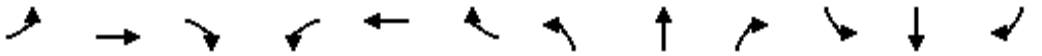
APPENDIX U

2017 No Build Route 9 Intersection Analysis



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	2359	254	140	1779	451	3	0	29	25	154	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	390		250	0		0	0		0
Storage Lanes	1		0	1		1	0		1	1		1
Taper Length (ft)	50		50	50		50	50		50	50		50
Lane Util. Factor	1.00	0.91	0.91	1.00	0.91	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Ped Bike Factor												
Frt		0.985				0.850			0.850			0.850
Flt Protected	0.950			0.950				0.950		0.950	0.999	
Satd. Flow (prot)	1752	4960	0	1752	5036	1568	0	1752	1568	1665	1751	1568
Flt Permitted	0.950			0.950				0.950		0.950	0.999	
Satd. Flow (perm)	1752	4960	0	1752	5036	1568	0	1752	1568	1665	1751	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21				422			32			26
Link Speed (mph)		45			45			25			25	
Link Distance (ft)		3513			454			634			595	
Travel Time (s)		53.2			6.9			17.3			16.2	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	168	2564	276	152	1934	490	3	0	32	27	167	26
Shared Lane Traffic (%)										10%		
Lane Group Flow (vph)	168	2840	0	152	1934	490	0	3	32	24	170	26
Turn Type	Prot			Prot		Perm	Split		custom	Split		custom
Protected Phases	1	6		5	2		8	8		4	4	
Permitted Phases						2			5 8			1 4
Detector Phase	1	6		5	2	2	8	8	5 8	4	4	1 4
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0	10.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	14.0	23.0		12.0	23.0	23.0	10.0	10.0		10.0	10.0	
Total Split (s)	14.0	41.0	0.0	12.0	39.0	39.0	10.0	10.0	22.0	11.0	11.0	25.0
Total Split (%)	14.0%	41.0%	0.0%	12.0%	39.0%	39.0%	10.0%	10.0%	22.0%	11.0%	11.0%	25.0%
Yellow Time (s)	4.0	5.0		4.0	5.0	5.0	3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-3.0	0.0	-2.0	-3.0	-3.0	0.0	-1.0	-2.0	-1.0	-1.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lead		Lag	Lag	Lag						
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes						
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Act Effct Green (s)	16.5	61.8		8.0	53.3	53.3		6.0	14.0	7.0	7.0	25.1
Actuated g/C Ratio	0.16	0.62		0.08	0.53	0.53		0.06	0.14	0.07	0.07	0.25

Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	26.0
Total Split (s)	26.0
Total Split (%)	26%
Yellow Time (s)	10.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.58	0.92		1.09	0.72	0.47		0.03	0.13	0.21	1.38	0.06
Control Delay	49.0	25.5		145.8	22.3	5.3		45.0	10.8	48.3	251.3	7.2
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	49.0	25.5		145.8	22.3	5.3		45.0	10.8	48.3	251.3	7.2
LOS	D	C		F	C	A		D	B	D	F	A
Approach Delay		26.8			26.4			13.7			200.3	
Approach LOS		C			C			B			F	
Queue Length 50th (ft)	97	520		~109	336	21		2	0	15	~152	0
Queue Length 95th (ft)	#238	#1036		#236	#610	119		11	22	43	#291	11
Internal Link Dist (ft)		3433			374			554			515	
Turn Bay Length (ft)				390		250						
Base Capacity (vph)	289	3073		140	2684	1033		105	247	117	123	413
Starvation Cap Reductn	0	0		0	0	0		0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0		0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0		0	0	0	0	0
Reduced v/c Ratio	0.58	0.92		1.09	0.72	0.47		0.03	0.13	0.21	1.38	0.06

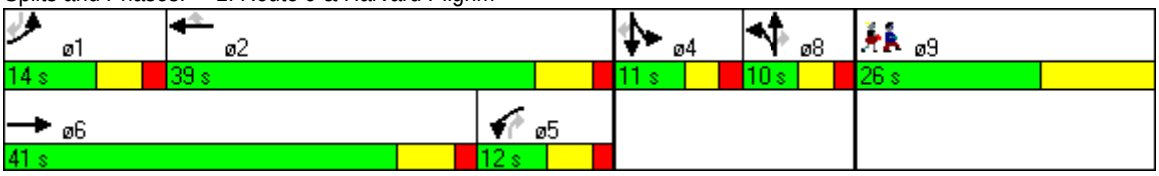
Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green, Master Intersection
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.38
Intersection Signal Delay: 33.1 Intersection LOS: C
Intersection Capacity Utilization 83.7% ICU Level of Service E
Analysis Period (min) 15

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

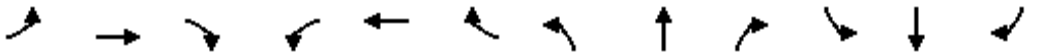
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Route 9 & Harvard Pilgrim



Lane Group	ø9
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	41	2076	4	17	2063	69	218	0	240	271	23	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	12	12	12	12	12	12	12	12	12	12	12
Grade (%)		0%			0%			0%			0%	
Storage Length (ft)	0		0	390		250	0		0	0		0
Storage Lanes	1		0	1		1	0		1	1		1
Taper Length (ft)	25		25	25		25	25		25	25		25
Lane Util. Factor	1.00	0.91	0.91	1.00	0.91	1.00	1.00	1.00	1.00	0.95	0.95	1.00
Ped Bike Factor												
Frt						0.850			0.850			0.850
Flt Protected	0.950			0.950				0.950		0.950	0.959	
Satd. Flow (prot)	1752	5036	0	1752	5036	1568	0	1752	1568	1665	1681	1568
Flt Permitted	0.950			0.950				0.950		0.950	0.959	
Satd. Flow (perm)	1752	5036	0	1752	5036	1568	0	1752	1568	1665	1681	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)						53			261			154
Link Speed (mph)		45			45			25			25	
Link Distance (ft)		3513			454			634			595	
Travel Time (s)		53.2			6.9			17.3			16.2	
Confl. Peds. (#/hr)												
Confl. Bikes (#/hr)												
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Growth Factor	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%	3%
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	0
Parking (#/hr)												
Mid-Block Traffic (%)		0%			0%			0%			0%	
Adj. Flow (vph)	45	2257	4	18	2242	75	237	0	261	295	25	154
Shared Lane Traffic (%)										46%		
Lane Group Flow (vph)	45	2261	0	18	2242	75	0	237	261	159	161	154
Turn Type	Prot			Prot		Perm	Split		custom	Split		custom
Protected Phases	1	6		5	2		8	8		4	4	
Permitted Phases						2			5 8			1 4
Detector Phase	1	6		5	2	2	8	8	5 8	4	4	1 4
Switch Phase												
Minimum Initial (s)	6.0	10.0		6.0	10.0	10.0	5.0	5.0		5.0	5.0	
Minimum Split (s)	14.0	23.0		12.0	23.0	23.0	10.0	10.0		10.0	10.0	
Total Split (s)	14.0	38.0	0.0	12.0	36.0	36.0	13.0	13.0	25.0	11.0	11.0	25.0
Total Split (%)	14.0%	38.0%	0.0%	12.0%	36.0%	36.0%	13.0%	13.0%	25.0%	11.0%	11.0%	25.0%
Yellow Time (s)	4.0	5.0		4.0	5.0	5.0	3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lost Time Adjust (s)	-2.0	-3.0	0.0	-2.0	-3.0	-3.0	0.0	-1.0	-2.0	-1.0	-1.0	-2.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	5.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lag	Lead		Lag	Lead	Lead						
Lead-Lag Optimize?	Yes	Yes		Yes	Yes	Yes						
Recall Mode	None	C-Max		None	C-Max	C-Max	None	None		None	None	
Act Effct Green (s)	10.0	54.8		8.0	52.8	52.8		9.0	17.0	7.0	7.0	21.0
Actuated g/C Ratio	0.10	0.55		0.08	0.53	0.53		0.09	0.17	0.07	0.07	0.21

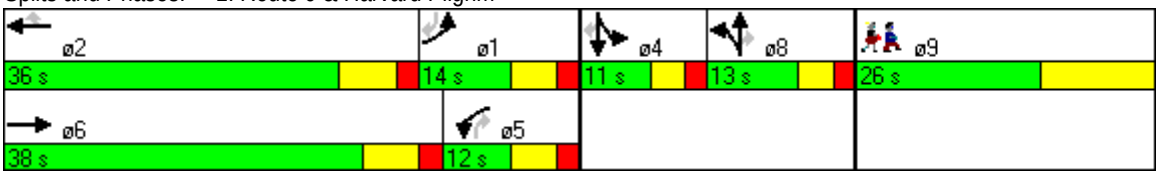
Lane Group	ø9
Lane Configurations	
Volume (vph)	
Ideal Flow (vphpl)	
Lane Width (ft)	
Grade (%)	
Storage Length (ft)	
Storage Lanes	
Taper Length (ft)	
Lane Util. Factor	
Ped Bike Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Right Turn on Red	
Satd. Flow (RTOR)	
Link Speed (mph)	
Link Distance (ft)	
Travel Time (s)	
Confl. Peds. (#/hr)	
Confl. Bikes (#/hr)	
Peak Hour Factor	
Growth Factor	
Heavy Vehicles (%)	
Bus Blockages (#/hr)	
Parking (#/hr)	
Mid-Block Traffic (%)	
Adj. Flow (vph)	
Shared Lane Traffic (%)	
Lane Group Flow (vph)	
Turn Type	
Protected Phases	9
Permitted Phases	
Detector Phase	
Switch Phase	
Minimum Initial (s)	4.0
Minimum Split (s)	26.0
Total Split (s)	26.0
Total Split (%)	26%
Yellow Time (s)	10.0
All-Red Time (s)	0.0
Lost Time Adjust (s)	
Total Lost Time (s)	
Lead/Lag	
Lead-Lag Optimize?	
Recall Mode	None
Act Effct Green (s)	
Actuated g/C Ratio	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
v/c Ratio	0.26	0.82		0.13	0.84	0.09		1.50	0.54	1.36	1.36	0.34
Control Delay	45.7	23.6		45.1	25.6	7.8		288.9	7.8	244.4	246.1	7.8
Queue Delay	0.0	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	45.7	23.6		45.1	25.6	7.8		288.9	7.8	244.4	246.1	7.8
LOS	D	C		D	C	A		F	A	F	F	A
Approach Delay		24.0			25.2			141.6			168.1	
Approach LOS		C			C			F			F	
Queue Length 50th (ft)	27	355		11	370	6		~211	0	~141	~143	0
Queue Length 95th (ft)	62	#782		33	#797	42		#362	55	#275	#277	51
Internal Link Dist (ft)		3433			374			554			515	
Turn Bay Length (ft)				390		250						
Base Capacity (vph)	175	2760		140	2659	853		158	483	117	118	451
Starvation Cap Reductn	0	0		0	0	0		0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0		0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0		0	0	0	0	0
Reduced v/c Ratio	0.26	0.82		0.13	0.84	0.09		1.50	0.54	1.36	1.36	0.34

Intersection Summary

Area Type: Other
Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Green, Master Intersection
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.50
Intersection Signal Delay: 47.1 Intersection LOS: D
Intersection Capacity Utilization 75.2% ICU Level of Service D
Analysis Period (min) 15
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Route 9 & Harvard Pilgrim



Lane Group	ø9
v/c Ratio	
Control Delay	
Queue Delay	
Total Delay	
LOS	
Approach Delay	
Approach LOS	
Queue Length 50th (ft)	
Queue Length 95th (ft)	
Internal Link Dist (ft)	
Turn Bay Length (ft)	
Base Capacity (vph)	
Starvation Cap Reductn	
Spillback Cap Reductn	
Storage Cap Reductn	
Reduced v/c Ratio	

Intersection Summary