KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING
1850 Centennial Park Drive, Suite 130, Reston, Virginia 20191 P 703-885-8970 F 703-885-8971

MEMORANDUM

Date: December 18, 2013 Project #: 11764.31

To: Amir Salahshoor, PE
VDOT Northern Region
4975 Alliance Drive
Fairfax, Virginia 22030

From: Chris Tiesler, PE & Xavier Harmony

Project: Braddock Road/Pleasant Valley Road RFP Design

Subject: Sensitivity Analysis

Kittelson & Associates, Inc. (KAI) has prepared this memorandum in response to a request by the Virginia Department of Transportation (VDOT) to assess citizen concerns regarding potential downstream capacity effects of the proposed roundabout at the Braddock Road/Pleasant Valley Road intersection in Fairfax County, Virginia. As documented below, the proposed roundabout is not anticipated to adversely impact downstream intersections.

EXECUTIVE SUMMARY

This sensitivity analysis was conducted to address citizen concerns regarding potential impacts of the proposed roundabout at adjacent intersections. The primary concern was that by improving traffic operations at the Braddock Road/Pleasant Valley Road intersection itself, adjacent intersections would experience adverse effects due to improved traffic flow away (or downstream) from the roundabout, making it more difficult to access Braddock Road or Pleasant Valley Road from a side street. Key findings are summarized below.

- Converting the intersection from all-way stop control to a roundabout will have no discernable or adverse impact to adjacent intersections. This conclusion is supported by traffic engineering theory and confirmed through the results of the sensitivity analysis.
    - Previous analyses indicate that a single-lane roundabout could increase the overall peak hour capacity of this intersection by as much as 20 percent. The exact increase is difficult to measure/estimate because demand varies by approach and is subject to the randomness of turning movement patterns, but the overall capacity increase is ultimately limited to 20 percent by the overall number of travel lanes at the intersection (a single-lane roundabout).

- The sensitivity analysis contained herein tested the effects of increased capacity at adjacent intersections (assumed both a 10 percent and 20 percent increase in basic capacity and throughput) that could theoretically result from converting the intersection to a single-lane roundabout. The results show a 20 percent increase would only increase average control delay at adjacent intersections (average time a person waits at a stop sign or a traffic signal) between 0.1 and 4.5 seconds during peak periods. Therefore, the capacity of downstream intersections will not be adversely affected by the proposed roundabout.

BACKGROUND

VDOT is currently preparing Request for Proposal (RFP) plans for a new roundabout at the Braddock Road/Pleasant Valley Road intersection to replace the existing all-way stop controlled intersection. Current directional peak hour volume patterns place a disproportionate amount of demand on the eastbound (weekday a.m.), southbound (weekday a.m. and p.m.), and westbound (weekday p.m.) approaches, which result in long delays and extensive queuing on certain approaches. After a thorough alternatives analysis of several potential intersection control forms, a single-lane roundabout was selected as the preferred alternative to be carried forward based on its performance across a wide range of criteria including traffic operations, safety, cost, and minimizing impacts to right-of-way and the physical/natural/built environment.

PLATOON DISPERSION THEORY

Traffic signals can produce platoons of vehicles departing an intersection, but typically disperse by the time they reach a point about 0.6 miles downstream of the signal[1]. Patterns of vehicles departing an unsignalized intersection (all-way stop control, roundabout) are inherently random and subject to factors such as demand for individual movements, driver behavior/aggressiveness, and the nature of the intersection control form itself. Chapter 16 of the 2010 *Highway Capacity Manual* provides further insight into determining when an individual intersection is considered to operate in isolation of upstream intersections, noting that "a segment or intersection is sufficiently distant from the nearest upstream signal if an intermediate intersection uses stop or yield control to regulate through traffic on the facility[2]."

In other words, the fact that the Braddock Road/Pleasant Valley Road intersection itself is unsignalized (stop or yield controlled) means that adjacent intersections are considered to be isolated. Such intersections experience negligible influence from an upstream intersection and arrivals are effectively random and without discernible platoon patterns.

[1] Transportation Research Board. *Highway Capacity Manual.* Chapter 17: Urban Street Segments, page 17-6. 2010.

[2] Transportation Research Board. *Highway Capacity Manual.* Chapter 16: Urban Street Facilities, page 16-6. 2010.

OPERATIONAL ANALYSIS

To further corroborate the documented research and guidance noted above, KAI conducted a sensitivity analysis of traffic operations at several downstream intersections of significance. Previous analyses indicate that a single-lane roundabout will substantially increase the overall peak hour capacity of the intersection. While the exact increase is difficult to measure/estimate because demand varies by approach and is subject to the randomness of turning movement patterns, overall capacity/throughput may increase by as much as 10 to 20 percent where demand is highest. Conversion of the intersection control from all-way stop control to a single-lane roundabout will incrementally increase departure rates from the intersection and result in additional vehicles reaching these downstream intersections during peak periods.

VDOT provided Synchro 8 files and the most recently-available turning movement counts at downstream intersections where this phenomenon would most likely have an impact. Peak hour operational analyses were conducted at the following locations and time periods based on the predominant traffic flows. Distances and directions from the Braddock Road/Pleasant Valley Road intersection are noted in parentheses.

Weekday a.m. peak hour:

- Pleasant Valley Road/Martins Hundred Road (2.57 miles south)
- Pleasant Valley Road/US Route 29 (4.10 miles south)
- Braddock Road/Pleasant Forest Drive (0.28 miles east)
- Braddock Road/Sully Park Drive (2.00 miles east)

Weekday p.m. peak hour:

- Pleasant Valley Road/Martins Hundred Road (2.57 miles south)
- Pleasant Valley Road/US Route 29 (4.10 miles south)
- Braddock Road/Ticonderoga Road/Loudoun County Parkway (2.39 miles west)

Note that the Pleasant Valley Road/US Route 50 intersection was not evaluated because of on-going construction and the lower levels of traffic departing from the Braddock Road/Pleasant Valley Road intersection toward this particular intersection during the peak periods evaluated.

Sensitivity Analysis

Baseline traffic operations (existing conditions) were established at each identified location and time period and evaluated in Synchro 8. Current departure rates from the Braddock Road/Pleasant Valley Road intersection were then grown by 10 and 20 percent to conduct a sensitivity analysis and model the impact to downstream intersection traffic operations related to the conversion from all-way stop control to a single-lane roundabout.

Additional volumes were assigned proportionally according to the current turning movement distribution patterns at downstream intersections. *Attachment "A" contains the demand calculations for increased throughput.* Table 1 summarizes the operational analysis results across the three scenarios for comparison purposes.

Table 1 Traffic Operational Results – Sensitivity Analysis

Intersection	Peak Hour	Existing Conditions (Baseline)						10% Departure Rate Increase						20% Departure Rate Increase					
		Volume Departing from B/PV	Average Vehicle/Minute	CM[1]	LOS[2]	Delay (sec)	V/C[3]	Volume Departing from B/PV (# veh added)	Average Vehicle/Minute (# veh/min added)	CM[1]	LOS[2]	Delay (sec)	V/C[3]	Volume Departing from B/PV (# veh added)	Average Vehicle/Minute (# veh/min added)	CM[1]	LOS[2]	Delay (sec)	V/C[3]
Pleasant Valley Road/ US Route 29	AM	207	3.5	--	D	40.3	0.73	228 (+21)	3.8 (+0.3)	--	D	40.5	0.73	248 (+41)	4.1 (+0.6)	--	D	40.8	0.73
Pleasant Valley Road/ Martins Hundred Road				EB	B	14.8	0.03			EB	B	14.9	0.03			EB	C	15.1	0.03
Braddock Road/ Pleasant Forest Drive		861	14.4	NB	C	19.9	0.10	947 (+86)	15.8 (+1.4)	NB	C	22.0	0.12	1,033 (+172)	17.2 (+2.8)	NB	C	24.4	0.13
Braddock Road/ Sully Park Drive				--	B	18.0	0.58			--	B	18.0	0.58			--	B	18.1	0.58
Pleasant Valley Road/ US Route 29	PM	456	7.6	--	D	44.6	0.65	502 (+46)	8.4 (+0.8)	--	D	45.1	0.65	547 (+91)	9.1 (+1.5)	--	D	45.6	0.66
Pleasant Valley Road/ Martins Hundred Road				EB	C	18.6	0.02			EB	C	19.1	0.02			EB	C	19.6	0.02
Braddock Road/ Pleasant Forest Drive		343	5.7	NB	B	11.8	0.03	377 (+34)	6.3 (+0.6)	NB	B	12.2	0.03	412 (+69)	6.9 (+1.2)	NB	B	12.5	0.03
Braddock Road/ Ticonderoga Road/ Loudoun County Parkway		558	9.3	--	C	25.5	0.55	614 (+56)	10.2 (+0.9)	--	C	25.7	0.56	670 (+112)	11.2 (+1.9)	--	C	25.8	0.57

EB - Eastbound Approach; NB – Northbound Approach
B/PV – Braddock Road/Pleasant Valley Road
[1] Critical Movement/Approach of two-way stop-controlled intersection
[2] Level of Service
[3] Volume-to-Capacity Ratio

Note: Reported LOS, Delay, and V/C ratios at signalized intersections are for the overall intersection; at unsignalized (stop-controlled) intersections, these measures represent only the critical stop-controlled approach with the highest delay (uncontrolled movements have no delay).

Level of Service (LOS): A concept developed to quantify the degree of comfort (including such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles) afforded to drivers as they travel through an intersection or roadway segment. Six grades are used to denote the various level of service from “A” to “F”.

Volume-to-Capacity (V/C) Ratio: The ratio of traffic volume to the capacity of an intersection or individual movement.

As shown in Table 1, each intersection/critical movement operates at Level of Service (LOS) D or better under all scenarios and time periods. The sensitivity analysis demonstrates that even a 20 percent increase in departure rates from the Braddock Road/Pleasant Valley Road intersection will have a limited effect on downstream intersections during peak periods. Effects of a 20 percent increase in departure rate at each downstream intersection are summarized below. *Attachment "B" contains the Synchro 8 operational worksheets for all scenarios.*

Pleasant Valley Road/US 29 (AM & PM)

- During the weekday a.m. peak hour, a 20 percent increase in departure rate would add 41 additional vehicles to the southbound approach (less than one vehicle per minute) and 0.5 seconds of average control delay to the intersection.
- During the weekday p.m. peak hour, a 20 percent increase in departure rate would add 91 additional vehicles to the southbound approach (1.5 vehicles per minute) and 1.0 seconds of average control delay to the intersection.

Pleasant Valley Road/Martins Hundred Road (AM & PM)

- During the weekday a.m. peak hour, a 20 percent increase in departure rate would add 41 additional vehicles to the southbound approach (less than one vehicle per minute). The average driver waiting to make an eastbound turn from Martins Hundred Road onto Pleasant Valley Road would have to wait an additional 0.3 seconds.
- During the weekday p.m. peak hour, a 20 percent increase in departure rate would add 91 additional vehicles to the southbound approach (1.5 vehicles per minute). The average driver waiting to make an eastbound turn from Martins Hundred Road onto Pleasant Valley Road would have to wait an additional 1.0 seconds.

Braddock Road/Pleasant Forest Drive (AM & PM)

- During the weekday a.m. peak hour, a 20 percent increase in departure rate would add 172 additional vehicles to the eastbound approach (2.8 vehicles per minute). The average driver waiting to make an northbound turn from Pleasant Forest Drive onto Braddock Road would have to wait an additional 4.5 seconds.
- During the weekday p.m. peak hour, a 20 percent increase in departure rate would add 69 additional vehicles to the eastbound approach (1.5 vehicles per minute). The average driver waiting to make an northbound turn from Pleasant Forest Drive onto Braddock Road would have to wait an additional 0.7 seconds.

Braddock Road/Sully Park Drive (AM only)

- During the weekday a.m. peak hour, a 20 percent increase in departure rate would add 172 additional vehicles to the eastbound approach (2.8 vehicles per minute) and 0.1 seconds of average control delay to the intersection.

Braddock Road/Ticonderoga Road /Loudoun County Parkway (PM only)

- During the weekday p.m. peak hour, a 20 percent increase in departure rate would add 112 additional vehicles to the westbound approach (1.9 vehicles per minute) and 0.3 seconds of average control delay to the intersection.

CONCLUSION

The proposed single-lane roundabout at the Braddock Road/Pleasant Valley Road intersection will not adversely impact downstream intersections. A sensitivity analysis at downstream adjacent intersection demonstrates that even a 20 percent increase in departure rates from the Braddock Road/Pleasant Valley Road intersection is only expected to increase average control delay at downstream intersections between 0.1 and 4.5 seconds during peak periods. All of the downstream intersections are forecast to operate below capacity and Level of Service D or better.

We trust this memorandum addresses citizen concerns regarding potential downstream capacity effects of the proposed roundabout at the Braddock Road/Pleasant Valley Road intersection. Please contact us at (703) 885-8970 with any questions.

ATTACHMENTS

Attachment “A” – Demand Calculations

Attachment “B” – Synchro 8 Operational Worksheets

Attachment A

Demand Calculations

Time of Day	Direction	Volume	+10%	+20%
AM Peak Hour	Eastbound	861	86	172
	Westbound	202	20	40
	Northbound	282	28	56
	Southbound	207	21	41
PM Peak Hour	Eastbound	343	34	69
	Westbound	558	56	112
	Northbound	195	20	39
	Southbound	456	46	91

New Intersections Trips Distributed

Time of Day	Intersection	Direction	Movement	Distribution	+10%	+20%
AM Peak Hour	Pleasant Valley Road & Rt 29*	Southbound	Left	71.2%	14	26
			Right	2.4%	0	1
			Through	26.5%	5	9
	Pleasant Valley Road & Martins Hundred Rd	Southbound	Left	11.5%	2	5
			Right	88.5%	19	36
			Through	0.0%	0	0
	Braddock Rd & Pleasant Forest Dr	Eastbound	Left	0.0%	0	0
			Right	99.2%	85	171
			Through	0.8%	1	1
	Braddock Road & Sully Park Drive*	Eastbound	Left	1.2%	11	22
			Right	19.8%	55	111
			Through	79.0%	19	38
PM Peak Hour	Pleasant Valley Road & Rt 29*	Southbound	Left	56.0%	25	49
			Right	0.8%	0	1
			Through	43.3%	20	38
	Pleasant Valley Road & Martins Hundred Rd	Southbound	Left	2.8%	1	3
			Right	96.9%	45	88
			Through	0.2%	0	0
	Braddock Rd & Pleasant Forest Dr	Eastbound	Left	0.0%	0	0
			Right	97.4%	33	67
			Through	2.6%	1	2
	Braddock Road & Ticonderoga Rd	Westbound	Left	11.4%	6	13
			Right	56.3%	32	63
			Through	32.3%	18	36

**Volumes at this intersection are calculated from the through volumes from the upstream intersection.*

Attachment B

Synchro 8 Operational Worksheets

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	1	2	47	0	40	0	357	68	30	231	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	1	2	47	0	40	0	357	68	30	231	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	688	716	231	650	648	357	231			425		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	688	716	231	650	648	357	231			425		
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 %	98	100	100	87	100	94	100			97		
cM capacity (veh/h)	333	346	808	373	379	687	1337			1134		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	10	87	0	357	68	30	231
Volume Left	7	47	0	0	0	30	0
Volume Right	2	40	0	0	68	0	0
cSH	379	472	1700	1700	1700	1134	1700
Volume to Capacity	0.03	0.18	0.00	0.21	0.04	0.03	0.14
Queue Length 95th (ft)	2	17	0	0	0	2	0
Control Delay (s)	14.8	14.3	0.0	0.0	0.0	8.3	0.0
Lane LOS	B	B				A	
Approach Delay (s)	14.8	14.3	0.0			0.9	
Approach LOS	B	B					

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	37.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	854	7	3	200	20	8
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	854	7	3	200	20	8
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			861		1064	858
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			861		1064	858
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		92	98
cM capacity (veh/h)			781		246	357

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	861	203	28
Volume Left	0	3	20
Volume Right	7	0	8
cSH	1700	781	270
Volume to Capacity	0.51	0.00	0.10
Queue Length 95th (ft)	0	0	9
Control Delay (s)	0.0	0.2	19.9
Lane LOS		A	C
Approach Delay (s)	0.0	0.2	19.9
Approach LOS			C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	55.4%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	396	1210	28	68	270	268	4	22	54	484	16	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			2%			0%			0%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1724	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1724	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	396	1210	28	68	270	268	4	22	54	484	16	180
RTOR Reduction (vph)	0	0	15	0	0	198	0	0	48	0	0	90
Lane Group Flow (vph)	396	1210	13	68	270	70	4	22	6	252	248	90
Heavy Vehicles (%)	0%	2%	2%	2%	2%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2		3	3	5	4	4	1
Permitted Phases			6			2			3			4
Actuated Green, G (s)	40.3	65.5	65.5	10.7	35.9	35.9	5.9	5.9	16.6	28.6	28.6	68.9
Effective Green, g (s)	40.3	65.5	65.5	10.7	35.9	35.9	5.9	5.9	16.6	28.6	28.6	68.9
Actuated g/C Ratio	0.29	0.47	0.47	0.08	0.26	0.26	0.04	0.04	0.12	0.21	0.21	0.50
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Vehicle Extension (s)	3.5	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.5
Lane Grp Cap (vph)	526	1677	750	135	910	415	75	81	190	354	356	805
v/s Ratio Prot	c0.22	c0.34		0.04	0.08		0.00	c0.01	0.00	c0.15	0.14	0.03
v/s Ratio Perm			0.01			0.04			0.00			0.02
v/c Ratio	0.75	0.72	0.02	0.50	0.30	0.17	0.05	0.27	0.03	0.71	0.70	0.11
Uniform Delay, d1	44.4	29.1	19.3	61.2	41.0	39.6	63.5	64.1	53.7	51.0	50.8	18.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.2	1.9	0.0	2.9	0.4	0.4	0.3	1.8	0.1	6.6	5.8	0.1
Delay (s)	50.6	31.0	19.3	64.1	41.4	40.0	63.8	65.9	53.8	57.6	56.6	18.5
Level of Service	D	C	B	E	D	D	E	E	D	E	E	B
Approach Delay (s)		35.5			43.3			57.6			46.9	
Approach LOS		D			D			E			D	

Intersection Summary			
HCM 2000 Control Delay	40.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	138.2	Sum of lost time (s)	27.5
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	91	472	162	89	418	9	152	78	70	4	64	256
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			-1%			0%			0%	
Total Lost time (s)	6.5	6.5		6.5	6.5	6.5		7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.96		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00		1.00	1.00
Satd. Flow (prot)	1770	3404		1778	1872	1591		1803	1583		1857	1583
Flt Permitted	0.40	1.00		0.36	1.00	1.00		0.76	1.00		0.97	1.00
Satd. Flow (perm)	745	3404		677	1872	1591		1415	1583		1815	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	91	472	162	89	418	9	152	78	70	4	64	256
RTOR Reduction (vph)	0	32	0	0	0	6	0	0	53	0	0	195
Lane Group Flow (vph)	91	602	0	89	418	3	0	230	17	0	68	61
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2		2	4		4	8		8
Actuated Green, G (s)	29.6	24.5		30.0	24.7	24.7		15.5	15.5		15.5	15.5
Effective Green, g (s)	29.6	24.5		30.0	24.7	24.7		15.5	15.5		15.5	15.5
Actuated g/C Ratio	0.45	0.38		0.46	0.38	0.38		0.24	0.24		0.24	0.24
Clearance Time (s)	6.5	6.5		6.5	6.5	6.5		7.0	7.0		7.0	7.0
Vehicle Extension (s)	2.0	4.0		2.0	4.0	4.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)	417	1277		400	708	601		335	375		430	375
v/s Ratio Prot	0.02	0.18		c0.02	c0.22							
v/s Ratio Perm	0.08			0.08		0.00		c0.16	0.01		0.04	0.04
v/c Ratio	0.22	0.47		0.22	0.59	0.01		0.69	0.04		0.16	0.16
Uniform Delay, d1	10.6	15.5		10.1	16.3	12.6		22.7	19.2		19.7	19.7
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.4		0.1	1.5	0.0		4.6	0.0		0.1	0.1
Delay (s)	10.6	15.9		10.2	17.8	12.7		27.3	19.2		19.8	19.8
Level of Service	B	B		B	B	B		C	B		B	B
Approach Delay (s)		15.2			16.4			25.4			19.8	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM 2000 Control Delay	18.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	65.3	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	1	2	47	0	40	0	357	68	32	250	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	1	2	47	0	40	0	357	68	32	250	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	711	739	250	674	671	357	250			425		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	711	739	250	674	671	357	250			425		
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 %	98	100	100	87	100	94	100			97		
cM capacity (veh/h)	321	335	789	359	367	687	1316			1134		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	10	87	0	357	68	32	250
Volume Left	7	47	0	0	0	32	0
Volume Right	2	40	0	0	68	0	0
cSH	366	460	1700	1700	1700	1134	1700
Volume to Capacity	0.03	0.19	0.00	0.21	0.04	0.03	0.15
Queue Length 95th (ft)	2	17	0	0	0	2	0
Control Delay (s)	15.1	14.6	0.0	0.0	0.0	8.3	0.0
Lane LOS	C	B				A	
Approach Delay (s)	15.1	14.6	0.0			0.9	
Approach LOS	C	B					

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	37.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	939	8	3	200	20	8
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	939	8	3	200	20	8
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			947		1149	943
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			947		1149	943
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		91	97
cM capacity (veh/h)			725		219	318

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	947	203	28
Volume Left	0	3	20
Volume Right	8	0	8
cSH	1700	725	240
Volume to Capacity	0.56	0.00	0.12
Queue Length 95th (ft)	0	0	10
Control Delay (s)	0.0	0.2	22.0
Lane LOS		A	C
Approach Delay (s)	0.0	0.2	22.0
Approach LOS			C

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	396	1210	28	68	270	268	4	22	54	498	16	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			2%			0%			0%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1724	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1724	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	396	1210	28	68	270	268	4	22	54	498	16	185
RTOR Reduction (vph)	0	0	15	0	0	199	0	0	48	0	0	92
Lane Group Flow (vph)	396	1210	13	68	270	69	4	22	6	259	255	93
Heavy Vehicles (%)	0%	2%	2%	2%	2%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2		3	3	5	4	4	1
Permitted Phases			6			2			3			4
Actuated Green, G (s)	40.2	65.3	65.3	10.7	35.8	35.8	5.9	5.9	16.6	29.8	29.8	70.0
Effective Green, g (s)	40.2	65.3	65.3	10.7	35.8	35.8	5.9	5.9	16.6	29.8	29.8	70.0
Actuated g/C Ratio	0.29	0.47	0.47	0.08	0.26	0.26	0.04	0.04	0.12	0.21	0.21	0.50
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Vehicle Extension (s)	3.5	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.5
Lane Grp Cap (vph)	521	1660	742	134	901	411	75	80	188	367	369	812
v/s Ratio Prot	c0.22	c0.34		0.04	0.08		0.00	c0.01	0.00	c0.15	0.15	0.03
v/s Ratio Perm			0.01			0.04			0.00			0.02
v/c Ratio	0.76	0.73	0.02	0.51	0.30	0.17	0.05	0.28	0.03	0.71	0.69	0.11
Uniform Delay, d1	45.1	29.8	19.8	61.7	41.6	40.1	64.0	64.6	54.2	50.6	50.5	18.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.6	2.0	0.0	3.0	0.4	0.4	0.3	1.9	0.1	6.1	5.5	0.1
Delay (s)	51.7	31.8	19.8	64.7	42.0	40.5	64.3	66.4	54.3	56.7	56.0	18.3
Level of Service	D	C	B	E	D	D	E	E	D	E	E	B
Approach Delay (s)		36.4			43.9			58.1			46.3	
Approach LOS		D			D			E			D	

Intersection Summary			
HCM 2000 Control Delay	40.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	139.2	Sum of lost time (s)	27.5
Intersection Capacity Utilization	76.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	102	528	181	89	418	9	152	78	70	4	64	256
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			-1%			0%			0%	
Total Lost time (s)	6.5	6.5		6.5	6.5	6.5		7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.96		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00		1.00	1.00
Satd. Flow (prot)	1770	3404		1778	1872	1591		1803	1583		1857	1583
Flt Permitted	0.40	1.00		0.32	1.00	1.00		0.76	1.00		0.97	1.00
Satd. Flow (perm)	737	3404		595	1872	1591		1415	1583		1815	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	102	528	181	89	418	9	152	78	70	4	64	256
RTOR Reduction (vph)	0	32	0	0	0	6	0	0	53	0	0	196
Lane Group Flow (vph)	102	677	0	89	418	3	0	230	17	0	68	60
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2		2	4		4	8		8
Actuated Green, G (s)	30.1	24.8		30.1	24.8	24.8		15.5	15.5		15.5	15.5
Effective Green, g (s)	30.1	24.8		30.1	24.8	24.8		15.5	15.5		15.5	15.5
Actuated g/C Ratio	0.46	0.38		0.46	0.38	0.38		0.24	0.24		0.24	0.24
Clearance Time (s)	6.5	6.5		6.5	6.5	6.5		7.0	7.0		7.0	7.0
Vehicle Extension (s)	2.0	4.0		2.0	4.0	4.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)	421	1286		368	707	601		334	374		428	374
v/s Ratio Prot	c0.02	0.20		0.02	c0.22							
v/s Ratio Perm	0.09			0.09		0.00		c0.16	0.01		0.04	0.04
v/c Ratio	0.24	0.53		0.24	0.59	0.01		0.69	0.04		0.16	0.16
Uniform Delay, d1	10.5	15.8		10.3	16.3	12.7		22.8	19.3		19.9	19.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.5		0.1	1.6	0.0		4.7	0.0		0.1	0.1
Delay (s)	10.6	16.3		10.4	17.9	12.7		27.5	19.4		19.9	20.0
Level of Service	B	B		B	B	B		C	B		B	B
Approach Delay (s)		15.6			16.5			25.6			20.0	
Approach LOS		B			B			C			B	

Intersection Summary			
HCM 2000 Control Delay	18.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	65.6	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	7	1	2	47	0	40	0	357	68	35	267	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	7	1	2	47	0	40	0	357	68	35	267	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	734	762	267	696	694	357	267			425		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	734	762	267	696	694	357	267			425		
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 %	98	100	100	86	100	94	100			97		
cM capacity (veh/h)	309	324	772	346	355	687	1297			1134		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	10	87	0	357	68	35	267
Volume Left	7	47	0	0	0	35	0
Volume Right	2	40	0	0	68	0	0
cSH	353	448	1700	1700	1700	1134	1700
Volume to Capacity	0.03	0.19	0.00	0.21	0.04	0.03	0.16
Queue Length 95th (ft)	2	18	0	0	0	2	0
Control Delay (s)	15.5	15.0	0.0	0.0	0.0	8.3	0.0
Lane LOS	C	B				A	
Approach Delay (s)	15.5	15.0	0.0			1.0	
Approach LOS	C	B					

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	37.5%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1025	8	3	200	20	8
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	1025	8	3	200	20	8
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			1033		1235	1029
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			1033		1235	1029
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		90	97
cM capacity (veh/h)			673		194	284

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	1033	203	28
Volume Left	0	3	20
Volume Right	8	0	8
cSH	1700	673	213
Volume to Capacity	0.61	0.00	0.13
Queue Length 95th (ft)	0	0	11
Control Delay (s)	0.0	0.2	24.4
Lane LOS		A	C
Approach Delay (s)	0.0	0.2	24.4
Approach LOS			C

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	64.4%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	396	1210	28	68	270	268	4	22	54	510	17	189
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			2%			0%			0%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00
Satd. Flow (prot)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1724	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00
Satd. Flow (perm)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1724	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	396	1210	28	68	270	268	4	22	54	510	17	189
RTOR Reduction (vph)	0	0	15	0	0	199	0	0	48	0	0	94
Lane Group Flow (vph)	396	1210	13	68	270	69	4	22	6	265	262	95
Heavy Vehicles (%)	0%	2%	2%	2%	2%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2		3	3	5	4	4	1
Permitted Phases			6			2			3			4
Actuated Green, G (s)	40.2	65.3	65.3	10.7	35.8	35.8	6.0	6.0	16.7	30.1	30.1	70.3
Effective Green, g (s)	40.2	65.3	65.3	10.7	35.8	35.8	6.0	6.0	16.7	30.1	30.1	70.3
Actuated g/C Ratio	0.29	0.47	0.47	0.08	0.26	0.26	0.04	0.04	0.12	0.22	0.22	0.50
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Vehicle Extension (s)	3.5	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.5
Lane Grp Cap (vph)	519	1655	740	134	898	410	76	81	189	369	371	813
v/s Ratio Prot	c0.22	c0.34		0.04	0.08		0.00	c0.01	0.00	c0.15	0.15	0.03
v/s Ratio Perm			0.01			0.04			0.00			0.03
v/c Ratio	0.76	0.73	0.02	0.51	0.30	0.17	0.05	0.27	0.03	0.72	0.71	0.12
Uniform Delay, d1	45.4	30.0	19.9	61.9	41.8	40.3	64.1	64.7	54.3	50.8	50.7	18.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.8	2.1	0.0	3.0	0.4	0.4	0.3	1.8	0.1	6.5	6.0	0.1
Delay (s)	52.1	32.1	20.0	64.9	42.2	40.7	64.4	66.5	54.4	57.4	56.7	18.4
Level of Service	D	C	B	E	D	D	E	E	D	E	E	B
Approach Delay (s)		36.8			44.1			58.2			46.8	
Approach LOS		D			D			E			D	

Intersection Summary			
HCM 2000 Control Delay	41.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	139.6	Sum of lost time (s)	27.5
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	113	583	200	89	418	9	152	78	70	4	64	256
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			-1%			0%			0%	
Total Lost time (s)	6.5	6.5		6.5	6.5	6.5		7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.96		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00		1.00	1.00
Satd. Flow (prot)	1770	3404		1778	1872	1591		1803	1583		1857	1583
Flt Permitted	0.39	1.00		0.28	1.00	1.00		0.76	1.00		0.98	1.00
Satd. Flow (perm)	727	3404		518	1872	1591		1415	1583		1816	1583
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	113	583	200	89	418	9	152	78	70	4	64	256
RTOR Reduction (vph)	0	32	0	0	0	6	0	0	53	0	0	194
Lane Group Flow (vph)	113	751	0	89	418	3	0	230	17	0	68	62
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	1	6		5	2			4			8	
Permitted Phases	6			2		2	4		4	8		8
Actuated Green, G (s)	31.0	25.5		30.6	25.3	25.3		16.1	16.1		16.1	16.1
Effective Green, g (s)	31.0	25.5		30.6	25.3	25.3		16.1	16.1		16.1	16.1
Actuated g/C Ratio	0.46	0.38		0.46	0.38	0.38		0.24	0.24		0.24	0.24
Clearance Time (s)	6.5	6.5		6.5	6.5	6.5		7.0	7.0		7.0	7.0
Vehicle Extension (s)	2.0	4.0		2.0	4.0	4.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)	422	1297		336	707	601		340	380		437	380
v/s Ratio Prot	c0.02	0.22		0.02	c0.22							
v/s Ratio Perm	0.10			0.10		0.00		c0.16	0.01		0.04	0.04
v/c Ratio	0.27	0.58		0.26	0.59	0.01		0.68	0.04		0.16	0.16
Uniform Delay, d1	10.6	16.4		10.6	16.7	13.0		23.0	19.5		20.0	20.1
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Incremental Delay, d2	0.1	0.8		0.2	1.6	0.0		4.2	0.0		0.1	0.1
Delay (s)	10.7	17.2		10.8	18.2	13.0		27.2	19.5		20.1	20.1
Level of Service	B	B		B	B	B		C	B		C	C
Approach Delay (s)		16.4			16.8			25.4			20.1	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	18.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	66.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	1	1	22	0	47	4	397	61	13	444	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	3	1	1	22	0	47	4	397	61	13	444	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	922	936	444	876	876	397	445			458		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	922	936	444	876	876	397	445			458		
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	92	100	93	100			99		
cM capacity (veh/h)	230	261	614	265	283	652	1115			1103		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	5	69	4	397	61	13	445
Volume Left	3	22	4	0	0	13	0
Volume Right	1	47	0	0	61	0	1
cSH	270	445	1115	1700	1700	1103	1700
Volume to Capacity	0.02	0.16	0.00	0.23	0.04	0.01	0.26
Queue Length 95th (ft)	1	14	0	0	0	1	0
Control Delay (s)	18.6	14.6	8.2	0.0	0.0	8.3	0.0
Lane LOS	C	B	A			A	
Approach Delay (s)	18.6	14.6	0.1			0.2	
Approach LOS	C	B					

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	34.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	334	9	20	414	5	12
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	334	9	20	414	5	12
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			343		792	338
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			343		792	338
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		99	98
cM capacity (veh/h)			1216		352	704

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	343	434	17
Volume Left	0	20	5
Volume Right	9	0	12
cSH	1700	1216	544
Volume to Capacity	0.20	0.02	0.03
Queue Length 95th (ft)	0	1	2
Control Delay (s)	0.0	0.5	11.8
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	11.8
Approach LOS			B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	412	8	60	790	868	50	12	100	440	6	340
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			2%			0%			0%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1721	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1721	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	170	412	8	60	790	868	50	12	100	440	6	340
RTOR Reduction (vph)	0	0	4	0	0	399	0	0	87	0	0	195
Lane Group Flow (vph)	170	412	4	60	790	469	50	12	13	224	222	145
Heavy Vehicles (%)	0%	2%	2%	2%	2%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2		3	3	5	4	4	1
Permitted Phases			6			2			3			4
Actuated Green, G (s)	22.1	93.9	93.9	11.4	83.2	83.2	10.5	10.5	21.9	28.8	28.8	50.9
Effective Green, g (s)	22.1	93.9	93.9	11.4	83.2	83.2	10.5	10.5	21.9	28.8	28.8	50.9
Actuated g/C Ratio	0.13	0.55	0.55	0.07	0.48	0.48	0.06	0.06	0.13	0.17	0.17	0.30
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Vehicle Extension (s)	3.5	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.5
Lane Grp Cap (vph)	231	1930	863	116	1693	773	107	115	201	286	288	477
v/s Ratio Prot	c0.09	0.12		0.03	0.23		c0.03	0.01	0.00	c0.13	0.13	0.04
v/s Ratio Perm			0.00			c0.29			0.00			0.05
v/c Ratio	0.74	0.21	0.01	0.52	0.47	0.61	0.47	0.10	0.06	0.78	0.77	0.30
Uniform Delay, d1	72.2	20.1	17.8	77.7	29.6	32.5	78.1	76.4	66.1	68.7	68.5	46.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.9	0.1	0.0	3.9	0.4	2.0	3.2	0.4	0.1	13.1	12.0	0.4
Delay (s)	84.1	20.2	17.8	81.5	30.1	34.5	81.3	76.8	66.2	81.7	80.5	47.3
Level of Service	F	C	B	F	C	C	F	E	E	F	F	D
Approach Delay (s)		38.6			34.1			71.6			66.5	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	44.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	172.1	Sum of lost time (s)	27.5
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	1	1	22	0	47	4	397	61	14	489	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	3	1	1	22	0	47	4	397	61	14	489	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	970	984	490	924	923	397	490			458		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	970	984	490	924	923	397	490			458		
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	91	100	93	100			99		
cM capacity (veh/h)	213	245	579	246	265	652	1073			1103		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	5	69	4	397	61	14	490
Volume Left	3	22	4	0	0	14	0
Volume Right	1	47	0	0	61	0	1
cSH	251	427	1073	1700	1700	1103	1700
Volume to Capacity	0.02	0.16	0.00	0.23	0.04	0.01	0.29
Queue Length 95th (ft)	2	14	0	0	0	1	0
Control Delay (s)	19.6	15.0	8.4	0.0	0.0	8.3	0.0
Lane LOS	C	C	A			A	
Approach Delay (s)	19.6	15.0	0.1			0.2	
Approach LOS	C	C					

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	36.7%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	367	10	20	414	5	12
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	367	10	20	414	5	12
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			377		826	372
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			377		826	372
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		99	98
cM capacity (veh/h)			1181		336	674

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	377	434	17
Volume Left	0	20	5
Volume Right	10	0	12
cSH	1700	1181	520
Volume to Capacity	0.22	0.02	0.03
Queue Length 95th (ft)	0	1	3
Control Delay (s)	0.0	0.5	12.2
Lane LOS		A	B
Approach Delay (s)	0.0	0.5	12.2
Approach LOS			B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	412	8	60	790	868	50	12	100	465	6	360
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			2%			0%			0%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1721	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1721	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	170	412	8	60	790	868	50	12	100	465	6	360
RTOR Reduction (vph)	0	0	4	0	0	402	0	0	87	0	0	193
Lane Group Flow (vph)	170	412	4	60	790	466	50	12	13	237	234	167
Heavy Vehicles (%)	0%	2%	2%	2%	2%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2		3	3	5	4	4	1
Permitted Phases			6			2			3			4
Actuated Green, G (s)	22.2	93.9	93.9	11.4	83.1	83.1	10.5	10.5	21.9	30.1	30.1	52.3
Effective Green, g (s)	22.2	93.9	93.9	11.4	83.1	83.1	10.5	10.5	21.9	30.1	30.1	52.3
Actuated g/C Ratio	0.13	0.54	0.54	0.07	0.48	0.48	0.06	0.06	0.13	0.17	0.17	0.30
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Vehicle Extension (s)	3.5	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.5
Lane Grp Cap (vph)	231	1916	857	115	1679	766	107	115	199	297	298	487
v/s Ratio Prot	c0.09	0.12		0.03	0.23		c0.03	0.01	0.00	c0.14	0.14	0.04
v/s Ratio Perm			0.00			c0.29			0.00			0.06
v/c Ratio	0.74	0.22	0.01	0.52	0.47	0.61	0.47	0.10	0.06	0.80	0.79	0.34
Uniform Delay, d1	72.8	20.6	18.3	78.4	30.4	33.2	78.7	77.0	66.7	68.7	68.6	47.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.9	0.1	0.0	4.2	0.4	2.0	3.2	0.4	0.1	13.8	12.7	0.5
Delay (s)	84.7	20.7	18.3	82.6	30.8	35.2	81.9	77.4	66.9	82.6	81.3	47.6
Level of Service	F	C	B	F	C	D	F	E	E	F	F	D
Approach Delay (s)		39.1			34.8			72.3			67.1	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	45.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	173.4	Sum of lost time (s)	27.5
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	1	1	22	0	47	4	397	61	16	532	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	3	1	1	22	0	47	4	397	61	16	532	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	1016	1030	532	970	970	397	533			458		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1016	1030	532	970	970	397	533			458		
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 %	98	100	100	90	100	93	100			99		
cM capacity (veh/h)	198	229	547	228	249	652	1035			1103		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2
Volume Total	5	69	4	397	61	16	533
Volume Left	3	22	4	0	0	16	0
Volume Right	1	47	0	0	61	0	1
cSH	234	409	1035	1700	1700	1103	1700
Volume to Capacity	0.02	0.17	0.00	0.23	0.04	0.01	0.31
Queue Length 95th (ft)	2	15	0	0	0	1	0
Control Delay (s)	20.7	15.6	8.5	0.0	0.0	8.3	0.0
Lane LOS	C	C	A			A	
Approach Delay (s)	20.7	15.6	0.1			0.2	
Approach LOS	C	C					

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	39.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	401	11	20	414	5	12
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	401	11	20	414	5	12
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			412		860	406
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			412		860	406
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		98	98
cM capacity (veh/h)			1147		320	644

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	412	434	17
Volume Left	0	20	5
Volume Right	11	0	12
cSH	1700	1147	497
Volume to Capacity	0.24	0.02	0.03
Queue Length 95th (ft)	0	1	3
Control Delay (s)	0.0	0.6	12.5
Lane LOS		A	B
Approach Delay (s)	0.0	0.6	12.5
Approach LOS			B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	412	8	60	790	868	50	12	100	489	7	378
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		0%			2%			0%			0%	
Total Lost time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00
Satd. Flow (prot)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1721	1615
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.95	1.00
Satd. Flow (perm)	1805	3539	1583	1752	3504	1599	1770	1900	1583	1715	1721	1615
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	170	412	8	60	790	868	50	12	100	489	7	378
RTOR Reduction (vph)	0	0	4	0	0	402	0	0	87	0	0	193
Lane Group Flow (vph)	170	412	4	60	790	466	50	12	13	249	247	185
Heavy Vehicles (%)	0%	2%	2%	2%	2%	0%	2%	0%	2%	0%	0%	0%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA	pm+ov	Split	NA	pm+ov
Protected Phases	1	6		5	2		3	3	5	4	4	1
Permitted Phases			6			2			3			4
Actuated Green, G (s)	22.2	93.9	93.9	11.4	83.1	83.1	10.5	10.5	21.9	30.1	30.1	52.3
Effective Green, g (s)	22.2	93.9	93.9	11.4	83.1	83.1	10.5	10.5	21.9	30.1	30.1	52.3
Actuated g/C Ratio	0.13	0.54	0.54	0.07	0.48	0.48	0.06	0.06	0.13	0.17	0.17	0.30
Clearance Time (s)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	6.5	6.5	7.0
Vehicle Extension (s)	3.5	5.0	5.0	3.0	5.0	5.0	3.0	3.0	3.0	3.0	3.0	3.5
Lane Grp Cap (vph)	231	1916	857	115	1679	766	107	115	199	297	298	487
v/s Ratio Prot	c0.09	0.12		0.03	0.23		c0.03	0.01	0.00	c0.15	0.14	0.05
v/s Ratio Perm			0.00			c0.29			0.00			0.07
v/c Ratio	0.74	0.22	0.01	0.52	0.47	0.61	0.47	0.10	0.06	0.84	0.83	0.38
Uniform Delay, d1	72.8	20.6	18.3	78.4	30.4	33.2	78.7	77.0	66.7	69.3	69.2	47.7
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.9	0.1	0.0	4.2	0.4	2.0	3.2	0.4	0.1	18.3	17.1	0.6
Delay (s)	84.7	20.7	18.3	82.6	30.8	35.2	81.9	77.4	66.9	87.6	86.2	48.3
Level of Service	F	C	B	F	C	D	F	E	E	F	F	D
Approach Delay (s)		39.1			34.8			72.3			70.2	
Approach LOS		D			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	46.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	173.4	Sum of lost time (s)	27.5
Intersection Capacity Utilization	84.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	112	148	12	60	296	170	10	28	10	280	156	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		3%			-3%			2%			-2%	
Total Lost time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0	7.0	7.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85		0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (prot)	1743	1814		1796	1891	1607		1774		1787	1881	1599
Flt Permitted	0.44	1.00		0.66	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (perm)	816	1814		1240	1891	1607		1774		1787	1881	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	112	148	12	60	296	170	10	28	10	280	156	260
RTOR Reduction (vph)	0	0	0	0	0	122	0	8	0	0	0	197
Lane Group Flow (vph)	112	160	0	60	296	48	0	40	0	280	156	63
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases	6			2		2						4
Actuated Green, G (s)	30.5	24.0		28.5	23.0	23.0		4.4		19.9	19.9	19.9
Effective Green, g (s)	30.5	24.0		28.5	23.0	23.0		4.4		19.9	19.9	19.9
Actuated g/C Ratio	0.37	0.29		0.35	0.28	0.28		0.05		0.24	0.24	0.24
Clearance Time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	377	532		469	531	451		95		434	457	388
v/s Ratio Prot	c0.02	0.09		0.01	c0.16			c0.02		c0.16	0.08	
v/s Ratio Perm	0.09			0.04		0.03						0.04
v/c Ratio	0.30	0.30		0.13	0.56	0.11		0.43		0.65	0.34	0.16
Uniform Delay, d1	17.4	22.4		18.0	25.1	21.8		37.5		27.8	25.5	24.4
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	0.3		0.0	1.3	0.1		3.1		3.3	0.4	0.2
Delay (s)	17.6	22.7		18.0	26.3	21.9		40.5		31.1	26.0	24.6
Level of Service	B	C		B	C	C		D		C	C	C
Approach Delay (s)		20.6			23.9			40.5			27.5	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	81.8	Sum of lost time (s)	28.0
Intersection Capacity Utilization	61.5%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	112	148	12	66	328	188	10	28	10	280	156	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		3%			-3%			2%			-2%	
Total Lost time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0	7.0	7.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85		0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (prot)	1743	1814		1796	1891	1607		1774		1787	1881	1599
Flt Permitted	0.40	1.00		0.66	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (perm)	741	1814		1240	1891	1607		1774		1787	1881	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	112	148	12	66	328	188	10	28	10	280	156	260
RTOR Reduction (vph)	0	0	0	0	0	133	0	8	0	0	0	197
Lane Group Flow (vph)	112	160	0	66	328	55	0	40	0	280	156	63
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases	6			2		2						4
Actuated Green, G (s)	31.5	25.0		29.7	24.1	24.1		4.4		20.1	20.1	20.1
Effective Green, g (s)	31.5	25.0		29.7	24.1	24.1		4.4		20.1	20.1	20.1
Actuated g/C Ratio	0.38	0.30		0.36	0.29	0.29		0.05		0.24	0.24	0.24
Clearance Time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	359	545		480	548	466		93		432	454	386
v/s Ratio Prot	c0.02	0.09		0.01	c0.17			c0.02		c0.16	0.08	
v/s Ratio Perm	0.09			0.04		0.03						0.04
v/c Ratio	0.31	0.29		0.14	0.60	0.12		0.43		0.65	0.34	0.16
Uniform Delay, d1	17.5	22.3		17.8	25.3	21.7		38.1		28.3	26.0	24.9
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	0.3		0.0	1.8	0.1		3.2		3.3	0.5	0.2
Delay (s)	17.6	22.6		17.9	27.1	21.8		41.4		31.7	26.5	25.1
Level of Service	B	C		B	C	C		D		C	C	C
Approach Delay (s)		20.5			24.3			41.4			28.0	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	25.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	83.1	Sum of lost time (s)	28.0
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	112	148	12	73	359	206	10	28	10	280	156	260
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		3%			-3%			2%			-2%	
Total Lost time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0	7.0	7.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85		0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (prot)	1743	1814		1796	1891	1607		1774		1787	1881	1599
Flt Permitted	0.37	1.00		0.66	1.00	1.00		0.99		0.95	1.00	1.00
Satd. Flow (perm)	672	1814		1240	1891	1607		1774		1787	1881	1599
Peak-hour factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	112	148	12	73	359	206	10	28	10	280	156	260
RTOR Reduction (vph)	0	0	0	0	0	145	0	8	0	0	0	197
Lane Group Flow (vph)	112	160	0	73	359	61	0	40	0	280	156	63
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases	6			2		2						4
Actuated Green, G (s)	32.5	26.0		30.9	25.2	25.2		4.4		20.4	20.4	20.4
Effective Green, g (s)	32.5	26.0		30.9	25.2	25.2		4.4		20.4	20.4	20.4
Actuated g/C Ratio	0.38	0.31		0.37	0.30	0.30		0.05		0.24	0.24	0.24
Clearance Time (s)	7.0	7.0		7.0	7.0	7.0		7.0		7.0	7.0	7.0
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0		3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	340	558		490	563	479		92		431	454	386
v/s Ratio Prot	c0.03	0.09		0.01	c0.19			c0.02		c0.16	0.08	
v/s Ratio Perm	0.10			0.04		0.04						0.04
v/c Ratio	0.33	0.29		0.15	0.64	0.13		0.44		0.65	0.34	0.16
Uniform Delay, d1	17.6	22.2		17.7	25.7	21.6		38.9		28.8	26.5	25.3
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00		1.00	1.00	1.00
Incremental Delay, d2	0.2	0.3		0.1	2.4	0.1		3.3		3.4	0.5	0.2
Delay (s)	17.8	22.5		17.8	28.1	21.8		42.2		32.2	27.0	25.5
Level of Service	B	C		B	C	C		D		C	C	C
Approach Delay (s)		20.6			24.9			42.2			28.5	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	26.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	84.5	Sum of lost time (s)	28.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group