A in the AM and LOS B in the PM for all three signal phasing strategies for the adjusted volumes.

The approach for SB MD 650 for the current conditions in the previous study had an overall delay of 4.3 sec/veh and 7.0 sec/veh, both LOS A. This compares to slightly higher delays in the adjusted volumes for this study in each case except for the PM volumes with the two-phased signal which goes up to a LOS C when the volumes are adjusted.

The additional left turns from SB MD 650 also causes additional queuing. For the two-phased signal, the NB MD 650 approach has a 95 percentile queue of 524'. For the three-phased signal strategies, the 95 percentile queue for NB traffic extends to 889'. The left turns from NB MD 650 also causes more queuing for the SB MD 650 approach based on the phasing arrangement, by up to 75' when comparing the two-phase option to the three-phase options. The entire queue lengths reported is based from the Synchro report that calculates the queue length as the lane with the highest possible queue in the lane group.

Adjusted Proposed Analysis

The following three tables summarize the Synchro analysis with the additional projected traffic that the police station will generate.

TWO PHASE SIGNAL							
		AM			PM		
		Delay (sec/veh)	LOS	95th Percentile Queue (ft)	Delay (sec/veh)	LOS	95th Percentile Queue (ft)
New Hampshire Ave Northbound	L/U-Turn	46.5	D	40	7.0	A	37
	T/R	2.3	A	118	5.7	A	529
	Approach	3.2	A		5.7	A	
New Hampshire Ave Southbound	L	3.3	A	20	413.1	F	197
	T/R	4.6	A	432	2.8	A	163
	Approach	4.6	A		21.1	C	
Heartfields Drive Westbound	L/T	69.1	E	50	80.7	F	102
	R	66.3	E	23	69.1	E	81
	Approach	68.0	E		75.6	E	
Quaint Acres Drive Eastbound	L/T/R	74.9	E	96	66.1	E	44
Overall Intersection		5.5	A		13.1	B	

Table 4: Synchro Analysis Summary for Adjusted Proposed Volumes at a Two-Phased Signal

THREE PHASE SIGNAL (SBL Protected/Permissive)							
		AM			PM		
		Delay (sec/veh)	LOS	95th Percentile Queue (ft)	Delay (sec/veh)	LOS	95th Percentile Queue (ft)
New Hampshire Ave Northbound	L/U-Turn	49.9	D	42	11.3	B	58
	T/R	5.0	A	190	13.9	B	866
	Approach	5.9	A		13.8	B	
New Hampshire Ave Southbound	L	2.5	A	15	47.5	D	99
	T/R	4.6	A	432	2.8	A	163
	Approach	4.6	A		4.9	A	
Heartfields Drive Westbound	L/T	69.1	E	50	80.7	F	102
	R	66.3	E	23	65.4	E	41
	Approach	68.0	E		73.9	E	
Quaint Acres Drive Eastbound	L/T/R	74.9	E	96	66.1	E	44
Overall Intersection		6.3	A		12.2	B	

Table 5: Synchro Analysis Summary for Adjusted Proposed Volumes at a Three-Phased Signal with southbound lefts having a phase

THREE PHASE SIGNAL (NBL & SBL Protected/Permissive)							
		AM			PM		
		Delay (sec/veh)	LOS	95th Percentile Queue (ft)	Delay (sec/veh)	LOS	95th Percentile Queue (ft)
New Hampshire Ave Northbound	L/U-Turn	12.0	B	16	4.4	A	19
	T/R	4.0	A	174	14.0	B	866
	Approach	4.6	A		13.8	B	
New Hampshire Ave Southbound	L	2.4	A	13	44.9	D	99
	T/R	8.0	A	628	5.9	A	251
	Approach	7.9	A		7.7	A	
Heartfields Drive Westbound	L/T	72.7	E	52	80.7	F	102
	R	68.3	E	23	65.4	E	41
	Approach	71.1	E		73.9	E	
Quaint Acres Drive Eastbound	L/T/R	70.9	E	62	66.1	E	44
Overall Intersection		8.1	A		13.2	B	

Table 6: Synchro Analysis Summary for Adjusted Proposed Volumes at a Three-Phased Signal with southbound and northbound lefts having a shared phase

There is very little difference in the results compared to the adjusted existing conditions. The only change in LOS is for the NB left turns which goes up one letter grade in each scenario in the AM and from a LOS A to LOS B in the PM three-phase scenario where only the SB left turns get an additional phase.

For all scenarios simulated in both the adjusted existing and adjusted proposed, a pedestrian phase crossing MD 650 was not included. It is worth noting that the current pedestrian phase at the signal is approximately 30 seconds. This is between four to eight seconds longer than any of the simulated runs for the Quaint Acres Drive/Heartfields Drive phase. This means that the current queue and delay for MD 650 in both directions at the existing pedestrian signal would be more than a proposed two-phased full signal, if the pedestrian phase was not called. The three-phased signal would result in only a slight increase in delay and queue for the MD 650 thru movements that would need to wait for the opposing left turn phase.

Conclusions

This study was a supplement of the June 2009 traffic signal analysis at the request of SHA to examine the effects of the intersection of MD 650 and Heartfields Drive/Quaint Acres Drive if the median on MD 650 were closed at Milestone Drive.

The previous study showed that a full traffic signal is warranted at the intersection of MD 650 and Heartfields Drive/Quaint Acres Drive based on existing conditions. This study gave further analysis on the effects of a full traffic signal if the MD 650 median were closed at Milestone Drive to prohibit all left turn movements at the current intersection.

This study concluded that the study intersection would still operate under acceptable conditions if a full traffic signal were installed with a median closure on MD 650 at Milestone Drive. However, unless there is clear evidence from existing crash data that the MD 650/Milestone Drive intersection has a safety concern with the left turning traffic from MD 650, our recommendation is not to adjust the MD 650 median at Milestone Drive. There are several reasons for this recommendation:

- 1) The overall LOS for the PM peak hour at Heartfields Drive/Quaint Acres Drive is LOS A for existing conditions and LOS B with the median closure at Milestone Drive. Although an LOS B is still acceptable, this adds additional delay that may not be needed.
- 2) The Quaint Acres neighborhood has only two access points into their community, both from MD 650; Quaint Acres Drive and Milestone Drive. By closing the median on MD 650 at Milestone Drive, all traffic coming from the south on MD 650 will be forced to make a left-turn or u-turn at only one location, Quaint Acres Drive, to get to the community. This is limiting a street network that is already sparse. It also makes access to the church on Milestone Drive more difficult.
- 3) Similarly, the Sherbrooke Woods neighborhood only has two access points from MD 650; Heartfields Drive and Milestone Drive. However, this neighborhood also has access to US 29 via Stewart Lane. Drivers from the north who use Milestone Drive to access Stewart Lane and areas north, would be forced to drive through the neighborhood at Quaint Acres Drive and Sherbrooke Woods Lane with a median closure on MD 650 at Milestone Drive. This is again making a very limited street network more limiting and converting the residential street of Sherbrooke Woods Lane into a street with through traffic.
- 4) Adding a full traffic signal without the median closure at Milestone Drive would allow a signal to be installed that could possibly have just two phases. With a median closure at Milestone Drive, a three-phased signal would likely be needed with the left turns for MD 650 in both directions having a protected phase followed by permissive lefts during the MD 650 thru phase. This added phase increases the average delay of MD 650 thru traffic.

The recommendation based on this study is to install a full traffic signal at MD 650 and Heartfields Drive/Quaint Acres Drive without any adjustments to the MD 650/Milestone Drive intersection. If SHA deems that there is crash data that supports the left turning traffic from MD 650 to Milestone Drive to be a major safety concern, then our recommendation is to only then close the median at this intersection, except for emergency vehicles, and install a three-phased full signal at the study intersection with left turns from both sides of MD 650 being protected/permissive.

APPENDIX

SYNCHRO OUTPUT

AM Peak
Adjusted Existing Volumes

2 phase
2/18/2010

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	10	5	16	5	12	2	16	1302	46	2796
Turn Type	Perm		Perm		Perm	Perm	Perm		Perm	
Protected Phases		4		8				2		6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	2	2	2	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	26.0	26.0	26.0	26.0	26.0	124.0	124.0	124.0	124.0	124.0
Total Split (%)	17.3%	17.3%	17.3%	17.3%	17.3%	82.7%	82.7%	82.7%	82.7%	82.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effect Green (s)		10.3		10.2	10.2		131.3	131.3	131.3	131.3
Actuated g/C Ratio		0.07		0.07	0.07		0.88	0.88	0.88	0.88
v/c Ratio		0.51		0.23	0.11		0.37	0.32	0.18	0.68
Control Delay		76.5		70.5	28.5		26.6	2.4	3.9	5.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		76.5		70.5	28.5		26.6	2.4	3.9	5.0
LOS		E		E	C		C	A	A	A
Approach Delay		76.5		54.9				2.7		5.0
Approach LOS		E		D				A		A

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.68

Intersection Signal Delay: 5.5

Intersection LOS: A

Intersection Capacity Utilization 74.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 3: Quaint Acres Dr & MD 650

			
124 s		26 s	
			
124 s		26 s	

AM Peak
Adjusted Existing Volumes

2 phase
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	10	5	38	16	5	12	2	16	1302	19	46	2796
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.90			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1666			1793	1583		1770	5074		1770	5083
Flt Permitted		0.93			0.75	1.00		0.03	1.00		0.17	1.00
Satd. Flow (perm)		1559			1389	1583		58	5074		316	5083
Peak-hour factor, PHF	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)	11	5	41	17	5	13	2	17	1415	21	50	3039
RTOR Reduction (vph)	0	5	0	0	0	12	0	0	1	0	0	0
Lane Group Flow (vph)	0	52	0	0	22	1	0	19	1435	0	50	3047
Turn Type	Perm			Perm			Perm	Perm	Perm		Perm	
Protected Phases		4			8				2			6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		9.1			9.1	9.1		128.9	128.9		128.9	128.9
Effective Green, g (s)		9.1			9.1	9.1		128.9	128.9		128.9	128.9
Actuated g/C Ratio		0.06			0.06	0.06		0.86	0.86		0.86	0.86
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		95			84	96		50	4360		272	4368
v/s Ratio Prot									0.28			c0.60
v/s Ratio Perm		c0.03			0.02	0.00		0.33			0.16	
v/c Ratio		0.55			0.26	0.01		0.38	0.33		0.18	0.70
Uniform Delay, d1		68.5			67.2	66.2		2.2	2.1		1.8	3.7
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		6.7			1.7	0.0		20.6	0.2		1.5	0.9
Delay (s)		75.2			68.9	66.2		22.8	2.3		3.2	4.6
Level of Service		E			E	E		C	A		A	A
Approach Delay (s)		75.2			67.9				2.5			4.6
Approach LOS		E			E				A			A
Intersection Summary												
HCM Average Control Delay			5.3				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			74.0%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

AM Peak
Adjusted Existing Volumes

2 phase
2/18/2010



Movement	SBR
Lane Configurations	
Volume (vph)	7
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	8
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

PM Peak
Adjusted Existing Volumes

2 phase
2/18/2010

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	5	0	48	0	42	11	36	2889	77	1574
Turn Type	Perm		Perm		Perm	Perm	Perm		Perm	
Protected Phases		4		8				2		6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	2	2	2	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	128.0	128.0	128.0	128.0	128.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	85.3%	85.3%	85.3%	85.3%	85.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effect Green (s)		10.9		11.0	11.0		130.6	130.6	130.6	130.6
Actuated g/C Ratio		0.07		0.07	0.07		0.87	0.87	0.87	0.87
v/c Ratio		0.21		0.51	0.38		0.26	0.73	1.68	0.39
Control Delay		30.2		83.5	67.2		6.3	5.9	392.4	2.9
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		30.2		83.5	67.2		6.3	5.9	392.4	2.9
LOS		C		F	E		A	A	F	A
Approach Delay		30.2		75.8				5.9		21.0
Approach LOS		C		E				A		C

Intersection Summary

Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 130
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.68
 Intersection Signal Delay: 12.6
 Intersection Capacity Utilization 83.3%
 Analysis Period (min) 15

Intersection LOS: B
 ICU Level of Service E

Splits and Phases: 8: Quaint Acres Dr & MD 650



PM Peak
Adjusted Existing Volumes

2 phase
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations									  			  
Volume (vph)	5	0	21	48	0	42	11	36	2889	64	77	1574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.89			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.95	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1642			1770	1583		1770	5069		1770	5081
Flt Permitted		0.93			0.74	1.00		0.12	1.00		0.03	1.00
Satd. Flow (perm)		1546			1377	1583		228	5069		58	5081
Peak-hour factor, PHF	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)	5	0	23	52	0	46	12	39	3140	70	84	1711
RTOR Reduction (vph)	0	21	0	0	0	5	0	0	1	0	0	0
Lane Group Flow (vph)	0	7	0	0	52	41	0	51	3209	0	84	1721
Turn Type	Perm			Perm			Perm	Perm	Perm		Perm	
Protected Phases		4			8				2			6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		9.8			9.8	9.8		128.2	128.2		128.2	128.2
Effective Green, g (s)		9.8			9.8	9.8		128.2	128.2		128.2	128.2
Actuated g/C Ratio		0.07			0.07	0.07		0.85	0.85		0.85	0.85
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		101			90	103		195	4332		50	4343
v/s Ratio Prot									0.63			0.34
v/s Ratio Perm		0.00			0.04	0.03		0.22			0.145	
v/c Ratio		0.06			0.58	0.40		0.26	0.74		1.68	0.40
Uniform Delay, d1		65.8			68.1	67.3		2.0	4.3		10.9	2.4
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.3			8.7	2.6		3.2	1.2		378.0	0.3
Delay (s)		66.1			76.8	69.8		5.3	5.5		388.9	2.7
Level of Service		E			E	E		A	A		F	A
Approach Delay (s)		66.1			73.5				5.5			20.6
Approach LOS		E			E				A			C
Intersection Summary												
HCM Average Control Delay			12.4			HCM Level of Service			B			
HCM Volume to Capacity ratio			1.62									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			83.3%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

PM Peak
Adjusted Existing Volumes

2 phase
2/18/2010

Movement	SBR
Lane Configurations	
Volume (vph)	9
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	10
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

AM Peak
Adjusted Existing Volumes

3 Phase SBL Prot/Perm
2/18/2010

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	10	5	16	5	12	2	16	1302	46	2796
Turn Type	Perm		Perm		Perm	Perm	Perm		pm+pt	
Protected Phases		4		8				2	1	6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	2	2	2	1	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	10.0	22.0
Total Split (s)	23.0	23.0	23.0	23.0	23.0	116.0	116.0	116.0	11.0	127.0
Total Split (%)	15.3%	15.3%	15.3%	15.3%	15.3%	77.3%	77.3%	77.3%	7.3%	84.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag						Lag	Lag	Lag	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	None	C-Min
Act Effect Green (s)		10.2		10.1	10.1		121.5	121.5	130.2	131.4
Actuated g/C Ratio		0.07		0.07	0.07		0.81	0.81	0.87	0.88
v/c Ratio		0.51		0.23	0.11		0.37	0.35	0.16	0.68
Control Delay		75.2		70.5	28.5		32.0	5.3	3.1	5.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		75.2		70.5	28.5		32.0	5.3	3.1	5.0
LOS		E		E	C		C	A	A	A
Approach Delay		75.2		54.9				5.7		4.9
Approach LOS		E		D				A		A

Intersection Summary

Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.68
 Intersection Signal Delay: 6.4
 Intersection Capacity Utilization 74.0%
 Analysis Period (min) 15

Intersection LOS: A

ICU Level of Service D

Splits and Phases: 3: Quaint Acres Dr & MD 650



AM Peak
Adjusted Existing Volumes

3 Phase SBL Prot/Perm
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	10	5	38	16	5	12	2	16	1302	19	46	2796
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.90			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1666			1793	1583		1770	5074		1770	5083
Flt Permitted		0.93			0.75	1.00		0.03	1.00		0.16	1.00
Satd. Flow (perm)		1559			1388	1583		63	5074		289	5083
Peak-hour factor, PHF	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)	11	5	41	17	5	13	2	17	1415	21	50	3039
RTOR Reduction (vph)	0	6	0	0	0	12	0	0	1	0	0	0
Lane Group Flow (vph)	0	51	0	0	22	1	0	19	1435	0	50	3047
Turn Type	Perm			Perm			Perm	Perm	Perm	pm+pt		
Protected Phases		4			8				2		1	6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		9.0			9.0	9.0		118.0	118.0		129.0	129.0
Effective Green, g (s)		9.0			9.0	9.0		118.0	118.0		129.0	129.0
Actuated g/C Ratio		0.06			0.06	0.06		0.79	0.79		0.86	0.86
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		94			83	95		50	3992		298	4371
v/s Ratio Prot									0.28		0.01	c0.60
v/s Ratio Perm		c0.03			0.02	0.00		0.30			0.14	
v/c Ratio		0.55			0.27	0.01		0.38	0.36		0.17	0.70
Uniform Delay, d1		68.5			67.3	66.3		4.9	4.8		2.2	3.7
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		6.4			1.7	0.0		20.6	0.3		0.3	0.9
Delay (s)		74.9			69.1	66.3		25.4	5.0		2.5	4.6
Level of Service		E			E	E		C	A		A	A
Approach Delay (s)		74.9			68.0				5.3			4.6
Approach LOS		E			E				A			A
Intersection Summary												
HCM Average Control Delay			6.1				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)			12.0		
Intersection Capacity Utilization			74.0%				ICU Level of Service			D		
Analysis Period (min)			15									
c Critical Lane Group												

AM Peak
Adjusted Existing Volumes

3 Phase SBL Prot/Perm
2/18/2010

Movement	SBR
Lane Configurations	
Volume (vph)	7
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	8
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

PM Peak
Adjusted Existing Volumes

3 Phase SBL Prot/Perm
2/18/2010



Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔	↔			↔↔↔	↔	↔↔↔
Volume (vph)	5	5	48	5	42	11	36	2889	77	1574
Turn Type	Perm		Perm		Perm	Perm	Perm		pm+pt	
Protected Phases		4		8				2	1	6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	2	2	2	1	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	10.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	113.0	113.0	113.0	15.0	128.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	75.3%	75.3%	75.3%	10.0%	85.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag						Lag	Lag	Lag	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	None	C-Min
Act Effect Green (s)		11.3		11.5	11.5		115.2	115.2	129.0	130.2
Actuated g/C Ratio		0.08		0.08	0.08		0.77	0.77	0.86	0.87
v/c Ratio		0.23		0.55	0.28		0.28	0.82	0.60	0.39
Control Delay		33.9		85.5	20.4		11.7	15.1	43.4	3.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		33.9		85.5	20.4		11.7	15.1	43.4	3.0
LOS		C		F	C		B	B	D	A
Approach Delay		33.9		56.4				15.1		4.9
Approach LOS		C		E				B		A

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 100

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 12.5

Intersection LOS: B

Intersection Capacity Utilization 83.6%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 8: Quaint Acres Dr & MD 650

15 s	113 s	22 s
128 s		22 s

PM Peak
Adjusted Existing Volumes

3 Phase SBL Prot/Perm
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	5	5	21	48	5	42	11	36	2889	64	77	1574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.91			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1675			1781	1583		1770	5069		1770	5081
Flt Permitted		0.94			0.72	1.00		0.13	1.00		0.03	1.00
Satd. Flow (perm)		1592			1343	1583		239	5069		62	5081
Peak-hour factor, PHF	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)	5	5	23	52	5	46	12	39	3140	70	84	1711
RTOR Reduction (vph)	0	21	0	0	0	43	0	0	1	0	0	0
Lane Group Flow (vph)	0	12	0	0	57	3	0	51	3209	0	84	1721
Turn Type	Perm			Perm			Perm	Perm	Perm	pm+pt		
Protected Phases		4			8				2		1	6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		10.2			10.2	10.2		114.0	114.0		127.8	127.8
Effective Green, g (s)		10.2			10.2	10.2		114.0	114.0		127.8	127.8
Actuated g/C Ratio		0.07			0.07	0.07		0.76	0.76		0.85	0.85
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		108			91	108		182	3852		142	4329
v/s Ratio Prot									c0.63		c0.03	0.34
v/s Ratio Perm		0.01			c0.04	0.00		0.21			0.47	
v/c Ratio		0.11			0.63	0.03		0.28	0.83		0.59	0.40
Uniform Delay, d1		65.6			68.0	65.3		5.5	11.8		39.3	2.5
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.4			12.7	0.1		3.8	2.3		6.5	0.3
Delay (s)		66.1			80.7	65.4		9.3	14.0		45.8	2.8
Level of Service		E			F	E		A	B		D	A
Approach Delay (s)		66.1			73.9				14.0			4.8
Approach LOS		E			E				B			A
Intersection Summary												
HCM Average Control Delay			12.3				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)		18.0			
Intersection Capacity Utilization			83.6%				ICU Level of Service		E			
Analysis Period (min)			15									
c Critical Lane Group												

PM Peak
Adjusted Existing Volumes

3 Phase SBL Prot/Perm
2/18/2010

Movement	SBR
Lane Configurations	
Volume (vph)	9
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	10
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

AM Peak
Adjusted Existing Volumes

3 Phase NBL/SBL Prot/Perm

2/18/2010

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	10	5	16	5	12	2	16	1302	46	2796
Turn Type	Perm		Perm		Perm	pm+pt	pm+pt		pm+pt	
Protected Phases		4		8		5	5	2	1	6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	5	5	2	1	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	10.0	10.0	22.0	10.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	10.0	10.0	117.0	11.0	118.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	6.7%	6.7%	78.0%	7.3%	78.7%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag						Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min
Act Effect Green (s)		8.0		8.0	8.0		127.2	123.7	129.0	126.4
Actuated g/C Ratio		0.05		0.05	0.05		0.85	0.82	0.86	0.84
v/c Ratio		0.47		0.30	0.13		0.16	0.34	0.16	0.71
Control Delay		40.3		77.8	30.8		4.9	4.6	2.7	8.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		40.3		77.8	30.8		4.9	4.6	2.7	8.0
LOS		D		E	C		A	A	A	A
Approach Delay		40.3		60.4				4.6		7.9
Approach LOS		D		E				A		A

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 7.6

Intersection LOS: A

Intersection Capacity Utilization 74.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 3: Quaint Acres Dr & MD 650

		
11 s	117 s	22 s
		
10 s	118 s	22 s

AM Peak
Adjusted Existing Volumes

3 Phase NBL/SBL Prot/Perm

2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	10	5	38	16	5	12	2	16	1302	19	46	2796
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.90			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1666			1793	1583		1770	5074		1770	5083
Flt Permitted		0.93			0.74	1.00		0.03	1.00		0.16	1.00
Satd. Flow (perm)		1559			1373	1583		62	5074		302	5083
Peak-hour factor, PHF	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)	11	5	41	17	5	13	2	17	1415	21	50	3039
RTOR Reduction (vph)	0	38	0	0	0	12	0	0	1	0	0	0
Lane Group Flow (vph)	0	19	0	0	22	1	0	19	1435	0	50	3047
Turn Type	Perm			Perm			pm+pt	pm+pt			pm+pt	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		6.9			6.9	6.9		123.6	120.1		126.6	121.6
Effective Green, g (s)		6.9			6.9	6.9		123.6	120.1		126.6	121.6
Actuated g/C Ratio		0.05			0.05	0.05		0.82	0.80		0.84	0.81
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		72			63	73		91	4063		304	4121
v/s Ratio Prot								0.00	0.28		c0.01	c0.60
v/s Ratio Perm		0.01			c0.02	0.00		0.17			0.13	
v/c Ratio		0.26			0.35	0.01		0.21	0.35		0.16	0.74
Uniform Delay, d1		69.1			69.4	68.3		8.7	4.2		2.1	6.7
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		1.9			3.3	0.0		1.1	0.2		0.3	1.2
Delay (s)		71.0			72.7	68.3		9.8	4.4		2.4	7.9
Level of Service		E			E	E		A	A		A	A
Approach Delay (s)		71.0			71.1				4.5			7.8
Approach LOS		E			E				A			A
Intersection Summary												
HCM Average Control Delay			8.0			HCM Level of Service			A			
HCM Volume to Capacity ratio			0.67									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			74.0%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

AM Peak
Adjusted Existing Volumes

3 Phase NBL/SBL Prot/Perm
2/18/2010

Movement	SBR
Lane Configurations	
Volume (vph)	7
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	8
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

PM Peak
Adjusted Existing Volumes

3 Phase NBL/SBL Prot/Perm
2/18/2010

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	5	5	48	5	42	11	36	2889	77	1574
Turn Type	Perm		Perm		Perm	pm+pt	pm+pt		pm+pt	
Protected Phases		4		8		5	5	2	1	6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	5	5	2	1	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	10.0	10.0	22.0	10.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	11.0	11.0	113.0	15.0	117.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	7.3%	7.3%	75.3%	10.0%	78.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag						Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min
Act Effect Green (s)		11.3		11.5	11.5		121.0	115.2	126.2	120.7
Actuated g/C Ratio		0.08		0.08	0.08		0.81	0.77	0.84	0.80
v/c Ratio		0.23		0.55	0.28		0.21	0.82	0.59	0.42
Control Delay		33.9		85.5	20.4		4.7	15.2	43.6	6.2
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		33.9		85.5	20.4		4.7	15.2	43.6	6.2
LOS		C		F	C		A	B	D	A
Approach Delay		33.9		56.4				15.0		7.9
Approach LOS		C		E				B		A

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 100

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 13.5

Intersection LOS: B

Intersection Capacity Utilization 83.6%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 8: Quaint Acres Dr & MD 650

		
ø1	ø2	ø4
15 s	113 s	22 s
		
ø5	ø6	ø8
11 s	117 s	22 s

PM Peak
Adjusted Existing Volumes

3 Phase NBL/SBL Prot/Perm
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations									  			  
Volume (vph)	5	5	21	48	5	42	11	36	2889	64	77	1574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.91			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1675			1781	1583		1770	5069		1770	5081
Flt Permitted		0.94			0.72	1.00		0.12	1.00		0.03	1.00
Satd. Flow (perm)		1592			1343	1583		220	5069		64	5081
Peak-hour factor, PHF	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)	5	5	23	52	5	46	12	39	3140	70	84	1711
RTOR Reduction (vph)	0	21	0	0	0	43	0	0	1	0	0	0
Lane Group Flow (vph)	0	12	0	0	57	3	0	51	3209	0	84	1721
Turn Type	Perm			Perm			pm+pt	pm+pt			pm+pt	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		10.2			10.2	10.2		118.7	114.0		124.9	117.1
Effective Green, g (s)		10.2			10.2	10.2		118.7	114.0		124.9	117.1
Actuated g/C Ratio		0.07			0.07	0.07		0.79	0.76		0.83	0.78
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		108			91	108		223	3852		142	3967
v/s Ratio Prot								0.01	c0.63		c0.03	0.34
v/s Ratio Perm		0.01			c0.04	0.00		0.17			c0.46	
v/c Ratio		0.11			0.63	0.03		0.23	0.83		0.59	0.43
Uniform Delay, d1		65.6			68.0	65.3		3.7	11.8		37.6	5.5
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.4			12.7	0.1		0.5	2.3		6.5	0.3
Delay (s)		66.1			80.7	65.4		4.2	14.0		44.1	5.8
Level of Service		E			F	E		A	B		D	A
Approach Delay (s)		66.1			73.9				13.9			7.6
Approach LOS		E			E				B			A
Intersection Summary												
HCM Average Control Delay			13.2			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)			24.0			
Intersection Capacity Utilization			83.6%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

PM Peak
Adjusted Existing Volumes

3 Phase NBL/SBL Prot/Perm
2/18/2010

Movement	SBR
Lane Configurations	
Volume (vph)	9
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	10
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

AM Peak
Adjusted Existing Volumes

2 phase
2/18/2010

	→	←	↖	↗	↑	↘	↓
Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	57	22	13	19	1436	50	3047
v/c Ratio	0.51	0.23	0.11	0.37	0.32	0.18	0.68
Control Delay	76.5	70.5	28.5	26.6	2.4	3.9	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	76.5	70.5	28.5	26.6	2.4	3.9	5.0
Queue Length 50th (ft)	50	21	0	3	82	7	316
Queue Length 95th (ft)	97	50	23	#51	118	20	432
Internal Link Dist (ft)	310	370			340		467
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	212	185	222	51	4444	278	4452
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	0.27	0.12	0.06	0.37	0.32	0.18	0.68

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

PM Peak
Adjusted Existing Volumes

2 phase
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	28	52	46	51	3210	84	1721
v/c Ratio	0.21	0.51	0.38	0.26	0.73	1.68	0.39
Control Delay	30.2	83.5	67.2	6.3	5.9	392.4	2.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.2	83.5	67.2	6.3	5.9	392.4	2.9
Queue Length 50th (ft)	5	50	39	8	378	~72	112
Queue Length 95th (ft)	38	95	81	26	524	#195	161
Internal Link Dist (ft)	260	268			346		480
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	186	147	173	198	4417	50	4425
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	0.15	0.35	0.27	0.26	0.73	1.68	0.39

Intersection Summary

- ~ 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.

AM Peak
Adjusted Existing Volumes

3 Phase SBL Prot/Perm
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	57	22	13	19	1436	50	3047
v/c Ratio	0.51	0.23	0.11	0.37	0.35	0.16	0.68
Control Delay	75.2	70.5	28.5	32.0	5.3	3.1	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	75.2	70.5	28.5	32.0	5.3	3.1	5.0
Queue Length 50th (ft)	49	21	0	5	143	6	314
Queue Length 95th (ft)	96	50	23	#52	192	15	432
Internal Link Dist (ft)	310	370			340		467
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	182	157	191	51	4112	311	4453
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	0.31	0.14	0.07	0.37	0.35	0.16	0.68

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

PM Peak
Adjusted Existing Volumes

3 Phase SBL Prot/Perm
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	57	46	51	3210	84	1721
v/c Ratio	0.23	0.55	0.28	0.28	0.82	0.60	0.39
Control Delay	33.9	85.5	20.4	11.7	15.1	43.4	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	85.5	20.4	11.7	15.1	43.4	3.0
Queue Length 50th (ft)	9	55	0	14	704	31	117
Queue Length 95th (ft)	44	102	41	43	889	93	163
Internal Link Dist (ft)	260	268			346		480
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	190	143	210	183	3896	158	4409
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	0.17	0.40	0.22	0.28	0.82	0.53	0.39
Intersection Summary							

AM Peak
Adjusted Existing Volumes

3 Phase NBL/SBL Prot/Perm
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	57	22	13	19	1436	50	3047
v/c Ratio	0.47	0.30	0.13	0.16	0.34	0.16	0.71
Control Delay	40.3	77.8	30.8	4.9	4.6	2.7	8.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.3	77.8	30.8	4.9	4.6	2.7	8.0
Queue Length 50th (ft)	16	21	0	2	130	5	490
Queue Length 95th (ft)	63	52	23	6	174	12	619
Internal Link Dist (ft)	310	370			340		467
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	202	146	180	117	4187	320	4285
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	0.28	0.15	0.07	0.16	0.34	0.16	0.71
Intersection Summary							

PM Peak
Adjusted Existing Volumes

3 Phase NBL/SBL Prot/Perm
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	57	46	51	3210	84	1721
v/c Ratio	0.23	0.55	0.28	0.21	0.82	0.59	0.42
Control Delay	33.9	85.5	20.4	4.7	15.2	43.6	6.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	85.5	20.4	4.7	15.2	43.6	6.2
Queue Length 50th (ft)	9	55	0	6	709	31	198
Queue Length 95th (ft)	44	102	41	16	889	92	244
Internal Link Dist (ft)	260	268			346		480
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	190	143	210	238	3894	158	4086
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	0.17	0.40	0.22	0.21	0.82	0.53	0.42
Intersection Summary							

AM Peak
Adjusted Proposed Volumes

2 phase
2/18/2010

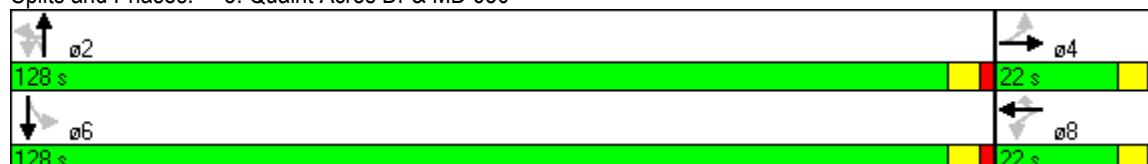
										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	10	5	16	5	12	2	26	1303	47	2796
Turn Type	Perm		Perm		Perm	Perm	Perm		Perm	
Protected Phases		4		8				2		6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	2	2	2	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	128.0	128.0	128.0	128.0	128.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	85.3%	85.3%	85.3%	85.3%	85.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effect Green (s)		10.2		10.1	10.1		131.4	131.4	131.4	131.4
Actuated g/C Ratio		0.07		0.07	0.07		0.88	0.88	0.88	0.88
v/c Ratio		0.51		0.23	0.11		0.59	0.32	0.18	0.68
Control Delay		75.2		70.5	28.5		55.3	2.4	4.0	5.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		75.2		70.5	28.5		55.3	2.4	4.0	5.0
LOS		E		E	C		E	A	A	A
Approach Delay		75.2		54.9				3.5		4.9
Approach LOS		E		D				A		A

Intersection Summary

Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.68
 Intersection Signal Delay: 5.7
 Intersection Capacity Utilization 74.0%
 Analysis Period (min) 15

Intersection LOS: A
 ICU Level of Service D

Splits and Phases: 3: Quaint Acres Dr & MD 650



AM Peak
Adjusted Proposed Volumes

2 phase
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations									  			  
Volume (vph)	10	5	38	16	5	12	2	26	1303	19	47	2796
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.90			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1666			1793	1583		1770	5074		1770	5083
Flt Permitted		0.93			0.75	1.00		0.03	1.00		0.17	1.00
Satd. Flow (perm)		1559			1388	1583		58	5074		316	5083
Peak-hour factor, PHF	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)	11	5	41	17	5	13	2	28	1416	21	51	3039
RTOR Reduction (vph)	0	6	0	0	0	12	0	0	1	0	0	0
Lane Group Flow (vph)	0	51	0	0	22	1	0	30	1436	0	51	3047
Turn Type	Perm			Perm			Perm	Perm	Perm		Perm	
Protected Phases		4			8				2			6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		9.0			9.0	9.0		129.0	129.0		129.0	129.0
Effective Green, g (s)		9.0			9.0	9.0		129.0	129.0		129.0	129.0
Actuated g/C Ratio		0.06			0.06	0.06		0.86	0.86		0.86	0.86
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		94			83	95		50	4364		272	4371
v/s Ratio Prot									0.28			c0.60
v/s Ratio Perm		c0.03			0.02	0.00		0.52			0.16	
v/c Ratio		0.55			0.27	0.01		0.60	0.33		0.19	0.70
Uniform Delay, d1		68.5			67.3	66.3		3.0	2.1		1.8	3.7
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		6.4			1.7	0.0		43.5	0.2		1.5	0.9
Delay (s)		74.9			69.1	66.3		46.5	2.3		3.3	4.6
Level of Service		E			E	E		D	A		A	A
Approach Delay (s)		74.9			68.0				3.2			4.6
Approach LOS		E			E				A			A
Intersection Summary												
HCM Average Control Delay			5.5				HCM Level of Service		A			
HCM Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			74.0%				ICU Level of Service		D			
Analysis Period (min)			15									
c Critical Lane Group												

AM Peak
Adjusted Proposed Volumes

2 phase
2/18/2010



Movement	SBR
Line Configurations	
Volume (vph)	7
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	8
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

PM Peak
Adjusted Proposed Volumes

2 phase
2/18/2010

	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔	↔		↔	↔↔↔	↔	↔↔↔
Volume (vph)	5	5	48	5	42	11	49	2890	78	1574
Turn Type	Perm		Perm		Perm	Perm	Perm		Perm	
Protected Phases		4		8				2		6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	2	2	2	6	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	128.0	128.0	128.0	128.0	128.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	85.3%	85.3%	85.3%	85.3%	85.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effect Green (s)		11.3		11.5	11.5		130.2	130.2	130.2	130.2
Actuated g/C Ratio		0.08		0.08	0.08		0.87	0.87	0.87	0.87
v/c Ratio		0.23		0.55	0.37		0.33	0.73	1.70	0.39
Control Delay		33.9		85.5	65.9		8.1	6.2	400.7	3.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		33.9		85.5	65.9		8.1	6.2	400.7	3.0
LOS		C		F	E		A	A	F	A
Approach Delay		33.9		76.7				6.2		21.7
Approach LOS		C		E				A		C

Intersection Summary

Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 130
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.70
 Intersection Signal Delay: 13.1
 Intersection Capacity Utilization 84.4%
 Analysis Period (min) 15

Intersection LOS: B
 ICU Level of Service E

Splits and Phases: 8: Quaint Acres Dr & MD 650

↑ 2	↑ 4
128 s	22 s
↓ 6	↓ 8
128 s	22 s

PM Peak
Adjusted Proposed Volumes

2 phase
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations									  			  
Volume (vph)	5	5	21	48	5	42	11	49	2890	64	78	1574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.91			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1675			1781	1583		1770	5069		1770	5081
Flt Permitted		0.94			0.72	1.00		0.12	1.00		0.03	1.00
Satd. Flow (perm)		1592			1343	1583		227	5069		58	5081
Peak-hour factor, PHF	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)	5	5	23	52	5	46	12	53	3141	70	85	1711
RTOR Reduction (vph)	0	21	0	0	0	5	0	0	1	0	0	0
Lane Group Flow (vph)	0	12	0	0	57	41	0	65	3210	0	85	1721
Turn Type	Perm			Perm		Perm	Perm	Perm			Perm	
Protected Phases		4			8				2			6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		10.2			10.2	10.2		127.8	127.8		127.8	127.8
Effective Green, g (s)		10.2			10.2	10.2		127.8	127.8		127.8	127.8
Actuated g/C Ratio		0.07			0.07	0.07		0.85	0.85		0.85	0.85
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		108			91	108		193	4319		49	4329
v/s Ratio Prot									0.63			0.34
v/s Ratio Perm		0.01			0.04	0.03		0.29			0.146	
v/c Ratio		0.11			0.63	0.38		0.34	0.74		1.73	0.40
Uniform Delay, d1		65.6			68.0	66.9		2.3	4.5		11.1	2.5
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.4			12.7	2.3		4.7	1.2		402.0	0.3
Delay (s)		66.1			80.7	69.1		7.0	5.7		413.1	2.8
Level of Service		E			F	E		A	A		F	A
Approach Delay (s)		66.1			75.6				5.7			22.1
Approach LOS		E			E				A			C
Intersection Summary												
HCM Average Control Delay			13.1				HCM Level of Service			B		
HCM Volume to Capacity ratio			1.64									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			84.4%				ICU Level of Service		E			
Analysis Period (min)			15									
c Critical Lane Group												

PM Peak
Adjusted Proposed Volumes

2 phase
2/18/2010



Movement	SBR
Lane Configurations	
Volume (vph)	9
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	10
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

AM Peak
Adjusted Proposed Volumes

3 phase SBL Prot/Perm

2/18/2010

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	10	5	16	5	12	2	26	1303	47	2796
Turn Type	Perm		Perm		Perm	Perm	Perm		pm+pt	
Protected Phases		4		8				2	1	6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	2	2	2	1	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	10.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	117.0	117.0	117.0	11.0	128.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	78.0%	78.0%	78.0%	7.3%	85.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag						Lag	Lag	Lag	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	None	C-Min
Act Effect Green (s)		10.2		10.1	10.1		121.6	121.6	130.2	131.4
Actuated g/C Ratio		0.07		0.07	0.07		0.81	0.81	0.87	0.88
v/c Ratio		0.51		0.23	0.11		0.59	0.35	0.16	0.68
Control Delay		75.2		70.5	28.5		59.6	5.3	3.1	5.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		75.2		70.5	28.5		59.6	5.3	3.1	5.0
LOS		E		E	C		E	A	A	A
Approach Delay		75.2		54.9				6.4		4.9
Approach LOS		E		D				A		A

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.68

Intersection Signal Delay: 6.6

Intersection LOS: A

Intersection Capacity Utilization 74.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 3: Quaint Acres Dr & MD 650

		
11 s	117 s	22 s
		
128 s		22 s

AM Peak
Adjusted Proposed Volumes

3 phase SBL Prot/Perm
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Volume (vph)	10	5	38	16	5	12	2	26	1303	19	47	2796
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.90			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1666			1793	1583		1770	5074		1770	5083
Flt Permitted		0.93			0.75	1.00		0.03	1.00		0.15	1.00
Satd. Flow (perm)		1559			1388	1583		63	5074		289	5083
Peak-hour factor, PHF	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)	11	5	41	17	5	13	2	28	1416	21	51	3039
RTOR Reduction (vph)	0	6	0	0	0	12	0	0	1	0	0	0
Lane Group Flow (vph)	0	51	0	0	22	1	0	30	1436	0	51	3047
Turn Type	Perm			Perm			Perm	Perm	Perm	pm+pt		
Protected Phases		4			8				2		1	6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		9.0			9.0	9.0		118.1	118.1		129.0	129.0
Effective Green, g (s)		9.0			9.0	9.0		118.1	118.1		129.0	129.0
Actuated g/C Ratio		0.06			0.06	0.06		0.79	0.79		0.86	0.86
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		94			83	95		50	3995		297	4371
v/s Ratio Prot									0.28		0.01	c0.60
v/s Ratio Perm		c0.03			0.02	0.00		0.48			0.14	
v/c Ratio		0.55			0.27	0.01		0.60	0.36		0.17	0.70
Uniform Delay, d1		68.5			67.3	66.3		6.4	4.7		2.2	3.7
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		6.4			1.7	0.0		43.5	0.3		0.3	0.9
Delay (s)		74.9			69.1	66.3		49.9	5.0		2.5	4.6
Level of Service		E			E	E		D	A		A	A
Approach Delay (s)		74.9			68.0				5.9			4.6
Approach LOS		E			E				A			A
Intersection Summary												
HCM Average Control Delay			6.3				HCM Level of Service			A		
HCM Volume to Capacity ratio			0.69									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)		12.0			
Intersection Capacity Utilization			74.0%				ICU Level of Service		D			
Analysis Period (min)			15									
c Critical Lane Group												

Movement	SBR
Lane Configurations	
Volume (vph)	7
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	8
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

PM Peak
Adjusted Proposed Volumes

3 phase SBL Prot/Perm
2/18/2010

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	5	5	48	5	42	11	49	2890	78	1574
Turn Type	Perm		Perm		Perm	Perm	Perm		pm+pt	
Protected Phases		4		8				2	1	6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	2	2	2	1	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	10.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	114.0	114.0	114.0	14.0	128.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	76.0%	76.0%	76.0%	9.3%	85.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag						Lag	Lag	Lag	Lead	
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	None	C-Min
Act Effect Green (s)		11.3		11.5	11.5		115.4	115.4	129.0	130.2
Actuated g/C Ratio		0.08		0.08	0.08		0.77	0.77	0.86	0.87
v/c Ratio		0.23		0.55	0.28		0.36	0.82	0.61	0.39
Control Delay		33.9		85.5	20.4		13.8	14.9	44.9	3.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		33.9		85.5	20.4		13.8	14.9	44.9	3.0
LOS		C		F	C		B	B	D	A
Approach Delay		33.9		56.4				14.9		4.9
Approach LOS		C		E				B		A

Intersection Summary

Cycle Length: 150
 Actuated Cycle Length: 150
 Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
 Natural Cycle: 100
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.82
 Intersection Signal Delay: 12.4
 Intersection Capacity Utilization 84.4%
 Analysis Period (min) 15

Intersection LOS: B
 ICU Level of Service E

Splits and Phases: 8: Quaint Acres Dr & MD 650

		
ø1	ø2	ø4
14 s	114 s	22 s
		
ø6		ø8
128 s		22 s

PM Peak
Adjusted Proposed Volumes

3 phase SBL Prot/Perm

2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations									  			  
Volume (vph)	5	5	21	48	5	42	11	49	2890	64	78	1574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.91			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1675			1781	1583		1770	5069		1770	5081
Flt Permitted		0.94			0.72	1.00		0.13	1.00		0.03	1.00
Satd. Flow (perm)		1592			1343	1583		239	5069		62	5081
Peak-hour factor, PHF	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)	5	5	23	52	5	46	12	53	3141	70	85	1711
RTOR Reduction (vph)	0	21	0	0	0	43	0	0	1	0	0	0
Lane Group Flow (vph)	0	12	0	0	57	3	0	65	3210	0	85	1721
Turn Type	Perm			Perm			Perm	Perm	Perm	pm+pt		
Protected Phases		4			8				2		1	6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		10.2			10.2	10.2		114.2	114.2		127.8	127.8
Effective Green, g (s)		10.2			10.2	10.2		114.2	114.2		127.8	127.8
Actuated g/C Ratio		0.07			0.07	0.07		0.76	0.76		0.85	0.85
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		108			91	108		182	3859		139	4329
v/s Ratio Prot									c0.63		c0.03	0.34
v/s Ratio Perm		0.01			c0.04	0.00		0.27			0.49	
v/c Ratio		0.11			0.63	0.03		0.36	0.83		0.61	0.40
Uniform Delay, d1		65.6			68.0	65.3		5.9	11.6		39.7	2.5
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.4			12.7	0.1		5.4	2.2		7.7	0.3
Delay (s)		66.1			80.7	65.4		11.3	13.9		47.5	2.8
Level of Service		E			F	E		B	B		D	A
Approach Delay (s)		66.1			73.9				13.8			4.9
Approach LOS		E			E				B			A
Intersection Summary												
HCM Average Control Delay			12.2				HCM Level of Service			B		
HCM Volume to Capacity ratio			0.80									
Actuated Cycle Length (s)			150.0				Sum of lost time (s)		18.0			
Intersection Capacity Utilization			84.4%				ICU Level of Service		E			
Analysis Period (min)			15									
c Critical Lane Group												

Movement	SBR
Lane Configurations	
Volume (vph)	9
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	10
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

AM Peak
Adjusted Proposed Volumes

3 phase NBL&SBL Prot/Perm

2/18/2010

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	10	5	16	5	12	2	26	1303	47	2796
Turn Type	Perm		Perm		Perm	pm+pt	pm+pt		pm+pt	
Protected Phases		4		8		5	5	2	1	6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	5	5	2	1	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	10.0	10.0	22.0	10.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	11.0	11.0	117.0	11.0	117.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	7.3%	7.3%	78.0%	7.3%	78.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag						Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min
Act Effect Green (s)		8.0		8.0	8.0		127.3	123.8	128.9	126.3
Actuated g/C Ratio		0.05		0.05	0.05		0.85	0.83	0.86	0.84
v/c Ratio		0.47		0.30	0.14		0.25	0.34	0.16	0.71
Control Delay		39.3		77.8	30.8		10.5	4.6	2.7	8.1
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		39.3		77.8	30.8		10.5	4.6	2.7	8.1
LOS		D		E	C		B	A	A	A
Approach Delay		39.3		60.4				4.7		8.0
Approach LOS		D		E				A		A

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 90

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.71

Intersection Signal Delay: 7.7

Intersection LOS: A

Intersection Capacity Utilization 74.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 3: Quaint Acres Dr & MD 650

		
11 s	117 s	22 s
		
11 s	117 s	22 s

AM Peak
Adjusted Proposed Volumes

3 phase NBL&SBL Prot/Perm
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations									  			  
Volume (vph)	10	5	38	16	5	12	2	26	1303	19	47	2796
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.90			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1666			1793	1583		1770	5074		1770	5083
Flt Permitted		0.93			0.74	1.00		0.03	1.00		0.16	1.00
Satd. Flow (perm)		1559			1373	1583		62	5074		303	5083
Peak-hour factor, PHF	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)	11	5	41	17	5	13	2	28	1416	21	51	3039
RTOR Reduction (vph)	0	39	0	0	0	12	0	0	1	0	0	0
Lane Group Flow (vph)	0	18	0	0	22	1	0	30	1436	0	51	3047
Turn Type	Perm			Perm			pm+pt	pm+pt			pm+pt	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		6.9			6.9	6.9		123.8	120.1		126.4	121.4
Effective Green, g (s)		6.9			6.9	6.9		123.8	120.1		126.4	121.4
Actuated g/C Ratio		0.05			0.05	0.05		0.83	0.80		0.84	0.81
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		72			63	73		93	4063		304	4114
v/s Ratio Prot								c0.01	0.28		0.01	c0.60
v/s Ratio Perm		0.01			c0.02	0.00		0.26			0.14	
v/c Ratio		0.25			0.35	0.01		0.32	0.35		0.17	0.74
Uniform Delay, d1		69.0			69.4	68.3		10.0	4.2		2.1	6.8
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		1.8			3.3	0.0		2.0	0.2		0.3	1.2
Delay (s)		70.9			72.7	68.3		12.0	4.4		2.4	8.0
Level of Service		E			E	E		B	A		A	A
Approach Delay (s)		70.9			71.1				4.6			7.9
Approach LOS		E			E				A			A
Intersection Summary												
HCM Average Control Delay			8.1			HCM Level of Service			A			
HCM Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)			12.0			
Intersection Capacity Utilization			74.0%			ICU Level of Service			D			
Analysis Period (min)			15									
c Critical Lane Group												

AM Peak
Adjusted Proposed Volumes

3 phase NBL&SBL Prot/Perm
2/18/2010

Movement	SBR
Lane Configurations	
Volume (vph)	7
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	8
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

PM Peak
Adjusted Proposed Volumes

3 phase NBL&SBL Prot/Perm
2/18/2010

										
Lane Group	EBL	EBT	WBL	WBT	WBR	NBU	NBL	NBT	SBL	SBT
Lane Configurations										
Volume (vph)	5	5	48	5	42	11	49	2890	78	1574
Turn Type	Perm		Perm		Perm	pm+pt	pm+pt		pm+pt	
Protected Phases		4		8		5	5	2	1	6
Permitted Phases	4		8		8	2	2		6	
Detector Phase	4	4	8	8	8	5	5	2	1	6
Switch Phase										
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	22.0	22.0	22.0	22.0	22.0	10.0	10.0	22.0	10.0	22.0
Total Split (s)	22.0	22.0	22.0	22.0	22.0	12.0	12.0	114.0	14.0	116.0
Total Split (%)	14.7%	14.7%	14.7%	14.7%	14.7%	8.0%	8.0%	76.0%	9.3%	77.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	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
Lead/Lag						Lead	Lead	Lag	Lead	Lag
Lead-Lag Optimize?						Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	C-Min	None	C-Min
Act Effect Green (s)		11.3		11.5	11.5		121.4	115.3	125.7	120.3
Actuated g/C Ratio		0.08		0.08	0.08		0.81	0.77	0.84	0.80
v/c Ratio		0.23		0.55	0.28		0.27	0.82	0.61	0.42
Control Delay		33.9		85.5	20.4		5.3	15.0	45.5	6.3
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		33.9		85.5	20.4		5.3	15.0	45.5	6.3
LOS		C		F	C		A	B	D	A
Approach Delay		33.9		56.4				14.8		8.2
Approach LOS		C		E				B		A

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green

Natural Cycle: 100

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.82

Intersection Signal Delay: 13.5

Intersection LOS: B

Intersection Capacity Utilization 84.4%

ICU Level of Service E

Analysis Period (min) 15

Splits and Phases: 8: Quaint Acres Dr & MD 650

		
ø1	ø2	ø4
14 s	114 s	22 s
		
ø5	ø6	ø8
12 s	116 s	22 s

PM Peak
Adjusted Proposed Volumes

3 phase NBL&SBL Prot/Perm
2/18/2010

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBL	SBT
Lane Configurations									  			  
Volume (vph)	5	5	21	48	5	42	11	49	2890	64	78	1574
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Lane Util. Factor		1.00			1.00	1.00		1.00	0.91		1.00	0.91
Frt		0.91			1.00	0.85		1.00	1.00		1.00	1.00
Flt Protected		0.99			0.96	1.00		0.95	1.00		0.95	1.00
Satd. Flow (prot)		1675			1781	1583		1770	5069		1770	5081
Flt Permitted		0.94			0.72	1.00		0.12	1.00		0.03	1.00
Satd. Flow (perm)		1592			1343	1583		219	5069		64	5081
Peak-hour factor, PHF	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)	5	5	23	52	5	46	12	53	3141	70	85	1711
RTOR Reduction (vph)	0	21	0	0	0	43	0	0	1	0	0	0
Lane Group Flow (vph)	0	12	0	0	57	3	0	65	3210	0	85	1721
Turn Type	Perm			Perm			pm+pt	pm+pt			pm+pt	
Protected Phases		4			8		5	5	2		1	6
Permitted Phases	4			8		8	2	2			6	
Actuated Green, G (s)		10.2			10.2	10.2		119.1	114.1		124.5	116.8
Effective Green, g (s)		10.2			10.2	10.2		119.1	114.1		124.5	116.8
Actuated g/C Ratio		0.07			0.07	0.07		0.79	0.76		0.83	0.78
Clearance Time (s)		6.0			6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0	3.0		3.0	3.0
Lane Grp Cap (vph)		108			91	108		226	3856		141	3956
v/s Ratio Prot								0.01	c0.63		c0.03	0.34
v/s Ratio Perm		0.01			c0.04	0.00		0.22			c0.47	
v/c Ratio		0.11			0.63	0.03		0.29	0.83		0.60	0.43
Uniform Delay, d1		65.6			68.0	65.3		3.7	11.7		37.8	5.6
Progression Factor		1.00			1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2		0.4			12.7	0.1		0.7	2.3		7.1	0.3
Delay (s)		66.1			80.7	65.4		4.4	14.0		44.9	5.9
Level of Service		E			F	E		A	B		D	A
Approach Delay (s)		66.1			73.9				13.8			7.7
Approach LOS		E			E				B			A
Intersection Summary												
HCM Average Control Delay			13.2			HCM Level of Service			B			
HCM Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)			24.0			
Intersection Capacity Utilization			84.4%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

Movement	SBR
Lane Configurations	
Volume (vph)	9
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.92
Adj. Flow (vph)	10
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

AM Peak
Adjusted Proposed Volumes

2 phase
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	57	22	13	30	1437	51	3047
v/c Ratio	0.51	0.23	0.11	0.59	0.32	0.18	0.68
Control Delay	75.2	70.5	28.5	55.3	2.4	4.0	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	75.2	70.5	28.5	55.3	2.4	4.0	5.0
Queue Length 50th (ft)	49	21	0	7	82	7	314
Queue Length 95th (ft)	96	50	23	#40	118	20	432
Internal Link Dist (ft)	310	370			340		467
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	172	148	180	51	4445	278	4453
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	0.33	0.15	0.07	0.59	0.32	0.18	0.68

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

PM Peak
Adjusted Proposed Volumes

2 phase
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	57	46	65	3211	85	1721
v/c Ratio	0.23	0.55	0.37	0.33	0.73	1.70	0.39
Control Delay	33.9	85.5	65.9	8.1	6.2	400.7	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	85.5	65.9	8.1	6.2	400.7	3.0
Queue Length 50th (ft)	9	55	39	11	393	~75	117
Queue Length 95th (ft)	44	102	81	37	529	#197	163
Internal Link Dist (ft)	260	268			346		480
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	190	143	173	197	4401	50	4409
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	0.17	0.40	0.27	0.33	0.73	1.70	0.39

Intersection Summary

- ~ 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.

AM Peak
Adjusted Proposed Volumes

3 phase SBL Prot/Perm
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	57	22	13	30	1437	51	3047
v/c Ratio	0.51	0.23	0.11	0.59	0.35	0.16	0.68
Control Delay	75.2	70.5	28.5	59.6	5.3	3.1	5.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	75.2	70.5	28.5	59.6	5.3	3.1	5.0
Queue Length 50th (ft)	49	21	0	11	144	6	314
Queue Length 95th (ft)	96	50	23	#42	190	15	432
Internal Link Dist (ft)	310	370			340		467
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	172	148	180	51	4115	310	4453
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	0.33	0.15	0.07	0.59	0.35	0.16	0.68

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

PM Peak
Adjusted Proposed Volumes

3 phase SBL Prot/Perm
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	57	46	65	3211	85	1721
v/c Ratio	0.23	0.55	0.28	0.36	0.82	0.61	0.39
Control Delay	33.9	85.5	20.4	13.8	14.9	44.9	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	85.5	20.4	13.8	14.9	44.9	3.0
Queue Length 50th (ft)	9	55	0	20	707	32	117
Queue Length 95th (ft)	44	102	41	58	866	#99	163
Internal Link Dist (ft)	260	268			346		480
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	190	143	210	183	3901	149	4409
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	0.17	0.40	0.22	0.36	0.82	0.57	0.39

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

AM Peak
Adjusted Proposed Volumes

3 phase NBL&SBL Prot/Perm
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	57	22	13	30	1437	51	3047
v/c Ratio	0.47	0.30	0.14	0.25	0.34	0.16	0.71
Control Delay	39.3	77.8	30.8	10.5	4.6	2.7	8.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.3	77.8	30.8	10.5	4.6	2.7	8.1
Queue Length 50th (ft)	15	21	0	3	130	5	492
Queue Length 95th (ft)	62	52	23	16	174	13	628
Internal Link Dist (ft)	310	370			340		467
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	203	146	180	119	4188	319	4281
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	0.28	0.15	0.07	0.25	0.34	0.16	0.71
Intersection Summary							

PM Peak
Adjusted Proposed Volumes

3 phase NBL&SBL Prot/Perm
2/19/2010



Lane Group	EBT	WBT	WBR	NBL	NBT	SBL	SBT
Lane Group Flow (vph)	33	57	46	65	3211	85	1721
v/c Ratio	0.23	0.55	0.28	0.27	0.82	0.61	0.42
Control Delay	33.9	85.5	20.4	5.3	15.0	45.5	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	85.5	20.4	5.3	15.0	45.5	6.3
Queue Length 50th (ft)	9	55	0	8	712	32	199
Queue Length 95th (ft)	44	102	41	19	866	#99	251
Internal Link Dist (ft)	260	268			346		480
Turn Bay Length (ft)				250		250	
Base Capacity (vph)	190	143	210	243	3898	150	4076
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	0.17	0.40	0.22	0.27	0.82	0.57	0.42

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.