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MEMORANDUM

To: Ms. Nora Loughnane
Town Planner, Town of Westwood

Fr: Jeffrey S. Dirk, PE, PTOE, FITE
Nancy B. Doherty, PE

Re: **University Station – Canton Street/University Avenue**

Dt: February 20, 2013

At the request of BETA Group, Tetra Tech and Vanasse & Associates, Inc. (Tt/VAI) have completed an analysis of operating conditions at the Canton Street/University Avenue intersection with the planned MassDOT improvements and assuming that all traffic associated with the University Station project (hereafter referred to as the "Project") arriving from and departing to I-95 south of Dedham Street were to travel through the intersection.

The Build condition peak hour traffic volumes developed for purpose of this analysis are based on the distributions that were provided as a part of the February 19, 2013 preliminary analysis of the I-95/I-93 interchange (submitted under separate cover) and attached to this memorandum as Figure 1. As requested, all I-95 oriented Project traffic is assigned to the University Avenue/Canton Street intersection; however, this analysis does not assume that the full MassDOT I-95/I-93 Interchange Improvement Project is complete. As such, the 2022 Build peak hour volumes shown on Figure 2 do not include a redistribution of 2022 No-Build traffic (a redistribution that will occur when the interchange is complete).

The detailed analysis results are provided in Attachment A and are summarized in Table 1. For context, the analyses that were provided in the February 19, 2013 traffic memorandum concerning the I-95/I-93 Interchange Improvement Project are also provided in Table 1 to allow for a general comparison of operating conditions at the intersection with and without the completion of the I-95/I-93 Interchange Improvement Project.

Based on a review of Table 1, if all Project traffic arriving from and departing to points south of Dedham Street along I-95 were to travel through the University Avenue/Canton Street intersection, the overall level of service of the intersection would be LOS D or better for all 2022 peak hours, indicating that the current MassDOT design would maintain acceptable operating conditions at the intersection should all Project-related traffic destined to/from the south on I-95 traverse the Canton Street/University Avenue intersection.

Attachments:
Figures
Attachment A –Capacity Analyses

One Grant Street
Framingham, MA 01701
Tel 508.903.2000 Fax 508.903.2001

Table 1 2022 Build Condition – University Avenue at Canton Street Capacity Analyses Summary

	2022 Morning Peak Hour										2022 Afternoon Peak Hour										2022 Saturday Peak Hour									
	With I-95 Site Trips					With Full Interchange Improvement					With I-95 Site Trips					With Interchange Improvement					With I-95 Site Trips					With Interchange Improvement				
Location	**V/C**	**Del.**	**LOS**	**50th Q**	**95th Q**	**V/C**	**Del.**	**LOS**	**50th Q**	**95th Q**	**V/C**	**Del.**	**LOS**	**50th Q**	**95th Q**	**V/C**	**Del.**	**LOS**	**50th Q**	**95th Q**	**V/C**	**Del.**	**LOS**	**50th Q**	**95th Q**	**V/C**	**Del.**	**LOS**	**50th Q**	**95th Q**
University Avenue/Canton Street																													
Canton St. EB L	0.50	39	D	26	78	0.50	40	D	26	78	0.62	31	C	85	#221	0.68	35	D	89	#245	0.38	25	C	35	107	0.36	24	C	34	105
Canton St. EB TR	0.60	46	D	68	#154	0.65	49	D	70	#167	0.86	46	D	223	#450	0.94	59	E	229	#477	0.36	29	C	32	81	0.33	29	C	31	80
Canton St. WB L	0.86	31	C	261	#686	0.86	31	C	266	#689	0.92	71	E	82	#271	0.92	72	E	85	#271	0.38	22	C	38	113	0.36	21	C	37	111
Canton St. WB T	0.86	38	D	349	#790	0.86	38	D	349	#790	0.53	36	D	114	242	0.58	39	D	117	#249	0.41	29	C	43	#142	0.38	28	C	42	#129
Canton St. WB R	0.53	1	A	0	0	0.77	4	A	0	0	0.44	1	A	0	0	0.51	1	A	0	0	0.42	1	A	0	0	0.44	1	A	0	0
University Ave. NB L	0.77	77	E	30	#126	0.77	77	E	30	#126	0.20	32	C	14	50	0.22	33	C	15	51	0.05	21	C	3	19	0.05	20	B	3	19
University Ave. NB T	0.89	60	E	201	#480	0.89	60	E	201	#480	1.07	101	F	~294	#677	1.16	135	F	~330	#702	0.86	40	D	151	#446	0.81	34	C	147	#433
University Ave. NB R	0.14	10	B	0	19	0.14	10	A	0	18	0.78	39	D	144	#398	0.83	45	D	159	#424	0.08	15	B	0	19	0.08	14	B	0	19
University Ave. SB L	0.91	71	E	105	#247	0.99	88	F	114	#271	1.06	88	F	~276	#569	1.19	132	F	~411	#746	0.88	40	D	122	#320	1.01	69	E	128	#344
University Ave. SB TR	0.96	58	E	332	#768	0.96	58	E	332	#768	0.77	24	C	290	#735	0.74	22	C	274	#712	0.57	13	B	108	354	0.58	14	B	113	363
Intersection	**0.87**	**37**	**D**			**0.86**	**36**	**D**			**0.96**	**48**	**D**			**1.01**	**65**	**E**			**0.65**	**23**	**C**			**0.67**	**28**	**C**		

Note: v/c = volume-to-capacity ratio, Del. = Average delay expressed in seconds per vehicle, LOS= Level of Service, 50th Percentile Queue in feet, 95th Percentile Queue in feet
m = Queue metered by upstream signal, # = 95th percentile volume exceeds capacity, queue may be longer, ~ = Volume exceeds capacity, queue is theoretically infinite"

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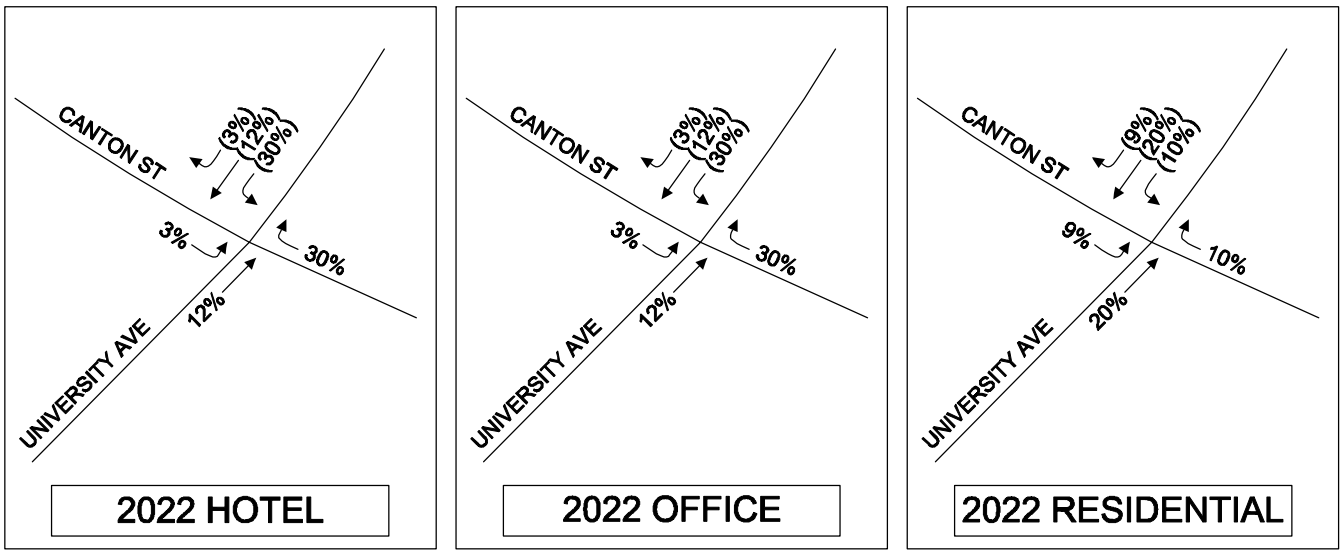

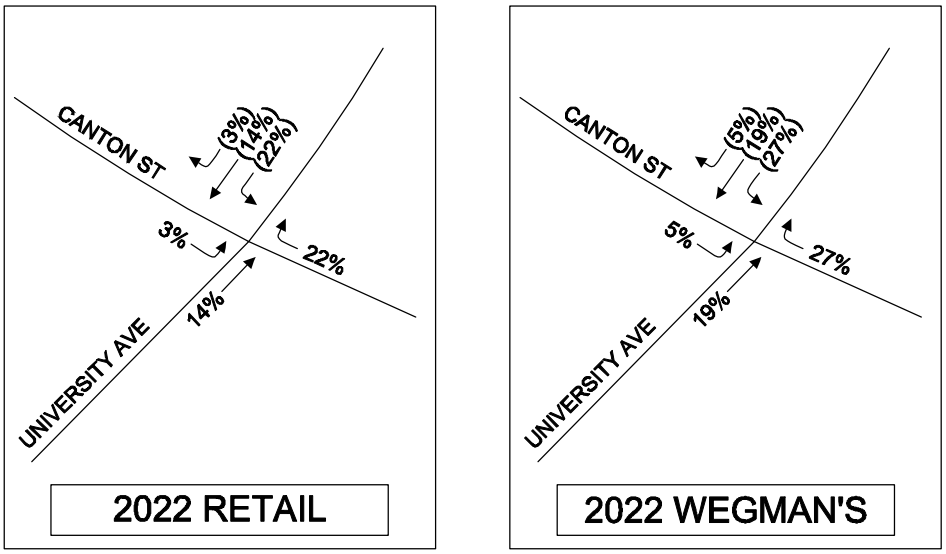

Not to Scale

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Westwood, Massachusetts

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Project Trip Distributions

Figure 1

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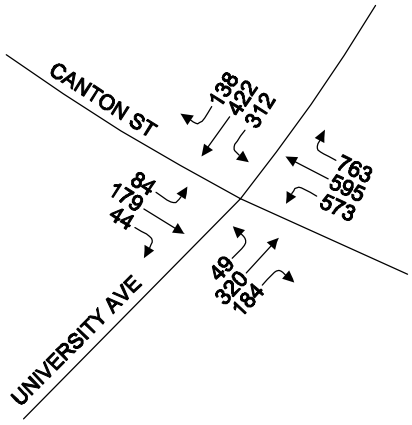

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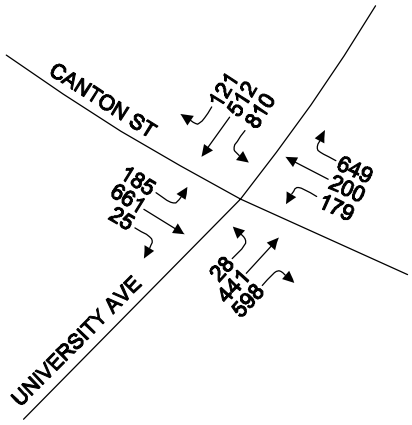

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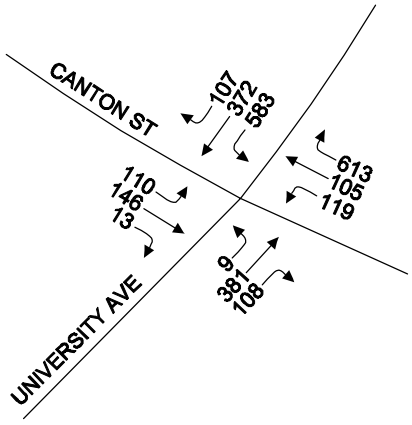

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2022 Build Peak Hour Traffic Volumes

Figure 2

304: Canton Street & University Ave

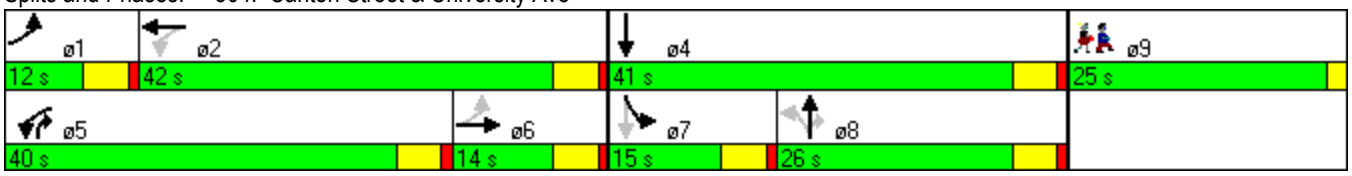
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	ø9
Lane Configurations											
Volume (vph)	84	179	573	595	763	49	320	184	312	422	
Lane Group Flow (vph)	91	243	623	647	829	53	348	200	339	609	
Turn Type	pm+pt		pm+pt		Free	Perm		pm+ov	Prot		
Protected Phases	1	6	5	2			8	5	7	4	9
Permitted Phases	6		2		Free	8		8		7	
Detector Phase	1	6	5	2		8	8	5	7	4	
Switch Phase											
Minimum Initial (s)	4.0	7.0	4.0	7.0		3.0	3.0	4.0	4.0	3.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	25.0
Total Split (s)	12.0	14.0	40.0	42.0	0.0	26.0	26.0	40.0	15.0	41.0	25.0
Total Split (%)	10.0%	11.7%	33.3%	35.0%	0.0%	21.7%	21.7%	33.3%	12.5%	34.2%	21%
Yellow Time (s)	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	0.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lead	Lag	Lead	Lag		Lag	Lag	Lead	Lead		
Lead-Lag Optimize?											
Recall Mode	None	None	None	None		None	None	None	None	None	None
Act Effct Green (s)	18.0	10.1	50.4	40.8	100.0	22.2	22.2	61.9	11.1	37.3	
Actuated g/C Ratio	0.18	0.10	0.50	0.41	1.00	0.22	0.22	0.62	0.11	0.37	
v/c Ratio	0.45	0.66	0.85	0.84	0.53	0.76	0.87	0.21	0.89	0.94	
Control Delay	28.5	50.4	33.7	40.6	1.3	96.2	60.8	1.7	70.4	53.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	28.5	50.4	33.7	40.6	1.3	96.2	60.8	1.7	70.4	53.8	
LOS	C	D	C	D	A	F	E	A	E	D	
Approach Delay		44.4		23.0			44.2			59.7	
Approach LOS		D		C			D			E	
Queue Length 50th (ft)	26	68	261	349	0	30	201	0	105	332	
Queue Length 95th (ft)	78	#154	#686	#790	0	#126	#480	19	#247	#768	
Internal Link Dist (ft)		800		114			1633			620	
Turn Bay Length (ft)	150				350	50		260	350		
Base Capacity (vph)	204	368	735	768	1553	70	402	945	381	651	
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	0.45	0.66	0.85	0.84	0.53	0.76	0.87	0.21	0.89	0.94	

Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 100	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 0.94	
Intersection Signal Delay: 36.8	Intersection LOS: D
Intersection Capacity Utilization 85.4%	ICU Level of Service E
Analysis Period (min) 15	

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

304: Canton Street & University Ave

Splits and Phases: 304: Canton Street & University Ave



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	84	179	44	573	595	763	49	320	184	312	422	138
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	14	12	12	12	12	12	12	12	12	11	12
Total Lost time (s)	4.0	4.0		4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1678	3474		1787	1881	1553	1671	1810	1404	3433	1721	
Flt Permitted	0.38	1.00		0.32	1.00	1.00	0.18	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	679	3474		607	1881	1553	317	1810	1404	3433	1721	
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)	91	195	48	623	647	829	53	348	200	339	459	150
RTOR Reduction (vph)	0	18	0	0	0	0	0	0	86	0	9	0
Lane Group Flow (vph)	91	225	0	623	647	829	53	348	114	339	600	0
Heavy Vehicles (%)	4%	3%	26%	1%	1%	4%	8%	5%	15%	2%	3%	2%
Turn Type	pm+pt			pm+pt		Free	Perm		pm+ov	Prot		
Protected Phases	1	6		5	2			8	5	7	4	
Permitted Phases	6			2		Free	8		8		7	
Actuated Green, G (s)	15.7	10.1		50.4	39.8	102.5	21.2	21.2	56.5	10.1	36.3	
Effective Green, g (s)	17.7	11.1		51.4	40.8	102.5	22.2	22.2	58.5	11.1	37.3	
Actuated g/C Ratio	0.17	0.11		0.50	0.40	1.00	0.22	0.22	0.57	0.11	0.36	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	182	376		722	749	1553	69	392	801	372	626	
v/s Ratio Prot	0.03	0.06		c0.31	c0.34			0.19	0.05	0.10	c0.35	
v/s Ratio Perm	0.05			0.13		c0.53	0.17		0.03			
v/c Ratio	0.50	0.60		0.86	0.86	0.53	0.77	0.89	0.14	0.91	0.96	
Uniform Delay, d1	37.1	43.6		20.4	28.3	0.0	37.7	38.9	10.3	45.2	31.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	2.2	2.6		10.4	10.1	1.3	39.2	20.8	0.1	25.8	25.7	
Delay (s)	39.2	46.1		30.8	38.4	1.3	76.9	59.7	10.4	71.0	57.6	
Level of Service	D	D		C	D	A	E	E	B	E	E	
Approach Delay (s)		44.3			21.5			44.8			62.4	
Approach LOS		D			C			D			E	

Intersection Summary			
HCM Average Control Delay	36.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	102.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

304: Canton Street & University Ave

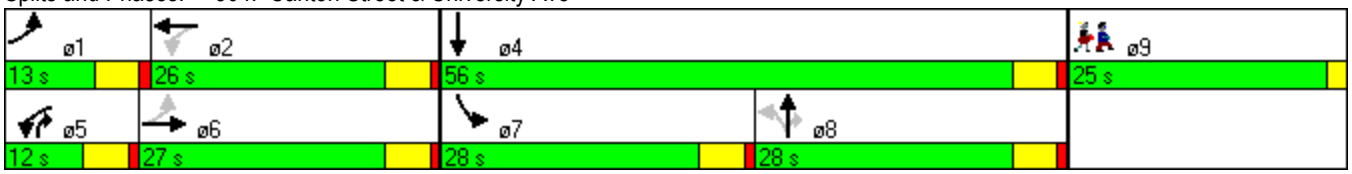
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	ø9
Lane Configurations											
Volume (vph)	185	661	179	200	649	28	441	598	810	512	
Lane Group Flow (vph)	201	745	195	217	705	30	479	650	880	689	
Turn Type	pm+pt		pm+pt		Free	Perm		pm+ov	Prot		
Protected Phases	1	6	5	2			8	5	7	4	9
Permitted Phases	6		2		Free	8		8			
Detector Phase	1	6	5	2		8	8	5	7	4	
Switch Phase											
Minimum Initial (s)	4.0	7.0	4.0	7.0		3.0	3.0	4.0	4.0	3.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	25.0
Total Split (s)	13.0	27.0	12.0	26.0	0.0	28.0	28.0	12.0	28.0	56.0	25.0
Total Split (%)	10.8%	22.5%	10.0%	21.7%	0.0%	23.3%	23.3%	10.0%	23.3%	46.7%	21%
Yellow Time (s)	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	0.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lead	Lag	Lead	Lag		Lag	Lag	Lead	Lead		
Lead-Lag Optimize?											
Recall Mode	None	None	None	None		None	None	None	None	None	None
Act Effct Green (s)	32.3	23.2	30.3	22.2	100.0	24.2	24.2	35.6	24.2	52.5	
Actuated g/C Ratio	0.32	0.23	0.30	0.22	1.00	0.24	0.24	0.36	0.24	0.52	
v/c Ratio	0.61	0.85	0.91	0.52	0.44	0.20	1.05	0.81	1.05	0.76	
Control Delay	36.0	47.9	71.0	41.1	0.9	37.5	94.8	20.3	82.3	27.0	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	36.0	47.9	71.0	41.1	0.9	37.5	94.8	20.3	82.3	27.0	
LOS	D	D	E	D	A	D	F	C	F	C	
Approach Delay		45.4		20.9			51.5			58.0	
Approach LOS		D		C			D			E	
Queue Length 50th (ft)	85	223	82	114	0	14	~294	144	~276	290	
Queue Length 95th (ft)	#221	#450	#271	242	0	50	#677	#398	#569	#735	
Internal Link Dist (ft)		800		114			1633			620	
Turn Bay Length (ft)	150				350	50		260	350		
Base Capacity (vph)	327	878	215	418	1599	152	455	807	839	904	
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	0.61	0.85	0.91	0.52	0.44	0.20	1.05	0.81	1.05	0.76	

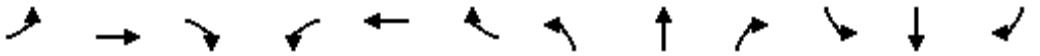
Intersection Summary	
Cycle Length: 120	
Actuated Cycle Length: 100	
Natural Cycle: 150	
Control Type: Actuated-Uncoordinated	
Maximum v/c Ratio: 1.05	
Intersection Signal Delay: 45.3	Intersection LOS: D
Intersection Capacity Utilization 89.2%	ICU Level of Service E
Analysis Period (min) 15	

~ 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: 304: Canton Street & University Ave





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	185	661	25	179	200	649	28	441	598	810	512	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	14	12	12	12	12	12	12	12	12	11	12
Total Lost time (s)	4.0	4.0		4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1711	3775		1752	1881	1599	1480	1881	1583	3467	1712	
Flt Permitted	0.41	1.00		0.18	1.00	1.00	0.40	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	741	3775		332	1881	1599	628	1881	1583	3467	1712	
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)	201	718	27	195	217	705	30	479	650	880	557	132
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	257	0	6	0
Lane Group Flow (vph)	201	743	0	195	217	705	30	479	393	880	683	0
Heavy Vehicles (%)	2%	1%	8%	3%	1%	1%	22%	1%	2%	1%	4%	5%
Bus Blockages (#/hr)	0	1	0	0	0	0	0	0	0	0	0	0
Turn Type	pm+pt			pm+pt		Free	Perm		pm+ov	Prot		
Protected Phases	1	6		5	2			8	5	7	4	
Permitted Phases	6			2		Free	8		8			
Actuated Green, G (s)	30.3	22.2		28.3	21.2	101.5	23.2	23.2	30.3	23.2	51.4	
Effective Green, g (s)	32.3	23.2		30.3	22.2	101.5	24.2	24.2	32.3	24.2	52.4	
Actuated g/C Ratio	0.32	0.23		0.30	0.22	1.00	0.24	0.24	0.32	0.24	0.52	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	323	863		212	411	1599	150	448	504	827	884	
v/s Ratio Prot	0.06	0.20		c0.07	0.12			c0.25	0.06	c0.25	0.40	
v/s Ratio Perm	0.14			c0.20		c0.44	0.05		0.19			
v/c Ratio	0.62	0.86		0.92	0.53	0.44	0.20	1.07	0.78	1.06	0.77	
Uniform Delay, d1	27.2	37.6		31.0	35.0	0.0	30.9	38.6	31.4	38.6	19.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	3.7	8.8		39.7	1.2	0.9	0.7	62.2	7.5	49.8	4.2	
Delay (s)	30.9	46.4		70.7	36.2	0.9	31.6	100.9	38.9	88.4	24.0	
Level of Service	C	D		E	D	A	C	F	D	F	C	
Approach Delay (s)		43.1			19.9			64.3			60.1	
Approach LOS		D			B			E			E	

Intersection Summary			
HCM Average Control Delay	48.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	101.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

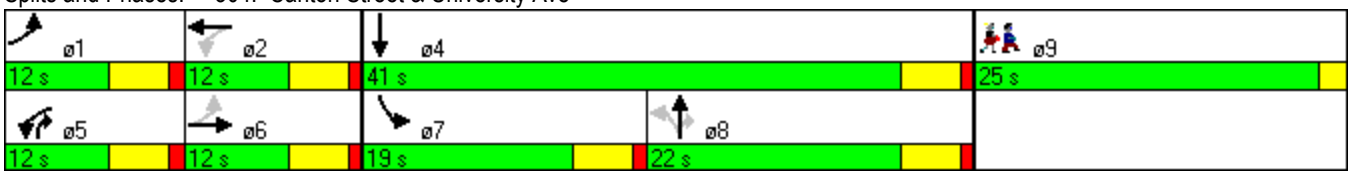
304: Canton Street & University Ave

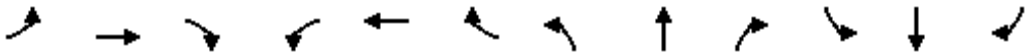
Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	ø9
Lane Configurations											
Volume (vph)	110	146	119	105	613	9	381	108	583	372	
Lane Group Flow (vph)	120	173	129	114	666	10	414	117	634	520	
Turn Type	pm+pt		pm+pt		Free	Perm		pm+ov	Prot		
Protected Phases	1	6	5	2			8	5	7	4	9
Permitted Phases	6		2		Free	8		8			
Detector Phase	1	6	5	2		8	8	5	7	4	
Switch Phase											
Minimum Initial (s)	4.0	7.0	4.0	7.0		3.0	3.0	4.0	4.0	3.0	4.0
Minimum Split (s)	12.0	12.0	12.0	12.0		12.0	12.0	12.0	12.0	12.0	25.0
Total Split (s)	12.0	12.0	12.0	12.0	0.0	22.0	22.0	12.0	19.0	41.0	25.0
Total Split (%)	13.3%	13.3%	13.3%	13.3%	0.0%	24.4%	24.4%	13.3%	21.1%	45.6%	28%
Yellow Time (s)	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	2.0
All-Red Time (s)	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0	1.0	0.0
Lost Time Adjust (s)	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag	Lead	Lag	Lead	Lag		Lag	Lag	Lead	Lead		
Lead-Lag Optimize?											
Recall Mode	None	None	None	None		None	None	None	None	None	None
Act Effct Green (s)	16.1	8.1	17.1	10.7	70.0	18.3	18.3	29.9	15.3	37.7	
Actuated g/C Ratio	0.23	0.12	0.24	0.15	1.00	0.26	0.26	0.43	0.22	0.54	
v/c Ratio	0.35	0.40	0.39	0.39	0.42	0.05	0.83	0.16	0.85	0.55	
Control Delay	25.0	32.2	25.8	36.7	0.8	24.8	43.0	3.1	40.4	15.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	25.0	32.2	25.8	36.7	0.8	24.8	43.0	3.1	40.4	15.1	
LOS	C	C	C	D	A	C	D	A	D	B	
Approach Delay		29.3		8.9			34.0			29.0	
Approach LOS		C		A			C			C	
Queue Length 50th (ft)	35	32	38	43	0	3	151	0	122	108	
Queue Length 95th (ft)	107	81	113	#142	0	19	#446	19	#320	354	
Internal Link Dist (ft)		800		114			1635			620	
Turn Bay Length (ft)	150				350	50		260	350		
Base Capacity (vph)	346	435	331	290	1599	192	497	724	749	942	
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	0.35	0.40	0.39	0.39	0.42	0.05	0.83	0.16	0.85	0.55	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 70
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 23.6 — Intersection LOS: C
Intersection Capacity Utilization 62.4% — ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 304: Canton Street & University Ave





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	146	13	119	105	613	9	381	108	583	372	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	14	12	12	12	12	12	12	12	12	11	12
Total Lost time (s)	4.0	4.0		4.0	4.0	3.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	
Frt	1.00	0.99		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1728	3679		1736	1900	1599	1480	1900	1538	3433	1733	
Flt Permitted	0.68	1.00		0.55	1.00	1.00	0.47	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1243	3679		1009	1900	1599	734	1900	1538	3433	1733	
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)	120	159	14	129	114	666	10	414	117	634	404	116
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	74	0	10	0
Lane Group Flow (vph)	120	166	0	129	114	666	10	414	43	634	510	0
Heavy Vehicles (%)	1%	3%	8%	4%	0%	1%	22%	0%	5%	2%	2%	4%
Turn Type	pm+pt			pm+pt		Free	Perm		pm+ov	Prot		
Protected Phases	1	6		5	2			8	5	7	4	
Permitted Phases	6			2		Free	8		8			
Actuated Green, G (s)	13.8	8.2		16.8	9.7	72.5	17.4	17.4	24.5	14.2	36.6	
Effective Green, g (s)	15.8	9.2		18.8	10.7	72.5	18.4	18.4	26.5	15.2	37.6	
Actuated g/C Ratio	0.22	0.13		0.26	0.15	1.00	0.25	0.25	0.37	0.21	0.52	
Clearance Time (s)	5.0	5.0		5.0	5.0		5.0	5.0	5.0	5.0	5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	315	467		343	280	1599	186	482	562	720	899	
v/s Ratio Prot	0.03	0.05		0.04	0.06			c0.22	0.01	c0.18	0.29	
v/s Ratio Perm	0.05			0.06		c0.42	0.01		0.02			
v/c Ratio	0.38	0.36		0.38	0.41	0.42	0.05	0.86	0.08	0.88	0.57	
Uniform Delay, d1	23.8	28.9		21.5	28.0	0.0	20.5	25.8	15.0	27.8	11.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.8	0.5		0.7	1.0	0.8	0.1	14.1	0.1	12.1	0.8	
Delay (s)	24.6	29.4		22.2	29.0	0.8	20.6	39.9	15.1	39.9	12.7	
Level of Service	C	C		C	C	A	C	D	B	D	B	
Approach Delay (s)		27.4			7.4			34.2			27.7	
Approach LOS		C			A			C			C	

Intersection Summary			
HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	72.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			