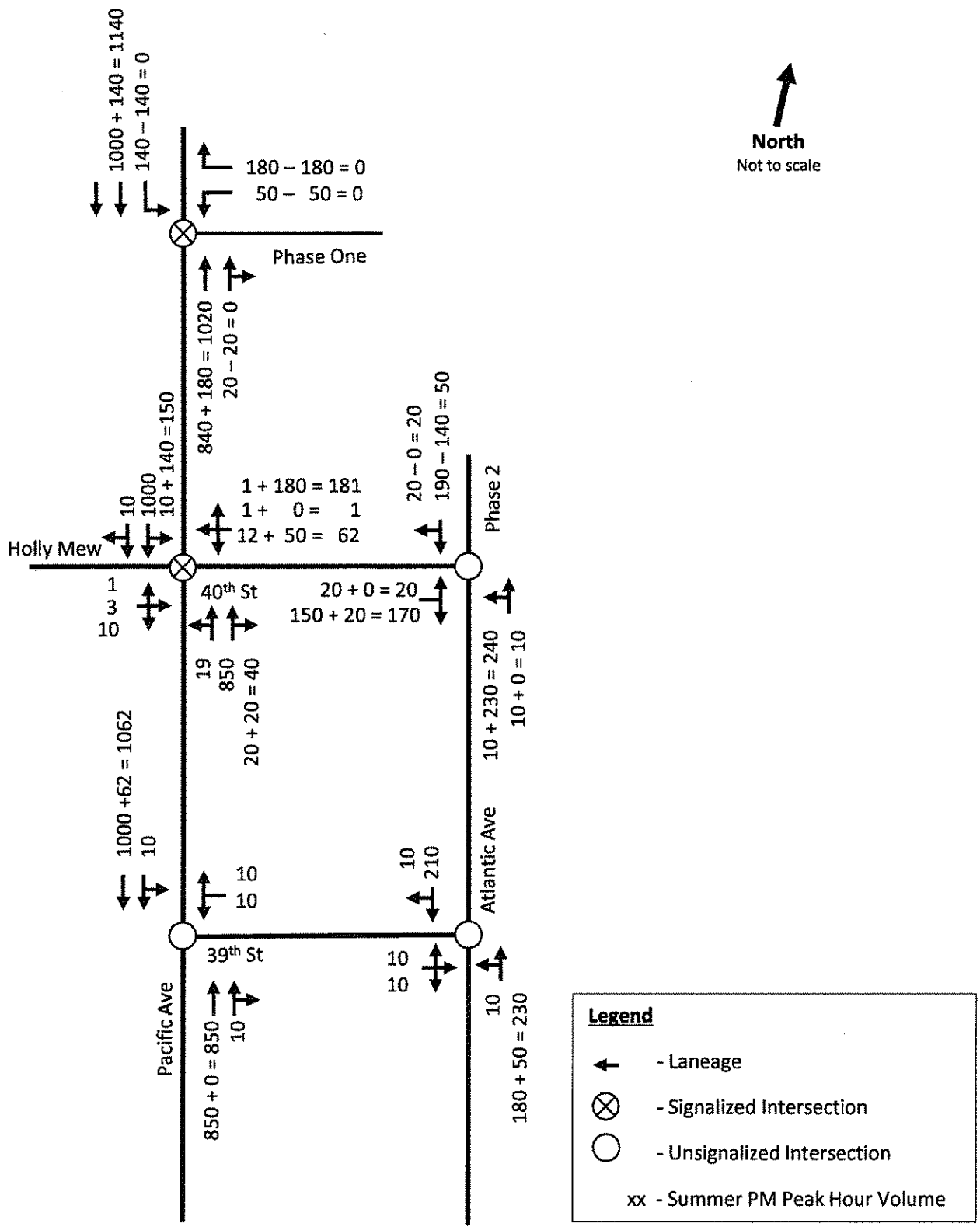
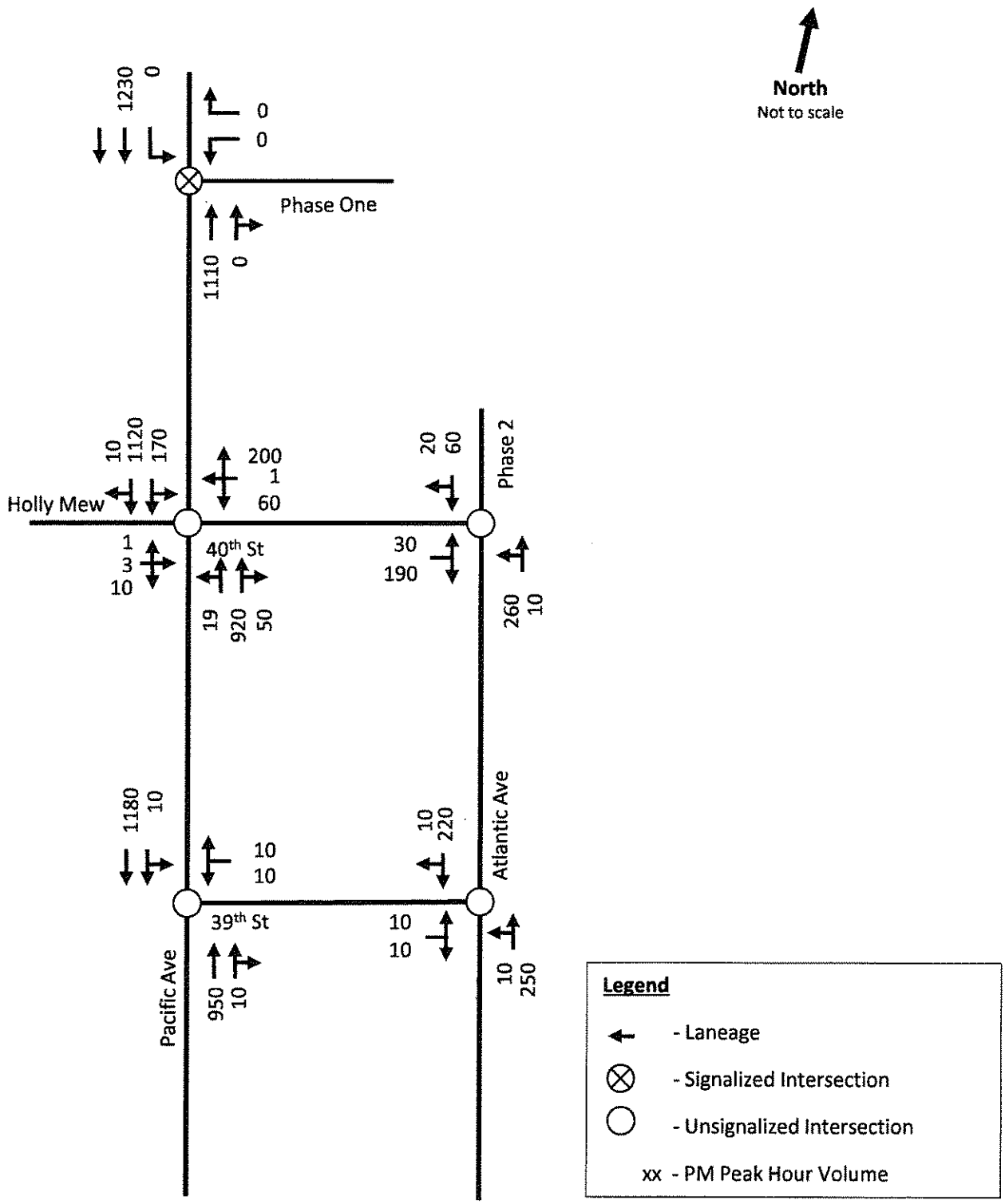
E 2016 Detailed Results – 40th St Signal

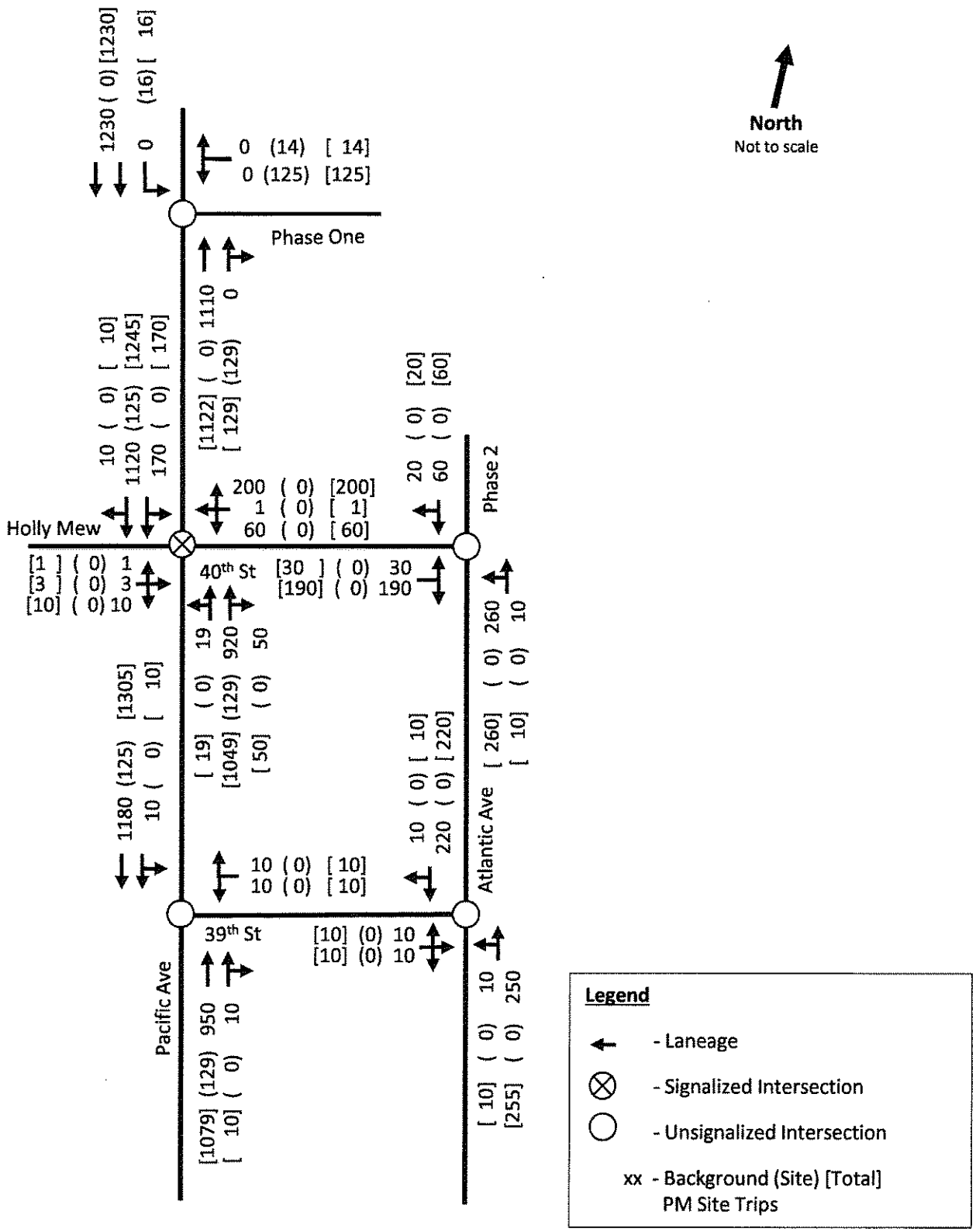
2015 Summer Volumes: Reconfigured Atlantic Avenue



2029 No Build: PM Summer Peak Hour Volumes



2029 Full Build Out: PM Summer Peak Hour Volumes



McPherson CONSULTING

Gold-Key Traffic Impact Analysis, Virginia Beach, Virginia
Scenario 2: 2016 Assumptions with Signal at 40th Street

App E
Figure 3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1	3	10	60	1	200	0	1049	50	170	1245	10
Future Volume (vph)	1	3	10	60	1	200	0	1049	50	170	1245	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5	4.5		4.5			4.5	
Lane Util. Factor		1.00			1.00	1.00		0.95			0.95	
Frt		0.90			1.00	0.85		0.99			1.00	
Flt Protected		1.00			0.95	1.00		1.00			0.99	
Satd. Flow (prot)		1677			1776	1583		3516			3498	
Flt Permitted		0.98			0.74	1.00		1.00			0.51	
Satd. Flow (perm)		1658			1370	1583		3516			1811	
Peak-hour factor, PHF	0.25	0.25	0.25	0.66	0.66	0.77	0.25	0.94	1.00	0.50	0.88	0.38
Adj. Flow (vph)	4	12	40	91	2	260	0	1116	50	340	1415	26
RTOR Reduction (vph)	0	33	0	0	0	212	0	3	0	0	1	0
Lane Group Flow (vph)	0	23	0	0	93	48	0	1163	0	0	1780	0
Turn Type	Perm	NA		Perm	NA	Perm		NA		pm+pt	NA	
Protected Phases		4			8			2		1	6	
Permitted Phases	4			8		8				6		
Actuated Green, G (s)		20.5			20.5	20.5		60.5			80.5	
Effective Green, g (s)		20.5			20.5	20.5		60.5			80.5	
Actuated g/C Ratio		0.19			0.19	0.19		0.55			0.73	
Clearance Time (s)		4.5			4.5	4.5		4.5			4.5	
Lane Grp Cap (vph)		308			255	295		1933			1563	
v/s Ratio Prot								0.33			c0.16	
v/s Ratio Perm		0.01			c0.07	0.03					c0.67	
v/c Ratio		0.08			0.36	0.16		0.60			1.14	
Uniform Delay, d1		36.9			39.1	37.6		16.6			14.8	
Progression Factor		1.00			1.00	1.00		1.00			1.62	
Incremental Delay, d2		0.5			4.0	1.2		1.4			70.2	
Delay (s)		37.4			43.1	38.8		18.0			94.0	
Level of Service		D			D	D		B			F	
Approach Delay (s)		37.4			39.9			18.0			94.0	
Approach LOS		D			D			B			F	

Intersection Summary			
HCM 2000 Control Delay	61.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	91.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	125	14	1122	129	16	1230
Future Volume (Veh/h)	125	14	1122	129	16	1230
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.66	0.77	0.92	0.58	0.63	0.92
Hourly flow rate (vph)	189	18	1220	222	25	1337
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			598			378
pX, platoon unblocked	0.86	0.78			0.78	
vC, conflicting volume	2050	721			1442	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	731	62			992	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	36	98			95	
cM capacity (veh/h)	294	767			538	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	207	813	629	25	668	668
Volume Left	189	0	0	25	0	0
Volume Right	18	0	222	0	0	0
cSH	310	1700	1700	538	1700	1700
Volume to Capacity	0.67	0.48	0.37	0.05	0.39	0.39
Queue Length 95th (ft)	112	0	0	4	0	0
Control Delay (s)	37.0	0.0	0.0	12.0	0.0	0.0
Lane LOS	E			B		
Approach Delay (s)	37.0	0.0		0.2		
Approach LOS	E					

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	49.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	30	190	260	10	60	20
Future Volume (Veh/h)	30	190	260	10	60	20
Sign Control	Free			Stop	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.38	0.40	0.83	0.83	0.71	0.50
Hourly flow rate (vph)	79	475	313	12	85	40
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh)						
Upstream signal (ft)	324					
pX, platoon unblocked						
vC, conflicting volume	0		240	158	633	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0		240	158	633	0
tC, single (s)	4.1		7.1	6.5	6.5	6.2
tC, 2 stage (s)						
tF (s)	2.2		3.5	4.0	4.0	3.3
p0 queue free %	95		43	98	77	96
cM capacity (veh/h)	1623		548	698	378	1085

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	79	475	325	125
Volume Left	79	0	313	0
Volume Right	0	475	0	40
cSH	1623	1700	552	477
Volume to Capacity	0.05	0.28	0.59	0.26
Queue Length 95th (ft)	4	0	95	26
Control Delay (s)	7.3	0.0	20.4	15.2
Lane LOS	A		C	C
Approach Delay (s)	1.0		20.4	15.2
Approach LOS			C	C

Intersection Summary			
Average Delay	9.1		
Intersection Capacity Utilization	31.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	20	0	70	10	0	5	100	1134	10	5	1166	25
Future Volume (vph)	20	0	70	10	0	5	100	1134	10	5	1166	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frt		0.90			0.96		1.00	1.00		1.00	1.00	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1649			1725		1770	3535		1770	3528	
Flt Permitted		0.94			0.85		0.14	1.00		0.18	1.00	
Satd. Flow (perm)		1573			1523		259	3535		329	3528	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	0	76	11	0	5	109	1233	11	5	1267	27
RTOR Reduction (vph)	0	60	0	0	13	0	0	1	0	0	1	0
Lane Group Flow (vph)	0	38	0	0	3	0	109	1243	0	5	1293	0
Turn Type	Perm	NA		Perm	NA		pm+pt	NA		Perm	NA	
Protected Phases		4			8		5	2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		22.5			22.5		78.5	78.5		63.5	63.5	
Effective Green, g (s)		22.5			22.5		78.5	78.5		63.5	63.5	
Actuated g/C Ratio		0.20			0.20		0.71	0.71		0.58	0.58	
Clearance Time (s)		4.5			4.5		4.5	4.5		4.5	4.5	
Lane Grp Cap (vph)		321			311		329	2522		189	2036	
v/s Ratio Prot							0.03	c0.35			c0.37	
v/s Ratio Perm		c0.02			0.00		0.21			0.02		
v/c Ratio		0.12			0.01		0.33	0.49		0.03	0.63	
Uniform Delay, d1		35.7			34.9		19.1	7.0		10.0	15.5	
Progression Factor		1.00			1.00		0.87	1.00		1.00	1.00	
Incremental Delay, d2		0.7			0.1		2.4	0.6		0.3	1.5	
Delay (s)		36.4			34.9		19.1	7.6		10.2	17.0	
Level of Service		D			C		B	A		B	B	
Approach Delay (s)		36.4			34.9			8.5			17.0	
Approach LOS		D			C			A			B	

Intersection Summary			
HCM 2000 Control Delay	13.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	10	10	1079	10	10	1305
Future Volume (Veh/h)	10	10	1079	10	10	1305
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	11	1173	11	11	1418
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						362
pX, platoon unblocked	0.74					
vC, conflicting volume	1910	592			1184	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1533	592			1184	
tC, single (s)	6.8	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	98			98	
cM capacity (veh/h)	78	449			586	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	22	782	402	484	945
Volume Left	11	0	0	11	0
Volume Right	11	0	11	0	0
cSH	133	1700	1700	586	1700
Volume to Capacity	0.17	0.46	0.24	0.02	0.56
Queue Length 95th (ft)	14	0	0	1	0
Control Delay (s)	37.3	0.0	0.0	0.5	0.0
Lane LOS	E			A	
Approach Delay (s)	37.3	0.0		0.2	
Approach LOS	E				

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	53.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	10	10	250	225	10
Future Volume (Veh/h)	10	10	10	250	225	10
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	11	11	272	245	11
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	544	250	256			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	544	250	256			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	99	99			
cM capacity (veh/h)	496	788	1309			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	22	283	256
Volume Left	11	11	0
Volume Right	11	0	11
cSH	608	1309	1700
Volume to Capacity	0.04	0.01	0.15
Queue Length 95th (ft)	3	1	0
Control Delay (s)	11.1	0.4	0.0
Lane LOS	B	A	
Approach Delay (s)	11.1	0.4	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	31.3%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 1: Pacific Avenue & 40th St

Movement	EB	WB	WB	NB	NB	SB	SB
Directions Served	LTR	LT	R	T	TR	LT	TR
Maximum Queue (ft)	96	150	168	303	302	423	396
Average Queue (ft)	27	55	78	208	185	234	211
95th Queue (ft)	72	116	140	292	278	406	387
Link Distance (ft)	244	252	252	310	310	522	522
Upstream Blk Time (%)				0	0	0	
Queuing Penalty (veh)				1	0	1	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 2: Pacific Avenue/Atlantic Avenue & Phase 1

Movement	WB	NB	NB	SB	SB	SB
Directions Served	LR	T	TR	L	T	T
Maximum Queue (ft)	294	23	28	56	34	22
Average Queue (ft)	261	1	2	11	2	1
95th Queue (ft)	313	9	15	38	20	14
Link Distance (ft)	255	522	522		327	327
Upstream Blk Time (%)	91					
Queuing Penalty (veh)	0					
Storage Bay Dist (ft)				200		
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 3: Atlantic Avenue/Phase 2 & 40th St

Movement	EB	EB	NB	SB
Directions Served	L	R	LT	TR
Maximum Queue (ft)	4	26	143	90
Average Queue (ft)	0	4	65	38
95th Queue (ft)	3	18	112	68
Link Distance (ft)	252		307	345
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		200		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 4: Atlantic Avenue & 42nd St

Movement	EB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LTR	LTR	L	T	TR	L	T	TR
Maximum Queue (ft)	112	57	74	318	329	48	330	313
Average Queue (ft)	45	13	51	189	184	5	264	197
95th Queue (ft)	89	42	88	291	288	26	358	314
Link Distance (ft)	346	354		327	327		299	299
Upstream Blk Time (%)				0	0		7	2
Queuing Penalty (veh)				1	1		0	0
Storage Bay Dist (ft)			50			50		
Storage Blk Time (%)			22	22		0	35	
Queuing Penalty (veh)			132	23		0	2	

Intersection: 9: Pacific Avenue & 39th Street

Movement	WB	NB	NB	SB	SB
Directions Served	LR	T	TR	LT	T
Maximum Queue (ft)	56	38	17	57	14
Average Queue (ft)	17	2	1	10	0
95th Queue (ft)	45	18	9	43	10
Link Distance (ft)	255	332	332	310	310
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 10: Atlantic Avenue & 39th Street

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	31	53
Average Queue (ft)	15	3
95th Queue (ft)	40	23
Link Distance (ft)	255	324
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Network Summary

Network wide Queuing Penalty: 161