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MEMORANDUM

BATTERY PARK PEDESTRIAN + BICYCLE + STORMWATER CONNECTIVITY

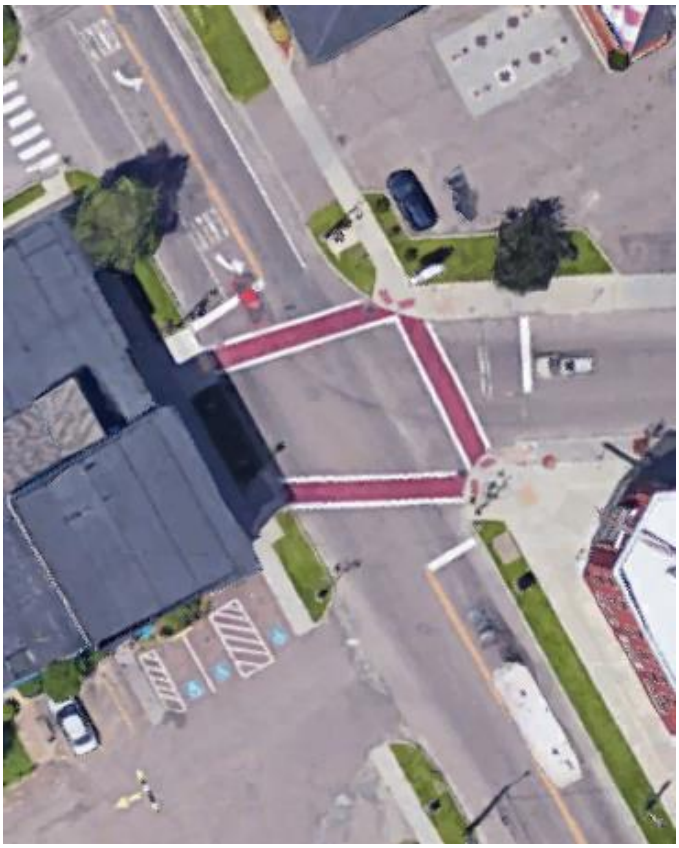
To: Bryan Davis, Marshall Distel, CCRPC
Nicole Losch, Elizabeth Gohringer, Burlington DPW
From: Lucy Gibson PE, Stephanie Weyer, PLA, Toole Design Group
Date: June 12, 2020
Re: Traffic Analysis for North Ave/North Street Intersection

As part of the above study to improve connectivity and access for people walking and biking to Battery Park, Toole Design has explored options for the North Avenue/North Street intersection. In order to facilitate safe bicycling between the Lakeview Terrace neighborhood greenway and North and Front Streets, as well as for cyclists traveling westbound North St to access Depot Street, extending bicycle lanes on North Avenue through the intersection is important. However, with limited space between the curbs, this will require reconfiguring the existing lane assignments of North Avenue's southbound approach to have one shared through-left turn lane, rather than an exclusive left turn lane. The figure on the following page shows the existing conditions on the left, and proposed alternative on the right. Also show are potential bicycle movements that will be better accommodated in the proposed condition, with bicycle lanes extending through the intersection.

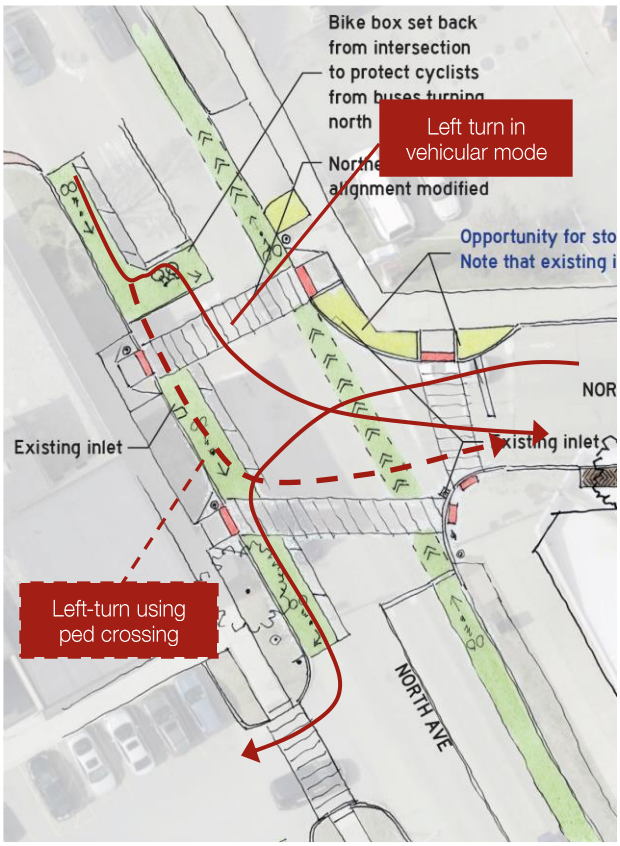
The traffic operations implications of this change were evaluated using the following methodology:

- Turning movement traffic counts conducted on June 13, 2016 were used as the baseline for the existing conditions traffic analysis.
- To adjust volumes for future (10 year) conditions, traffic volumes on North Avenue were increased by 10%, and those on North Street were increased by 5%. The VTrans recommended "background" growth rates for urban areas are 5% for a 10 year forecast; the higher growth on North Avenue is intended to reflect local land use growth, including the Cambrian Rise development.
- Synchro software was used to analyze the intersection operations and capacity, using on the current signal timing and phasing pattern. The future conditions signal timings were optimized to reduce vehicle delays and maintain acceptable levels of service for each approach of D or better.

Existing Conditions



Proposed Conditions



The existing and proposed level of service results are summarized in the table below, and provided in more detail on the attached pages. The 2016 AM and PM peak scenarios use the existing signal timing plan; all other scenarios use optimized signal timings.

EXISTING AND PROPOSED INTERSECTION OPERATIONS RESULTS

Scenario	Existing LOS	Existing Average Delay (sec)	Proposed LOS	Proposed Average Delay (sec)
2016 AM Peak	C	32	C	22
2016 PM Peak	C	32	C	22
2030 AM Peak	C	21	C	27
2030 PM Peak	C	26	C	26

DISCUSSION

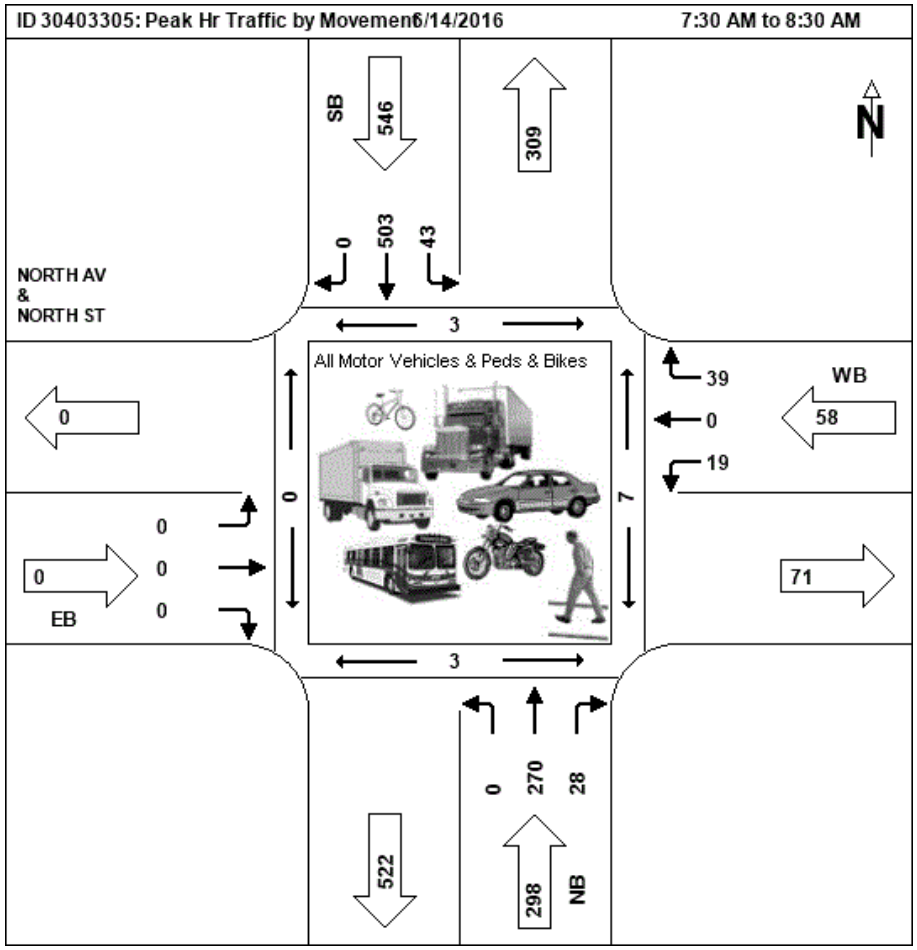
The traffic operations analysis results show that the average intersection delay and level of service will not change noticeably among the different scenarios. With signal timing optimization, the average delay is shown to be lower in the proposed conditions than compared to the existing signal timing. For any future scenario, the vehicle delay will vary with the exact signal timing that is implemented; however, this analysis shows that levels of service will be well

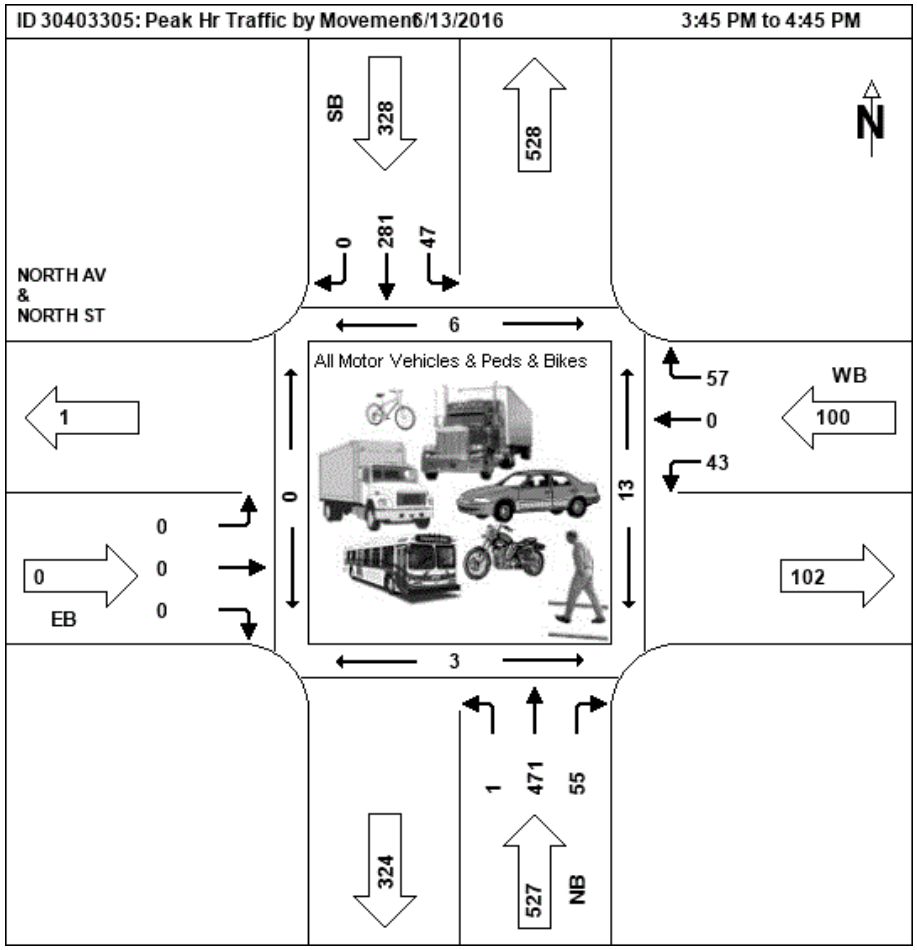
within the acceptable range with the removal of the southbound left turn lane. In the proposed scenarios, there will be longer average and 95th percentile vehicle queues on the southbound approach, due to vehicles stacking up behind left turning cars. However, the queues are not excessive, and delays are still within the acceptable range. The benefits of the proposed design will be greater safety and comfort for cyclists traveling through the intersection.

ATTACHMENTS

- 2016 Peak Hour Turning Movement Counts
- 2016 Traffic Analysis Summary Table
- 2030 Traffic Analysis Summary Table
- 2016 Synchro Reports
    - AM Existing
    - PM Existing
    - AM Proposed
    - PM Proposed
- 2030 Synchro Reports
    - AM Existing
    - PM Existing
    - AM Proposed
    - PM Proposed

TURNING MOVEMENT COUNTS





Source: VTrans

2016 | Baseline Conditions

North St/North Ave LOS Results
Count date: 13-Jun-16

	North Street WB				North Ave NB				North Ave SB				Overall		
	Delay (sec)	LOS	50th Q	95th Q	Delay (sec)	LOS	50th Q	95th Q	Delay (sec)	LOS	50th Q	95th Q	Delay (sec)	LOS	V/C
AM Existing Geometry	27	C	10	42	26	C	156	238	36	D	311	462	32	C	0.39
AM Proposed Geometry	29	C	9	42	15	B	96	158	25	C	221	394	22	C	0.43
PM Existing Geometry	26	C	22	63	37	D	317	500	24	C	132	205	32	C	0.44
PM Proposed Geometry	34	C	20	65	22	C	200	317	19	B	114	199	22	C	0.44

Change in Southbound Queue

	Average		95th Percentile	
	Feet	Vehicles	Feet	Vehicles
AM	-90	-5	-68	-4
PM	-18	-1	-6	-1

2030 | Future Conditions

Adjustments: 10% growth on North Ave; 5% growth on North St

North St/North Ave LOS Results
Count date: 13-Jun-16

	North Street WB				North Ave NB				North Ave SB				Overall		
	Delay (sec)	LOS	50th Q	95th Q	Delay (sec)	LOS	50th Q	95th Q	Delay (sec)	LOS	50th Q	95th Q	Delay (sec)	LOS	V/C
AM Existing Geometry	35	D	12	49	17	B	136	206	22	C	276	402	21	C	0.41
AM Proposed Geometry	30	C	9	44	16	B	108	178	32	C	257	460	27	C	0.50
PM Existing Geometry	31	C	23	69	29	C	288	449	18	C	117	184	26	C	0.47
PM Proposed Geometry	35	C	21	67	25	C	230	408	26	C	140	285	26	C	0.48

Change in Southbound Queue

	Average		95th Percentile	
	Feet	Vehicles	Feet	Vehicles
AM	-19	-1	58	3
PM	23	2	101	6

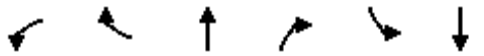
Lane Group	WBL	NBT	SBL	SBT	Ø5
Protected Phases	6	4		8	5
Permitted Phases			8		
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.0
Total Split (s)	35.0	45.0	45.0	45.0	22.0
Total Split (%)	34.3%	44.1%	44.1%	44.1%	22%
Maximum Green (s)	29.0	39.0	39.0	39.0	16.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lead/Lag	Lag				Lead
Lead-Lag Optimize?	Yes				Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Ped
Walk Time (s)					7.0
Flash Dont Walk (s)					9.0
Pedestrian Calls (#/hr)					0
90th %ile Green (s)	29.0	39.0	39.0	39.0	16.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
70th %ile Green (s)	29.0	39.0	39.0	39.0	16.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
50th %ile Green (s)	29.0	39.0	39.0	39.0	16.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
30th %ile Green (s)	29.0	39.0	39.0	39.0	16.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
10th %ile Green (s)	29.0	39.0	39.0	39.0	16.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped

Intersection Summary
Cycle Length: 102
Actuated Cycle Length: 102
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 102
70th %ile Actuated Cycle: 102
50th %ile Actuated Cycle: 102
30th %ile Actuated Cycle: 102
10th %ile Actuated Cycle: 102

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	63	323	47	547
v/c Ratio	0.13	0.48	0.15	0.80
Control Delay	13.3	26.7	22.4	38.1
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.3	26.7	22.4	38.1
Queue Length 50th (ft)	10	156	20	311
Queue Length 95th (ft)	42	238	47	#462
Internal Link Dist (ft)	318	448		428
Turn Bay Length (ft)			80	
Base Capacity (vph)	488	679	311	688
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.13	0.48	0.15	0.80

Intersection Summary

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



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	19	39	270	28	43	503
Future Volume (vph)	19	39	270	28	43	503
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)	6.0		6.0		6.0	6.0
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.91		0.99		1.00	1.00
Flt Protected	0.98		1.00		0.95	1.00
Satd. Flow (prot)	1612		1778		1711	1801
Flt Permitted	0.98		1.00		0.45	1.00
Satd. Flow (perm)	1612		1778		815	1801
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	42	293	30	47	547
RTOR Reduction (vph)	30	0	0	0	0	0
Lane Group Flow (vph)	33	0	323	0	47	547
Turn Type	Prot		NA		Perm	NA
Protected Phases	6		4			8
Permitted Phases					8	
Actuated Green, G (s)	29.0		39.0		39.0	39.0
Effective Green, g (s)	29.0		39.0		39.0	39.0
Actuated g/C Ratio	0.28		0.38		0.38	0.38
Clearance Time (s)	6.0		6.0		6.0	6.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	458		679		311	688
v/s Ratio Prot	c0.02		0.18			c0.30
v/s Ratio Perm					0.06	
v/c Ratio	0.07		0.48		0.15	0.80
Uniform Delay, d1	26.7		23.8		20.6	28.0
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.3		2.4		1.0	9.2
Delay (s)	27.0		26.2		21.7	37.2
Level of Service	C		C		C	D
Approach Delay (s)	27.0		26.2			36.0
Approach LOS	C		C			D

Intersection Summary			
HCM 2000 Control Delay	32.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	102.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	NBT	SBL	SBT	Ø5
Protected Phases	6	4		8	5
Permitted Phases			8		
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	24.0	22.5	22.5	22.0
Total Split (s)	35.0	45.0	45.0	45.0	22.0
Total Split (%)	34.3%	44.1%	44.1%	44.1%	22%
Maximum Green (s)	29.0	39.0	39.0	39.0	16.0
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0
Lead/Lag	Lag				Lead
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Ped
Walk Time (s)					7.0
Flash Dont Walk (s)					6.0
Pedestrian Calls (#/hr)					20
90th %ile Green (s)	29.0	39.0	39.0	39.0	13.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
70th %ile Green (s)	29.0	39.0	39.0	39.0	13.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
50th %ile Green (s)	29.0	39.0	39.0	39.0	13.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
30th %ile Green (s)	29.0	39.0	39.0	39.0	13.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
10th %ile Green (s)	29.0	39.0	39.0	39.0	13.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped

Intersection Summary
Cycle Length: 102
Actuated Cycle Length: 99
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 99
70th %ile Actuated Cycle: 99
50th %ile Actuated Cycle: 99
30th %ile Actuated Cycle: 99
10th %ile Actuated Cycle: 99

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	109	572	51	295
v/c Ratio	0.21	0.82	0.37	0.42
Control Delay	13.9	38.2	30.8	24.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	13.9	38.2	30.8	24.0
Queue Length 50th (ft)	22	317	22	132
Queue Length 95th (ft)	63	#500	60	205
Internal Link Dist (ft)	318	448		428
Turn Bay Length (ft)			80	
Base Capacity (vph)	520	699	139	709
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.82	0.37	0.42

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	43	57	471	55	47	271
Future Volume (vph)	43	57	471	55	47	271
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)	6.0		6.0		6.0	6.0
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.92		0.99		1.00	1.00
Flt Protected	0.98		1.00		0.95	1.00
Satd. Flow (prot)	1627		1775		1711	1801
Flt Permitted	0.98		1.00		0.20	1.00
Satd. Flow (perm)	1627		1775		354	1801
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	62	512	60	51	295
RTOR Reduction (vph)	44	0	0	0	0	0
Lane Group Flow (vph)	65	0	572	0	51	295
Turn Type	Prot		NA		Perm	NA
Protected Phases	6		4			8
Permitted Phases					8	
Actuated Green, G (s)	29.0		39.0		39.0	39.0
Effective Green, g (s)	29.0		39.0		39.0	39.0
Actuated g/C Ratio	0.29		0.39		0.39	0.39
Clearance Time (s)	6.0		6.0		6.0	6.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	476		699		139	709
v/s Ratio Prot	c0.04		c0.32			0.16
v/s Ratio Perm					0.14	
v/c Ratio	0.14		0.82		0.37	0.42
Uniform Delay, d1	25.8		26.8		21.3	21.7
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.6		10.3		7.3	1.8
Delay (s)	26.4		37.1		28.6	23.5
Level of Service	C		D		C	C
Approach Delay (s)	26.4		37.1			24.3
Approach LOS	C		D			C

Intersection Summary			
HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	99.0	Sum of lost time (s)	18.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

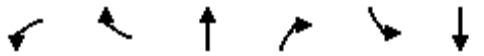
Lane Group	WBL	NBT	SBL	SBT	Ø9
Protected Phases	8	2		6	9
Permitted Phases			6		
Minimum Initial (s)	5.0	5.0	5.0	5.0	1.0
Minimum Split (s)	15.0	22.5	22.5	22.5	22.0
Total Split (s)	15.0	38.0	38.0	38.0	22.0
Total Split (%)	20.0%	50.7%	50.7%	50.7%	29%
Maximum Green (s)	10.0	33.0	33.0	33.0	20.0
Yellow Time (s)	3.0	3.0	3.0	3.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	0.0
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Ped
Walk Time (s)					7.0
Flash Dont Walk (s)					12.0
Pedestrian Calls (#/hr)					20
90th %ile Green (s)	10.0	33.0	33.0	33.0	19.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
70th %ile Green (s)	10.0	33.0	33.0	33.0	19.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
50th %ile Green (s)	10.0	33.0	33.0	33.0	19.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
30th %ile Green (s)	10.0	33.0	33.0	33.0	19.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
10th %ile Green (s)	10.0	33.0	33.0	33.0	19.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 74
Control Type: Semi Act-Uncoord
90th %ile Actuated Cycle: 74
70th %ile Actuated Cycle: 74
50th %ile Actuated Cycle: 74
30th %ile Actuated Cycle: 74
10th %ile Actuated Cycle: 74

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	63	323	594
v/c Ratio	0.25	0.41	0.78
Control Delay	16.9	15.9	26.3
Queue Delay	0.0	0.0	0.0
Total Delay	16.9	15.9	26.3
Queue Length 50th (ft)	9	96	221
Queue Length 95th (ft)	42	158	#394
Internal Link Dist (ft)	318	448	428
Turn Bay Length (ft)			
Base Capacity (vph)	254	792	763
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.25	0.41	0.78

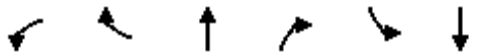
Intersection Summary

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



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	19	39	270	28	43	503
Future Volume (vph)	19	39	270	28	43	503
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)	5.0		5.0			5.0
Lane Util. Factor	1.00		1.00			1.00
Frt	0.91		0.99			1.00
Flt Protected	0.98		1.00			1.00
Satd. Flow (prot)	1612		1778			1794
Flt Permitted	0.98		1.00			0.95
Satd. Flow (perm)	1612		1778			1712
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	42	293	30	47	547
RTOR Reduction (vph)	36	0	0	0	0	0
Lane Group Flow (vph)	27	0	323	0	0	594
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	10.0		33.0			33.0
Effective Green, g (s)	10.0		33.0			33.0
Actuated g/C Ratio	0.14		0.45			0.45
Clearance Time (s)	5.0		5.0			5.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	217		792			763
v/s Ratio Prot	c0.02		0.18			
v/s Ratio Perm						c0.35
v/c Ratio	0.12		0.41			0.78
Uniform Delay, d1	28.1		13.9			17.4
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	1.2		1.6			7.7
Delay (s)	29.3		15.4			25.1
Level of Service	C		B			C
Approach Delay (s)	29.3		15.4			25.1
Approach LOS	C		B			C

Intersection Summary			
HCM 2000 Control Delay	22.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	74.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	61.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

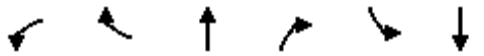


Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	43	57	471	55	47	281
Future Volume (vph)	43	57	471	55	47	281
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)	6.0		6.0			6.0
Lane Util. Factor	1.00		1.00			1.00
Frt	0.92		0.99			1.00
Flt Protected	0.98		1.00			0.99
Satd. Flow (prot)	1627		1775			1788
Flt Permitted	0.98		1.00			0.74
Satd. Flow (perm)	1627		1775			1339
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	62	512	60	51	305
RTOR Reduction (vph)	55	0	0	0	0	0
Lane Group Flow (vph)	54	0	572	0	0	356
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	8.0		33.0			33.0
Effective Green, g (s)	8.0		33.0			33.0
Actuated g/C Ratio	0.11		0.45			0.45
Clearance Time (s)	6.0		6.0			6.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	178		802			605
v/s Ratio Prot	c0.03		c0.32			
v/s Ratio Perm						0.27
v/c Ratio	0.30		0.71			0.59
Uniform Delay, d1	29.9		16.2			14.9
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	4.3		5.4			4.2
Delay (s)	34.2		21.5			19.1
Level of Service	C		C			B
Approach Delay (s)	34.2		21.5			19.1
Approach LOS	C		C			B

Intersection Summary			
HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	109	572	356
v/c Ratio	0.47	0.71	0.59
Control Delay	22.7	22.3	19.9
Queue Delay	0.0	0.0	0.0
Total Delay	22.7	22.3	19.9
Queue Length 50th (ft)	20	200	114
Queue Length 95th (ft)	65	317	199
Internal Link Dist (ft)	318	448	428
Turn Bay Length (ft)			
Base Capacity (vph)	233	802	605
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.47	0.71	0.59

Intersection Summary



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	43	57	471	55	47	281
Future Volume (vph)	43	57	471	55	47	281
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)	6.0		6.0			6.0
Lane Util. Factor	1.00		1.00			1.00
Frt	0.92		0.99			1.00
Flt Protected	0.98		1.00			0.99
Satd. Flow (prot)	1627		1775			1788
Flt Permitted	0.98		1.00			0.74
Satd. Flow (perm)	1627		1775			1339
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	62	512	60	51	305
RTOR Reduction (vph)	55	0	0	0	0	0
Lane Group Flow (vph)	54	0	572	0	0	356
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	8.0		33.0			33.0
Effective Green, g (s)	8.0		33.0			33.0
Actuated g/C Ratio	0.11		0.45			0.45
Clearance Time (s)	6.0		6.0			6.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	178		802			605
v/s Ratio Prot	c0.03		c0.32			
v/s Ratio Perm						0.27
v/c Ratio	0.30		0.71			0.59
Uniform Delay, d1	29.9		16.2			14.9
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	4.3		5.4			4.2
Delay (s)	34.2		21.5			19.1
Level of Service	C		C			B
Approach Delay (s)	34.2		21.5			19.1
Approach LOS	C		C			B

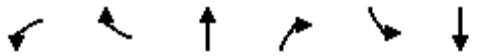
Intersection Summary			
HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	66.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	WBL	NBT	SBL	SBT	Ø5
Protected Phases	6	8		4	5
Permitted Phases			4		
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.0
Total Split (s)	23.0	55.0	55.0	55.0	22.0
Total Split (%)	23.0%	55.0%	55.0%	55.0%	22%
Maximum Green (s)	17.0	49.0	49.0	49.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	0.0
Lead/Lag	Lag				Lead
Lead-Lag Optimize?	Yes				Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Ped
Walk Time (s)					7.0
Flash Dont Walk (s)					12.0
Pedestrian Calls (#/hr)					10
90th %ile Green (s)	17.0	49.0	49.0	49.0	19.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
70th %ile Green (s)	17.0	49.0	49.0	49.0	19.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
50th %ile Green (s)	17.0	49.0	49.0	49.0	19.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
30th %ile Green (s)	17.0	49.0	49.0	49.0	19.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
10th %ile Green (s)	17.0	49.0	49.0	49.0	19.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped

Intersection Summary
Cycle Length: 100
Actuated Cycle Length: 99
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 99
70th %ile Actuated Cycle: 99
50th %ile Actuated Cycle: 99
30th %ile Actuated Cycle: 99
10th %ile Actuated Cycle: 99

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	67	356	51	601
v/c Ratio	0.21	0.41	0.12	0.67
Control Delay	18.0	17.6	14.5	23.7
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	18.0	17.6	14.5	23.7
Queue Length 50th (ft)	12	136	17	276
Queue Length 95th (ft)	49	206	39	402
Internal Link Dist (ft)	318	448		428
Turn Bay Length (ft)			80	
Base Capacity (vph)	313	879	425	891
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.21	0.41	0.12	0.67

Intersection Summary



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	19	39	270	28	43	503
Future Volume (vph)	19	39	270	28	43	503
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)	6.0		6.0		6.0	6.0
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.91		0.99		1.00	1.00
Flt Protected	0.98		1.00		0.95	1.00
Satd. Flow (prot)	1611		1778		1711	1801
Flt Permitted	0.98		1.00		0.48	1.00
Satd. Flow (perm)	1611		1778		860	1801
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	110%	110%	110%	110%
Adj. Flow (vph)	22	45	323	33	51	601
RTOR Reduction (vph)	37	0	0	0	0	0
Lane Group Flow (vph)	30	0	356	0	51	601
Turn Type	Prot		NA		Perm	NA
Protected Phases	6		8			4
Permitted Phases					4	
Actuated Green, G (s)	17.0		49.0		49.0	49.0
Effective Green, g (s)	17.0		49.0		49.0	49.0
Actuated g/C Ratio	0.17		0.49		0.49	0.49
Clearance Time (s)	6.0		6.0		6.0	6.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	276		880		425	891
v/s Ratio Prot	c0.02		0.20			c0.33
v/s Ratio Perm					0.06	
v/c Ratio	0.11		0.40		0.12	0.67
Uniform Delay, d1	34.6		15.8		13.4	19.0
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	0.8		1.4		0.6	4.1
Delay (s)	35.4		17.2		14.0	23.0
Level of Service	D		B		B	C
Approach Delay (s)	35.4		17.2			22.3
Approach LOS	D		B			C

Intersection Summary			
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	99.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	43.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	WBL	NBT	SBL	SBT	Ø9
Protected Phases	8	2		6	9
Permitted Phases			6		
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5
Total Split (s)	22.5	45.0	45.0	45.0	22.5
Total Split (%)	25.0%	50.0%	50.0%	50.0%	25%
Maximum Green (s)	16.5	39.0	39.0	39.0	20.5
Yellow Time (s)	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	0.0
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Ped
Walk Time (s)					7.0
Flash Dont Walk (s)					11.0
Pedestrian Calls (#/hr)					20
90th %ile Green (s)	16.5	39.0	39.0	39.0	18.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
70th %ile Green (s)	16.5	39.0	39.0	39.0	18.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
50th %ile Green (s)	16.5	39.0	39.0	39.0	18.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
30th %ile Green (s)	16.5	39.0	39.0	39.0	18.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
10th %ile Green (s)	16.5	39.0	39.0	39.0	18.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped

Intersection Summary
Cycle Length: 90
Actuated Cycle Length: 87.5
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 87.5
70th %ile Actuated Cycle: 87.5
50th %ile Actuated Cycle: 87.5
30th %ile Actuated Cycle: 87.5
10th %ile Actuated Cycle: 87.5

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	114	629	56	324
v/c Ratio	0.32	0.80	0.34	0.40
Control Delay	17.7	30.0	23.1	18.3
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	17.7	30.0	23.1	18.3
Queue Length 50th (ft)	23	288	20	117
Queue Length 95th (ft)	69	#449	54	184
Internal Link Dist (ft)	318	448		428
Turn Bay Length (ft)			80	
Base Capacity (vph)	359	791	166	802
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.32	0.80	0.34	0.40

Intersection Summary

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

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	43	57	471	55	47	271
Future Volume (vph)	43	57	471	55	47	271
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)	6.0		6.0		6.0	6.0
Lane Util. Factor	1.00		1.00		1.00	1.00
Frt	0.92		0.99		1.00	1.00
Flt Protected	0.98		1.00		0.95	1.00
Satd. Flow (prot)	1627		1775		1711	1801
Flt Permitted	0.98		1.00		0.21	1.00
Satd. Flow (perm)	1627		1775		373	1801
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	110%	110%	110%	110%
Adj. Flow (vph)	49	65	563	66	56	324
RTOR Reduction (vph)	53	0	0	0	0	0
Lane Group Flow (vph)	61	0	629	0	56	324
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	16.5		39.0		39.0	39.0
Effective Green, g (s)	16.5		39.0		39.0	39.0
Actuated g/C Ratio	0.19		0.45		0.45	0.45
Clearance Time (s)	6.0		6.0		6.0	6.0
Vehicle Extension (s)	3.0		3.0		3.0	3.0
Lane Grp Cap (vph)	306		791		166	802
v/s Ratio Prot	c0.04		c0.35			0.18
v/s Ratio Perm					0.15	
v/c Ratio	0.20		0.80		0.34	0.40
Uniform Delay, d1	29.9		20.8		15.8	16.4
Progression Factor	1.00		1.00		1.00	1.00
Incremental Delay, d2	1.5		8.1		5.4	1.5
Delay (s)	31.4		28.9		21.2	17.9
Level of Service	C		C		C	B
Approach Delay (s)	31.4		28.9			18.4
Approach LOS	C		C			B

Intersection Summary			
HCM 2000 Control Delay	25.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	87.5	Sum of lost time (s)	14.0
Intersection Capacity Utilization	56.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

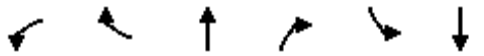
Lane Group	WBL	NBT	SBL	SBT	Ø9
Protected Phases	8	2		6	9
Permitted Phases			6		
Minimum Initial (s)	5.0	5.0	5.0	5.0	1.0
Minimum Split (s)	15.0	22.5	22.5	22.5	22.0
Total Split (s)	15.0	38.0	38.0	38.0	22.0
Total Split (%)	20.0%	50.7%	50.7%	50.7%	29%
Maximum Green (s)	9.0	32.0	32.0	32.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	0.0
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Ped
Walk Time (s)					7.0
Flash Dont Walk (s)					11.0
Pedestrian Calls (#/hr)					15
90th %ile Green (s)	9.0	32.0	32.0	32.0	18.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
70th %ile Green (s)	9.0	32.0	32.0	32.0	18.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
50th %ile Green (s)	9.0	32.0	32.0	32.0	18.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
30th %ile Green (s)	9.0	32.0	32.0	32.0	18.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
10th %ile Green (s)	9.0	32.0	32.0	32.0	18.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 73
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 73
70th %ile Actuated Cycle: 73
50th %ile Actuated Cycle: 73
30th %ile Actuated Cycle: 73
10th %ile Actuated Cycle: 73

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	67	356	652
v/c Ratio	0.28	0.46	0.88
Control Delay	17.5	16.8	34.2
Queue Delay	0.0	0.0	0.0
Total Delay	17.5	16.8	34.2
Queue Length 50th (ft)	9	108	257
Queue Length 95th (ft)	44	178	#460
Internal Link Dist (ft)	318	448	428
Turn Bay Length (ft)			
Base Capacity (vph)	238	778	745
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.28	0.46	0.88

Intersection Summary

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



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	19	39	270	28	43	503
Future Volume (vph)	19	39	270	28	43	503
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)	6.0		6.0			6.0
Lane Util. Factor	1.00		1.00			1.00
Frt	0.91		0.99			1.00
Flt Protected	0.98		1.00			1.00
Satd. Flow (prot)	1611		1778			1794
Flt Permitted	0.98		1.00			0.94
Satd. Flow (perm)	1611		1778			1701
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	110%	110%	110%	110%
Adj. Flow (vph)	22	45	323	33	51	601
RTOR Reduction (vph)	39	0	0	0	0	0
Lane Group Flow (vph)	28	0	356	0	0	652
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	9.0		32.0			32.0
Effective Green, g (s)	9.0		32.0			32.0
Actuated g/C Ratio	0.12		0.44			0.44
Clearance Time (s)	6.0		6.0			6.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	198		779			745
v/s Ratio Prot	c0.02		0.20			
v/s Ratio Perm						c0.38
v/c Ratio	0.14		0.46			0.88
Uniform Delay, d1	28.5		14.4			18.7
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	1.5		1.9			13.6
Delay (s)	30.0		16.3			32.3
Level of Service	C		B			C
Approach Delay (s)	30.0		16.3			32.3
Approach LOS	C		B			C

Intersection Summary			
HCM 2000 Control Delay	26.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

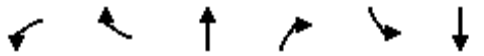
Lane Group	WBL	NBT	SBL	SBT	Ø9
Protected Phases	8	2		6	9
Permitted Phases			6		
Minimum Initial (s)	8.0	8.0	8.0	8.0	1.0
Minimum Split (s)	14.0	22.5	22.5	22.5	22.0
Total Split (s)	14.0	39.0	39.0	39.0	22.0
Total Split (%)	18.7%	52.0%	52.0%	52.0%	29%
Maximum Green (s)	8.0	33.0	33.0	33.0	20.0
Yellow Time (s)	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	2.0	2.0	2.0	2.0	0.0
Lead/Lag					
Lead-Lag Optimize?					
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0
Minimum Gap (s)	3.0	3.0	3.0	3.0	3.0
Time Before Reduce (s)	0.0	0.0	0.0	0.0	0.0
Time To Reduce (s)	0.0	0.0	0.0	0.0	0.0
Recall Mode	Max	Max	Max	Max	Ped
Walk Time (s)					7.0
Flash Dont Walk (s)					11.0
Pedestrian Calls (#/hr)					20
90th %ile Green (s)	8.0	33.0	33.0	33.0	18.0
90th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
70th %ile Green (s)	8.0	33.0	33.0	33.0	18.0
70th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
50th %ile Green (s)	8.0	33.0	33.0	33.0	18.0
50th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
30th %ile Green (s)	8.0	33.0	33.0	33.0	18.0
30th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped
10th %ile Green (s)	8.0	33.0	33.0	33.0	18.0
10th %ile Term Code	MaxR	MaxR	MaxR	MaxR	Ped

Intersection Summary
Cycle Length: 75
Actuated Cycle Length: 73
Control Type: Actuated-Uncoordinated
90th %ile Actuated Cycle: 73
70th %ile Actuated Cycle: 73
50th %ile Actuated Cycle: 73
30th %ile Actuated Cycle: 73
10th %ile Actuated Cycle: 73

Lane Group	WBL	NBT	SBT
Lane Group Flow (vph)	114	629	392
v/c Ratio	0.48	0.78	0.75
Control Delay	22.8	25.8	27.7
Queue Delay	0.0	0.0	0.0
Total Delay	22.8	25.8	27.7
Queue Length 50th (ft)	21	230	140
Queue Length 95th (ft)	67	#408	#285
Internal Link Dist (ft)	318	448	428
Turn Bay Length (ft)			
Base Capacity (vph)	236	802	524
Starvation Cap Reductn	0	0	0
Spillback Cap Reductn	0	0	0
Storage Cap Reductn	0	0	0
Reduced v/c Ratio	0.48	0.78	0.75

Intersection Summary

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



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	43	57	471	55	47	281
Future Volume (vph)	43	57	471	55	47	281
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11
Total Lost time (s)	6.0		6.0			6.0
Lane Util. Factor	1.00		1.00			1.00
Frt	0.92		0.99			1.00
Flt Protected	0.98		1.00			0.99
Satd. Flow (prot)	1627		1775			1788
Flt Permitted	0.98		1.00			0.64
Satd. Flow (perm)	1627		1775			1159
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor (vph)	105%	105%	110%	110%	110%	110%
Adj. Flow (vph)	49	65	563	66	56	336
RTOR Reduction (vph)	58	0	0	0	0	0
Lane Group Flow (vph)	56	0	629	0	0	392
Turn Type	Prot		NA		Perm	NA
Protected Phases	8		2			6
Permitted Phases					6	
Actuated Green, G (s)	8.0		33.0			33.0
Effective Green, g (s)	8.0		33.0			33.0
Actuated g/C Ratio	0.11		0.45			0.45
Clearance Time (s)	6.0		6.0			6.0
Vehicle Extension (s)	3.0		3.0			3.0
Lane Grp Cap (vph)	178		802			523
v/s Ratio Prot	c0.03		c0.35			
v/s Ratio Perm						0.34
v/c Ratio	0.32		0.78			0.75
Uniform Delay, d1	30.0		17.0			16.6
Progression Factor	1.00		1.00			1.00
Incremental Delay, d2	4.6		7.6			9.5
Delay (s)	34.6		24.5			26.1
Level of Service	C		C			C
Approach Delay (s)	34.6		24.5			26.1
Approach LOS	C		C			C

Intersection Summary			
HCM 2000 Control Delay	26.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	71.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group