Transportation
Land Development
Environmental
Services

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Memorandum

To: City of Newton, Massachusetts
Attn: David Koses, Project Manager.
Department of Planning and
Community Development
1000 Commonwealth Avenue
Newton, Massachusetts

Date: October 15, 2012

Project No.: 10865.00

From: Randall C. Hart
Director
Transportation Planning & Engineering
Land Development

Mathew Kealey, P.E. PTOE
Project Manger

Re: Proposed Station at Riverside
Redevelopment
Newton, Massachusetts

Vanasse Hangen Brustlin, Inc (VHB) has prepared responses to comments made by Fay Spofford & Thorndike (FST) in their peer review letter dated August 7, 2012. The August 7, 2012 FST letter provided comments on the February 2012 Traffic Impact and Access Study (TIAS) prepared for the Station at Riverside Redevelopment project which is located at the existing Riverside MBTA Station along Grove Street in Newton, Massachusetts. Generally speaking, FST concurred with the methodology and analyses presented in the TIAS, but had some comments, questions, and suggestions that warranted further evaluation and response. As such, VHB has prepared this memorandum which focuses exclusively on the questions, comments, and suggestions and does not reiterate discussion in areas of the TIAS where we are in general agreement. Because the comments in the FST letter were not numbered, a heading for each section has been provided for ease of reference.

FEBRUARY 2012 TRAFFIC IMPACT AND ACCESS STUDY (TIAS)

TRAFFIC DISTRIBUTION

Comment: *(page 6 of 11)"While the regional traffic distribution pattern identified on Table 9 of the TIAS is reasonable, we conclude that the site-related traffic distributed to Grove Street-Auburn Street-Washington Street corridor should be increased. Site generated traffic is too strongly oriented to the regional highway system. This is based on both historic counts and confirmed by new counts FST conducted on June 21, 2012 pertaining to the Riverside Office driveways and MBTA driveway. We recommend re-analysis of 13 intersections, 11 intervening intersections with expected site-related traffic assuming increase of 60-85 additional trips per hour during peak hours compared to the volumes presented in the TIAS. These include:*

- *Grove Street at the Route 128 Northbound Ramps not signalized*
- *Grove Street at the Riverside MBTA Parking Lot Driveway- signalized*
- *Grove Street at the Riverside Office Building (south) and Apartment Driveways- signalized.*

- *Grove Street at Hancock Street- not signalized*
- *Grove Street at Woodland Road- not signalized*
- *Grove Street at Central/ Street Auburn Street-signalized*
- *Commonwealth Avenue (Route 30) at Auburn Street- signalized*
- *Washington Street (Route 16) at Auburn Street-signalized*
- *Washington Street (Route 16) at Perkins Street and Massachusetts Turnpike (I-90) EB On-Ramp (two intersections)-signalized*
- *Washington Street (Route 16) at Massachusetts Turnpike (I-90) WB Off-Ramp-signalized*

Conversely, traffic reductions of up to 60-85 site related vehicle trips per hour during the peak hours are expected at the Grove Street Exit 22 roundabouts and the site driveway intersection with the C-D Road."

Response: To assess the project impacts with modification to the site traffic distribution, VHB has reanalyzed the 13 intersections mentioned above with the recommended traffic distribution. The results of this assessment are outlined in Tables 1-4, which are described below:

- **Table 1 –** Comparison of signalized intersection between the February 2012 TIAS capacity analysis and capacity analysis with the recommended modifications to the trip distribution.
- **Table 2 –** Comparison of unsignalized intersection between the February 2012 TIAS capacity analysis and capacity analysis with the recommended modifications to the trip distribution.
- **Table 3** - Comparison of February 2012 TIAS mitigated intersection capacity analysis and mitigated intersection capacity analysis with the recommended modifications to the trip distribution. These analyses were conducted for Option A and Option B-2.
- **Table 4 –** Summary of capacity analysis for additional mitigated intersections.

All details of the revised assessment are included in the Appendix of this document.

Table 1 Signalized Intersection Capacity Analysis

Location	2022 No-Build Conditions					2022 Build Conditions (2012 TIAS)					2022 Build Conditions (Updated*)				
				Vehicle Queues					Vehicle Queues					Vehicle Queues	
	v/c [a]	Delay [b]	LOS [c]	50th	95th	v/c	Delay	LOS	50th	95th	v/c	Delay	LOS	50th	95th
Grove Street at Riverside Office Building Center Driveway															
Weekday Morning															
Apartment Driveway WB LTR	0.20	28	C	5	23	0.32	29	C	15	42	0.21	31	C	6	23
Grove Street NB L	0.67	21	C	90	273	0.70	25	C	103	277	0.70	25	C	109	273
Grove Street NB TR	0.50	4	A	61	278	0.53	5	A	67	306	0.53	4	A	71	318
Grove Street SB LTR	0.66	18	B	113	373	0.73	22	C	143	486	0.72	20	B	155	524
Overall	**0.63**	**13**	**B**	--	--	**0.68**	**15**	**B**	--	--	**0.68**	**14**	**B**	--	--
Weekday Evening															
Apartment Driveway WB LTR	0.35	30	C	1	16	0.37	32	C	1	16	0.34	32	C	1	16
Grove Street NB L	0.85	152	F	2	30	0.77	115	F	3	30	0.81	134	F	3	30
Grove Street NB TR	0.42	3	A	0	239	0.44	3	A	0	270	0.48	3	A	0	310
Grove Street SB LTR	0.46	5	A	0	314	0.48	5	A	0	351	0.49	5	A	0	373
Overall	**0.48**	**6**	**A**	--	--	**0.50**	**6**	**A**	--	--	**0.48**	**6**	**A**	--	--
Grove Street at Central Street and Auburn Street															
Weekday Morning															
Central Street EB LTR	0.31	19	B	44	113	0.31	19	B	44	113	0.31	20	B	44	114
Auburn Street WB LTR	0.46	22	C	53	157	0.61	26	C	73	232	0.72	30	C	89	284
Grove Street NB LTR	0.56	14	B	111	303	0.58	14	B	115	315	0.61	15	B	124	338
Auburn Street SB LTR	0.69	18	B	118	387	0.71	18	B	122	401	0.72	19	B	124	408
Overall	**0.61**	**17**	**B**	--	--	**0.67**	**18**	**B**	--	--	**0.72**	**20**	**B**	--	--
Weekday Evening															
Central Street EB LTR	0.30	19	B	44	120	0.30	19	B	44	120	0.30	19	B	44	120
Auburn Street WB LTR	0.57	24	C	74	217	0.66	27	C	86	261	0.75	32	C	99	303
Grove Street NB LTR	0.59	14	B	120	331	0.62	15	B	127	351	0.69	16	B	146	453
Auburn Street SB LTR	0.87	29	C	152	493	0.89	31	C	156	503	0.94	40	D	163	519
Overall	**0.76**	**22**	**C**	--	--	**0.81**	**23**	**C**	--	--	**0.87**	**27**	**C**	--	--

* Analysis was conducted based on the redistribution recommended by FST.

Table 1 Signalized Intersection Capacity Analysis (Continued)

Location	2022 No-Build Conditions					2022 Build Conditions (2012 TIAS)					2022 Build Conditions (Updated*)				
				Vehicle Queues					Vehicle Queues					Vehicle Queues	
	v/c [a]	Delay [b]	LOS [c]	50th	95th	v/c	Delay	LOS	50th	95th	v/c	Delay	LOS	50th	95th
Washington Street at Auburn Street															
Weekday Morning															
Auburn Street EB L	0.83	35	D	208	207	0.83	35	D	214	213	0.83	33	C	227	230
Auburn Street EB R	0.02	19	B	3	10	0.02	19	B	3	10	0.02	18	B	3	10
Washington Street NB LT	0.69	14	B	244	365	0.70	15	B	250	368	0.74	17	B	272	378
Washington Street SB TR	0.74	10	A	148	338	0.77	11	B	205	348	0.83	14	B	292	500
Overall	**0.77**	**15**	**B**	--	--	**0.79**	**16**	**B**	--	--	**0.83**	**18**	**B**	--	--
Weekday Evening															
Auburn Street EB L	0.81	34	C	197	274	0.80	33	C	202	285	0.76	26	C	224	340
Auburn Street EB R	0.02	20	B	2	12	0.01	19	B	2	12	0.01	16	B	2	12
Washington Street NB LT	0.73	15	B	259	385	0.74	16	B	269	390	0.90	27	C	322	478
Washington Street SB TR	0.81	16	B	327	370	0.84	18	B	364	402	0.96	31	C	209	513
Overall	**0.81**	**18**	**B**	--	--	**0.83**	**19**	**B**	--	--	**0.88**	**29**	**C**	--	--
Commonwealth Avenue at Auburn Street (East)															
Weekday Morning															
Auburn Street EB LTR	1.07	108	F	237	604	1.12	127	F	248	632	1.21	162	F	299	695
Auburn Street WB LTR	1.12	125	F	254	624	1.22	165	F	315	700	1.32	205	F	364	767
Commonwealth Avenue NB LTR	0.75	35	D	232	577	0.75	35	D	232	577	0.75	35	D	232	577
Commonwealth Avenue SB L	0.37	20	B	34	111	0.37	20	B	34	111	0.37	20	B	34	111
Commonwealth Avenue SB TR	0.53	19	B	147	415	0.53	19	B	147	415	0.53	19	B	147	415
Carriage Road NWB LTR	0.01	55	D	0	0	0.01	55	D	0	0	0.01	55	D	0	0
Overall	**0.84**	**64**	**E**	--	--	**0.87**	**78**	**E**	--	--	**0.90**	**97**	**F**	--	--
Weekday Evening															
Auburn Street EB LTR	0.97	76	E	200	467	1.04	93	F	214	503	1.22	157	F	293	621
Auburn Street WB LTR	0.90	61	E	186	467	1.06	100	F	220	558	1.06	98	F	230	577
Commonwealth Avenue NB L	0.85	44	D	230	607	0.85	44	D	230	607	0.85	44	D	230	607
Commonwealth Avenue NB TR	0.44	23	C	36	121	0.44	23	C	36	121	0.44	23	C	36	121
Commonwealth Avenue SB LTR	0.60	21	C	158	451	0.60	21	C	158	451	0.60	21	C	158	451
Carriage Road NWB LTR	0.75	131	F	10	24	0.79	145	F	10	24	0.79	145	F	10	24
Overall	**0.88**	**47**	**D**	--	--	**0.91**	**59**	**E**	--	--	**0.96**	**75**	**E**	--	--

* Analysis was conducted based on the redistribution recommended by FST.

Table 1 Signalized Intersection Capacity Analysis (Continued)

Location	2022 No-Build Conditions					2022 Build Conditions (2012 TIAS)					2022 Build Conditions (Updated*)				
				Vehicle Queues					Vehicle Queues					Vehicle Queues	
	v/c [a]	Delay [b]	LOS [c]	50th	95th	v/c	Delay	LOS	50th	95th	v/c	Delay	LOS	50th	95th
Washington Street at Perkins Street															
Weekday Morning															
Washington Street EB TR	0.73	14	B	155	502	0.74	14	B	158	522	0.78	16	B	175	567
Perkins Street NB LTR	0.01	32	C	0	0	0.01	32	C	0	0	0.01	32	C	0	0
Washington Street SB T	0.01	26	C	2	4	0.01	26	C	2	4	0.01	26	C	2	3
Washington Street SB R	0.48	78	E	119	150	0.49	78	E	120	149	0.50	76	E	118	144
Overall	0.59	46	D	--	--	0.60	47	D	--	--	0.62	46	D	--	--
Weekday Evening															
Washington Street EB TR	1.26	140	F	614	953	1.29	153	F	624	967	1.35	178	F	654	991
Perkins Street NB LTR	0.01	32	C	0	0	0.17	33	C	4	14	0.17	33	C	4	14
Washington Street SB T	0.03	21	C	5	6	0.03	21	C	5	6	0.03	21	C	5	6
Washington Street SB R	0.62	32	C	13	6	0.63	29	C	11	23	0.64	28	C	11	22
Overall	0.90	87	F	--	--	0.93	92	F	--	--	0.96	105	F	--	--
Washington Street at MassPike EB On-Ramp															
Weekday Morning															
Washington Street EB T	0.50	4	A	10	44	0.51	4	A	12	46	0.54	4	A	24	56
Washington Street SB L	0.23	21	C	63	65	0.23	20	C	63	63	0.22	20	B	63	57
Overall	0.38	8	A	--	--	0.38	8	A	--	--	0.40	8	A	--	--
Weekday Evening															
Washington Street EB T	0.65	6	A	31	44	0.66	6	A	31	44	0.71	7	A	33	45
Washington Street SB L	0.19	16	B	64	33	0.18	16	B	63	33	0.18	16	B	63	33
Overall	0.40	8	A	--	--	0.41	8	A	--	--	0.43	9	A	--	--
Washington Street at MassPike WB Off-Ramp															
Weekday Morning															
MassPike Off-Ramp (to Route 16 EB)	0.30	16	B	67	116	0.30	16	B	67	116	0.30	16	B	67	116
MassPike Off-Ramp (to Route 16 WB)	0.44	17	B	82	132	0.46	17	B	90	143	0.49	18	B	100	155
Washington Street WB (to Route 16 EB)	0.21	14	B	0	25	0.21	14	B	0	25	0.21	14	B	0	25
Washington Street WB (to Route 16 WB)	0.46	17	B	122	162	0.46	17	B	124	164	0.46	17	B	124	164
Overall	0.45	16	B	--	--	0.46	16	B	--	--	0.48	16	B	--	--
Weekday Evening															
MassPike Off-Ramp (to Route 16 EB)	0.28	13	B	63	108	0.28	13	B	63	108	0.28	13	B	63	108
MassPike Off-Ramp (to Route 16 WB)	0.74	19	B	215	300	0.75	20	B	223	311	0.78	21	C	235	328
Washington Street WB (to Route 16 EB)	0.11	17	B	0	21	0.11	17	B	0	21	0.11	17	B	0	21
Washington Street WB (to Route 16 WB)	0.65	23	C	176	222	0.65	23	C	178	224	0.65	23	C	178	224
Overall	0.70	20	B	--	--	0.71	20	B	--	--	0.72	20	C	--	--

a volume to capacity ratio
b average delay in seconds per vehicle
c level of service
d 50th percentile queue length, measured in feet
e 95th percentile queue length, measured in feet

Table 2 Unsignalized Intersection Capacity Analysis

Location	Critical Side Street Movement	Peak Period	2022 No-Build Conditions				2022 Build Conditions (2012 TIAS)				2022 Build Conditions (Updated*)			
			Dem [a]	v/c [b]	Del [c]	LOS [d]	Dem	v/c	Del	LOS	Dem	v/c	Del	LOS
Grove Street at Riverside Office Building (South Driveway)	WB LTR	Weekday Morning	15	0.17	47	E	15	0.21	60	F	15	0.24	72	F
		Weekday Evening	5	0.41	196	F	5	0.56	305	F	5	0.74	447	F
Grove Street at Riverside Office Building (North Driveway)	EB LTR	Weekday Morning	5	0.07	40	E	5	0.09	49	E	5	0.10	57	F
		Weekday Evening	105	0.64	52	F	105	0.76	77	F	105	0.90	117	F
Grove Street at Hancock Street	SB LR	Weekday Morning	15	0.05	12	B	25	0.09	13	B	25	0.09	14	B
		Weekday Evening	45	0.14	15	B	50	0.16	16	C	50	0.18	17	C
Grove Street at Woodland Road	NB LTR	Weekday Morning	475	1.05	78	F	495	1.14	108	F	525	1.20	131	F
		Weekday Evening	540	1.08	85	F	575	1.17	118	F	630	1.28	159	F

* Analysis was conducted based on the redistribution recommended by FST.
a demand in vehicles per hour for the most critical street approach or lane group
b volume-to-capacity ratio for the critical movement
c delay of critical approach only
d level of service of the critical movement
e The traffic counts did not show any vehicles exiting the Parish of the Messiah eastbound driveway. Critical movement becomes Commonwealth Avenue northbound left turn.
L left
T through
R right

Table 3 Mitigated Intersection Capacity Analysis Comparison – Option B-2 vs. Option A

Location	2022 Build with Mitigation Conditions Right-Turn C-D Road Access – Option A (2012 TIAS)					2022 Build with Mitigation Conditions Right-Turn C-D Road Access – Option A (Updated)					2022 Build with Mitigation Conditions Full C-D Road Access - Option B-2 (2012 TIAS)					2022 Build with Mitigation Conditions Full C-D Road Access - Option B-2 (Updated)				
				Vehicle Queues					Vehicle Queues					Vehicle Queues					Vehicle Queues	
	v/c[a]	Delay[b]	LOS[c]	50th[d]	95th[e]	v/c	Delay	LOS	50th	95th	v/c	Delay	LOS	50th	95th	v/c	Delay	LOS	50th	95th
Grove Street at Riverside MBTA Driveway [f]																				
Weekday Morning																				
Grove Street EB L	0.17	4	A	8	21	0.17	4	A	8	23	0.17	4	A	8	23	0.16	3	A	7	16
Grove Street EB T	0.73	7	A	132	288	0.74	8	A	144	324	0.73	7	A	134	312	0.72	7	A	131	227
Grove Street WB T	0.53	10	A	86	164	0.53	10	A	90	175	0.48	8	A	86	172	0.48	8	A	85	144
Grove Street WB R	0.05	4	A	0	8	0.07	4	A	0	9	0.06	4	A	0	8	0.07	4	A	0	9
MBTA Driveway SB LR	--	--	--	--	--	--	--	--	--	--	0.30	19	B	49	156	--	--	--	--	--
MBTA Driveway SB L	0.27	18	B	13	41	0.39	19	B	22	58	--	--	--	--	--	0.48	19	C	20	68
MBTA Driveway SB R	0.07	14	B	0	28	0.07	14	B	0	27	--	--	--	--	--	0.03	11	B	0	19
Overall	**0.66**	**9**	**A**	--	--	**0.68**	**9**	**A**	--	--	**0.66**	**8**	**A**	--	--	**0.68**	**8**	**A**	--	--
Weekday Evening																				
Grove Street EB L	0.45	10	B	13	38	0.43	10	B	13	34	0.52	11	B	13	37	0.48	11	B	12	30
Grove Street EB T	0.42	4	A	63	104	0.43	5	A	68	113	0.43	5	A	63	104	0.43	5	A	63	104
Grove Street WB T	0.88	23	C	231	449	0.89	25	C	241	461	0.87	22	C	231	449	0.88	22	C	231	449
Grove Street WB R	0.05	4	A	0	7	0.06	4	A	0	9	0.05	4	A	0	7	0.06	4	A	0	9
MBTA Driveway SB LR	--	--	--	--	--	--	--	--	--	--	0.72	32	C	60	153	--	--	--	--	--
MBTA Driveway SB L	0.54	25	C	43	83	0.73	34	C	66	141	--	--	--	--	--	0.72	32	C	68	152
MBTA Driveway SB R	0.55	17	B	68	135	0.55	17	B	69	135	--	--	--	--	--	0.07	13	B	0	24
Overall	**0.75**	**15**	**B**	--	--	**0.76**	**17**	**B**	--	--	**0.82**	**16**	**B**	--	--	**0.82**	**16**	**B**	--	--
Grove Street at the Route 128 NB Ramps [g]																				
Weekday Morning																				
Grove Street EB LT	0.60	9	A	--	0	0.59	8	A	--	0	0.58	8	A	--	187	0.56	8	A	--	175
Grove Street WB T	0.82	28	C	--	332	0.80	26	C	--	306	0.62	16	B	--	157	0.60	15	B	--	149
Grove Street WB R	0.54	12	B	--	116	0.14	11	B	--	19	0.13	11	B	--	17	0.13	11	B	--	17
Route 128 NB Off-Ramp LT	0.62	21	C	--	149	0.60	19	B	--	139	0.68	25	C	--	193	0.66	23	C	--	179
Route 128 NB Off-Ramp R	0.54	12	B	--	116	0.54	12	B	--	116	0.60	14	B	--	152	0.60	14	B	--	152
C-D Road SB LR	--	--	--	--	--	--	--	--	--	--	0.16	8	A	--	24	0.16	8	A	--	24
Overall	**0.82**	**16**	**B**	--	--	**0.80**	**15**	**B**	--	--	**0.68**	**13**	**B**	--	--	**0.66**	**13**	**B**	--	--
Weekday Evening																				
Grove Street EB LT	0.33	5	A	--	0	0.32	5	A	--	0	0.31	5	A	--	70	0.30	5	A	--	66
Grove Street WB T	0.95	38	D	--	676	0.94	24	D	--	623	0.71	16	B	--	222	0.70	15	B	--	213
Grove Street WB R	0.42	13	B	--	64	0.41	2	B	--	62	0.36	11	B	--	54	0.35	10	B	--	53
Route 128 NB Off-Ramp LT	0.29	9	A	--	41	0.29	9	A	--	40	0.31	10	A	--	47	0.30	9	A	--	46
Route 128 NB Off-Ramp R	0.42	8	A	--	68	0.41	8	A	--	67	0.43	8	A	--	78	0.43	8	A	--	77
C-D Road SB LR	--	--	--	--	--	--	--	--	--	--	0.55	20	B	--	114	0.54	19	B	--	113
Overall	**0.95**	**20**	**C**	--	--	**0.94**	**19**	**B**	--	--	**0.71**	**12**	**B**	--	--	**0.70**	**11**	**B**	--	--

* Analysis was conducted based on the redistribution recommended by FST.
a volume to capacity ratio.
b average delay in seconds per vehicle .
c level of service.
d 50th percentile queue length, measured in feet.
e 95th percentile queue length, measured in feet.
f Grove Street at the Riverside MBTA Driveway is proposed to be signalized under 2022 Build with Mitigation conditions.
g Grove Street at the Route 128 Northbound ramps is proposed to be reconstructed as a roundabout under 2022 Build with Mitigation conditions.
h Grove Street at the Route 128 Southbound ramps is proposed to be reconstructed as a roundabout under 2022 Build with Mitigation conditions.

Table 4 Signalized Intersection Capacity Analysis – Additional Mitigated Intersections

	2022 Build Conditions (2012 TIAS)					2022 Build with Mitigation Conditions (2012 TIAS)					2022 Build Conditions (updated)					2022 Build with Mitigation Conditions (updated)				
				Vehicle Queues					Vehicle Queues					Vehicle Queues					Vehicle Queues	
Location	v/c [a]	Delay [b]	LOS [c]	50th	95th	v/c	Delay	LOS	50th	95th	v/c	Delay	LOS	50th	95th	v/c	Delay	LOS	50th	95th
Washington Street at Perkins Street																				
Weekday Morning																				
Washington Street EB TR	0.74	14	B	158	522	0.73	12	B	105	227	0.73	12	B	105	227	0.73	12	B	105	227
Perkins Street NB LTR	0.01	32	C	0	0	0.01	32	C	0	0	0.01	32	C	0	0	0.01	32	C	0	0
Washington Street SB T	0.01	26	C	2	4	0.01	23	C	2	3	0.01	23	C	2	3	0.01	23	C	2	3
Washington Street SB R	0.49	78	E	120	149	0.49	18	B	25	18	0.49	18	B	25	18	0.49	18	B	25	18
Overall	0.60	47	D	--	--	0.59	15	B	--	--	0.59	15	B	--	--	0.59	15	B	--	--
Weekday Evening																				
Washington Street EB TR	1.29	153	F	624	967	1.15	91	F	644	793	1.35	178	F	654	991	1.07	65	E	691	848
Perkins Street NB LTR	0.17	33	C	4	14	0.17	33	C	4	15	0.17	33	C	4	14	0.19	37	D	4	16
Washington Street SB T	0.03	21	C	5	6	0.03	25	C	7	9	0.03	21	C	5	6	0.04	26	C	6	9
Washington Street SB R	0.63	29	C	11	23	0.63	40	D	0	0	0.64	28	C	11	22	0.64	18	B	25	1
Overall	0.93	92	F	--	--	0.89	66	E	--	--	0.96	105	F	--	--	0.87	42	D	--	--
Commonwealth Avenue at Auburn Street (East)																				
Weekday Morning																				
Auburn Street EB LTR	1.12	127	F	248	632						1.21	162	F	299	695	0.92	64	E	244	604
Auburn Street WB LTR	1.22	165	F	315	700						1.32	205	F	364	767	1.04	91	F	289	687
Commonwealth Avenue NB LTR	0.75	35	D	232	577						0.75	35	D	232	577	0.86	49	D	262	646
Commonwealth Avenue SB L	0.37	20	B	34	111						0.37	20	B	34	111	0.43	25	C	41	122
Commonwealth Avenue SB TR	0.53	19	B	147	415						0.53	19	B	147	415	0.59	23	C	177	457
Carriage Road NWB LTR	0.01	55	D	0	0						0.01	55	D	0	0	0.01	55	D	0	0
Overall	0.87	78	E	--	--						0.90	97	F	--	--	0.90	54	D	--	--
Weekday Evening																				
Auburn Street EB LTR	1.04	93	F	214	503						1.22	157	F	293	621	1.09	107	F	256	589
Auburn Street WB LTR	1.06	100	F	220	558						1.06	98	F	230	577	0.96	70	E	220	548
Commonwealth Avenue NB L	0.85	44	D	230	607						0.85	44	D	230	607	0.90	53	D	240	631
Commonwealth Avenue NB TR	0.44	23	C	36	121						0.44	23	C	36	121	0.47	25	C	39	125
Commonwealth Avenue SB LTR	0.60	21	C	158	451						0.60	21	C	158	451	0.63	23	C	169	466
Carriage Road NWB LTR	0.79	145	F	10	24						0.79	145	F	10	24	0.79	145	F	10	24
Overall	0.91	59	E	--	--						0.96	75	E	--	--	0.96	60	E	--	--

* Analysis was conducted based on the redistribution recommended by FST.
a volume to capacity ratio
b average delay in seconds per vehicle
c level of service
d 50th percentile queue length, measured in feet
e 95th percentile queue length, measured in feet

Comment: *(page 6 of 20 Technical Memorandum) Overall, based on TIAS data, FST estimates that approximately 80-85 vehicle trips and approximately 800 daily site-generated trips were assumed to use the Grove Street corridor to the north of the site. Based on actual measured turning movement at the existing site driveways the Applicant should assume 145-165 total vehicle trips per hour will be added during peak hours. This assumes approximately 29% of total site-generated traffic may use this corridor, rather than 14-16% as indicated in the TIAS. With the alternate distribution, consistent with the Table 9 TIAS distribution pattern, Grove Street peak hours would increase by from 65-80 vehicle trips per hour to a new total of up to 145-165 vehicle trips per hour. Impacts on study area intersections between the site and MassPike Exit 16 should be re-evaluated. Alternate mitigation should be proposed, if necessary. Mitigation proposed should preferably be non-structural to preserve the neighborhood character of include ways to keep site generated volumes within 10% of those projected in the TIAS, consistent with Newton's recent zoning change initiative. Affected locations are identical to those identified in the comment above.*

Response: As outlined in the response to comments above, a supplemental set of analyses has been conducted which considers the FST recommended traffic distribution to the east of the site. This assessment was conducted as a sensitivity analysis to determine the difference in traffic operations between VHB's trip distribution from the February 2012 TIAS and FST's recommendations. Under this assessment, 13 intersections where revaluated and the results are summarized in Tables 1-4 above. As demonstrated in the tables, the change in operation that would result at each location by a modification in the project traffic distribution is relatively minor. However, to address even minor changes in operational conditions as a result of the distribution modification, VHB is recommending the following addition to the Proponent's mitigation program (which is demonstrated in Table 4):

- Washington Street at Perkins Street. This intersections consists of a three-way signalized intersection under MassDOT jurisdiction This traffic signal is part of a traffic signal system in the vicinity of the Route 16 and MassPike interchange and timing and phasing changes are proposed here similar to other location within this system.
- Auburn Street at Commonwealth Avenue (eastern location); This intersection consists of a four-way signalized intersection under City of Newton jurisdiction. As outlined in Table 1, this intersection will operate at marginal levels in the future with and without this project. However, to attempt to add some efficiency to this location, the Proponent has determined that signal timing/phasing optimization would offer some improvement at this intersection, bringing the overall intersection back to LOS D during the weekday morning peak hour and LOS E during the weekday evening peak hour period.

Comment: *(page 9 of 20 Technical Memorandum) "We conclude that the structural mitigation measures proposed with Options A and B-2 are generally adequate. For site generated traffic destined to and from the MassPike to the east of Exit 16, the regional highway system reflects a less likely route choice. These motorists are more likely to favor use the Washington Street-Auburn Street-Grove Street corridor via the MBTA secondary driveway for cost and time saving reasons:*

Response: As a result of this comment and other similar comments in the Peer Review materials, VHB has prepared a supplemental analysis which considers traffic distribution modifications and updates to the traffic mitigation program. Details of this assessment are provided in the response to comments above.

Comment: *(Page 5 of 20 Technical Memorandum) "Data provided in the TIAS indicates that for the segment of site generated trip generally headed to and from the east on the MassPike (I-90), accessing Exit 16 via Grove/Auburn/Washington corridor is typically the fastest path. Additionally, site trips headed to and from*

the MassPike would need to pay a toll in each direction. Further explanation why nearly all of this segment of the site generated trips would avoid this northerly route must be provided.

Response: As a result of this comment and other similar comments in the Peer Review materials, VHB has prepared a supplemental analysis which considers traffic distribution modifications and updates to the traffic mitigation program. Details of this assessment are provided in the response to comments above.

Pedestrians and Bicycle Accommodation

Comment: *(page 7 of 11)"Pedestrian and bicycle access features of Options A and B-2 should be adjusted at the roundabouts and the Grove Street at MBTA site entrance during the design phase to reduce the potential hazardous pedestrian crossing maneuvers.*

- *Roundabouts should be designed to maximize deflection to the minimum entering speed that FHWA will allow for anticipated design vehicle. All exit traffic should be required to yield to Grove Street traffic at the west Exit 22; bicyclist coming from the Newton Lower Falls direction will have a safer merge opportunity.*
- *For Safety reasons, all pedestrian crosswalks should be located to the north side of the interchange to and from the Lower Fall s area, as that is where the sidewalks are proposed and pedestrians can cross one lane at a time between refuge areas."*

Cross walk on the south and east sides of the East Roundabouts should be eliminated. Pedestrian demands on the east side of Grove Street are very low and expected to remain low and would not meet demands for installation of a crosswalk at either location. Pedestrians who live in the condominium complex, should they choose to cross Grove Street would need to use the new marked shoulder area on the east side of Grove Street shared by bikes to cross a the Grove Street signal with the MBTA Driveway. Unlike the No-Build, pedestrians to and from the condominium complex would be able to cross Grove Street at the future MBTA Grove Street traffic signal that will have pedestrian actuation. Because large trees would be adversely affected, it is not anticipated that a sidewalk is warranted on the east side of Grove Street in the No-Build or Build conditions between Exit 22 and the MBTA site driveway. To the north of the MBTA site, however, an ADA compliant sidewalk on the east side of Grove Street and crosswalk would benefit existing Newton residents who live north of the site and on the east side of Grove Street. This action should be considered as a potential mitigation measure, working to retain all trees and using pervious sidewalk materials to accommodate tree roots. A crosswalk at Grove Street and the MBTA site drive should be considered to provide Lower Falls bicyclists coming from the south and residents who may be walking on the east side of Grove Street with a push button crossing opportunity to enter the site.

Response: Drawings of the proposed roundabouts provided in the February 2012 TIAS were conceptual in nature. As suggested, we intend to maximize the deflection on all approaches to the roundabouts as the design review process proceeds. Also as noted, we recommend that all exit traffic be placed under YIELD condition although MassDOT and FHWA will have final say in all treatments as they hold jurisdiction over the ramp locations.

As suggested, the proposed sidewalks located along the southeast and southwest sides of the intersection have been further considered. Based on the recommendations, VHB offers the following:

- The proposed sidewalk and pedestrian crossing on the south side of Grove Street at the Northbound Ramp intersection (across NB ramp to the bridge structure) was primarily added to the plan to accommodate bicyclists heading in an easterly direction across the bridge to Grove Street eastbound. It has been VHB's experience designing many of these types of roundabouts that some bicyclists are not comfortable using the travel lanes within the roundabout to traverse the intersection. The intention of including this section was predominately for this purpose although it would be available for pedestrian activity as well. For the purposes of this document, we have removed this section of sidewalk to be responsive to the comment but we believe, during design review, that MassDOT (who has jurisdiction over this area), will likely require that we bring the improvement back onto the plan.
- On the east side of the intersection, the crosswalk is proposed to provide a designated area for condominium oriented pedestrians to cross Grove Street to gain access to Lower Falls, the Hotel Indigo and restaurant, and the MBTA Station. While we do not anticipate high levels of pedestrian activity from the condominium complex (Woodland Grove Condominiums) and the Lower Falls/Hotel Indigo (restaurant) and the proposed redevelopment project, there will certainly be occasional pedestrian activity between these uses as there is today. It is not practical or safe to assume that pedestrians from the condo complex will find their way to the MBTA site Driveway traffic signal for crossings when no pedestrian accommodation is available. This is particularly true if they are headed to the Hotel Indigo or the restaurant located within this facility. Furthermore, the suggestion that these pedestrians can use the 4-foot shoulder or bike lane is not something that we would recommend. Therefore, establishing some form of crossing in close proximity to the Indigo is a reasonable compromise. While pedestrian volume will likely be low, we believe it is in the public's best interest to provide a means of crossing so that access can be gained to the Lower Falls, Hotel Indigo and the Station at Riverside Redevelopment project in a manageable way. To improve on the existing proposed crosswalk network, the Proponent will consider the addition of Rectangular Rapid Flashing Beacons for this location. Discussion and ultimately approval by MassDOT and potentially FHWA will be required.

Refer to Figures 19 and 20 attached for a demonstration of the changes proposed to the traffic and pedestrian plan.

Comment: *(page 13 of 20 Technical Memorandum) "FST questions whether the crosswalk on the south side of the east roundabout makes sense, as the sidewalk dead-ends abruptly on both ends, and crosswalk warrants are unlikely to be met for crossing at either of its end points.*

Response: Refer to response to comment above.

Comment: *(page 14 of 20 Technical Memorandum) "With Options A and B-2, Indigo Hotel access modifications and proposed to allow trucks at the front of the site to perform backing maneuvers on site rather than off-site onto Grove Street, as the existing geometric design necessitates. It would further be beneficial to enhance pedestrian safety on the west side of Grove Street by providing, if possible, some rear access to the Indigo Hotel to reduce conflicting movements between Hotel vehicles and future pedestrians and bicyclists.*

Response: Modifications to the Hotel Indigo are being proposed separately from the Station at Riverside Project. As the commenter notes, modification to the delivery is proposed to better accommodate the loading operations with as little influence on Grove Street as possible.

In the rear of the site, the Proponent has evaluated potential vehicular and pedestrian connections between the Hotel Indigo and the Station at Riverside site. Currently there is no vehicular connection proposed as the Indigo property has limited frontage along the existing CD Road and ultimately the proposed ramp from the CD Road to the site. As a ramp from the CD road into the site, there is really no opportunity to make a vehicular connection between the hotel and the ramp and the Hotel Indigo in a safe manner that MassDOT would be likely to approve. However, as defined in the plans for the site (copy attached in Appendix), the Proponent is proposing a pedestrian sidewalk connection between the Hotel Indigo parking area and the Station at Riverside site. This pedestrian connection will connect the Hotel Indigo with the proposed Office/Residential/Retail/Community Center/MBTA Platform through an extensive network of sidewalk and crosswalk connections.

Comment: *(page 15 of 30 Technical Memorandum) "Proceeding northerly on Grove Street, while 4 foots shoulder is acceptable minimal bicycle accommodation, we would recommend 5-foot bike lanes in both directions with two 11-foot travel lanes as bike lanes could then provide access between Lower Falls neighborhood and the secondary MBTA access.*

Response: Consistent with the directives by the City throughout the development of this project, the width of improvement along Grove Street has been minimized to remain consistent with the current character. Also as requested, bicycle accommodation has been maintained as part of this plan within the currently proposed roadway configuration. Expanding the roadway by 2 feet to increase the bike accommodation by one foot in each direction does not appear necessary.

Comment: *(page 15 of 20) "The walking environment for pedestrians crossing the two-lane northbound off-ramp and Grove Street approaches to the east Grove single lane roundabout is a concern. A potential "double jeopardy" crosswalk hazard is proposed in the TIAS under Options A and B-2 at the two-lane approach just east of the east Grove roundabout. FST recommends that the Applicant consider eliminating this crossing at the east Grove roundabout to eliminate the potential hazard and we do not believe that crosswalk warrants will be met. People who live in the condominiums on the corner should cross at the proposed traffic signal at the intersection of Grove Street and the MBTA site drive."*

Response: While we do not anticipate high levels of pedestrian activity from the condominium complex and the Hotel Indigo (restaurant) and the proposed redevelopment project, there will certainly be occasional pedestrian activity between these uses as there is today. It is not practical or safe to assume that pedestrians from the condo complex will find their way to the MBTA Site Driveway traffic signal for crossings when no pedestrian accommodation is available. This is particularly true if they are headed to the Hotel Indigo restaurant. Furthermore, the suggestion that these pedestrians can use the 4-foot shoulder or bike lane is not something that we would recommend. Therefore, establishing some form of crossing in close proximity to the Indigo is a reasonable compromise. While warrants may not be met, as discussed in detail in a previous comment response, it is in the public's best interest to provide a means of crossing so that access can be gained to the Lower Falls, Hotel Indigo and the Station at Riverside Redevelopment project. To improve on the existing proposed crosswalk network, the introduction of a Rectangular Rapid Flashing Beacons (RRFB) or similar will be considered for this location as design development is progressed. Discussion and ultimately approval by MassDOT and potentially FHWA will be required.

PARKING

Comment: (page 8 of 11)*"The site's parking strategy pertaining to individual site user groups and shared parking, as presented in the TIAS, is not clearly defined and needs to be. As presented in the TIAS, the MBTA*

garage and 11 surface parking spaces represent the supply of parking that will be available to satisfy future retail and community space parking demands. Unanswered questions include:

- *Where exactly will retail and community space parking employees and visitors park? It is not clear whether retail and community building parking demands will remove commuter spaces and require parking fees or whether the 11 spaces will be time period limited or reserved for retail or community building employees.*
- *How will retail and community building parking spaces be managed?*
- *What are the potential non-specific shared parking arrangements cited in the TIAS*
- *Will the office use parking supply and a portion of the residential parking supply be available for shared parking arrangements? If so, during what times of the day?*

These questions must be answered to evaluate whether the proposed site parking supply is adequate as proposed."

Response: First, it is important to note that the proposed MBTA garage will provide a total of 1,005 parking spaces, which replicates the existing 960 commuter spaces and provides an additional 45 spaces. It is anticipated that these 45 spaces will be available for use by the retail space and the community center. Since the preparation of the February TIAS, the Proponent has substantially advanced the site plan and as part of the local Zoning Board application, a detailed parking justification assessment for all parking on site has been prepared. Refer to the Appendix for a copy of the full parking justification assessment which provides responses to several of the comments and questions above.

In addition to that document, we offer the following:

- The community center and retail parking for the site is expected to take place in the 11 surface parking spaces and the 45 additional parking spaces provided within the MBTA parking garage.
- While specific details of the operations associated with the parking controls have yet to be determined, we anticipate that a "voucher" (or similar form of validation) type of system will be provided for people oriented to the retail and/or the community center to allow them to avoid the MBTA parking fee.
- As indicated in the parking justification memorandum, existing parking supply by the MBTA is generally underutilized with 300 ± spaces available on non-game days and therefore we expect parking to be available within the garage for retail and community opportunities on typical days and evenings.

In addition, the uses on site including the retail, community center, and perhaps even the office space are unique in consideration of parking supply. While the parking memorandum that was completed to justify the proposed parking supply relied on typical standards for parking and the potential for shared parking opportunities, the analysis is likely very conservative given the nature of the retail that is proposed on site. For the purposes of traffic projections and parking requirement, the retail portion of the project has been treated as "normal" shopping center or destination style retail which is not what is intended on site. The retail will be small individual uses that will be largely complementary to the office, residential, and MBTA uses on site. Types of uses that may be introduced would likely include: café, news shop, dry cleaner, bank, ATM, restaurant, or similar. These types of uses in this TOD type of setting would draw heavily from patrons of the MBTA,

residents who will live in the residential units and workers who reside in the office building. As a result, the demand for exclusive parking for the retail portion of the site is very likely overstated by treating the retail as standard destination type of retail.

Comment: *(page 17 of 20) "We therefore conclude that if the MBTA garage is to accommodate 1,005 MBTA users:*

- *The office component has a potential shortfall of 28 parking spaces;*
- *The retail component has a potential shortfall of 73 parking spaces;*
- *The Community Center has a potential shortfall of 39 parking spaces;*
- *The residential component has a potential surplus of 61 parking spaces at peak demands.*

Overall parking controls must be clearly defined to identify an appropriate shared parking strategy. At this time, it is unclear to us how an effective shared parking arrangement will be implemented to accommodate shortfalls in office, retail, and Community Center parking demands that occur simultaneously with the MBTA's peak parking demands. Are the retail and Community Center users going to have "free" parking, or are only the office and residential users going to have free parking? Can the Applicant cite any examples of comparable developments where users have been willing to pay $6 per day or more to shop at retail sites in lieu of free parking.

On Red Sox game days, as recommended in the TIAS, the Proponent should work with site users to provide an efficient way to accommodate vehicles. Particularly on weekends, and to a lesser extent during weekdays, the Proponent should identify whether an "events only" shared parking arrangement could be acceptable to office tenants to accommodate a portion or all parking demands that presently overflow into nearby Newton neighborhoods.

Response: A copy of the full parking justification assessment which provides response to several of the comments and questions above and response to comment above. To summarize some of the key points from that document, VHB offers the following:

- Potential shortfall of 28 spaces for the office component: As stated in FST's comment letter, the potential shortfall of 28 spaces for the office component is based on the 5% transit credit for office trip generation that was assumed in the February 2012 TIAS. It should be noted that the transit credit was only assumed to be 5% to provide a conservative assessment of the increase in vehicular traffic on the adjacent roadways. A study published in the ITE Compendium of Technical Papers titled *The Effect of Transit Service on Trips Generated by Suburban Development* concluded that "suburban office development located within 500 feet of a rail station can expect commuter trip transit mode shares of between 20 and 25 percent". If we assumed 18% transit use by office commuters, which would be appropriate for this site, the proposed parking supply would be adequate.
- It should be noted that the latest site plan provides 8,000 sf of community space compared to the 12,000 sf analyzed as part of the February 2012 TIAS, which represents a 33% reduction in area. As noted in FST's comments, parking for a recreational community center typically peaks between 6:00 PM and 8:00 PM. At this time, a substantial portion of the commuters parked in the garage will have left, which will increase the supply of available parking under normal conditions.
- The results of the parking justification assessment provided in the Appendix generally indicate that there are typically 300 ± spaces available in the MBTA parking lot at 4:45 PM

on weekdays. These spaces will be available for the retail and community space on typical weekdays.

In addition, it should be noted that the City will be requiring the preparation of a detailed parking management plan for the project. Further details about accommodation of parking demands for each use will be provided in that document.

ACCESS

Comment: (page 9 of 11)*"Grove Street physical alterations allow for full access of the future MBTA entrance. The proposed intersection treatment provides the greatest flexibility for access whether Option A or Option B-2 is accepted by MassDOT and FHWA. Nonetheless, we recommend the southbound site approach to Grove Street be designed with two lanes, rather than one lane with Option B-2, as proposed with Options A or F. A single southbound lane with maximum storage of 12 vehicles at 25 feet per car, is likely to congest the up toward the MBTA garage very quickly, thereby blocking the garage entrance or even the on-site northbound lane to the garage. Additionally, we recommend that the site/Grove Street signal be coordinated with the signal at the Riverside Equity site that is less than a quarter mile away."*

Response: As suggested, the egress movement from the site has been revised to include two lanes southbound from an area just south of the MBTA garage exit to Grove Street. We anticipate maintaining this two lane configuration under either option A or B-2 moving forward. During the formal design review process of the traffic signal at the Grove Street MBTA driveway, coordination between this proposed traffic signal and the existing signal to the east at the Riverside Office Park will be considered and implemented to the extent that it makes sense and is feasible to do so.

Comment: (Page 11 of 11)*"Generally, Option B-2 traffic operational features are preferable to Option A features, with on important exception. The left turn site line with Option B-2 could conceivably be jeopardized if snow banks or landscaping exceed 3.5 feet in height along the northbound C-D Road or the right side of the island on the left turn approach to the intersection. The identified sight line with Option B-2 must be addressed"*

Response: During normal conditions, adequate sight distance will be available at this location and safe operation would be expected. As the design development progresses, the Proponent will assess various treatments in this area to minimize or potentially eliminate the potential sight distance concern during large snow accumulation events. Measures to be considered will include but will not be limited to the following:

- Eliminating any landscaping in this area
- Review of the potential for grading in the island to create a minor depression that would be lower than the roadway.
- Evaluate "hard surface" type of treatments that can be plowed on a regular basis along with the access roadways.
- Minimize or eliminate signage along the south side of the roadway near stop bar to allow for free plowing of shoulder etc.

In addition to any treatments that are incorporated in the design, the Proponent will work with MassDOT to inform plow operators of the importance of maintaining clear limited scale or no snow

banks in the critical area, similar to other locations throughout the commonwealth where similar conditions exist.

Comment: *(page 7 of 20 Technical Memorandum) "The proposed unsignalized left turn movement, as illustrated in the TIAS with Option B-2 has a potential sight line issue during winter storm events if the height of snow banks to the left of the left turn approach and ramp exceeds 3.5 feet.*

Response: Refer to response to comment above.

Roundabouts

Comment: (p*age 11 of 20 Technical Memorandum*) *"The Applicant should provide an Auto Turn or equivalent analysis to show how the three roundabouts will operate with their largest design trucks for the most restrictive movements (i.e. U-turns) allowed in the roundabouts under Options A and B-2. This is important, as the larger the U-turn design vehicle, the larger the diameter of the roundabout, or conversely, smaller diameters can be tolerated if truck U-turns are not permitted. As illustrated, the roundabouts accommodate 30-foot trucks.. "*

Response: As requested, VHB has prepared Auto Turn analyses of each of the proposed roundabouts with the design vehicle that has been used. Please refer to the Appendix for figures that display the wheel turning paths at both Ramp interchange roundabouts and the internal site roundabout. As demonstrated, the ramp roundabouts have been designed to accommodate a WB-67. The internal site roundabout has been designed to accommodate a WB-50. The current design of the roundabouts under Options A and B-2 presented in the February 2012 TIAS result in the WB-67 driving over the curbing of the internal island to complete a U-turn maneuver. However, as shown in Figures 13 and 14 in the Appendix, it is possible to make minor modifications to the geometry of the roundabouts to fully accommodate a U-turn performed by a WB-67. It should be noted that MassDOT ultimately has control over the final design of both of the ramp roundabouts. Further discussions will be held with MassDOT during the design review process to determine if they see a need to accommodate this movement.

Comment: *(Page 11 of 20 Technical Memorandum) "The I-95 and southbound and northbound off ramp approaches to the west and east Grove roundabouts should be designed to address crossing movements of cyclists and pedestrians to and from the Newton Lower Falls neighborhood. Within the context of the largest design vehicle restrictions, we recommend that east and west Grove Street roundabout approach deflections be maximized to the extent allowed by FHWA and MassDOT within the context of the design vehicles being processed. When two lane approaches are provided, as is done at the east and west roundabout approaches from the interstate, both lanes should operate under yield control to Grove Street northbound traffic.*

Response: Drawings of the proposed roundabouts provided in the February 2012 TIAS were conceptual in nature. As suggested, we intend to maximize the deflection on all approaches to the roundabouts as the design review process proceeds. Also as noted, on all two lane approaches to the roundabouts, it is our intention to recommend "Yield" controls although MassDOT and FHWA will have final say in all treatments as they hold jurisdiction over the ramp locations.

Attachments

Operational Analyses

Signalized Intersection Analysis
Unsignalized Intersection Analysis
Site Access Analysis
Mitigated Signalized Intersection Analysis

Traffic and Pedestrian Plans

Parking Assessment

AutoTURN Truck Turning Movement Analysis

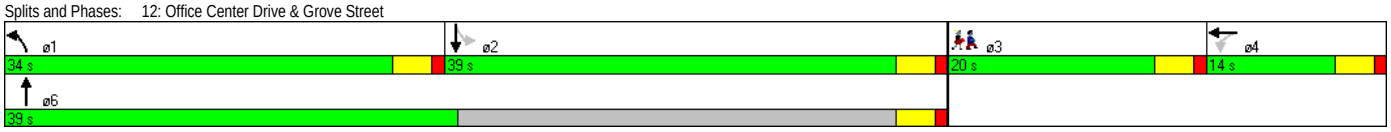
Operational Analyses
Signalized Intersection Analysis
Unsignalized Intersection Analysis
Site Access Analysis
Mitigated Signalized Intersection Analysis

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø3
Lane Configurations													
Volume (vph)	0	0	0	10	0	15	280	630	0	5	490	15	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	12	12	12	12	12	12	11	13	12	12	12	12	
Storage Length (ft)	0		0	0		0	100		0	0		0	
Storage Lanes	0		0	0		0	1		0	0		0	
Taper Length (ft)	25		25	25		25	25		25	25		25	
Satd. Flow (prot)	0	0	0	0	1713	0	1728	1944	0	0	1855	0	
Flt Permitted					0.980		0.950				0.994		
Satd. Flow (perm)	0	0	0	0	1713	0	1728	1944	0	0	1844	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)					25						2		
Link Speed (mph)		30			30			30			30		
Link Distance (ft)		123			166			282			224		
Travel Time (s)		2.8			3.8			6.4			5.1		
Peak Hour Factor	0.92	0.92	0.92	0.59	0.59	0.59	0.82	0.82	0.82	0.96	0.96	0.96	
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	1%	1%	1%	2%	2%	2%	
Adj. Flow (vph)	0	0	0	17	0	25	341	768	0	5	510	16	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	0	0	0	42	0	341	768	0	0	531	0	
Turn Type				Perm			Prot			Perm			
Protected Phases					4		1	6			2		3
Permitted Phases				4						2			
Detector Phase				4	4		1	6		2	2		
Switch Phase													
Minimum Initial (s)				6.0	6.0		6.0	6.0		6.0	6.0		12.0
Minimum Split (s)				11.0	11.0		11.0	15.0		15.0	15.0		20.0
Total Split (s)	0.0	0.0	0.0	14.0	14.0	0.0	34.0	39.0	0.0	39.0	39.0	0.0	20.0
Total Split (%)	0.0%	0.0%	0.0%	13.1%	13.1%	0.0%	31.8%	36.4%	0.0%	36.4%	36.4%	0.0%	19%
Maximum Green (s)				10.0	10.0		30.0	35.0		35.0	35.0		16.0
Yellow Time (s)				3.0	3.0		3.0	3.0		3.0	3.0		3.0
All-Red Time (s)				1.0	1.0		1.0	1.0		1.0	1.0		1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag				Lag	Lag		Lead			Lag	Lag		Lead
Lead-Lag Optimize?				Yes	Yes		Yes			Yes	Yes		Yes
Vehicle Extension (s)				2.0	2.0		2.0	2.0		2.0	2.0		2.0
Recall Mode				None	None		None	Min		Min	Min		None
Walk Time (s)													5.0
Flash Dont Walk (s)													11.0
Pedestrian Calls (#/hr)													5
Act Effct Green (s)					7.5		18.6	51.9			25.6		
Actuated g/C Ratio					0.12		0.30	0.85			0.42		
v/c Ratio					0.18		0.65	0.47			0.69		
Control Delay					24.3		29.4	5.5			24.6		
Queue Delay					0.0		0.0	0.0			0.0		
Total Delay					24.3		29.4	5.5			24.6		
LOS					C		C	A			C		
Approach Delay					24.3			12.8			24.6		
Approach LOS					C			B			C		
Queue Length 50th (ft)					6		109	71			155		
Queue Length 95th (ft)					23		273	318			#524		
Internal Link Dist (ft)		43			86			202			144		
Turn Bay Length (ft)							100						
Base Capacity (vph)					355		1014	1800			1228		
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					0.12		0.34	0.43			0.43		

Intersection Summary

Area Type: Other
Cycle Length: 107
Actuated Cycle Length: 61.4
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 16.8 Intersection LOS: B
Intersection Capacity Utilization 75.1% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 12: Office Center Drive & Grove Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	10	0	15	280	630	0	5	490	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	11	13	12	12	12	12
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					1.00		1.00	1.00			1.00	
Frt					0.92		1.00	1.00			1.00	
Flt Protected					0.98		0.95	1.00			1.00	
Satd. Flow (prot)					1713		1728	1944			1854	
Flt Permitted					0.98		0.95	1.00			0.99	
Satd. Flow (perm)					1713		1728	1944			1844	
Peak-hour factor, PHF	0.92	0.92	0.92	0.59	0.59	0.59	0.82	0.82	0.82	0.96	0.96	0.96
Adj. Flow (vph)	0	0	0	17	0	25	341	768	0	5	510	16
RTOR Reduction (vph)	0	0	0	0	24	0	0	0	0	0	1	0
Lane Group Flow (vph)	0	0	0	0	18	0	341	768	0	0	530	0
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	1%	1%	1%	2%	2%	2%
Turn Type				Perm			Prot			Perm		
Protected Phases					4		1	6			2	
Permitted Phases				4						2		
Actuated Green, G (s)					3.3		18.6	49.0			26.4	
Effective Green, g (s)					3.3		18.6	49.0			26.4	
Actuated g/C Ratio					0.05		0.28	0.74			0.40	
Clearance Time (s)					4.0		4.0	4.0			4.0	
Vehicle Extension (s)					2.0		2.0	2.0			2.0	
Lane Grp Cap (vph)					85		486	1439			735	
v/s Ratio Prot							c0.20	0.40				
v/s Ratio Perm					0.01						c0.29	
v/c Ratio					0.21		0.70	0.53			0.72	
Uniform Delay, d1					30.2		21.3	3.7			16.8	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					0.5		3.7	0.2			3.0	
Delay (s)					30.7		25.0	3.9			19.8	
Level of Service					C		C	A			B	
Approach Delay (s)		0.0			30.7			10.4			19.8	
Approach LOS		A			C			B			B	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	66.2	Sum of lost time (s)	17.9
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø2
Lane Configurations													
Volume (vph)	20	115	15	125	50	150	15	395	135	110	360	15	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	12	16	12	12	15	12	12	16	12	12	16	12	
Satd. Flow (prot)	0	2090	0	0	1923	0	0	2060	0	0	2059	0	
Flt Permitted		0.932			0.811			0.981			0.736		
Satd. Flow (perm)	0	1961	0	0	1590	0	0	2022	0	0	1533	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		7			54			27			3		
Link Speed (mph)		30			30			30			30		
Link Distance (ft)		598			316			168			222		
Travel Time (s)		13.6			7.2			3.8			5.0		
Peak Hour Factor	0.86	0.86	0.86	0.92	0.92	0.92	0.89	0.89	0.89	0.90	0.90	0.90	
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	1%	1%	1%	3%	3%	3%	
Adj. Flow (vph)	23	134	17	136	54	163	17	444	152	122	400	17	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	174	0	0	353	0	0	613	0	0	539	0	
Turn Type	Perm			Perm			Perm			Perm			
Protected Phases		3			3			1			1		2
Permitted Phases	3			3			1			1			
Detector Phase	3	3		3	3		1	1		1	1		
Switch Phase													
Minimum Initial (s)	17.0	17.0		17.0	17.0		30.0	30.0		30.0	30.0		15.0
Minimum Split (s)	22.3	22.3		22.3	22.3		35.2	35.2		35.2	35.2		17.0
Total Split (s)	22.3	22.3	0.0	22.3	22.3	0.0	35.2	35.2	0.0	35.2	35.2	0.0	17.0
Total Split (%)	29.9%	29.9%	0.0%	29.9%	29.9%	0.0%	47.2%	47.2%	0.0%	47.2%	47.2%	0.0%	23%
Maximum Green (s)	17.0	17.0		17.0	17.0		30.0	30.0		30.0	30.0		15.0
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0		2.0
All-Red Time (s)	2.3	2.3		2.3	2.3		2.2	2.2		2.2	2.2		0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.3	5.3	4.0	5.3	5.3	4.0	5.2	5.2	4.0	5.2	5.2	4.0	
Lead/Lag							Lead	Lead		Lead	Lead		Lag
Lead-Lag Optimize?							Yes	Yes		Yes	Yes		Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0		3.0
Recall Mode	Max	Max		Max	Max		Max	Max		Max	Max		None
Walk Time (s)													7.0
Flash Dont Walk (s)													8.0
Pedestrian Calls (#/hr)													5
Act Effct Green (s)		17.2			17.2			30.3			30.3		
Actuated g/C Ratio		0.28			0.28			0.50			0.50		
v/c Ratio		0.31			0.72			0.60			0.70		
Control Delay		19.9			29.0			14.9			20.5		
Queue Delay		0.0			0.0			0.0			0.0		
Total Delay		19.9			29.0			14.9			20.5		
LOS		B			C			B			C		
Approach Delay		19.9			29.0			14.9			20.5		
Approach LOS		B			C			B			C		
Queue Length 50th (ft)		44			89			124			124		
Queue Length 95th (ft)		114			#284			338			#408		
Internal Link Dist (ft)		518			236			88			142		
Turn Bay Length (ft)													
Base Capacity (vph)		559			487			1020			765		
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		0.31			0.72			0.60			0.70		

Intersection Summary

Area Type: Other
Cycle Length: 74.5
Actuated Cycle Length: 60.9
Natural Cycle: 90
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 20.2 Intersection LOS: C
Intersection Capacity Utilization 106.2% ICU Level of Service G
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 16: Central Street & Auburn Street

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	115	15	125	50	150	15	395	135	110	360	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	15	12	12	16	12	12	16	12
Total Lost time (s)		5.3			5.3			5.2			5.2	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.99			0.94			0.97			1.00	
Flt Protected		0.99			0.98			1.00			0.99	
Satd. Flow (prot)		2090			1923			2058			2058	
Flt Permitted		0.93			0.81			0.98			0.74	
Satd. Flow (perm)		1961			1589			2022			1532	
Peak-hour factor, PHF	0.86	0.86	0.86	0.92	0.92	0.92	0.89	0.89	0.89	0.90	0.90	0.90
Adj. Flow (vph)	23	134	17	136	54	163	17	444	152	122	400	17
RTOR Reduction (vph)	0	5	0	0	39	0	0	14	0	0	2	0
Lane Group Flow (vph)	0	169	0	0	314	0	0	599	0	0	537	0
Heavy Vehicles (%)	1%	1%	1%	0%	0%	0%	1%	1%	1%	3%	3%	3%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		3			3			1			1	
Permitted Phases	3			3			1			1		
Actuated Green, G (s)		17.2			17.2			30.3			30.3	
Effective Green, g (s)		17.2			17.2			30.3			30.3	
Actuated g/C Ratio		0.28			0.28			0.48			0.48	
Clearance Time (s)		5.3			5.3			5.2			5.2	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		540			437			980			743	
v/s Ratio Prot												
v/s Ratio Perm		0.09			c0.20			0.30			c0.35	
v/c Ratio		0.31			0.72			0.61			0.72	
Uniform Delay, d1		18.0			20.5			11.8			12.8	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		1.5			9.7			2.8			6.0	
Delay (s)		19.5			30.2			14.6			18.8	
Level of Service		B			C			B			B	
Approach Delay (s)		19.5			30.2			14.6			18.8	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	62.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	106.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL	NWR2	ø4
Lane Configurations																
Volume (vph)	15	310	90	10	270	175	35	435	5	140	0	450	30	0	15	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0			0		0	0		0		30		0	0		
Storage Lanes	0			0		0	0		0		1		0	1		
Taper Length (ft)	25			25		25	25		25		25		25	25		
Satd. Flow (prot)	0	1823	0	0	1747	0	0	1818	0	0	1736	1810	0	1611	0	
Flt Permitted		0.886			0.958			0.932			0.349					
Satd. Flow (perm)	0	1618	0	0	1675	0	0	1701	0	0	638	1810	0	1611	0	
Right Turn on Red			Yes			Yes							Yes		Yes	
Satd. Flow (RTOR)		9			21							3		630		
Link Speed (mph)		30			30			30				30		30		
Link Distance (ft)		1184			376			1200				268		491		
Travel Time (s)		26.9			8.5			27.3				6.1		11.2		
Peak Hour Factor	0.92	0.92	0.92	0.88	0.88	0.88	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.71	0.92	
Heavy Vehicles (%)	1%	1%	1%	3%	3%	3%	4%	4%	4%	4%	4%	4%	4%	0%	2%	
Adj. Flow (vph)	16	337	98	11	307	199	38	473	5	152	0	489	33	0	16	
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	451	0	0	517	0	0	516	0	0	152	522	0	16	0	
Turn Type	Perm			Perm			Perm			custom	D.P+P					
Protected Phases		3			3			2			1	1 2		5		4
Permitted Phases	3			3			2			1	2					
Detector Phase	3	3		3	3		2	2		1	1	1 2		5		
Switch Phase																
Minimum Initial (s)	10.0	10.0		10.0	10.0		15.0	15.0		10.0	10.0			4.0		15.0
Minimum Split (s)	15.0	15.0		15.0	15.0		21.0	21.0		15.0	15.0			9.0		27.0
Total Split (s)	30.0	30.0	0.0	30.0	30.0	0.0	51.0	51.0	0.0	15.0	15.0	66.0	0.0	9.0	0.0	27.0
Total Split (%)	22.7%	22.7%	0.0%	22.7%	22.7%	0.0%	38.6%	38.6%	0.0%	11.4%	11.4%	50.0%	0.0%	6.8%	0.0%	20%
Maximum Green (s)	25.0	25.0		25.0	25.0		45.0	45.0		10.0	10.0			4.0		21.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0			4.0		4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		2.0	2.0		1.0	1.0			1.0		2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	6.0	6.0	4.0	5.0	5.0	5.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lead		Lead	Lead		Lag	Lag		Lead	Lead					Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes					Yes
Vehicle Extension (s)	4.0	4.0		4.0	4.0		5.0	5.0		4.0	4.0			3.0		5.0
Recall Mode	Max	Max		Max	Max		Max	Max		Max	Max			None		None
Walk Time (s)																7.0
Flash Dont Walk (s)																8.0
Pedestrian Calls (#/hr)																5
Act Effct Green (s)		25.3			25.3			45.5			56.6	61.7		4.0		
Actuated g/C Ratio		0.24			0.24			0.44			0.55	0.59		0.04		
v/c Ratio		1.12			1.22			0.69			0.33	0.48		0.02		
Control Delay		120.5			152.5			31.7			13.9	16.0		0.1		
Queue Delay		0.0			0.0			0.0			0.0	0.0		0.0		
Total Delay		120.5			152.5			31.7			13.9	16.0		0.1		
LOS		F			F			C			B	B		A		
Approach Delay		120.5			152.5			31.7				15.5		0.1		
Approach LOS		F			F			C				B		A		
Queue Length 50th (ft)		~299			~364			232			34	147		0		
Queue Length 95th (ft)		#695			#767			#577			111	415		0		
Internal Link Dist (ft)		1104			296			1120				188		411		
Turn Bay Length (ft)											30					
Base Capacity (vph)		401			424			746			455	1077		668		
Starvation Cap Reductn		0			0			0			0	0		0		
Spillback Cap Reductn		0			0			0			0	0		0		
Storage Cap Reductn		0			0			0			0	0		0		
Reduced v/c Ratio		1.12			1.22			0.69			0.33	0.48		0.02		

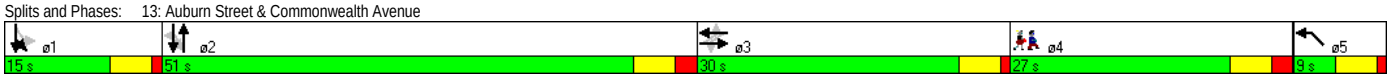
Intersection Summary

Area Type: Other
Cycle Length: 132
Actuated Cycle Length: 103.8
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 1.22
Intersection Signal Delay: 73.6 Intersection LOS: E
Intersection Capacity Utilization 100.5% ICU Level of Service G
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: 13: Auburn Street & Commonwealth Avenue



Movement	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL	NWR2
Lane Configurations															
Volume (vph)	15	310	90	10	270	175	35	435	5	140	0	450	30	0	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			6.0			5.0	5.0		5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00		1.00	
Frt		0.97			0.95			1.00			1.00	0.99		0.86	
Flt Protected		1.00			1.00			1.00			0.95	1.00		1.00	
Satd. Flow (prot)		1823			1747			1818			1736	1810		1611	
Flt Permitted		0.89			0.96			0.93			0.35	1.00		1.00	
Satd. Flow (perm)		1617			1675			1701			638	1810		1611	
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.71	0.92
Adj. Flow (vph)	16	337	98	11	307	199	38	473	5	152	0	489	33	0	16
RTOR Reduction (vph)	0	7	0	0	16	0	0	0	0	0	0	1	0	16	0
Lane Group Flow (vph)	0	444	0	0	501	0	0	516	0	0	152	521	0	0	0
Heavy Vehicles (%)	1%	1%	1%	3%	3%	3%	4%	4%	4%	4%	4%	4%	4%	0%	2%
Turn Type	Perm			Perm			Perm			custom	D.P+P				
Protected Phases		3			3			2			1	1 2		5	
Permitted Phases	3			3			2			1	2				
Actuated Green, G (s)		25.3			25.3			45.5			55.6	60.6		1.4	
Effective Green, g (s)		25.3			25.3			45.5			55.6	60.6		1.4	
Actuated g/C Ratio		0.23			0.23			0.41			0.50	0.54		0.01	
Clearance Time (s)		5.0			5.0			6.0			5.0			5.0	
Vehicle Extension (s)		4.0			4.0			5.0			4.0			3.0	
Lane Grp Cap (vph)		366			379			692			416	981		20	
v/s Ratio Prot											0.03	c0.29		c0.00	
v/s Ratio Perm		0.27			c0.30			c0.30			0.15				
v/c Ratio		1.21			1.32			0.75			0.37	0.53		0.01	
Uniform Delay, d1		43.2			43.2			28.2			17.1	16.5		54.5	
Progression Factor		1.00			1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2		118.6			162.0			7.2			2.5	2.1		0.2	
Delay (s)		161.8			205.2			35.4			19.6	18.5		54.7	
Level of Service		F			F			D			B	B		D	
Approach Delay (s)		161.8			205.2			35.4				18.7		54.7	
Approach LOS		F			F			D				B		D	

Intersection Summary				
HCM Average Control Delay	97.0	HCM Level of Service	F	
HCM Volume to Capacity ratio	0.90			
Actuated Cycle Length (s)	111.8	Sum of lost time (s)	29.5	
Intersection Capacity Utilization	100.5%	ICU Level of Service	G	
Analysis Period (min)	15			

c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	ø3
Lane Configurations							
Volume (vph)	365	10	0	1235	1015	390	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	50	0			0	
Storage Lanes	1	1	0			0	
Taper Length (ft)	25	25	25			25	
Satd. Flow (prot)	1805	1615	0	3539	3424	0	
Flt Permitted	0.950						
Satd. Flow (perm)	1805	1615	0	3539	3424	0	
Right Turn on Red		Yes				Yes	
Satd. Flow (RTOR)		5			66		
Link Speed (mph)	10			30	30		
Link Distance (ft)	1445			1829	884		
Travel Time (s)	98.5			41.6	20.1		
Peak Hour Factor	0.71	0.71	0.89	0.89	0.91	0.91	
Heavy Vehicles (%)	0%	0%	2%	2%	1%	1%	
Adj. Flow (vph)	514	14	0	1388	1115	429	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	514	14	0	1388	1544	0	
Turn Type		Perm	Perm				
Protected Phases	4			2	2		3
Permitted Phases		4	2				
Detector Phase	4	4	2	2	2		
Switch Phase							
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0		1.0
Minimum Split (s)	20.8	20.8	21.3	21.3	21.3		26.0
Total Split (s)	30.0	30.0	24.0	24.0	24.0	0.0	26.0
Total Split (%)	37.5%	37.5%	30.0%	30.0%	30.0%	0.0%	33%
Maximum Green (s)	25.2	25.2	18.7	18.7	18.7		24.0
Yellow Time (s)	3.8	3.8	4.2	4.2	4.2		2.0
All-Red Time (s)	1.0	1.0	1.1	1.1	1.1		0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.8	4.8	5.3	5.3	5.3	4.0	
Lead/Lag	Lag	Lag					Lead
Lead-Lag Optimize?	Yes	Yes					Yes
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0		2.0
Recall Mode	None	None	C-Max	C-Max	C-Max		None
Walk Time (s)							7.0
Flash Dont Walk (s)							17.0
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	27.3	27.3		42.6	42.6		
Actuated g/C Ratio	0.34	0.34		0.53	0.53		
v/c Ratio	0.83	0.03		0.74	0.83		
Control Delay	36.8	12.8		18.2	14.9		
Queue Delay	0.0	0.0		0.0	0.0		
Total Delay	36.8	12.8		18.2	14.9		
LOS	D	B		B	B		
Approach Delay	36.1			18.2	14.9		
Approach LOS	D			B	B		
Queue Length 50th (ft)	227	3		272	292		
Queue Length 95th (ft)	230	10		378	#500		
Internal Link Dist (ft)	1365			1749	804		
Turn Bay Length (ft)		50					
Base Capacity (vph)	635	571		1886	1855		
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	0.81	0.02		0.74	0.83		

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 75 (94%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 130
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 19.5 Intersection LOS: B
Intersection Capacity Utilization 69.2% ICU Level of Service C
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 26: Auburn Street & Washington Street

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	365	10	0	1235	1015	390
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.8	4.8		5.3	5.3	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frt	1.00	0.85		1.00	0.96	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1805	1615		3539	3425	
Flt Permitted	0.95	1.00		1.00	1.00	
Satd. Flow (perm)	1805	1615		3539	3425	
Peak-hour factor, PHF	0.71	0.71	0.89	0.89	0.91	0.91
Adj. Flow (vph)	514	14	0	1388	1115	429
RTOR Reduction (vph)	0	3	0	0	31	0
Lane Group Flow (vph)	514	11	0	1388	1513	0
Heavy Vehicles (%)	0%	0%	2%	2%	1%	1%
Turn Type		Perm	Perm			
Protected Phases	4			2	2	
Permitted Phases		4	2			
Actuated Green, G (s)	27.3	27.3		42.6	42.6	
Effective Green, g (s)	27.3	27.3		42.6	42.6	
Actuated g/C Ratio	0.34	0.34		0.53	0.53	
Clearance Time (s)	4.8	4.8		5.3	5.3	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	616	551		1885	1824	
v/s Ratio Prot	c0.28			0.39	c0.44	
v/s Ratio Perm		0.01				
v/c Ratio	0.83	0.02		0.74	0.83	
Uniform Delay, d1	24.3	17.5		14.4	15.7	
Progression Factor	1.00	1.00		1.00	0.62	
Incremental Delay, d2	9.1	0.0		2.6	3.9	
Delay (s)	33.4	17.5		17.0	13.6	
Level of Service	C	B		B	B	
Approach Delay (s)	33.0			17.0	13.6	
Approach LOS	C			B	B	

Intersection Summary			
HCM Average Control Delay	17.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.1
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		

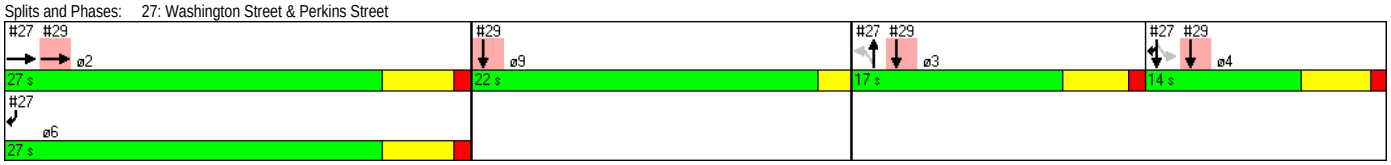
c Critical Lane Group

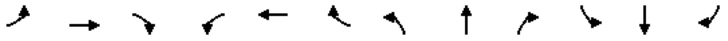
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø6	ø9
Lane Configurations														
Volume (vph)	0	1320	5	0	0	0	0	0	10	0	5	1330		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Satd. Flow (prot)	0	3606	0	0	0	0	0	1644	0	0	1900	2842		
Flt Permitted														
Satd. Flow (perm)	0	3606	0	0	0	0	0	1644	0	0	1900	2842		
Right Turn on Red			Yes			Yes			Yes			Yes		
Satd. Flow (RTOR)								623				1430		
Link Speed (mph)		30			30			30			30			
Link Distance (ft)		884			163			529			423			
Travel Time (s)		20.1			3.7			12.0			9.6			
Peak Hour Factor	0.97	0.97	0.97	0.92	0.92	0.92	0.75	0.75	0.75	0.93	0.93	0.93		
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%	0%		
Adj. Flow (vph)	0	1361	5	0	0	0	0	0	13	0	5	1430		
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	1366	0	0	0	0	0	13	0	0	5	1430		
Turn Type							Perm			Perm		custom		
Protected Phases		2						3			4	4 6	6	9
Permitted Phases							3			4				
Detector Phase		2					3	3		4	4	4 6		
Switch Phase														
Minimum Initial (s)		6.0					5.0	5.0		6.0	6.0		6.0	1.0
Minimum Split (s)		11.2					9.8	9.8		11.0	11.0		11.2	22.0
Total Split (s)	0.0	27.0	0.0	0.0	0.0	0.0	17.0	17.0	0.0	14.0	14.0	41.0	27.0	22.0
Total Split (%)	0.0%	33.8%	0.0%	0.0%	0.0%	0.0%	21.3%	21.3%	0.0%	17.5%	17.5%	51.3%	34%	28%
Maximum Green (s)		21.8					12.2	12.2		9.0	9.0		21.8	20.0
Yellow Time (s)		4.2					3.8	3.8		4.0	4.0		4.2	2.0
All-Red Time (s)		1.0					1.0	1.0		1.0	1.0		1.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Lost Time (s)	4.0	5.2	4.0	4.0	4.0	4.0	4.8	4.8	4.0	5.0	5.0	5.0		
Lead/Lag							Lead	Lead		Lag	Lag			
Lead-Lag Optimize?							Yes	Yes		Yes	Yes			
Vehicle Extension (s)		2.0					2.0	2.0		2.0	2.0		2.0	2.0
Recall Mode		C-Max					None	None		None	None		C-Max	None
Walk Time (s)														7.0
Flash Dont Walk (s)														13.0
Pedestrian Calls (#/hr)														0
Act Effct Green (s)		38.8						8.9			17.2	61.3		
Actuated g/C Ratio		0.48						0.11			0.22	0.77		
v/c Ratio		0.78						0.02			0.01	0.57		
Control Delay		19.7						0.0			20.4	4.8		
Queue Delay		0.0						0.0			0.0	0.1		
Total Delay		19.7						0.0			20.4	4.8		
LOS		B						A			C	A		
Approach Delay		19.7						0.0			4.9			
Approach LOS		B						A			A			
Queue Length 50th (ft)		175						0			2	118		
Queue Length 95th (ft)		#567						0			m3	144		
Internal Link Dist (ft)		804			83			449			343			
Turn Bay Length (ft)														
Base Capacity (vph)		1751						779			409	2512		
Starvation Cap Reductn		0						0			0	183		
Spillback Cap Reductn		0						0			0	0		
Storage Cap Reductn		0						0			0	0		
Reduced v/c Ratio		0.78						0.02			0.01	0.61		

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 74 (93%), Referenced to phase 2:EBT and 6:SBR, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 12.0 Intersection LOS: B
Intersection Capacity Utilization 58.9% 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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 27: Washington Street & Perkins Street





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1320	5	0	0	0	0	0	10	0	5	1330
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2						4.8			5.0	5.0
Lane Util. Factor		0.95						1.00			1.00	0.88
Frt		1.00						0.86			1.00	0.85
Flt Protected		1.00						1.00			1.00	1.00
Satd. Flow (prot)		3608						1644			1900	2842
Flt Permitted		1.00						1.00			1.00	1.00
Satd. Flow (perm)		3608						1644			1900	2842
Peak-hour factor, PHF	0.97	0.97	0.97	0.92	0.92	0.92	0.75	0.75	0.75	0.93	0.93	0.93
Adj. Flow (vph)	0	1361	5	0	0	0	0	0	13	0	5	1430
RTOR Reduction (vph)	0	0	0	0	0	0	0	12	0	0	0	338
Lane Group Flow (vph)	0	1366	0	0	0	0	0	1	0	0	5	1092
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%	0%
Turn Type							Perm			Perm		custom
Protected Phases		2						3			4	4 6
Permitted Phases							3			4		
Actuated Green, G (s)		38.9						8.9			17.2	61.1
Effective Green, g (s)		38.9						8.9			17.2	61.1
Actuated g/C Ratio		0.49						0.11			0.21	0.76
Clearance Time (s)		5.2						4.8			5.0	
Vehicle Extension (s)		2.0						2.0			2.0	
Lane Grp Cap (vph)		1754						183			409	2171
v/s Ratio Prot		c0.38						c0.00			0.00	c0.38
v/s Ratio Perm												
v/c Ratio		0.78						0.01			0.01	0.50
Uniform Delay, d1		17.0						31.6			24.7	3.6
Progression Factor		0.80						1.00			1.06	20.83
Incremental Delay, d2		2.2						0.0			0.0	0.1
Delay (s)		15.8						31.6			26.2	75.6
Level of Service		B						C			C	E
Approach Delay (s)		15.8			0.0			31.6			75.4	
Approach LOS		B			A			C			E	

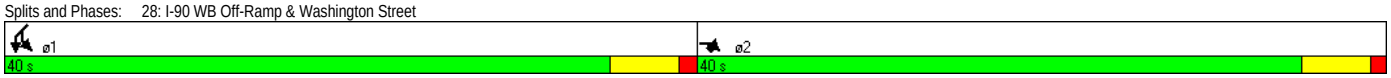
Intersection Summary			
HCM Average Control Delay	46.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	EBR2	NBL	NBR	NWL	NWR	SWL2	SWL	SWR
Lane Configurations										
Volume (vph)	0	205	710	0	0	0	0	655	625	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	1615	2842	0	0	0	0	3502	3502	0
Flt Permitted								0.950	0.950	
Satd. Flow (perm)	0	1615	2842	0	0	0	0	3502	3502	0
Right Turn on Red			Yes				Yes	Yes		Yes
Satd. Flow (RTOR)			225					744		
Link Speed (mph)	30			30		30			30	
Link Distance (ft)	462			423		194			297	
Travel Time (s)	10.5			9.6		4.4			6.8	
Peak Hour Factor	0.96	0.96	0.96	0.92	0.92	0.92	0.92	0.88	0.88	0.88
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	2%	0%	0%	0%
Adj. Flow (vph)	0	214	740	0	0	0	0	744	710	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	214	740	0	0	0	0	744	710	0
Turn Type		custom	custom					custom		
Protected Phases		2	2					1	1	
Permitted Phases		2	2					1		
Detector Phase		2	2					1	1	
Switch Phase										
Minimum Initial (s)		6.0	6.0					6.0	6.0	
Minimum Split (s)		11.0	11.0					11.0	11.0	
Total Split (s)	0.0	40.0	40.0	0.0	0.0	0.0	0.0	40.0	40.0	0.0
Total Split (%)	0.0%	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%	50.0%	50.0%	0.0%
Maximum Green (s)		35.0	35.0					35.0	35.0	
Yellow Time (s)		4.0	4.0					4.0	4.0	
All-Red Time (s)		1.0	1.0					1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	4.0	4.0	4.0	4.0	5.0	5.0	4.0
Lead/Lag		Lag	Lag					Lead	Lead	
Lead-Lag Optimize?		Yes	Yes					Yes	Yes	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	
Recall Mode		Max	Max					C-Max	C-Max	
Act Effct Green (s)		35.0	35.0					35.0	35.0	
Actuated g/C Ratio		0.44	0.44					0.44	0.44	
v/c Ratio		0.30	0.54					0.38	0.46	
Control Delay		16.1	12.8					1.8	17.1	
Queue Delay		0.0	0.0					0.0	0.0	
Total Delay		16.1	12.8					1.8	17.1	
LOS		B	B					A	B	
Approach Delay									9.3	
Approach LOS									A	
Queue Length 50th (ft)		67	100					0	124	
Queue Length 95th (ft)		116	155					25	164	
Internal Link Dist (ft)	382			343		114			217	
Turn Bay Length (ft)										
Base Capacity (vph)		707	1370					1951	1532	
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		0.30	0.54					0.38	0.46	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 7 (9%), Referenced to phase 1:SWL, Start of Green			
Natural Cycle: 40			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.54			
Intersection Signal Delay: 11.0		Intersection LOS: B	
Intersection Capacity Utilization Err%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 28: I-90 WB Off-Ramp & Washington Street



Movement	EBL	EBR	EBR2	NBL	NBR	NWL	NWR	SWL2	SWL	SWR
Lane Configurations										
Volume (vph)	0	205	710	0	0	0	0	655	625	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	
Lane Util. Factor		1.00	0.88					0.97	0.97	
Frt		0.85	0.85					1.00	1.00	
Flt Protected		1.00	1.00					0.95	0.95	
Satd. Flow (prot)		1615	2842					3502	3502	
Flt Permitted		1.00	1.00					0.95	0.95	
Satd. Flow (perm)		1615	2842					3502	3502	
Peak-hour factor, PHF	0.96	0.96	0.96	0.92	0.92	0.92	0.92	0.88	0.88	0.88
Adj. Flow (vph)	0	214	740	0	0	0	0	744	710	0
RTOR Reduction (vph)	0	0	127	0	0	0	0	419	0	0
Lane Group Flow (vph)	0	214	613	0	0	0	0	326	710	0
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	2%	0%	0%	0%
Turn Type		custom	custom					custom		
Protected Phases		2	2					1	1	
Permitted Phases		2	2					1		
Actuated Green, G (s)		35.0	35.0					35.0	35.0	
Effective Green, g (s)		35.0	35.0					35.0	35.0	
Actuated g/C Ratio		0.44	0.44					0.44	0.44	
Clearance Time (s)		5.0	5.0					5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		707	1243					1532	1532	
v/s Ratio Prot		0.13	c0.22					0.09	c0.20	
v/s Ratio Perm										
v/c Ratio		0.30	0.49					0.21	0.46	
Uniform Delay, d1		14.6	16.1					14.0	15.9	
Progression Factor		1.00	1.00					1.00	1.00	
Incremental Delay, d2		1.1	1.4					0.3	1.0	
Delay (s)		15.7	17.5					14.3	16.9	
Level of Service		B	B					B	B	
Approach Delay (s)	17.1			0.0		0.0			15.5	
Approach LOS	B			A		A			B	

Intersection Summary			
HCM Average Control Delay	16.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

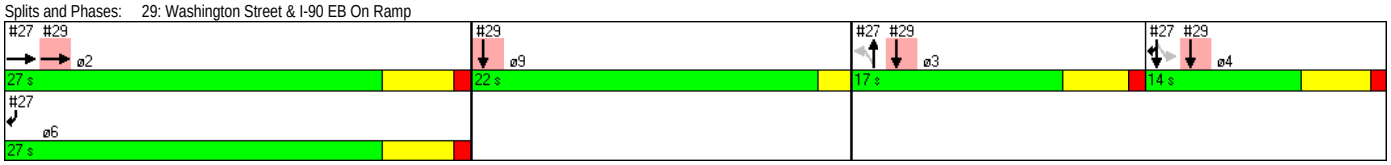
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø3	ø4	ø6	ø9
Lane Configurations		↑↑									↑↑					
Volume (vph)	0	915	0	0	0	0	0	0	0	0	285	0				
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Satd. Flow (prot)	0	3610	0	0	0	0	0	0	0	0	3610	0				
Flt Permitted																
Satd. Flow (perm)	0	3610	0	0	0	0	0	0	0	0	3610	0				
Right Turn on Red			Yes			Yes			Yes	Yes		Yes				
Satd. Flow (RTOR)																
Link Speed (mph)		30			30			30			30					
Link Distance (ft)		163			219			298			150					
Travel Time (s)		3.7			5.0			6.8			3.4					
Peak Hour Factor	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93				
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%				
Adj. Flow (vph)	0	943	0	0	0	0	0	0	0	0	306	0				
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	943	0	0	0	0	0	0	0	0	306	0				
Turn Type																
Protected Phases		2									3 4 9		3	4	6	9
Permitted Phases																
Detector Phase		2									3 4					
Switch Phase																
Minimum Initial (s)		6.0											5.0	6.0	6.0	1.0
Minimum Split (s)		11.2											9.8	11.0	11.2	22.0
Total Split (s)	0.0	27.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.0	0.0	17.0	14.0	27.0	22.0
Total Split (%)	0.0%	33.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	66.3%	0.0%	21%	18%	34%	28%
Maximum Green (s)		21.8											12.2	9.0	21.8	20.0
Yellow Time (s)		4.2											3.8	4.0	4.2	2.0
All-Red Time (s)		1.0											1.0	1.0	1.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Total Lost Time (s)	4.0	5.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.8	4.0				
Lead/Lag													Lead	Lag		
Lead-Lag Optimize?													Yes	Yes		
Vehicle Extension (s)		2.0											2.0	2.0	2.0	2.0
Recall Mode		C-Max											None	None	C-Max	None
Walk Time (s)																7.0
Flash Dont Walk (s)																13.0
Pedestrian Calls (#/hr)																0
Act Effct Green (s)		38.8									31.2					
Actuated g/C Ratio		0.48									0.39					
v/c Ratio		0.54									0.22					
Control Delay		5.5									18.3					
Queue Delay		0.5									0.0					
Total Delay		6.0									18.3					
LOS		A									B					
Approach Delay		6.0									18.3					
Approach LOS		A									B					
Queue Length 50th (ft)		24									63					
Queue Length 95th (ft)		#56									57					
Internal Link Dist (ft)		83			139			218			70					
Turn Bay Length (ft)																
Base Capacity (vph)		1753									1335					
Starvation Cap Reductn		387									0					
Spillback Cap Reductn		0									0					
Storage Cap Reductn		0									0					
Reduced v/c Ratio		0.69									0.23					

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 74 (93%), Referenced to phase 2:EBT and 6:SBR, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 9.0 Intersection LOS: A
Intersection Capacity Utilization 41.5% ICU Level of Service A
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 29: Washington Street & I-90 EB On Ramp



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑									↑↑	
Volume (vph)	0	915	0	0	0	0	0	0	0	0	285	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2									4.8	
Lane Util. Factor		0.95									0.95	
Frt		1.00									1.00	
Flt Protected		1.00									1.00	
Satd. Flow (prot)		3610									3610	
Flt Permitted		1.00									1.00	
Satd. Flow (perm)		3610									3610	
Peak-hour factor, PHF	0.97	0.97	0.97	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.93	0.93
Adj. Flow (vph)	0	943	0	0	0	0	0	0	0	0	306	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	943	0	0	0	0	0	0	0	0	306	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type												
Protected Phases		2									3 4 9	
Permitted Phases												
Actuated Green, G (s)		38.9									30.9	
Effective Green, g (s)		38.9									30.9	
Actuated g/C Ratio		0.49									0.39	
Clearance Time (s)		5.2										
Vehicle Extension (s)		2.0										
Lane Grp Cap (vph)		1755									1394	
v/s Ratio Prot		c0.26									c0.08	
v/s Ratio Perm												
v/c Ratio		0.54									0.22	
Uniform Delay, d1		14.3									16.5	
Progression Factor		0.24									1.19	
Incremental Delay, d2		0.8									0.0	
Delay (s)		4.1									19.7	
Level of Service		A									B	
Approach Delay (s)		4.1			0.0			0.0			19.7	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	7.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		

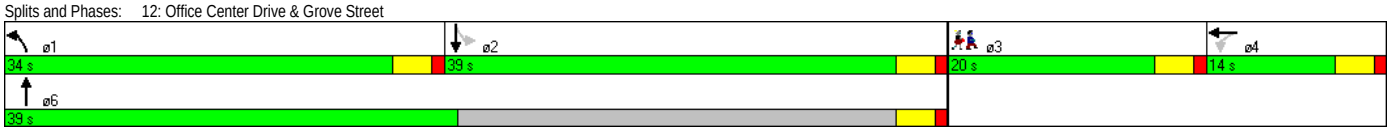
c Critical Lane Group

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø3
Lane Configurations													
Volume (vph)	0	0	0	5	0	5	15	620	5	10	550	5	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	12	12	12	12	12	12	11	13	12	12	12	12	
Storage Length (ft)	0		0	0		0	100		0	0		0	
Storage Lanes	0		0	0		0	1		0	0		0	
Taper Length (ft)	25		25	25		25	25		25	25		25	
Satd. Flow (prot)	0	0	0	0	1728	0	1728	1942	0	0	1877	0	
Flt Permitted					0.976		0.950				0.989		
Satd. Flow (perm)	0	0	0	0	1728	0	1728	1942	0	0	1859	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)					7			1					
Link Speed (mph)		30			30			30			30		
Link Distance (ft)		123			166			282			224		
Travel Time (s)		2.8			3.8			6.4			5.1		
Peak Hour Factor	0.92	0.92	0.92	0.67	0.67	0.67	0.89	0.89	0.89	0.91	0.91	0.91	
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	1%	1%	1%	1%	1%	1%	
Adj. Flow (vph)	0	0	0	7	0	7	17	697	6	11	604	5	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	0	0	0	14	0	17	703	0	0	620	0	
Turn Type				Perm			Prot			Perm			
Protected Phases					4		1	6			2		3
Permitted Phases				4						2			
Detector Phase				4	4		1	6		2	2		
Switch Phase													
Minimum Initial (s)				6.0	6.0		6.0	6.0		6.0	6.0		12.0
Minimum Split (s)				11.0	11.0		11.0	15.0		15.0	15.0		20.0
Total Split (s)	0.0	0.0	0.0	14.0	14.0	0.0	34.0	39.0	0.0	39.0	39.0	0.0	20.0
Total Split (%)	0.0%	0.0%	0.0%	13.1%	13.1%	0.0%	31.8%	36.4%	0.0%	36.4%	36.4%	0.0%	19%
Maximum Green (s)				10.0	10.0		30.0	35.0		35.0	35.0		16.0
Yellow Time (s)				3.0	3.0		3.0	3.0		3.0	3.0		3.0
All-Red Time (s)				1.0	1.0		1.0	1.0		1.0	1.0		1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lead/Lag				Lag	Lag		Lead			Lag	Lag		Lead
Lead-Lag Optimize?				Yes	Yes		Yes			Yes	Yes		Yes
Vehicle Extension (s)				2.0	2.0		2.0	2.0		2.0	2.0		2.0
Recall Mode				None	None		None	Min		Min	Min		None
Walk Time (s)													5.0
Flash Dont Walk (s)													11.0
Pedestrian Calls (#/hr)													5
Act Effct Green (s)					6.9		6.9	45.2			44.1		
Actuated g/C Ratio					0.14		0.14	0.92			0.90		
v/c Ratio					0.06		0.07	0.39			0.37		
Control Delay					21.1		25.9	3.9			6.1		
Queue Delay					0.0		0.0	0.0			0.0		
Total Delay					21.1		25.9	3.9			6.1		
LOS					C		C	A			A		
Approach Delay					21.1			4.4			6.1		
Approach LOS					C			A			A		
Queue Length 50th (ft)					1		3	0			0		
Queue Length 95th (ft)					16		30	310			373		
Internal Link Dist (ft)		43			86			202			144		
Turn Bay Length (ft)							100						
Base Capacity (vph)					408		1207	1847			1659		
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					0.03		0.01	0.38			0.37		

Intersection Summary

Area Type: Other
Cycle Length: 107
Actuated Cycle Length: 48.9
Natural Cycle: 70
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.39
Intersection Signal Delay: 5.4 Intersection LOS: A
Intersection Capacity Utilization 48.9% ICU Level of Service A
Analysis Period (min) 15

Splits and Phases: 12: Office Center Drive & Grove Street



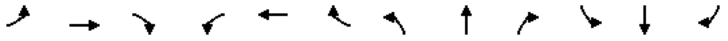
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	0	0	5	0	5	15	620	5	10	550	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	12	12	12	12	12	11	13	12	12	12	12
Total Lost time (s)					4.0		4.0	4.0			4.0	
Lane Util. Factor					1.00		1.00	1.00			1.00	
Frt					0.93		1.00	1.00			1.00	
Flt Protected					0.98		0.95	1.00			1.00	
Satd. Flow (prot)					1729		1728	1941			1877	
Flt Permitted					0.98		0.95	1.00			0.99	
Satd. Flow (perm)					1729		1728	1941			1858	
Peak-hour factor, PHF	0.92	0.92	0.92	0.67	0.67	0.67	0.89	0.89	0.89	0.91	0.91	0.91
Adj. Flow (vph)	0	0	0	7	0	7	17	697	6	11	604	5
RTOR Reduction (vph)	0	0	0	0	7	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	7	0	17	703	0	0	620	0
Heavy Vehicles (%)	2%	2%	2%	0%	0%	0%	1%	1%	1%	1%	1%	1%
Turn Type				Perm			Prot			Perm		
Protected Phases					4		1	6			2	
Permitted Phases				4						2		
Actuated Green, G (s)					0.7		0.7	44.6			39.9	
Effective Green, g (s)					0.7		0.7	44.6			39.9	
Actuated g/C Ratio					0.01		0.01	0.76			0.68	
Clearance Time (s)					4.0		4.0	4.0			4.0	
Vehicle Extension (s)					2.0		2.0	2.0			2.0	
Lane Grp Cap (vph)					21		21	1467			1257	
v/s Ratio Prot							0.01	c0.36				
v/s Ratio Perm					0.00						0.33	
v/c Ratio					0.34		0.81	0.48			0.49	
Uniform Delay, d1					28.9		29.1	2.8			4.6	
Progression Factor					1.00		1.00	1.00			1.00	
Incremental Delay, d2					3.5		104.9	0.1			0.1	
Delay (s)					32.4		133.9	2.8			4.8	
Level of Service					C		F	A			A	
Approach Delay (s)		0.0			32.4			5.9			4.8	
Approach LOS		A			C			A			A	

Intersection Summary			
HCM Average Control Delay	5.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	59.0	Sum of lost time (s)	13.7
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø2
Lane Configurations													
Volume (vph)	10	140	10	120	100	105	15	440	165	155	385	10	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Lane Width (ft)	12	16	12	12	15	12	12	16	12	12	16	12	
Satd. Flow (prot)	0	2128	0	0	1964	0	0	2033	0	0	2096	0	
Flt Permitted		0.972			0.816			0.983			0.607		
Satd. Flow (perm)	0	2074	0	0	1632	0	0	2001	0	0	1290	0	
Right Turn on Red			Yes			Yes			Yes			Yes	
Satd. Flow (RTOR)		4			30			29			2		
Link Speed (mph)		30			30			30			30		
Link Distance (ft)		598			316			168			222		
Travel Time (s)		13.6			7.2			3.8			5.0		
Peak Hour Factor	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.91	0.91	0.93	0.93	0.93	
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	2%	2%	2%	1%	1%	1%	
Adj. Flow (vph)	11	152	11	132	110	115	16	484	181	167	414	11	
Shared Lane Traffic (%)													
Lane Group Flow (vph)	0	174	0	0	357	0	0	681	0	0	592	0	
Turn Type	Perm			Perm			Perm			Perm			
Protected Phases		3			3			1			1		2
Permitted Phases	3			3			1			1			
Detector Phase	3	3		3	3		1	1		1	1		
Switch Phase													
Minimum Initial (s)	17.0	17.0		17.0	17.0		30.0	30.0		30.0	30.0		15.0
Minimum Split (s)	22.3	22.3		22.3	22.3		35.2	35.2		35.2	35.2		17.0
Total Split (s)	22.3	22.3	0.0	22.3	22.3	0.0	35.2	35.2	0.0	35.2	35.2	0.0	17.0
Total Split (%)	29.9%	29.9%	0.0%	29.9%	29.9%	0.0%	47.2%	47.2%	0.0%	47.2%	47.2%	0.0%	23%
Maximum Green (s)	17.0	17.0		17.0	17.0		30.0	30.0		30.0	30.0		15.0
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0		2.0
All-Red Time (s)	2.3	2.3		2.3	2.3		2.2	2.2		2.2	2.2		0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.3	5.3	4.0	5.3	5.3	4.0	5.2	5.2	4.0	5.2	5.2	4.0	
Lead/Lag							Lead	Lead		Lead	Lead		Lag
Lead-Lag Optimize?							Yes	Yes		Yes	Yes		Yes
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0		3.0
Recall Mode	Max	Max		Max	Max		Max	Max		Max	Max		None
Walk Time (s)													7.0
Flash Dont Walk (s)													8.0
Pedestrian Calls (#/hr)													5
Act Effct Green (s)		17.2			17.2			30.3			30.3		
Actuated g/C Ratio		0.28			0.28			0.50			0.50		
v/c Ratio		0.30			0.74			0.67			0.92		
Control Delay		19.9			31.5			17.1			39.2		
Queue Delay		0.0			0.0			0.0			0.0		
Total Delay		19.9			31.5			17.1			39.2		
LOS		B			C			B			D		
Approach Delay		19.9			31.5			17.1			39.2		
Approach LOS		B			C			B			D		
Queue Length 50th (ft)		44			99			146			163		
Queue Length 95th (ft)		120			#303			#453			#519		
Internal Link Dist (ft)		518			236			88			142		
Turn Bay Length (ft)													
Base Capacity (vph)		588			482			1011			643		
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		0.30			0.74			0.67			0.92		

Intersection Summary			
Area Type:	Other		
Cycle Length: 74.5			
Actuated Cycle Length: 60.9			
Natural Cycle: 100			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.92			
Intersection Signal Delay: 27.5		Intersection LOS: C	
Intersection Capacity Utilization 113.5%		ICU Level of Service H	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 16: Central Street & Auburn Street



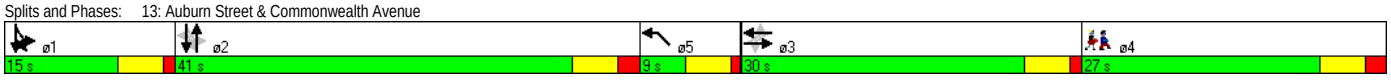
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	10	140	10	120	100	105	15	440	165	155	385	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	12	16	12	12	15	12	12	16	12	12	16	12
Total Lost time (s)		5.3			5.3			5.2			5.2	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.99			0.96			0.96			1.00	
Flt Protected		1.00			0.98			1.00			0.99	
Satd. Flow (prot)		2128			1963			2033			2097	
Flt Permitted		0.97			0.82			0.98			0.61	
Satd. Flow (perm)		2076			1631			2001			1291	
Peak-hour factor, PHF	0.92	0.92	0.92	0.91	0.91	0.91	0.91	0.91	0.91	0.93	0.93	0.93
Adj. Flow (vph)	11	152	11	132	110	115	16	484	181	167	414	11
RTOR Reduction (vph)	0	3	0	0	22	0	0	15	0	0	1	0
Lane Group Flow (vph)	0	171	0	0	335	0	0	666	0	0	591	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	2%	2%	2%	1%	1%	1%
Turn Type	Perm			Perm			Perm			Perm		
Protected Phases		3			3			1			1	
Permitted Phases	3			3			1			1		
Actuated Green, G (s)		17.2			17.2			30.3			30.3	
Effective Green, g (s)		17.2			17.2			30.3			30.3	
Actuated g/C Ratio		0.28			0.28			0.48			0.48	
Clearance Time (s)		5.3			5.3			5.2			5.2	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		571			449			970			626	
v/s Ratio Prot												
v/s Ratio Perm		0.08			c0.21			0.33			c0.46	
v/c Ratio		0.30			0.75			0.69			0.94	
Uniform Delay, d1		17.9			20.7			12.4			15.3	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		1.3			10.8			4.0			24.6	
Delay (s)		19.2			31.5			16.4			39.9	
Level of Service		B			C			B			D	
Approach Delay (s)		19.2			31.5			16.4			39.9	
Approach LOS		B			C			B			D	

Intersection Summary			
HCM Average Control Delay	27.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	62.5	Sum of lost time (s)	15.0
Intersection Capacity Utilization	113.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL	NWR	NWR2	ø4
Lane Configurations																	
Volume (vph)	20	300	90	10	225	165	30	435	10	155	0	505	20	5	5	5	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0			0		0	0		0		30		0	0	0		
Storage Lanes	0			0		0	0		0		1		0	1	0		
Taper Length (ft)	25			25		25	25		25		25		25	25	25		
Satd. Flow (prot)	0	1821	0	0	1774	0	0	1852	0	0	1770	1852	0	1704	0	0	
Flt Permitted		0.889			0.956			0.939			0.303			0.981			
Satd. Flow (perm)	0	1622	0	0	1698	0	0	1744	0	0	564	1852	0	1704	0	0	
Right Turn on Red			Yes			Yes							Yes			Yes	
Satd. Flow (RTOR)		10			26							2		5			
Link Speed (mph)		30			30			30				30		30			
Link Distance (ft)		1184			376			1200				268		491			
Travel Time (s)		26.9			8.5			27.3				6.1		11.2			
Peak Hour Factor	0.82	0.82	0.82	0.86	0.86	0.86	0.92	0.92	0.92	0.95	0.95	0.95	0.95	0.55	0.55	0.92	
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%	2%	0%	0%	2%	
Adj. Flow (vph)	24	366	110	12	262	192	33	473	11	163	0	532	21	9	9	5	
Shared Lane Traffic (%)																	
Lane Group Flow (vph)	0	500	0	0	466	0	0	517	0	0	163	553	0	23	0	0	
Turn Type	Perm			Perm			Perm			D.P+P	D.P+P						
Protected Phases		3			3			2		1	1	1 2		5			4
Permitted Phases	3			3			2			2	2						
Detector Phase	3	3		3	3		2	2		1	1	1 2		5			
Switch Phase																	
Minimum Initial (s)	10.0	10.0		10.0	10.0		15.0	15.0		10.0	10.0			4.0			15.0
Minimum Split (s)	15.0	15.0		15.0	15.0		21.0	21.0		15.0	15.0			9.0			27.0
Total Split (s)	30.0	30.0	0.0	30.0	30.0	0.0	41.0	41.0	0.0	15.0	15.0	56.0	0.0	9.0	0.0	0.0	27.0
Total Split (%)	24.6%	24.6%	0.0%	24.6%	24.6%	0.0%	33.6%	33.6%	0.0%	12.3%	12.3%	45.9%	0.0%	7.4%	0.0%	0.0%	22%
Maximum Green (s)	25.0	25.0		25.0	25.0		35.0	35.0		10.0	10.0			4.0			21.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0			4.0			4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		2.0	2.0		1.0	1.0			1.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	6.0	6.0	4.0	5.0	5.0	5.0	4.0	5.0	4.0	4.0	
Lead/Lag	Lead	Lead		Lead	Lead		Lag	Lag		Lead	Lead						Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes						Yes
Vehicle Extension (s)	4.0	4.0		4.0	4.0		5.0	5.0		4.0	4.0			3.0			5.0
Recall Mode	Max	Max		Max	Max		Max	Max		Max	Max			None			None
Walk Time (s)																	7.0
Flash Dont Walk (s)																	8.0
Pedestrian Calls (#/hr)																	5
Act Effct Green (s)		25.3			25.3			35.5			46.6	51.7		4.1			
Actuated g/C Ratio		0.27			0.27			0.38			0.50	0.55		0.04			
v/c Ratio		1.12			0.97			0.78			0.40	0.54		0.29			
Control Delay		113.8			70.2			37.8			16.2	18.3		50.4			
Queue Delay		0.0			0.0			0.0			0.0	0.0		0.0			
Total Delay		113.8			70.2			37.8			16.2	18.3		50.4			
LOS		F			E			D			B	B		D			
Approach Delay		113.8			70.2			37.8				17.8		50.4			
Approach LOS		F			E			D				B		D			
Queue Length 50th (ft)		~293			230			230			36	158		10			
Queue Length 95th (ft)		#621			#577			#607			121	451		24			
Internal Link Dist (ft)		1104			296			1120				188		411			
Turn Bay Length (ft)											30						
Base Capacity (vph)		446			478			660			411	1021		79			
Starvation Cap Reductn		0			0			0			0	0		0			
Spillback Cap Reductn		0			0			0			0	0		0			
Storage Cap Reductn		0			0			0			0	0		0			
Reduced v/c Ratio		1.12			0.97			0.78			0.40	0.54		0.29			

Intersection Summary			
Area Type:	Other		
Cycle Length: 122			
Actuated Cycle Length: 93.8			
Natural Cycle: 150			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.12			
Intersection Signal Delay: 55.4		Intersection LOS: E	
Intersection Capacity Utilization 104.9%		ICU Level of Service G	
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: 13: Auburn Street & Commonwealth Avenue



Movement	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL	NWR	NWR2
Lane Configurations																
Volume (vph)	20	300	90	10	225	165	30	435	10	155	0	505	20	5	5	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			6.0			5.0	5.0		5.0		
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00		1.00		
Frt		0.97			0.94			1.00			1.00	0.99		0.92		
Flt Protected		1.00			1.00			1.00			0.95	1.00		0.98		
Satd. Flow (prot)		1821			1774			1851			1770	1852		1703		
Flt Permitted		0.89			0.96			0.94			0.30	1.00		0.98		
Satd. Flow (perm)		1622			1698			1745			565	1852		1703		
Peak-hour factor, PHF	0.82	0.82	0.82	0.86	0.86	0.86	0.92	0.92	0.92	0.95	0.95	0.95	0.95	0.55	0.55	0.92
Adj. Flow (vph)	24	366	110	12	262	192	33	473	11	163	0	532	21	9	9	5
RTOR Reduction (vph)	0	8	0	0	20	0	0	0	0	0	0	1	0	5	0	0
Lane Group Flow (vph)	0	492	0	0	446	0	0	517	0	0	163	552	0	18	0	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%	2%	0%	0%	2%
Turn Type	Perm			Perm			Perm			D.P+P	D.P+P					
Protected Phases		3			3			2		1	1	1 2		5		
Permitted Phases	3			3			2			2	2					
Actuated Green, G (s)		25.3			25.3			35.5			45.6	50.6		1.4		
Effective Green, g (s)		25.3			25.3			35.5			45.6	50.6		1.4		
Actuated g/C Ratio		0.25			0.25			0.35			0.45	0.50		0.01		
Clearance Time (s)		5.0			5.0			6.0			5.0			5.0		
Vehicle Extension (s)		4.0			4.0			5.0			4.0			3.0		
Lane Grp Cap (vph)		404			422			609			373	921		23		
v/s Ratio Prot											0.04	c0.30		c0.01		
v/s Ratio Perm		c0.30			0.26			c0.30			0.15					
v/c Ratio		1.22			1.06			0.85			0.44	0.60		0.79		
Uniform Delay, d1		38.2			38.2			30.6			18.9	18.3		50.0		
Progression Factor		1.00			1.00			1.00			1.00	1.00		1.00		
Incremental Delay, d2		119.1			60.0			13.8			3.7	2.9		94.5		
Delay (s)		157.3			98.2			44.4			22.6	21.2		144.5		
Level of Service		F			F			D			C	C		F		
Approach Delay (s)		157.3			98.2			44.4				21.5		144.5		
Approach LOS		F			F			D				C		F		

Intersection Summary			
HCM Average Control Delay	74.7	HCM Level of Service	E
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	101.7	Sum of lost time (s)	29.4
Intersection Capacity Utilization	104.9%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	ø3
Lane Configurations							
Volume (vph)	460	10	5	1320	1095	485	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0	50	0			0	
Storage Lanes	1	1	0			0	
Taper Length (ft)	25	25	25			25	
Satd. Flow (prot)	1805	1615	0	3610	3410	0	
Flt Permitted	0.950			0.884			
Satd. Flow (perm)	1805	1615	0	3191	3410	0	
Right Turn on Red		Yes				Yes	
Satd. Flow (RTOR)		4			86		
Link Speed (mph)	10			30	30		
Link Distance (ft)	1445			1829	884		
Travel Time (s)	98.5			41.6	20.1		
Peak Hour Factor	0.88	0.88	0.93	0.93	0.95	0.95	
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%	
Adj. Flow (vph)	523	11	5	1419	1153	511	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	523	11	0	1424	1664	0	
Turn Type		Perm	Perm				
Protected Phases	4			2	2		3
Permitted Phases		4	2				
Detector Phase	4	4	2	2	2		
Switch Phase							
Minimum Initial (s)	6.0	6.0	6.0	6.0	6.0		1.0
Minimum Split (s)	20.8	20.8	21.3	21.3	21.3		26.0
Total Split (s)	27.0	27.0	27.0	27.0	27.0	0.0	26.0
Total Split (%)	33.8%	33.8%	33.8%	33.8%	33.8%	0.0%	33%
Maximum Green (s)	22.2	22.2	21.7	21.7	21.7		24.0
Yellow Time (s)	3.8	3.8	4.2	4.2	4.2		2.0
All-Red Time (s)	1.0	1.0	1.1	1.1	1.1		0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	4.8	4.8	5.3	5.3	5.3	4.0	
Lead/Lag	Lag	Lag					Lead
Lead-Lag Optimize?	Yes	Yes					Yes
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0		2.0
Recall Mode	None	None	C-Max	C-Max	C-Max		None
Walk Time (s)							7.0
Flash Dont Walk (s)							17.0
Pedestrian Calls (#/hr)							0
Act Effct Green (s)	30.3	30.3		39.6	39.6		
Actuated g/C Ratio	0.38	0.38		0.50	0.50		
v/c Ratio	0.77	0.02		0.90	0.96		
Control Delay	30.9	13.3		28.0	30.7		
Queue Delay	0.0	0.0		0.0	0.0		
Total Delay	30.9	13.3		28.0	30.7		
LOS	C	B		C	C		
Approach Delay	30.6			28.0	30.7		
Approach LOS	C			C	C		
Queue Length 50th (ft)	224	2		322	209		
Queue Length 95th (ft)	#340	12		#478	#513		
Internal Link Dist (ft)	1365			1749	804		
Turn Bay Length (ft)		50					
Base Capacity (vph)	683	614		1581	1732		
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	0.77	0.02		0.90	0.96		

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 30 (38%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 150
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 29.6 Intersection LOS: C
Intersection Capacity Utilization 79.7% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 26: Auburn Street & Washington Street

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	460	10	5	1320	1095	485
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.8	4.8		5.3	5.3	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frt	1.00	0.85		1.00	0.95	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1805	1615		3609	3410	
Flt Permitted	0.95	1.00		0.88	1.00	
Satd. Flow (perm)	1805	1615		3192	3410	
Peak-hour factor, PHF	0.88	0.88	0.93	0.93	0.95	0.95
Adj. Flow (vph)	523	11	5	1419	1153	511
RTOR Reduction (vph)	0	2	0	0	43	0
Lane Group Flow (vph)	523	9	0	1424	1621	0
Heavy Vehicles (%)	0%	0%	0%	0%	1%	1%
Turn Type		Perm	Perm			
Protected Phases	4			2	2	
Permitted Phases		4	2			
Actuated Green, G (s)	30.3	30.3		39.6	39.6	
Effective Green, g (s)	30.3	30.3		39.6	39.6	
Actuated g/C Ratio	0.38	0.38		0.50	0.50	
Clearance Time (s)	4.8	4.8		5.3	5.3	
Vehicle Extension (s)	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	684	612		1580	1688	
v/s Ratio Prot	c0.29				c0.48	
v/s Ratio Perm		0.01		0.45		
v/c Ratio	0.76	0.01		0.90	0.96	
Uniform Delay, d1	21.7	15.5		18.4	19.4	
Progression Factor	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.6	0.0		8.7	11.1	
Delay (s)	26.3	15.5		27.1	30.6	
Level of Service	C	B		C	C	
Approach Delay (s)	26.1			27.1	30.6	
Approach LOS	C			C	C	

Intersection Summary			
HCM Average Control Delay	28.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.1
Intersection Capacity Utilization	79.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

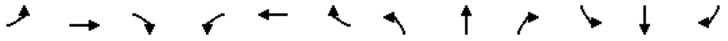
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø6	ø9
Lane Configurations														
Volume (vph)	0	1830	5	0	0	0	5	0	10	0	15	1755		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Satd. Flow (prot)	0	3610	0	0	0	0	0	1698	0	0	1900	2842		
Flt Permitted								0.303						
Satd. Flow (perm)	0	3610	0	0	0	0	0	523	0	0	1900	2842		
Right Turn on Red			Yes			Yes			Yes			Yes		
Satd. Flow (RTOR)								17				1828		
Link Speed (mph)		30			30			30			30			
Link Distance (ft)		884			163			529			423			
Travel Time (s)		20.1			3.7			12.0			9.6			
Peak Hour Factor	0.93	0.93	0.93	0.92	0.92	0.92	0.60	0.60	0.60	0.96	0.96	0.96		
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%	0%		
Adj. Flow (vph)	0	1968	5	0	0	0	8	0	17	0	16	1828		
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	1973	0	0	0	0	0	25	0	0	16	1828		
Turn Type							Perm			Perm		custom		
Protected Phases		2						3			4	4 6	6	9
Permitted Phases							3			4				
Detector Phase		2					3	3		4	4	4 6		
Switch Phase														
Minimum Initial (s)		6.0					5.0	5.0		6.0	6.0		6.0	1.0
Minimum Split (s)		11.2					9.8	9.8		11.0	11.0		11.2	22.0
Total Split (s)	0.0	24.0	0.0	0.0	0.0	0.0	17.0	17.0	0.0	17.0	17.0	41.0	24.0	22.0
Total Split (%)	0.0%	30.0%	0.0%	0.0%	0.0%	0.0%	21.3%	21.3%	0.0%	21.3%	21.3%	51.3%	30%	28%
Maximum Green (s)		18.8					12.2	12.2		12.0	12.0		18.8	20.0
Yellow Time (s)		4.2					3.8	3.8		4.0	4.0		4.2	2.0
All-Red Time (s)		1.0					1.0	1.0		1.0	1.0		1.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Lost Time (s)	4.0	5.2	4.0	4.0	4.0	4.0	4.8	4.8	4.0	5.0	5.0	5.0		
Lead/Lag							Lead	Lead		Lag	Lag			
Lead-Lag Optimize?							Yes	Yes		Yes	Yes			
Vehicle Extension (s)		2.0					2.0	2.0		2.0	2.0		2.0	2.0
Recall Mode		C-Max					None	None		None	None		C-Max	None
Walk Time (s)														7.0
Flash Dont Walk (s)														13.0
Pedestrian Calls (#/hr)														0
Act Effct Green (s)		32.4						8.7			23.8	61.5		
Actuated g/C Ratio		0.40						0.11			0.30	0.77		
v/c Ratio		1.35						0.35			0.03	0.70		
Control Delay		181.8						32.3			16.3	2.5		
Queue Delay		47.7						0.0			0.0	0.2		
Total Delay		229.4						32.3			16.3	2.7		
LOS		F						C			B	A		
Approach Delay		229.4						32.3			2.8			
Approach LOS		F						C			A			
Queue Length 50th (ft)		~654						4			5	11		
Queue Length 95th (ft)		m#991						14			m6	22		
Internal Link Dist (ft)		804			83			449			343			
Turn Bay Length (ft)														
Base Capacity (vph)		1464						94			566	2607		
Starvation Cap Reductn		0						0			0	208		
Spillback Cap Reductn		107						0			0	0		
Storage Cap Reductn		0						0			0	0		
Reduced v/c Ratio		1.45						0.27			0.03	0.76		

Intersection Summary

Area Type: Other
Cycle Length: 80
Actuated Cycle Length: 80
Offset: 36 (45%), Referenced to phase 2:EBT and 6:SBR, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.35
Intersection Signal Delay: 119.4 Intersection LOS: F
Intersection Capacity Utilization 73.7% 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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 27: Washington Street & Perkins Street



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1830	5	0	0	0	5	0	10	0	15	1755
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2						4.8			5.0	5.0
Lane Util. Factor		0.95						1.00			1.00	0.88
Frt		1.00						0.91			1.00	0.85
Flt Protected		1.00						0.98			1.00	1.00
Satd. Flow (prot)		3609						1698			1900	2842
Flt Permitted		1.00						0.30			1.00	1.00
Satd. Flow (perm)		3609						524			1900	2842
Peak-hour factor, PHF	0.93	0.93	0.93	0.92	0.92	0.92	0.60	0.60	0.60	0.96	0.96	0.96
Adj. Flow (vph)	0	1968	5	0	0	0	8	0	17	0	16	1828
RTOR Reduction (vph)	0	0	0	0	0	0	0	15	0	0	0	427
Lane Group Flow (vph)	0	1973	0	0	0	0	0	10	0	0	16	1401
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%	0%
Turn Type							Perm			Perm		custom
Protected Phases		2						3			4	4 6
Permitted Phases							3			4		
Actuated Green, G (s)		32.5						8.7			23.8	61.3
Effective Green, g (s)		32.5						8.7			23.8	61.3
Actuated g/C Ratio		0.41						0.11			0.30	0.77
Clearance Time (s)		5.2						4.8			5.0	
Vehicle Extension (s)		2.0						2.0			2.0	
Lane Grp Cap (vph)		1466						57			565	2178
v/s Ratio Prot		c0.55									0.01	c0.49
v/s Ratio Perm								c0.02				
v/c Ratio		1.35						0.17			0.03	0.64
Uniform Delay, d1		23.8						32.4			19.9	4.3
Progression Factor		0.83						1.00			1.07	6.43
Incremental Delay, d2		158.0						0.5			0.0	0.3
Delay (s)		177.7						32.9			21.3	28.0
Level of Service		F						C			C	C
Approach Delay (s)		177.7			0.0			32.9			28.0	
Approach LOS		F			A			C			C	

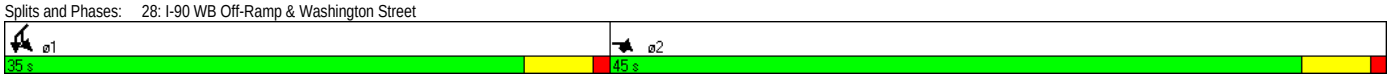
Intersection Summary			
HCM Average Control Delay	104.9	HCM Level of Service	F
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	EBR2	NBL	NBR	NWL	NWR	SWL2	SWL	SWR
Lane Configurations										
Volume (vph)	0	205	1035	0	0	0	0	330	735	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	0	1615	2842	0	0	0	0	3502	3502	0
Flt Permitted								0.950	0.950	
Satd. Flow (perm)	0	1615	2842	0	0	0	0	3502	3502	0
Right Turn on Red			Yes				Yes	Yes		Yes
Satd. Flow (RTOR)			90					384		
Link Speed (mph)	30			30		30			30	
Link Distance (ft)	462			423		194			297	
Travel Time (s)	10.5			9.6		4.4			6.8	
Peak Hour Factor	0.90	0.90	0.90	0.92	0.92	0.92	0.92	0.86	0.86	0.86
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	2%	0%	0%	0%
Adj. Flow (vph)	0	228	1150	0	0	0	0	384	855	0
Shared Lane Traffic (%)										
Lane Group Flow (vph)	0	228	1150	0	0	0	0	384	855	0
Turn Type		custom	custom					custom		
Protected Phases		2	2					1	1	
Permitted Phases		2	2					1		
Detector Phase		2	2					1	1	
Switch Phase										
Minimum Initial (s)		6.0	6.0					6.0	6.0	
Minimum Split (s)		11.0	11.0					11.0	11.0	
Total Split (s)	0.0	45.0	45.0	0.0	0.0	0.0	0.0	35.0	35.0	0.0
Total Split (%)	0.0%	56.3%	56.3%	0.0%	0.0%	0.0%	0.0%	43.8%	43.8%	0.0%
Maximum Green (s)		40.0	40.0					30.0	30.0	
Yellow Time (s)		4.0	4.0					4.0	4.0	
All-Red Time (s)		1.0	1.0					1.0	1.0	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	5.0	5.0	4.0	4.0	4.0	4.0	5.0	5.0	4.0
Lead/Lag		Lag	Lag					Lead	Lead	
Lead-Lag Optimize?		Yes	Yes					Yes	Yes	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	
Recall Mode		Max	Max					C-Max	C-Max	
Act Effct Green (s)		40.0	40.0					30.0	30.0	
Actuated g/C Ratio		0.50	0.50					0.38	0.38	
v/c Ratio		0.28	0.78					0.25	0.65	
Control Delay		12.8	19.8					2.4	23.5	
Queue Delay		0.0	0.0					0.0	0.0	
Total Delay		12.8	19.8					2.4	23.5	
LOS		B	B					A	C	
Approach Delay									17.0	
Approach LOS									B	
Queue Length 50th (ft)		63	235					0	178	
Queue Length 95th (ft)		108	328					21	224	
Internal Link Dist (ft)	382			343		114			217	
Turn Bay Length (ft)										
Base Capacity (vph)		808	1466					1553	1313	
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		0.28	0.78					0.25	0.65	

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 57 (71%), Referenced to phase 1:SWL, Start of Green			
Natural Cycle: 55			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.78			
Intersection Signal Delay: 17.9		Intersection LOS: B	
Intersection Capacity Utilization Err%		ICU Level of Service H	
Analysis Period (min) 15			

Splits and Phases: 28: I-90 WB Off-Ramp & Washington Street



Movement	EBL	EBR	EBR2	NBL	NBR	NWL	NWR	SWL2	SWL	SWR
Lane Configurations										
Volume (vph)	0	205	1035	0	0	0	0	330	735	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0	5.0					5.0	5.0	
Lane Util. Factor		1.00	0.88					0.97	0.97	
Frt		0.85	0.85					1.00	1.00	
Flt Protected		1.00	1.00					0.95	0.95	
Satd. Flow (prot)		1615	2842					3502	3502	
Flt Permitted		1.00	1.00					0.95	0.95	
Satd. Flow (perm)		1615	2842					3502	3502	
Peak-hour factor, PHF	0.90	0.90	0.90	0.92	0.92	0.92	0.92	0.86	0.86	0.86
Adj. Flow (vph)	0	228	1150	0	0	0	0	384	855	0
RTOR Reduction (vph)	0	0	45	0	0	0	0	240	0	0
Lane Group Flow (vph)	0	228	1105	0	0	0	0	144	855	0
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	2%	0%	0%	0%
Turn Type		custom	custom					custom		
Protected Phases		2	2					1	1	
Permitted Phases		2	2					1		
Actuated Green, G (s)		40.0	40.0					30.0	30.0	
Effective Green, g (s)		40.0	40.0					30.0	30.0	
Actuated g/C Ratio		0.50	0.50					0.38	0.38	
Clearance Time (s)		5.0	5.0					5.0	5.0	
Vehicle Extension (s)		3.0	3.0					3.0	3.0	
Lane Grp Cap (vph)		808	1421					1313	1313	
v/s Ratio Prot		0.14	c0.39					0.04	c0.24	
v/s Ratio Perm										
v/c Ratio		0.28	0.78					0.11	0.65	
Uniform Delay, d1		11.6	16.4					16.3	20.7	
Progression Factor		1.00	1.00					1.00	1.00	
Incremental Delay, d2		0.9	4.2					0.2	2.5	
Delay (s)		12.5	20.6					16.5	23.2	
Level of Service		B	C					B	C	
Approach Delay (s)	19.3			0.0		0.0			21.1	
Approach LOS	B			A		A			C	

Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

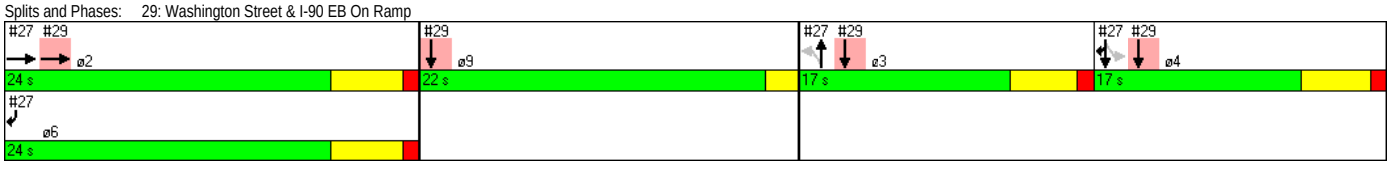
c Critical Lane Group

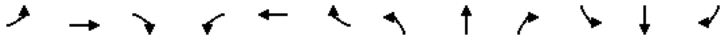
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø3	ø4	ø6	ø9
Lane Configurations		↑↑									↑↑					
Volume (vph)	0	965	0	0	0	0	0	0	0	0	295	0				
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900				
Satd. Flow (prot)	0	3610	0	0	0	0	0	0	0	0	3610	0				
Flt Permitted																
Satd. Flow (perm)	0	3610	0	0	0	0	0	0	0	0	3610	0				
Right Turn on Red			Yes			Yes			Yes	Yes		Yes				
Satd. Flow (RTOR)																
Link Speed (mph)		30			30			30			30					
Link Distance (ft)		163			219			298			150					
Travel Time (s)		3.7			5.0			6.8			3.4					
Peak Hour Factor	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92	0.96	0.96	0.96				
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%				
Adj. Flow (vph)	0	1038	0	0	0	0	0	0	0	0	307	0				
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	1038	0	0	0	0	0	0	0	0	307	0				
Turn Type																
Protected Phases		2									3 4 9		3	4	6	9
Permitted Phases																
Detector Phase		2									3 4					
Switch Phase																
Minimum Initial (s)		6.0											5.0	6.0	6.0	1.0
Minimum Split (s)		11.2											9.8	11.0	11.2	22.0
Total Split (s)	0.0	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0	0.0	17.0	17.0	24.0	22.0
Total Split (%)	0.0%	30.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	70.0%	0.0%	21%	21%	30%	28%
Maximum Green (s)		18.8											12.2	12.0	18.8	20.0
Yellow Time (s)		4.2											3.8	4.0	4.2	2.0
All-Red Time (s)		1.0											1.0	1.0	1.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Total Lost Time (s)	4.0	5.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.8	4.0				
Lead/Lag													Lead	Lag		
Lead-Lag Optimize?													Yes	Yes		
Vehicle Extension (s)		2.0											2.0	2.0	2.0	2.0
Recall Mode		C-Max											None	None	C-Max	None
Walk Time (s)																7.0
Flash Dont Walk (s)																13.0
Pedestrian Calls (#/hr)																0
Act Effct Green (s)		32.4									37.6					
Actuated g/C Ratio		0.40									0.47					
v/c Ratio		0.71									0.18					
Control Delay		11.9									14.0					
Queue Delay		36.3									0.0					
Total Delay		48.3									14.0					
LOS		D									B					
Approach Delay		48.3									14.0					
Approach LOS		D									B					
Queue Length 50th (ft)		33									63					
Queue Length 95th (ft)		m45									33					
Internal Link Dist (ft)		83			139			218			70					
Turn Bay Length (ft)																
Base Capacity (vph)		1464									1632					
Starvation Cap Reductn		491									0					
Spillback Cap Reductn		0									0					
Storage Cap Reductn		0									0					
Reduced v/c Ratio		1.07									0.19					

Intersection Summary			
Area Type:	Other		
Cycle Length: 80			
Actuated Cycle Length: 80			
Offset: 36 (45%), Referenced to phase 2:EBT and 6:SBR, Start of Green			
Natural Cycle: 120			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.35			
Intersection Signal Delay: 40.4		Intersection LOS: D	
Intersection Capacity Utilization 43.2%		ICU Level of Service A	
Analysis Period (min) 15			

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 29: Washington Street & I-90 EB On Ramp





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	965	0	0	0	0	0	0	0	0	295	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2									4.8	
Lane Util. Factor		0.95									0.95	
Frt		1.00									1.00	
Flt Protected		1.00									1.00	
Satd. Flow (prot)		3610									3610	
Flt Permitted		1.00									1.00	
Satd. Flow (perm)		3610									3610	
Peak-hour factor, PHF	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92	0.96	0.96	0.96
Adj. Flow (vph)	0	1038	0	0	0	0	0	0	0	0	307	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1038	0	0	0	0	0	0	0	0	307	0
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Turn Type												
Protected Phases		2									3 4 9	
Permitted Phases												
Actuated Green, G (s)		32.5									37.3	
Effective Green, g (s)		32.5									37.3	
Actuated g/C Ratio		0.41									0.47	
Clearance Time (s)		5.2										
Vehicle Extension (s)		2.0										
Lane Grp Cap (vph)		1467									1683	
v/s Ratio Prot		c0.29									c0.09	
v/s Ratio Perm												
v/c Ratio		0.71									0.18	
Uniform Delay, d1		19.8									12.5	
Progression Factor		0.32									1.24	
Incremental Delay, d2		0.3									0.0	
Delay (s)		6.6									15.5	
Level of Service		A									B	
Approach Delay (s)		6.6			0.0			0.0			15.5	
Approach LOS		A			A			A			B	

Intersection Summary			
HCM Average Control Delay	8.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.0
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
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)	0	0	15	10	0	5	0	905	5	5	495	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.88	0.88	0.88	0.88	0.80	0.80	0.80	0.97	0.97	0.97
Hourly flow rate (vph)	0	0	17	11	0	6	0	1131	6	5	510	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)											282	
pX, platoon unblocked	0.76	0.76	0.76	0.76	0.76		0.76					
vC, conflicting volume	1661	1658	510	1672	1655	1134	510			1138		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1712	1709	192	1727	1705	1134	192			1138		
tC, single (s)	7.2	6.6	6.3	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.6	4.1	3.4	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	97	78	100	98	100			99		
cM capacity (veh/h)	51	66	633	52	69	249	1050			614		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	17	17	1138	515
Volume Left	0	11	0	5
Volume Right	17	6	6	0
cSH	633	70	1700	614
Volume to Capacity	0.03	0.24	0.67	0.01
Queue Length 95th (ft)	2	21	0	1
Control Delay (s)	10.8	72.2	0.0	0.2
Lane LOS	B	F		A
Approach Delay (s)	10.8	72.2	0.0	0.2
Approach LOS	B	F		

Intersection Summary					
Average Delay			0.9		
Intersection Capacity Utilization			57.9%	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 (veh/h)	5	0	0	5	5	5	45	580	20	5	505	60
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.63	0.63	0.63	0.58	0.58	0.58	0.77	0.77	0.77	0.97	0.97	0.97
Hourly flow rate (vph)	8	0	0	9	9	9	58	753	26	5	521	62
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								224				
pX, platoon unblocked	0.80	0.80		0.80	0.80	0.80				0.80		
vC, conflicting volume	1458	1458	552	1445	1476	766	582			779		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1447	1447	552	1431	1470	583	582			599		
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 %	90	100	100	90	91	98	94			99		
cM capacity (veh/h)	77	99	538	86	96	413	997			786		

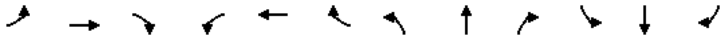
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	8	26	838	588
Volume Left	8	9	58	5
Volume Right	0	9	26	62
cSH	77	123	997	786
Volume to Capacity	0.10	0.21	0.06	0.01
Queue Length 95th (ft)	8	19	5	0
Control Delay (s)	57.4	42.0	1.5	0.2
Lane LOS	F	E	A	A
Approach Delay (s)	57.4	42.0	1.5	0.2
Approach LOS	F	E		

Intersection Summary					
Average Delay			2.0		
Intersection Capacity Utilization			71.6%	ICU Level of Service	C
Analysis Period (min)			15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	0	25	60	530	540	70
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.61	0.61	0.76	0.76	0.88	0.88
Hourly flow rate (vph)	0	41	79	697	614	80
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				1042		
pX, platoon unblocked	0.86					
vC, conflicting volume	1509	653	693			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1510	653	693			
tC, single (s)	6.5	6.3	4.1			
tC, 2 stage (s)						
tF (s)	3.6	3.4	2.2			
p0 queue free %	100	91	91			
cM capacity (veh/h)	102	460	907			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	41	776	693
Volume Left	0	79	0
Volume Right	41	0	80
cSH	460	907	1700
Volume to Capacity	0.09	0.09	0.41
Queue Length 95th (ft)	7	7	0
Control Delay (s)	13.6	2.2	0.0
Lane LOS	B	A	
Approach Delay (s)	13.6	2.2	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	10	85	70	85	55	25	10	450	65	40	455	0
Peak Hour Factor	0.70	0.70	0.70	0.86	0.86	0.86	0.84	0.84	0.84	0.93	0.93	0.93
Hourly flow rate (vph)	14	121	100	99	64	29	12	536	77	43	489	0

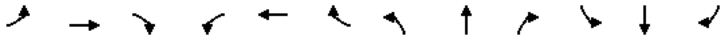
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	236	192	625	532
Volume Left (vph)	14	99	12	43
Volume Right (vph)	100	29	77	0
Hadj (s)	-0.24	0.05	-0.05	0.03
Departure Headway (s)	7.9	8.4	6.9	7.0
Degree Utilization, x	0.52	0.45	1.20	1.04
Capacity (veh/h)	437	415	527	518
Control Delay (s)	19.0	17.9	131.3	75.8
Approach Delay (s)	19.0	17.9	131.3	75.8
Approach LOS	C	C	F	F

Intersection Summary					
Delay			82.2		
HCM Level of Service			F		
Intersection Capacity Utilization			74.1%	ICU Level of Service	D
Analysis Period (min)			15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	285	5	0	0	0	640	5	5	550	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.77	0.77	0.77	0.42	0.42	0.42	0.89	0.89	0.89	0.90	0.90	0.90
Hourly flow rate (vph)	0	0	370	12	0	0	0	719	6	6	611	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)											282	
pX, platoon unblocked	0.83	0.83	0.83	0.83	0.83		0.83					
vC, conflicting volume	1344	1347	611	1714	1344	722	611			725		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1312	1315	425	1759	1312	722	425			725		
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 %	100	100	29	26	100	100	100			99		
cM capacity (veh/h)	113	131	524	16	132	430	942			883		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	370	12	725	617
Volume Left	0	12	0	6
Volume Right	370	0	6	0
cSH	524	16	1700	883
Volume to Capacity	0.71	0.74	0.43	0.01
Queue Length 95th (ft)	140	47	0	0
Control Delay (s)	26.7	447.2	0.0	0.2
Lane LOS	D	F		A
Approach Delay (s)	26.7	447.2	0.0	0.2
Approach LOS	D	F		

Intersection Summary					
Average Delay	8.9				
Intersection Capacity Utilization	60.2%	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 (veh/h)	85	5	15	15	0	5	0	615	10	5	535	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.87	0.87	0.87	0.61	0.61	0.61	0.87	0.87	0.87	0.92	0.92	0.92
Hourly flow rate (vph)	98	6	17	25	0	8	0	707	11	5	582	5
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								224				
pX, platoon unblocked	0.84	0.84		0.84	0.84	0.84				0.84		
vC, conflicting volume	1316	1313	584	1328	1310	713	587			718		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1280	1277	584	1294	1274	560	587			567		
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 %	17	96	97	77	100	98	100			99		
cM capacity (veh/h)	118	140	515	107	137	437	993			846		

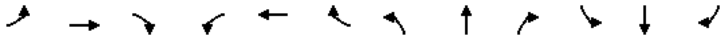
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	121	33	718	592
Volume Left	98	25	0	5
Volume Right	17	8	11	5
cSH	133	132	993	846
Volume to Capacity	0.90	0.25	0.00	0.01
Queue Length 95th (ft)	149	23	0	0
Control Delay (s)	117.4	41.0	0.0	0.2
Lane LOS	F	E		A
Approach Delay (s)	117.4	41.0	0.0	0.2
Approach LOS	F	E		

Intersection Summary					
Average Delay	10.7				
Intersection Capacity Utilization	46.4%	ICU Level of Service		A	
Analysis Period (min)	15				

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	45	65	625	520	25
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.75	0.75	0.86	0.86	0.87	0.87
Hourly flow rate (vph)	7	60	76	727	598	29
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)				1042		
pX, platoon unblocked	0.93					
vC, conflicting volume	1490	612	626			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1489	612	626			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	88	92			
cM capacity (veh/h)	118	497	960			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	67	802	626
Volume Left	7	76	0
Volume Right	60	0	29
cSH	376	960	1700
Volume to Capacity	0.18	0.08	0.37
Queue Length 95th (ft)	16	6	0
Control Delay (s)	16.6	2.0	0.0
Lane LOS	C	A	
Approach Delay (s)	16.6	2.0	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	10	110	40	50	50	40	30	520	80	40	450	10
Peak Hour Factor	0.76	0.76	0.76	0.90	0.90	0.90	0.90	0.90	0.90	0.89	0.89	0.89
Hourly flow rate (vph)	13	145	53	56	56	44	33	578	89	45	506	11

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	211	156	700	562
Volume Left (vph)	13	56	33	45
Volume Right (vph)	53	44	89	11
Hadj (s)	-0.12	-0.05	-0.03	0.02
Departure Headway (s)	7.8	8.1	6.6	6.6
Degree Utilization, x	0.45	0.35	1.28	1.03
Capacity (veh/h)	442	426	558	547
Control Delay (s)	17.1	15.4	158.8	72.7
Approach Delay (s)	17.1	15.4	158.8	72.7
Approach LOS	C	C	F	F

Intersection Summary					
Delay			97.0		
HCM Level of Service			F		
Intersection Capacity Utilization			66.4%	ICU Level of Service	C
Analysis Period (min)			15		

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	80	135	80	825	395	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	1%	
Storage Length (ft)	0	0	125			200
Storage Lanes	1	1	1			1
Taper Length (ft)	25	25	25			25
Satd. Flow (prot)	1641	1468	1787	1881	1853	1575
Flt Permitted	0.950		0.347			
Satd. Flow (perm)	1641	1468	653	1881	1853	1575
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		147				136
Link Speed (mph)	30			30	30	
Link Distance (ft)	236			1342	2037	
Travel Time (s)	5.4			30.5	46.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	10%	1%	1%	2%	2%
Adj. Flow (vph)	87	147	87	897	429	136
Shared Lane Traffic (%)						
Lane Group Flow (vph)	87	147	87	897	429	136
Turn Type		pm+ov	pm+pt			pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4	2			6
Detector Phase	4	5	5	2	6	4
Switch Phase						
Minimum Initial (s)	6.0	6.0	6.0	10.0	10.0	6.0
Minimum Split (s)	20.0	11.0	11.0	20.0	20.0	20.0
Total Split (s)	20.0	11.0	11.0	40.0	29.0	20.0
Total Split (%)	33.3%	18.3%	18.3%	66.7%	48.3%	33.3%
Yellow Time (s)	3.0	3.0	3.0	3.0	3.0	3.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag		Lead	Lead		Lag	
Lead-Lag Optimize?		Yes	Yes		Yes	
Recall Mode	None	None	None	None	None	None
Act Effct Green (s)	9.2	17.0	27.3	29.8	22.1	31.7
Actuated g/C Ratio	0.21	0.40	0.63	0.69	0.51	0.74
v/c Ratio	0.25	0.22	0.14	0.69	0.45	0.11
Control Delay	20.8	3.6	4.5	10.3	13.0	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.8	3.6	4.5	10.3	13.0	0.8
LOS	C	A	A	B	B	A
Approach Delay	10.0			9.8	10.0	
Approach LOS	A			A	B	
Queue Length 50th (ft)	22	0	8	144	90	0
Queue Length 95th (ft)	58	27	23	324	175	9
Internal Link Dist (ft)	156			1262	1957	
Turn Bay Length (ft)			125			200
Base Capacity (vph)	700	668	607	1456	1100	1319
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.22	0.14	0.62	0.39	0.10

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 43			
Natural Cycle: 60			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.69			
Intersection Signal Delay: 9.9		Intersection LOS: A	
Intersection Capacity Utilization 56.8%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 10: Riverside MBTA Driveway & Grove Street

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	80	135	80	825	395	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	1%	
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1641	1468	1787	1881	1853	1575
Flt Permitted	0.95	1.00	0.35	1.00	1.00	1.00
Satd. Flow (perm)	1641	1468	653	1881	1853	1575
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	147	87	897	429	136
RTOR Reduction (vph)	0	113	0	0	0	58
Lane Group Flow (vph)	87	34	87	897	429	78
Heavy Vehicles (%)	10%	10%	1%	1%	2%	2%
Turn Type		pm+ov	pm+pt			pm+ov
Protected Phases	4	5	5	2	6	4
Permitted Phases		4	2			6
Actuated Green, G (s)	6.1	10.3	28.7	28.7	19.5	25.6
Effective Green, g (s)	6.1	10.3	28.7	28.7	19.5	25.6
Actuated g/C Ratio	0.14	0.23	0.64	0.64	0.44	0.57
Clearance Time (s)	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
Lane Grp Cap (vph)	223	501	525	1205	807	1076
v/s Ratio Prot	c0.05	0.01	0.02	c0.48	0.23	0.01
v/s Ratio Perm		0.02	0.09			0.04
v/c Ratio	0.39	0.07	0.17	0.74	0.53	0.07
Uniform Delay, d1	17.7	13.5	3.8	5.5	9.3	4.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.1	0.1	2.5	0.7	0.0
Delay (s)	18.8	13.6	4.0	8.1	10.0	4.3
Level of Service	B	B	A	A	A	A
Approach Delay (s)	15.5			7.7	8.6	
Approach LOS	B			A	A	

Intersection Summary			
HCM Average Control Delay	9.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	44.8	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	160	315	120	485	735	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	125			200
Storage Lanes	1	1	1			1
Taper Length (ft)	25	25	25			25
Satd. Flow (prot)	1703	1524	1752	1845	1881	1599
Flt Permitted	0.950		0.121			
Satd. Flow (perm)	1703	1524	223	1845	1881	1599
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		126				117
Link Speed (mph)	30			30	30	
Link Distance (ft)	236			1067	276	
Travel Time (s)	5.4			24.3	6.3	
Peak Hour Factor	0.85	0.85	0.91	0.91	0.90	0.90
Heavy Vehicles (%)	6%	6%	3%	3%	1%	1%
Adj. Flow (vph)	188	371	132	533	817	117
Shared Lane Traffic (%)						
Lane Group Flow (vph)	188	371	132	533	817	117
Turn Type		pt+ov	pm+pt			pm+ov
Protected Phases	4	4 5	5	2	6	4
Permitted Phases			2			6
Detector Phase	4	4 5	5	2	6	4
Switch Phase						
Minimum Initial (s)	6.0		6.0	10.0	10.0	6.0
Minimum Split (s)	11.0		11.0	15.0	15.0	11.0
Total Split (s)	14.0	25.0	11.0	46.0	35.0	14.0
Total Split (%)	23.3%	41.7%	18.3%	76.7%	58.3%	23.3%
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		None	None	None	None
Act Effct Green (s)	8.7	19.8	39.0	39.0	28.0	41.7
Actuated g/C Ratio	0.15	0.34	0.67	0.67	0.48	0.72
v/c Ratio	0.73	0.61	0.43	0.43	0.90	0.10
Control Delay	44.0	15.9	8.4	5.5	28.8	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.0	15.9	8.4	5.5	28.8	0.8
LOS	D	B	A	A	C	A
Approach Delay	25.4			6.1	25.3	
Approach LOS	C			A	C	
Queue Length 50th (ft)	66	69	13	68	241	0
Queue Length 95th (ft)	#141	135	34	113	#461	9
Internal Link Dist (ft)	156			987	196	
Turn Bay Length (ft)			125			200
Base Capacity (vph)	266	584	310	1316	982	1195
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.64	0.43	0.41	0.83	0.10

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 57.8
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 19.4 — Intersection LOS: B
Intersection Capacity Utilization 66.7% — ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 10: Riverside MBTA Driveway & Grove Street

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	160	315	120	485	735	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1703	1524	1752	1845	1881	1599
Flt Permitted	0.95	1.00	0.12	1.00	1.00	1.00
Satd. Flow (perm)	1703	1524	224	1845	1881	1599
Peak-hour factor, PHF	0.85	0.85	0.91	0.91	0.90	0.90
Adj. Flow (vph)	188	371	132	533	817	117
RTOR Reduction (vph)	0	83	0	0	0	43
Lane Group Flow (vph)	188	288	132	533	817	74
Heavy Vehicles (%)	6%	6%	3%	3%	1%	1%
Turn Type		pt+ov	pm+pt			pm+ov
Protected Phases	4	4 5	5	2	6	4
Permitted Phases			2			6
Actuated Green, G (s)	8.7	19.7	39.0	39.0	28.0	36.7
Effective Green, g (s)	8.7	19.7	39.0	39.0	28.0	36.7
Actuated g/C Ratio	0.15	0.34	0.68	0.68	0.49	0.64
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	257	520	310	1247	913	1156
v/s Ratio Prot	c0.11	c0.19	0.04	0.29	c0.43	0.01
v/s Ratio Perm			0.24			0.04
v/c Ratio	0.73	0.55	0.43	0.43	0.89	0.06
Uniform Delay, d1	23.4	15.4	9.5	4.3	13.5	4.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	10.2	1.3	0.9	0.2	11.2	0.0
Delay (s)	33.6	16.7	10.4	4.5	24.7	4.0
Level of Service	C	B	B	A	C	A
Approach Delay (s)	22.4			5.7	22.1	
Approach LOS	C			A	C	

Intersection Summary			
HCM Average Control Delay	17.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	57.7	Sum of lost time (s)	10.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	80	40	80	825	395	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	1%	
Storage Length (ft)	0	0	125			200
Storage Lanes	1	1	1			1
Taper Length (ft)	25	25	25			25
Satd. Flow (prot)	1641	1468	1787	1881	1853	1575
Flt Permitted	0.950		0.375			
Satd. Flow (perm)	1641	1468	705	1881	1853	1575
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		43				136
Link Speed (mph)	30			30	30	
Link Distance (ft)	236			1342	2037	
Travel Time (s)	5.4			30.5	46.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	10%	10%	1%	1%	2%	2%
Adj. Flow (vph)	87	43	87	897	429	136
Shared Lane Traffic (%)						
Lane Group Flow (vph)	87	43	87	897	429	136
Turn Type		pt+ov	pm+pt			pm+ov
Protected Phases	4	4 5	5	2	6	4
Permitted Phases			2			6
Detector Phase	4	4 5	5	2	6	4
Switch Phase						
Minimum Initial (s)	6.0		6.0	10.0	10.0	6.0
Minimum Split (s)	11.0		11.0	15.0	15.0	11.0
Total Split (s)	12.0	23.0	11.0	48.0	37.0	12.0
Total Split (%)	20.0%	38.3%	18.3%	80.0%	61.7%	20.0%
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		None	None	None	None
Act Effct Green (s)	8.1	16.0	27.1	29.8	24.4	33.9
Actuated g/C Ratio	0.19	0.38	0.65	0.71	0.58	0.81
v/c Ratio	0.27	0.07	0.13	0.67	0.40	0.10
Control Delay	23.5	5.9	3.5	8.2	9.8	0.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.5	5.9	3.5	8.2	9.8	0.8
LOS	C	A	A	A	A	A
Approach Delay	17.7			7.8	7.7	
Approach LOS	B			A	A	
Queue Length 50th (ft)	20	0	7	131	85	0
Queue Length 95th (ft)	68	19	16	227	144	9
Internal Link Dist (ft)	156			1262	1957	
Turn Bay Length (ft)			125			200
Base Capacity (vph)	344	572	652	1708	1378	1269
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.08	0.13	0.53	0.31	0.11

Intersection Summary			
Area Type:	Other		
Cycle Length: 60			
Actuated Cycle Length: 41.8			
Natural Cycle: 45			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.67			
Intersection Signal Delay: 8.5		Intersection LOS: A	
Intersection Capacity Utilization 56.8%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 10: Riverside MBTA Driveway & Grove Street

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	80	40	80	825	395	125
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)	0%			0%	1%	
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1641	1468	1787	1881	1853	1575
Flt Permitted	0.95	1.00	0.37	1.00	1.00	1.00
Satd. Flow (perm)	1641	1468	705	1881	1853	1575
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	87	43	87	897	429	136
RTOR Reduction (vph)	0	31	0	0	0	55
Lane Group Flow (vph)	87	12	87	897	429	81
Heavy Vehicles (%)	10%	10%	1%	1%	2%	2%
Turn Type		pt+ov	pm+pt			pm+ov
Protected Phases	4	4 5	5	2	6	4
Permitted Phases			2			6
Actuated Green, G (s)	4.9	12.9	29.6	29.6	21.6	26.5
Effective Green, g (s)	4.9	12.9	29.6	29.6	21.6	26.5
Actuated g/C Ratio	0.11	0.29	0.67	0.67	0.49	0.60
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	181	426	542	1251	899	1115
v/s Ratio Prot	c0.05	0.01	0.01	c0.48	0.23	0.01
v/s Ratio Perm			0.10			0.04
v/c Ratio	0.48	0.03	0.16	0.72	0.48	0.07
Uniform Delay, d1	18.6	11.3	3.3	4.8	7.7	3.8
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.0	0.0	0.1	2.0	0.4	0.0
Delay (s)	20.6	11.3	3.4	6.8	8.1	3.8
Level of Service	C	B	A	A	A	A
Approach Delay (s)	17.5			6.5	7.0	
Approach LOS	B			A	A	

Intersection Summary			
HCM Average Control Delay	7.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	44.5	Sum of lost time (s)	10.0
Intersection Capacity Utilization	56.8%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	160	85	120	485	735	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0	0	125			200
Storage Lanes	1	1	1			1
Taper Length (ft)	25	25	25			25
Satd. Flow (prot)	1703	1524	1752	1845	1881	1599
Flt Permitted	0.950		0.124			
Satd. Flow (perm)	1703	1524	229	1845	1881	1599
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		100				117
Link Speed (mph)	30			30	30	
Link Distance (ft)	236			1067	276	
Travel Time (s)	5.4			24.3	6.3	
Peak Hour Factor	0.85	0.85	0.91	0.91	0.90	0.90
Heavy Vehicles (%)	6%	6%	3%	3%	1%	1%
Adj. Flow (vph)	188	100	132	533	817	117
Shared Lane Traffic (%)						
Lane Group Flow (vph)	188	100	132	533	817	117
Turn Type		pt+ov	pm+pt			pm+ov
Protected Phases	4	4 5	5	2	6	4
Permitted Phases			2			6
Detector Phase	4	4 5	5	2	6	4
Switch Phase						
Minimum Initial (s)	6.0		6.0	10.0	10.0	6.0
Minimum Split (s)	11.0		11.0	15.0	15.0	11.0
Total Split (s)	13.0	24.0	11.0	47.0	36.0	13.0
Total Split (%)	21.7%	40.0%	18.3%	78.3%	60.0%	21.7%
Yellow Time (s)	3.0		3.0	3.0	3.0	3.0
All-Red Time (s)	2.0		2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lead/Lag			Lead		Lag	
Lead-Lag Optimize?			Yes		Yes	
Recall Mode	None		None	None	None	None
Act Effct Green (s)	8.4	19.9	35.2	35.2	27.2	42.4
Actuated g/C Ratio	0.16	0.37	0.65	0.65	0.50	0.78
v/c Ratio	0.71	0.16	0.40	0.44	0.86	0.09
Control Delay	44.5	4.7	7.3	5.4	24.3	0.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.5	4.7	7.3	5.4	24.3	0.7
LOS	D	A	A	A	C	A
Approach Delay	30.7			5.8	21.4	
Approach LOS	C			A	C	
Queue Length 50th (ft)	68	0	12	63	231	0
Queue Length 95th (ft)	#152	24	30	104	#449	9
Internal Link Dist (ft)	156			987	196	
Turn Bay Length (ft)			125			200
Base Capacity (vph)	265	583	327	1417	1133	1236
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.17	0.40	0.38	0.72	0.09

Intersection Summary

Area Type: Other
Cycle Length: 60
Actuated Cycle Length: 54.1
Natural Cycle: 60
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 17.3 — Intersection LOS: B
Intersection Capacity Utilization 66.7% — ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 10: Riverside MBTA Driveway & Grove Street

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	160	85	120	485	735	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	1703	1524	1752	1845	1881	1599
Flt Permitted	0.95	1.00	0.12	1.00	1.00	1.00
Satd. Flow (perm)	1703	1524	229	1845	1881	1599
Peak-hour factor, PHF	0.85	0.85	0.91	0.91	0.90	0.90
Adj. Flow (vph)	188	100	132	533	817	117
RTOR Reduction (vph)	0	68	0	0	0	41
Lane Group Flow (vph)	188	32	132	533	817	76
Heavy Vehicles (%)	6%	6%	3%	3%	1%	1%
Turn Type		pt+ov	pm+pt			pm+ov
Protected Phases	4	4 5	5	2	6	4
Permitted Phases			2			6
Actuated Green, G (s)	8.4	17.8	36.6	36.6	27.2	35.6
Effective Green, g (s)	8.4	17.8	36.6	36.6	27.2	35.6
Actuated g/C Ratio	0.15	0.32	0.67	0.67	0.49	0.65
Clearance Time (s)	5.0		5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	260	493	274	1228	930	1180
v/s Ratio Prot	c0.11	0.02	0.04	c0.29	c0.43	0.01
v/s Ratio Perm			0.28			0.04
v/c Ratio	0.72	0.07	0.48	0.43	0.88	0.06
Uniform Delay, d1	22.2	12.9	9.1	4.3	12.4	3.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	9.5	0.1	1.3	0.2	9.4	0.0
Delay (s)	31.7	12.9	10.5	4.6	21.9	3.6
Level of Service	C	B	B	A	C	A
Approach Delay (s)	25.2			5.7	19.6	
Approach LOS	C			A	B	

Intersection Summary			
HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	15.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

LANE SUMMARY

Site: New Site - 1

Grove Street at NB Ramps
2022 AM Build
Right-Turns on C-D Road Access
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Lane Length ft	SL Type	Cap. Adj. %	Prob. Block. %
South: NB Ramps																
Lane 1	57	258	0	314	3.0	528	0.595	100	19.3	LOS B	5.4	139.3	1600	–	0.0	0.0
Lane 2	0	0	448	448	3.0	828	0.541	100	12.1	LOS B	4.5	116.3	1600	–	0.0	0.0
Approach	57	258	448	763	3.0		0.595		15.0	LOS B	5.4	139.3				
East: Grove Street																
Lane 1	0	586	0	586	6.0	733	0.800	100	25.5	LOS C	11.7	305.8	1600	–	0.0	0.0
Lane 2	0	0	57	57	6.0	405	0.142	100	11.1	LOS B	0.7	18.5	1600	–	0.0	0.0
Approach	0	586	57	644	6.0		0.800		24.2	LOS C	11.7	305.8				
West: Grove Street																
Lane 1	302	634	0	936	2.0	1599	0.585	100	8.3	LOS A	0.0	0.0	1600	–	0.0	0.0
Approach	302	634	0	936	2.0		0.585		8.3	LOS A	0.0	0.0				
Intersection				2343	3.4		0.800		14.9	LOS B	11.7	305.8				

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Model used.

LANE SUMMARY

Grove Street at NB Ramps
2022 AM Build
Full Access on C-D Road
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Lane Length ft	SL Type	Cap. Adj. %	Prob. Block. %
South: NB Ramps																
Lane 1	60	272	0	332	3.0	501	0.662	100	23.4	LOS C	7.0	179.3	1600	–	0.0	0.0
Lane 2	0	0	473	473	3.0	790	0.598	100	14.1	LOS B	5.9	152.2	1600	–	0.0	0.0
Approach	60	272	473	804	3.0		0.662		17.9	LOS B	7.0	179.3				
East: Grove Street																
Lane 1	0	451	0	451	3.0	753	0.599	100	14.7	LOS B	5.8	148.8	1600	–	0.0	0.0
Lane 2	0	0	54	54	3.0	418	0.130	100	10.5	LOS B	0.7	16.8	1600	–	0.0	0.0
Approach	0	451	54	505	3.0		0.599		14.2	LOS B	5.8	148.8				
North: Access Road																
Lane 1	1	0	103	104	2.0	643	0.162	100	7.5	LOS A	0.9	24.0	1600	–	0.0	0.0
Approach	1	0	103	104	2.0		0.162		7.5	LOS A	0.9	24.0				
West: Grove Street																
Lane 1	283	592	0	875	4.0	1566	0.559	100	8.0	LOS A	6.8	174.9	1600	–	0.0	0.0
Approach	283	592	0	875	4.0		0.559		8.0	LOS A	6.8	174.9				
Intersection				2289	3.3		0.662		12.8	LOS B	7.0	179.3				

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Model used.

SIDRA INTERSECTION

LANE SUMMARY

Grove Street at NB Ramps
2022 PM Build
Right-Turns on C-D Road Access
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Lane Length ft	SL Type	Cap. Adj. %	Prob. Block. %
South: NB Ramps																
Lane 1	59	140	0	199	3.0	690	0.288	100	8.8	LOS A	1.6	39.9	1600	–	0.0	0.0
Lane 2	0	0	425	425	3.0	1027	0.413	100	8.0	LOS A	2.6	67.3	1600	–	0.0	0.0
Approach	59	140	425	624	3.0		0.413		8.3	LOS A	2.6	67.3				
East: Grove Street																
Lane 1	0	941	0	941	3.0	1007	0.935	100	35.0	LOS D	24.3	621.9	1600	–	0.0	0.0
Lane 2	0	0	226	226	3.0	554	0.408	100	13.0	LOS B	2.4	62.1	1600	–	0.0	0.0
Approach	0	941	226	1167	3.0		0.935		30.8	LOS C	24.3	621.9				
West: Grove Street																
Lane 1	171	329	0	500	4.0	1568	0.319	100	5.0	LOS A	0.0	0.0	1600	–	0.0	0.0
Approach	171	329	0	500	4.0		0.319		5.0	LOS A	0.0	0.0				
Intersection				2290	3.2		0.935		19.0	LOS B	24.3	621.9				

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Model used.

LANE SUMMARY

Grove Street at NB Ramps
2022 PM Build
Full Access on C-D Road
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Lane Length ft	SL Type	Cap. Adj. %	Prob. Block. %
South: NB Ramps																
Lane 1	60	141	0	201	3.0	666	0.302	100	9.2	LOS A	1.8	45.6	1600	–	0.0	0.0
Lane 2	0	0	429	429	3.0	1004	0.427	100	8.4	LOS A	3.0	77.3	1600	–	0.0	0.0
Approach	60	141	429	630	3.0		0.427		8.6	LOS A	3.0	77.3				
East: Grove Street																
Lane 1	0	701	0	701	3.0	998	0.702	100	15.1	LOS B	8.3	212.7	1600	–	0.0	0.0
Lane 2	0	0	228	228	3.0	644	0.354	100	10.4	LOS B	2.1	52.9	1600	–	0.0	0.0
Approach	0	701	228	929	3.0		0.702		14.0	LOS B	8.3	212.7				
North: Access Road																
Lane 1	1	0	250	251	2.0	463	0.542	100	19.3	LOS B	4.5	113.2	1600	–	0.0	0.0
Approach	1	0	250	251	2.0		0.542		19.3	LOS B	4.5	113.2				
West: Grove Street																
Lane 1	158	304	0	462	4.0	1563	0.296	100	4.7	LOS A	2.6	65.9	1600	–	0.0	0.0
Approach	158	304	0	462	4.0		0.296		4.7	LOS A	2.6	65.9				
Intersection				2273	3.1		0.702		11.2	LOS B	8.3	212.7				

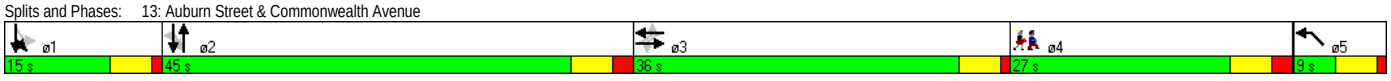
Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
HCM Delay Model used.

Lane Group	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL	NWR2	ø4
Lane Configurations																
Volume (vph)	15	310	90	10	270	175	35	435	5	140	0	450	30	0	15	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0			0		0	0		0		30		0	0		
Storage Lanes	0			0		0	0		0		1		0	1		
Taper Length (ft)	25			25		25	25		25		25		25	25		
Satd. Flow (prot)	0	1823	0	0	1747	0	0	1818	0	0	1736	1810	0	1611	0	
Flt Permitted		0.944			0.985			0.931			0.305					
Satd. Flow (perm)	0	1724	0	0	1723	0	0	1699	0	0	557	1810	0	1611	0	
Right Turn on Red			Yes			Yes							Yes		Yes	
Satd. Flow (RTOR)		10			22							3		600		
Link Speed (mph)		30			30			30				30		30		
Link Distance (ft)		1184			376			1200				268		491		
Travel Time (s)		26.9			8.5			27.3				6.1		11.2		
Peak Hour Factor	0.92	0.92	0.92	0.88	0.88	0.88	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.71	0.92	
Heavy Vehicles (%)	1%	1%	1%	3%	3%	3%	4%	4%	4%	4%	4%	4%	4%	0%	2%	
Adj. Flow (vph)	16	337	98	11	307	199	38	473	5	152	0	489	33	0	16	
Shared Lane Traffic (%)																
Lane Group Flow (vph)	0	451	0	0	517	0	0	516	0	0	152	522	0	16	0	
Turn Type	Perm			Perm			Perm			custom	D.P+P					
Protected Phases		3			3			2			1	1 2		5		4
Permitted Phases	3			3			2			1	2					
Detector Phase	3	3		3	3		2	2		1	1	1 2		5		
Switch Phase																
Minimum Initial (s)	10.0	10.0		10.0	10.0		15.0	15.0		10.0	10.0			4.0		15.0
Minimum Split (s)	15.0	15.0		15.0	15.0		21.0	21.0		15.0	15.0			9.0		27.0
Total Split (s)	36.0	36.0	0.0	36.0	36.0	0.0	45.0	45.0	0.0	15.0	15.0	60.0	0.0	9.0	0.0	27.0
Total Split (%)	27.3%	27.3%	0.0%	27.3%	27.3%	0.0%	34.1%	34.1%	0.0%	11.4%	11.4%	45.5%	0.0%	6.8%	0.0%	20%
Maximum Green (s)	31.0	31.0		31.0	31.0		39.0	39.0		10.0	10.0			4.0		21.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0			4.0		4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		2.0	2.0		1.0	1.0			1.0		2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	6.0	6.0	4.0	5.0	5.0	5.0	4.0	5.0	4.0	
Lead/Lag	Lead	Lead		Lead	Lead		Lag	Lag		Lead	Lead					Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes					Yes
Vehicle Extension (s)	4.0	4.0		4.0	4.0		5.0	5.0		4.0	4.0			3.0		5.0
Recall Mode	Max	Max		Max	Max		Max	Max		Max	Max			None		None
Walk Time (s)																7.0
Flash Dont Walk (s)																8.0
Pedestrian Calls (#/hr)																5
Act Effct Green (s)		31.3			31.3			39.4			50.6	55.6		4.0		
Actuated g/C Ratio		0.30			0.30			0.38			0.49	0.54		0.04		
v/c Ratio		0.86			0.96			0.80			0.39	0.54		0.03		
Control Delay		51.7			67.3			41.3			18.1	20.4		0.1		
Queue Delay		0.0			0.0			0.0			0.0	0.0		0.0		
Total Delay		51.7			67.3			41.3			18.1	20.4		0.1		
LOS		D			E			D			B	C		A		
Approach Delay		51.7			67.3			41.3				19.9		0.1		
Approach LOS		D			E			D				B		A		
Queue Length 50th (ft)		244			289			262			41	177		0		
Queue Length 95th (ft)		#604			#687			#646			122	457		0		
Internal Link Dist (ft)		1104			296			1120				188		411		
Turn Bay Length (ft)											30					
Base Capacity (vph)		527			536			645			386	971		639		
Starvation Cap Reductn		0			0			0			0	0		0		
Spillback Cap Reductn		0			0			0			0	0		0		
Storage Cap Reductn		0			0			0			0	0		0		
Reduced v/c Ratio		0.86			0.96			0.80			0.39	0.54		0.03		

Intersection Summary

Area Type: Other
Cycle Length: 132
Actuated Cycle Length: 103.8
Natural Cycle: 150
Control Type: Semi Act-Uncoord
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 42.7 — Intersection LOS: D
Intersection Capacity Utilization 100.5% — ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 13: Auburn Street & Commonwealth Avenue



Movement	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL	NWR2
Lane Configurations															
Volume (vph)	15	310	90	10	270	175	35	435	5	140	0	450	30	0	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			6.0			5.0	5.0		5.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00		1.00	
Frt		0.97			0.95			1.00			1.00	0.99		0.86	
Flt Protected		1.00			1.00			1.00			0.95	1.00		1.00	
Satd. Flow (prot)		1823			1747			1818			1736	1810		1611	
Flt Permitted		0.94			0.98			0.93			0.31	1.00		1.00	
Satd. Flow (perm)		1724			1723			1698			558	1810		1611	
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.71	0.92
Adj. Flow (vph)	16	337	98	11	307	199	38	473	5	152	0	489	33	0	16
RTOR Reduction (vph)	0	7	0	0	16	0	0	0	0	0	0	2	0	16	0
Lane Group Flow (vph)	0	444	0	0	501	0	0	516	0	0	152	520	0	0	0
Heavy Vehicles (%)	1%	1%	1%	3%	3%	3%	4%	4%	4%	4%	4%	4%	4%	0%	2%
Turn Type	Perm			Perm			Perm			custom	D.P+P				
Protected Phases		3			3			2			1	1 2		5	
Permitted Phases	3			3			2			1	2				
Actuated Green, G (s)		31.3			31.3			39.4			49.5	54.5		1.4	
Effective Green, g (s)		31.3			31.3			39.4			49.5	54.5		1.4	
Actuated g/C Ratio		0.28			0.28			0.35			0.44	0.49		0.01	
Clearance Time (s)		5.0			5.0			6.0			5.0			5.0	
Vehicle Extension (s)		4.0			4.0			5.0			4.0			3.0	
Lane Grp Cap (vph)		483			483			599			354	883		20	
v/s Ratio Prot											0.04	c0.29		c0.00	
v/s Ratio Perm		0.26			c0.29			c0.30			0.15				
v/c Ratio		0.92			1.04			0.86			0.43	0.59		0.01	
Uniform Delay, d1		39.0			40.2			33.6			21.0	20.6		54.5	
Progression Factor		1.00			1.00			1.00			1.00	1.00		1.00	
Incremental Delay, d2		25.0			51.0			15.0			3.8	2.9		0.2	
Delay (s)		64.0			91.2			48.7			24.8	23.4		54.7	
Level of Service		E			F			D			C	C		D	
Approach Delay (s)		64.0			91.2			48.7				23.7		54.7	
Approach LOS		E			F			D				C		D	

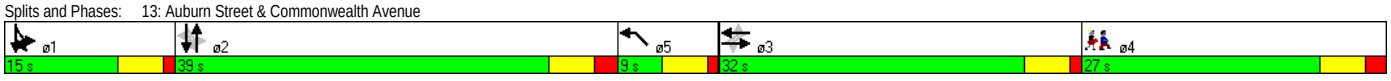
Intersection Summary			
HCM Average Control Delay	54.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	111.7	Sum of lost time (s)	29.5
Intersection Capacity Utilization	100.5%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

Lane Group	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL	NWR	NWR2	ø4
Lane Configurations																	
Volume (vph)	20	300	90	10	225	165	30	435	10	155	0	505	20	5	5	5	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	
Storage Length (ft)	0			0		0	0		0		30		0	0	0		
Storage Lanes	0			0		0	0		0		1		0	1	0		
Taper Length (ft)	25			25		25	25		25		25		25	25	25		
Satd. Flow (prot)	0	1821	0	0	1774	0	0	1852	0	0	1770	1852	0	1704	0	0	
Flt Permitted		0.915			0.969			0.938			0.282			0.981			
Satd. Flow (perm)	0	1670	0	0	1721	0	0	1742	0	0	525	1852	0	1704	0	0	
Right Turn on Red			Yes			Yes							Yes			Yes	
Satd. Flow (RTOR)		11			27							2		5			
Link Speed (mph)		30			30			30				30		30			
Link Distance (ft)		1184			376			1200				268		491			
Travel Time (s)		26.9			8.5			27.3				6.1		11.2			
Peak Hour Factor	0.82	0.82	0.82	0.86	0.86	0.86	0.92	0.92	0.92	0.95	0.95	0.95	0.95	0.55	0.55	0.92	
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%	2%	0%	0%	2%	
Adj. Flow (vph)	24	366	110	12	262	192	33	473	11	163	0	532	21	9	9	5	
Shared Lane Traffic (%)																	
Lane Group Flow (vph)	0	500	0	0	466	0	0	517	0	0	163	553	0	23	0	0	
Turn Type	Perm			Perm			Perm			D.P+P	D.P+P						
Protected Phases		3			3			2		1	1	1 2		5			4
Permitted Phases	3			3			2			2	2						
Detector Phase	3	3		3	3		2	2		1	1	1 2		5			
Switch Phase																	
Minimum Initial (s)	10.0	10.0		10.0	10.0		15.0	15.0		10.0	10.0			4.0			15.0
Minimum Split (s)	15.0	15.0		15.0	15.0		21.0	21.0		15.0	15.0			9.0			27.0
Total Split (s)	32.0	32.0	0.0	32.0	32.0	0.0	39.0	39.0	0.0	15.0	15.0	54.0	0.0	9.0	0.0	0.0	27.0
Total Split (%)	26.2%	26.2%	0.0%	26.2%	26.2%	0.0%	32.0%	32.0%	0.0%	12.3%	12.3%	44.3%	0.0%	7.4%	0.0%	0.0%	22%
Maximum Green (s)	27.0	27.0		27.0	27.0		33.0	33.0		10.0	10.0			4.0			21.0
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0			4.0			4.0
All-Red Time (s)	1.0	1.0		1.0	1.0		2.0	2.0		1.0	1.0			1.0			2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.0	5.0	4.0	5.0	5.0	4.0	6.0	6.0	4.0	5.0	5.0	5.0	4.0	5.0	4.0	4.0	
Lead/Lag	Lead	Lead		Lead	Lead		Lag	Lag		Lead	Lead						Lag
Lead-Lag Optimize?	Yes	Yes		Yes	Yes		Yes	Yes		Yes	Yes						Yes
Vehicle Extension (s)	4.0	4.0		4.0	4.0		5.0	5.0		4.0	4.0			3.0			5.0
Recall Mode	Max	Max		Max	Max		Max	Max		Max	Max			None			None
Walk Time (s)																	7.0
Flash Dont Walk (s)																	8.0
Pedestrian Calls (#/hr)																	5
Act Effct Green (s)		27.4			27.4			33.4			44.6	49.7		4.1			
Actuated g/C Ratio		0.29			0.29			0.36			0.48	0.53		0.04			
v/c Ratio		1.01			0.89			0.83			0.42	0.56		0.29			
Control Delay		77.8			53.0			42.8			17.9	19.9		50.4			
Queue Delay		0.0			0.0			0.0			0.0	0.0		0.0			
Total Delay		77.8			53.0			42.8			17.9	19.9		50.4			
LOS		E			D			D			B	B		D			
Approach Delay		77.8			53.0			42.8				19.5		50.4			
Approach LOS		E			D			D				B		D			
Queue Length 50th (ft)		256			220			240			39	169		10			
Queue Length 95th (ft)		#589			#548			#631			125	466		24			
Internal Link Dist (ft)		1104			296			1120				188		411			
Turn Bay Length (ft)											30						
Base Capacity (vph)		495			521			621			384	981		79			
Starvation Cap Reductn		0			0			0			0	0		0			
Spillback Cap Reductn		0			0			0			0	0		0			
Storage Cap Reductn		0			0			0			0	0		0			
Reduced v/c Ratio		1.01			0.89			0.83			0.42	0.56		0.29			

Intersection Summary			
Area Type:	Other		
Cycle Length: 122			
Actuated Cycle Length: 93.8			
Natural Cycle: 150			
Control Type: Actuated-Uncoordinated			
Maximum v/c Ratio: 1.01			
Intersection Signal Delay: 45.4		Intersection LOS: D	
Intersection Capacity Utilization 104.9%		ICU Level of Service G	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 13: Auburn Street & Commonwealth Avenue



Movement	EBL	EBT	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL	NWR	NWR2
Lane Configurations																
Volume (vph)	20	300	90	10	225	165	30	435	10	155	0	505	20	5	5	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.0			5.0			6.0			5.0	5.0		5.0		
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00		1.00		
Frt		0.97			0.94			1.00			1.00	0.99		0.92		
Flt Protected		1.00			1.00			1.00			0.95	1.00		0.98		
Satd. Flow (prot)		1821			1774			1851			1770	1852		1703		
Flt Permitted		0.91			0.97			0.94			0.28	1.00		0.98		
Satd. Flow (perm)		1670			1722			1743			525	1852		1703		
Peak-hour factor, PHF	0.82	0.82	0.82	0.86	0.86	0.86	0.92	0.92	0.92	0.95	0.95	0.95	0.95	0.55	0.55	0.92
Adj. Flow (vph)	24	366	110	12	262	192	33	473	11	163	0	532	21	9	9	5
RTOR Reduction (vph)	0	8	0	0	20	0	0	0	0	0	0	1	0	5	0	0
Lane Group Flow (vph)	0	492	0	0	446	0	0	517	0	0	163	552	0	18	0	0
Heavy Vehicles (%)	1%	1%	1%	1%	1%	1%	2%	2%	2%	2%	2%	2%	2%	0%	0%	2%
Turn Type	Perm			Perm			Perm			D.P+P	D.P+P					
Protected Phases		3			3			2		1	1	1 2		5		
Permitted Phases	3			3			2			2	2					
Actuated Green, G (s)		27.4			27.4			33.4			43.5	48.5		1.4		
Effective Green, g (s)		27.4			27.4			33.4			43.5	48.5		1.4		
Actuated g/C Ratio		0.27			0.27			0.33			0.43	0.48		0.01		
Clearance Time (s)		5.0			5.0			6.0			5.0			5.0		
Vehicle Extension (s)		4.0			4.0			5.0			4.0			3.0		
Lane Grp Cap (vph)		450			464			572			348	883		23		
v/s Ratio Prot											0.05	c0.30		c0.01		
v/s Ratio Perm		c0.29			0.26			c0.30			0.15					
v/c Ratio		1.09			0.96			0.90			0.47	0.63		0.79		
Uniform Delay, d1		37.2			36.6			32.6			20.4	19.8		50.0		
Progression Factor		1.00			1.00			1.00			1.00	1.00		1.00		
Incremental Delay, d2		70.1			33.3			20.2			4.5	3.3		94.5		
Delay (s)		107.2			69.9			52.8			24.9	23.2		144.5		
Level of Service		F			E			D			C	C		F		
Approach Delay (s)		107.2			69.9			52.8				23.5		144.5		
Approach LOS		F			E			D				C		F		

Intersection Summary			
HCM Average Control Delay	60.1	HCM Level of Service	E
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	101.7	Sum of lost time (s)	29.4
Intersection Capacity Utilization	104.9%	ICU Level of Service	G
Analysis Period (min)	15		

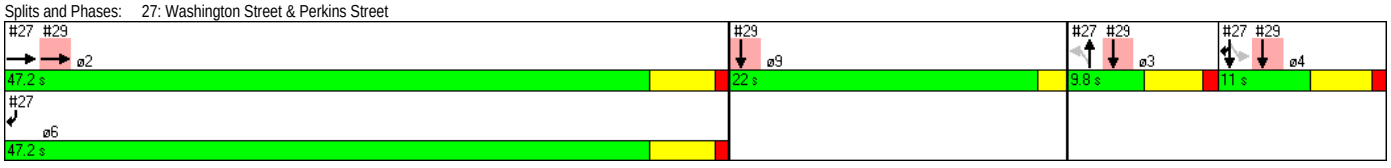
c Critical Lane Group

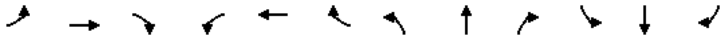
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	ø6	ø9
Lane Configurations														
Volume (vph)	0	1830	5	0	0	0	5	0	10	0	15	1755		
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900		
Satd. Flow (prot)	0	3610	0	0	0	0	0	1698	0	0	1900	2842		
Flt Permitted								0.275						
Satd. Flow (perm)	0	3610	0	0	0	0	0	474	0	0	1900	2842		
Right Turn on Red			Yes			Yes			Yes			Yes		
Satd. Flow (RTOR)								17				1828		
Link Speed (mph)		30			30			30			30			
Link Distance (ft)		884			163			529			423			
Travel Time (s)		20.1			3.7			12.0			9.6			
Peak Hour Factor	0.93	0.93	0.93	0.92	0.92	0.92	0.60	0.60	0.60	0.96	0.96	0.96		
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%	0%		
Adj. Flow (vph)	0	1968	5	0	0	0	8	0	17	0	16	1828		
Shared Lane Traffic (%)														
Lane Group Flow (vph)	0	1973	0	0	0	0	0	25	0	0	16	1828		
Turn Type							Perm			Perm		custom		
Protected Phases		2						3			4	4 6	6	9
Permitted Phases							3			4				
Detector Phase		2					3	3		4	4	4 6		
Switch Phase														
Minimum Initial (s)		6.0					5.0	5.0		6.0	6.0		6.0	1.0
Minimum Split (s)		11.2					9.8	9.8		11.0	11.0		11.2	22.0
Total Split (s)	0.0	47.2	0.0	0.0	0.0	0.0	9.8	9.8	0.0	11.0	11.0	58.2	47.2	22.0
Total Split (%)	0.0%	52.4%	0.0%	0.0%	0.0%	0.0%	10.9%	10.9%	0.0%	12.2%	12.2%	64.7%	52%	24%
Maximum Green (s)		42.0					5.0	5.0		6.0	6.0		42.0	20.0
Yellow Time (s)		4.2					3.8	3.8		4.0	4.0		4.2	2.0
All-Red Time (s)		1.0					1.0	1.0		1.0	1.0		1.0	0.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
Total Lost Time (s)	4.0	5.2	4.0	4.0	4.0	4.0	4.8	4.8	4.0	5.0	5.0	5.0		
Lead/Lag							Lead	Lead		Lag	Lag			
Lead-Lag Optimize?							Yes	Yes		Yes	Yes			
Vehicle Extension (s)		2.0					2.0	2.0		2.0	2.0		2.0	2.0
Recall Mode		C-Max					None	None		None	None		C-Max	None
Walk Time (s)														7.0
Flash Dont Walk (s)														13.0
Pedestrian Calls (#/hr)														0
Act Effct Green (s)		46.0						9.6			19.5	70.6		
Actuated g/C Ratio		0.51						0.11			0.22	0.78		
v/c Ratio		1.07						0.38			0.04	0.70		
Control Delay		66.9						37.9			24.7	1.8		
Queue Delay		0.0						0.0			0.0	0.3		
Total Delay		66.9						37.9			24.7	2.2		
LOS		E						D			C	A		
Approach Delay		66.9						37.9			2.4			
Approach LOS		E						D			A			
Queue Length 50th (ft)		~691						4			6	25		
Queue Length 95th (ft)		#848						16			m9	1		
Internal Link Dist (ft)		804			83			449			343			
Turn Bay Length (ft)														
Base Capacity (vph)		1844						66			411	2624		
Starvation Cap Reductn		0						0			0	285		
Spillback Cap Reductn		0						0			0	0		
Storage Cap Reductn		0						0			0	0		
Reduced v/c Ratio		1.07						0.38			0.04	0.78		

Intersection Summary

Area Type: Other
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:EBT and 6:SBR, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.07
Intersection Signal Delay: 35.8 Intersection LOS: D
Intersection Capacity Utilization 73.7% 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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 27: Washington Street & Perkins Street





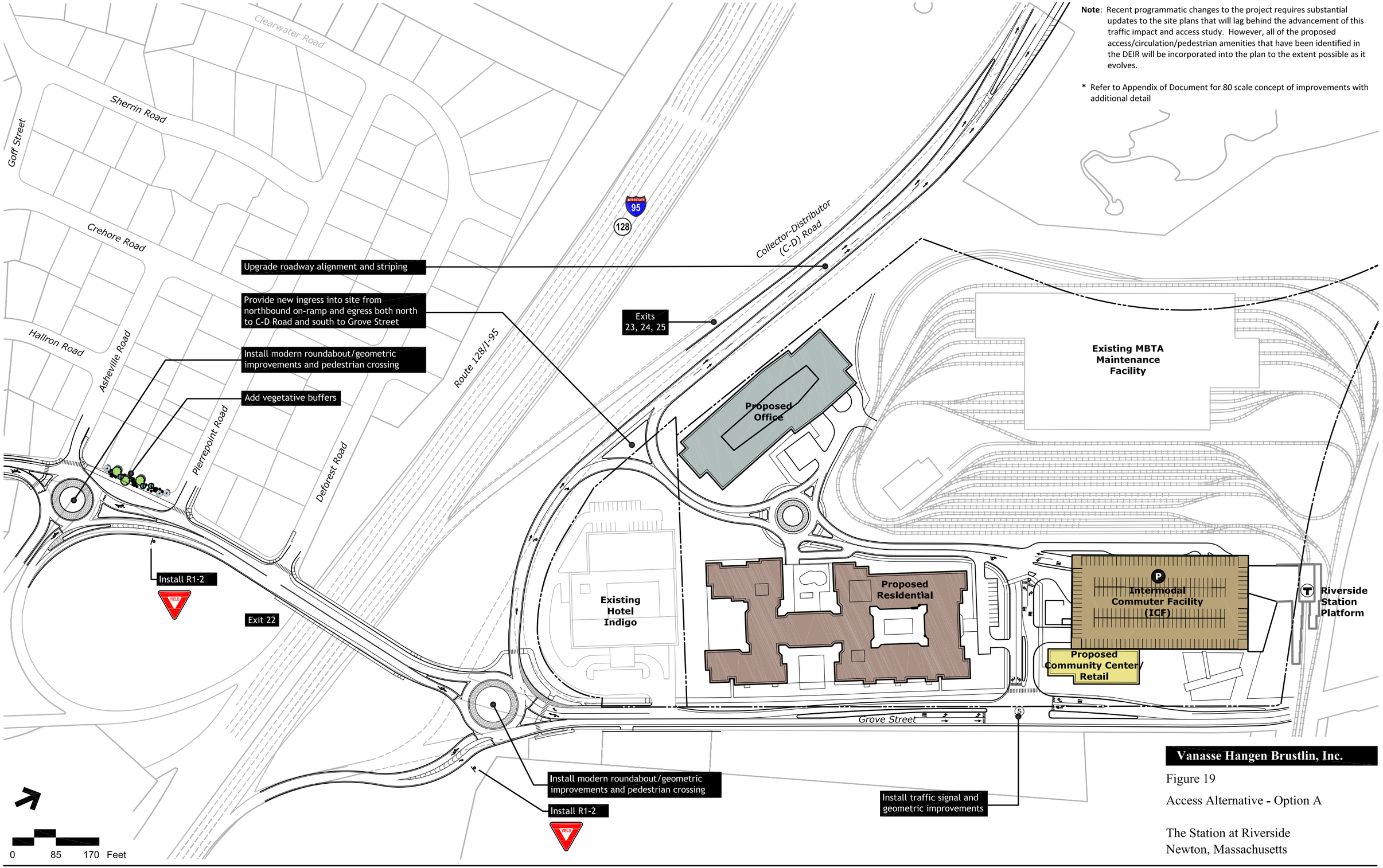
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	1830	5	0	0	0	5	0	10	0	15	1755
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.2						4.8			5.0	5.0
Lane Util. Factor		0.95						1.00			1.00	0.88
Frt		1.00						0.91			1.00	0.85
Flt Protected		1.00						0.98			1.00	1.00
Satd. Flow (prot)		3609						1698			1900	2842
Flt Permitted		1.00						0.28			1.00	1.00
Satd. Flow (perm)		3609						475			1900	2842
Peak-hour factor, PHF	0.93	0.93	0.93	0.92	0.92	0.92	0.60	0.60	0.60	0.96	0.96	0.96
Adj. Flow (vph)	0	1968	5	0	0	0	8	0	17	0	16	1828
RTOR Reduction (vph)	0	0	0	0	0	0	0	15	0	0	0	398
Lane Group Flow (vph)	0	1973	0	0	0	0	0	10	0	0	16	1430
Heavy Vehicles (%)	0%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%	0%
Turn Type							Perm			Perm		custom
Protected Phases		2						3			4	4 6
Permitted Phases							3			4		
Actuated Green, G (s)		45.9						9.6			19.5	70.4
Effective Green, g (s)		45.9						9.6			19.5	70.4
Actuated g/C Ratio		0.51						0.11			0.22	0.78
Clearance Time (s)		5.2						4.8			5.0	
Vehicle Extension (s)		2.0						2.0			2.0	
Lane Grp Cap (vph)		1841						51			412	2223
v/s Ratio Prot		c0.55									0.01	c0.50
v/s Ratio Perm								c0.02				
v/c Ratio		1.07						0.19			0.04	0.64
Uniform Delay, d1		22.1						36.7			27.8	4.3
Progression Factor		1.00						1.00			0.93	4.04
Incremental Delay, d2		43.2						0.7			0.0	0.3
Delay (s)		65.2						37.3			25.9	17.7
Level of Service		E						D			C	B
Approach Delay (s)		65.2			0.0			37.3			17.7	
Approach LOS		E			A			D			B	

Intersection Summary				
HCM Average Control Delay	42.3	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.87			
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	15.0	
Intersection Capacity Utilization	73.7%	ICU Level of Service	D	
Analysis Period (min)	15			

c Critical Lane Group

Traffic and Pedestrian Plans

\\vhb\proj\Wat-LD\10865.00\graphics\FIGURES\2012 EIR\Offsite Improvements-Option A.dwg



Note: Recent programmatic changes to the project requires substantial updates to the site plans that will lag behind the advancement of this traffic impact and access study. However, all of the proposed access/circulation/pedestrian amenities that have been identified in the DEIR will be incorporated into the plan to the extent possible as it evolves.

* Refer to Appendix of Document for 80 scale concept of improvements with additional detail

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Figure 19

Access Alternative - Option A

The Station at Riverside
Newton, Massachusetts

Note: Recent programmatic changes to the project requires substantial updates to the site plans that will lag behind the advancement of this traffic impact and access study. However, all of the proposed access/circulation/pedestrian amenities that have been identified in the DEIR will be incorporated into the plan to the extent possible as it evolves.

* Refer to Appendix of Document for 80 scale concept of improvements with additional detail

Clearwater Road
Sherrin Road
Goff Street
Crehore Road
Hallron Road
Asheville Road
Pierrepoint Road
Deforest Road
Route 128/I-95
Collector-Distributor (C-D) Road
Grove Street

Upgrade roadway alignment and striping

Provide new ingress into site from northbound on-ramp and egress both north to C-D Road and south to Grove Street

Exits 23, 24, 25

Install modern roundabout/geometric improvements and pedestrian crossing

Add vegetative buffers

Install R1-2

Exit 22

Install R1-2

Existing Hotel Indigo

Proposed Office

Existing MBTA Maintenance Facility

Proposed Residential

Intermodal Commuter Facility (ICF)

Riverside Station Platform

Proposed Community Center/ Retail

Install modern roundabout/geometric improvements and pedestrian crossing

Install R1-2

Install traffic signal and geometric improvements

0 85 170 Feet

Vanasse Hangen Brustlin, Inc.

Figure 20

Access Alternative - Option B-2

The Station at Riverside
Newton, Massachusetts

Parking Assessment

Transportation
Land Development
Environmental
Services

Vanasse Hangen Brustlin, Inc.

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Memorandum

To: Mr. Kevin Daly
The Walsh Company
99 Summer Street
Boston, MA 02110

Date: August 21, 2012

From: William Cranshaw, P.E.
Project Manager, Planning.

Re: Station at Riverside –
Parking Justification

1.0 INTRODUCTION

The recently approved Mixed Use 3/Transit-Oriented District regulations require that the parking provided for the Station at Riverside project "is appropriate to the intensity of development, types of uses, hours of operation, availability of alternative modes of travel and encourages the use of alternatives without over-supplying parking."

To ensure that there is not an over-supply of parking provided by a transit-oriented development the regulations require that there be "a shared-parking analysis that demonstrates that the number of parking spaces to be provided is appropriate to the context, taking into consideration the mix of uses; the demand for parking spaces at different times of day, week and year; availability of alternative modes of transportation; and other site-specific influences on parking supply and demand, such as, but not limited to, Red Sox home games." This memorandum presents a detailed parking evaluation for the Station at Riverside project.

2.0 PROJECT DESCRIPTION

The Station at Riverside project is located at the existing Riverside MBTA station that is a regional transportation hub, and consists of two primary major development phases. The first is the construction of an Intermodal Commuter Facility (ICF) by the MBTA. In essence, the ICF is a consolidation of various transportation related activities including short and long-term commuter parking, local and regional bus services, and MBTA rail platform into a single new multi-level parking structure. The second major phase is the redevelopment of the existing surface commuter parking lot for a mixed-use, transit oriented development (TOD). Together, the two major phases constitute the Station at Riverside project containing the following overall building program:

- Building A is a 225,000 sf office building that includes a 571-space garage.
- Building B is a 290 unit residential building, with 5,000 sf of ancillary retail space. The building includes a 429-space parking garage and 12 surface spaces located on the east side of the building. The parking garage will be reserved for use by residents only.

- Building C consists of 15,000 sf of retail space and an 8,000 sf community center. Building C is adjacent to, and accessible from, the new MBTA parking garage.
- The 960-space MBTA parking lot will be replaced by a 1,005-space parking garage, an increase of 45 spaces.

Additionally, the project site is immediately adjacent to an existing 191-room, full-service hotel. The Indigo Hotel has dedicated parking for its overnight guests; however, potential overflow parking has been considered in the evaluation presented in this memorandum.

3.0 SHARED PARKING METHODOLOGY

The basic premise of shared parking is that a single parking space can serve the parking needs of two or more individual land uses. This occurs routinely in urban areas where, for example, a parking space used during the day by commuters is used during the evening by restaurant patrons. Suburban mixed-use developments can provide a similar synergy of parking utilization.

The Urban Land Institute has studied shared parking among mixed-use development and has developed methodology for evaluating shared parking that is documented in "Shared Parking", Second Edition, which was published in 2005. The ULI procedure involves the following steps:

- Gather and review project data such as dwelling units, restaurant seating, and square footage of retail and office space.
- Select base parking ratios for each land use. These ratios (e.g., x parking space per dwelling unit or y parking spaces per 1,000 sf of office space) tend to represent (1) the parking required for the peak hour of the peak day of the week during the peak month of the year, and (2) locations where there are few travel mode options other than personal vehicle use. The ULI *Shared Parking* report and the ITE *Parking Generation* report provide national standards for the base rates, but the use of locally calibrated rates based on zoning requirements or data collected at comparable facilities is encouraged.
- Adjust the base parking rates for non-auto mode applicable to the site. This should be done separately for employee and customer/visitor parking. The ULI *Shared Parking* report provides data separately for employee and customer/visitor parking demand.
- Determine the season, day and time of peak parking demand by evaluating the monthly, daily and hourly parking demand variations for each type of land use. Time-of-day, day-of-week, and monthly factors are provided in the ULI *Shared Parking* report.
- Make appropriate adjustments for "internal capture" of parking demand to eliminate double counting parking demand in situations where, for example, office employees are also retail customers.

Any shared parking evaluation should also include consideration of how "sharable" are the parking spaces. There may be parking policies that reserve some parking spaces for a single land use (such as reserved parking for residents), or as a practical reality the location of available parking is too distant from many destinations within the project site.

3.1 Base Parking Requirements

The zoning requirements for standalone uses provide a good starting point for the discussion of base parking requirements before adjustments for non-auto mode splits; seasonal, day-of-week, and time-of-

day parking occupancy patterns; and internal capture of parking demand. The City's zoning requirements for the uses proposed are as follows:

- Office: 1 space/250 sf of GFA up to 20,000 sf and 1 space/333 sf of GFA in excess of 20,000 sf
- Residential: 2 Spaces/Dwelling Unit but Board of Alderman may permit fewer by special permit, but no less than 1.25
- Retail: 1 Space/300 sf of GFA, plus 1 Space/3 employees on largest shift
- Public/Community: While no parking requirements have been established for this type of use, we have assumed a parking rate of 1 Space/ 150 sf of GFA. This is likely conservative since a majority of the use of this space will be from the neighborhoods surrounding the site and people may choose to walk to this facility.

4.0 PROPOSED PARKING EVALUATION

4.1 Availability of MBTA parking

Under existing conditions, the MBTA parking supply is more than adequate to accommodate typical daily parking demands. In fact, the parking supply is substantially underutilized. It is only during "game day" Red Sox events when the parking supply becomes fully utilized. With the proposed project in place, there is no reason to believe that the normal parking demands will change and therefore on typical days, there will be more parking that is needed within the IFC.

To substantiate the number of commuter parking spaces reasonably anticipated to be available in the new ICF a monitoring camera was positioned and parking occupancy data were gathered for the period of May 8 through July 31, 2012. Images from 9:15 am, 12:45 pm and 4:45 pm on each of the 85 days were reviewed and the parking occupancy determined. A sample of the images is shown below. The results of the parking occupancy counts are summarized in graphical form attached to this document.

Sample Camera Image – Wednesday May 9, 2012. 12:45pm.

The study found that there were always at least 300 parking spaces available in the MBTA lot on weekdays. The only exception was the1 weekday when there was an afternoon Red Sox game. The MBTA parking was at capacity on that day.

4.2 Project-related Parking

The following presents an evaluation of the parking demands for each of the new buildings, as well as the effects from Red Sox parking and a full-capacity event at the Indigo Hotel and restaurant. Because Building B parking is reserved for residents only, and because the remaining uses are predominately office, the parking evaluation focuses on each building separately rather than a project-wide summary analysis. The per-building discussion provides a clearer understanding of the parking issues and the findings regarding the adequacy and appropriateness of the parking supply provided.

4.2 Project-related Parking

The parking associated with each of the three buildings is described separately in the sections that follow.

4.2.1 Building A

Building A contains 225,000 sf of office space and 571spaces of structured parking. The zoning regulations would otherwise require a minimum of 4 parking spaces per 1,000 sf for the first 20,000 sf, and 3 parking spaces per 1,000 sf thereafter. The total required parking, before transit-oriented design considerations, is therefore 696 spaces.

The building provides 571 parking spaces; or 82% of the base parking requirements of the zoning regulations. A study published in the ITE Compendium of Technical Papers titled *The Effect of Transit Service on Trips Generated by Suburban Development* concluded that “suburban office development located within 500 feet of a rail station can expect commuter trip transit mode shares of between 20 and 25 percent”. Therefore, the assumption of 18% transit use by office commuters is appropriate for this site, and ensures that there is not an over-supply of parking.

As a worst-case scenario, even if the transit share of office commuters was only 10%, the parking demand would be 626 spaces, 55 more than the 571 provided in the office garage. Overflow parking of 55 cars could easily be accommodated in the ICF, which will typically have an estimated 300 available spaces.

4.2.2 Building B

The residential building will have 290 units, with 60% of the units being studio or one bedroom apartments. The project includes 15% affordable housing units. The building also includes 5,000 sf of ancillary retail space. The project provides 441 parking spaces, of which 12 are surface spaces and 429 are in the garage.

Building B: Residential Parking

The garage parking is reserved and assigned solely for residents. The 429 available spaces provides an average of 1.48 parking spaces per unit. The default parking requirement of the zoning regulations is a minimum of 2 spaces per apartment unit, the same as for single-family homes, although the zoning regulation recognizes that a lesser parking requirement may sometimes be appropriate. For those situations the zoning regulations provide a special permit process that allows parking as low as 1.25 spaces per unit.

The 1.48 parking spaces provided per unit is an adequate amount of parking for a location adjacent to a high-frequency transit service and given that some of the parking is "unbundled" from the base rent. Each unit has only 1 parking space included in the base rent and the other parking spaces are available at additional cost. The justification for the 1.48 spaces provided per residential unit is illustrated by the following table that compares the proposed parking at Riverside with parking provided at similar TOD locations.

Development	City	Transit Line	No. of Dwelling Units	No. of Parking Spaces	Spaces per Unit
Station at Riverside	Newton	Green Line	290	429	1.48
Woodland Station	Newton	Green Line	180	230	1.28
Station Landing – Phase I	Medford	Orange Line	292	414	1.42
Station Landing – Phase II	Medford	Orange Line	168	168	1.00

To some extent, it appears that the residential parking may be over-supplied. However, even if that turns out to be true there will not likely be any negative impacts such as encouraging excess automobile traffic activity. One reason is that some of the parking spaces are tandem spaces and if only one of the two paired spaces were assigned to a resident, the empty tandem space could not be used by others. Another reason is that the parking garage will be restricted and will not provide transient parking. Other than residential parking, the only other users that might be accommodated are employees of the Building B retail space, and, in the unlikely event it was necessary and mutually agreeable to all parties, employees from Building A or Building C.

Building B: Retail Parking

The retail component of Building B is 5,000 sf. The type of retail uses expected throughout the site is retail that is complimentary to the existing uses. These "service style" retail facilities may include a coffee shop, convenience store, dry cleaner, bank, ATM, restaurant, etc. Such types of uses will draw heavily on the traffic (both vehicular and pedestrian) that will already be present on the site for MBTA, office, and residential uses. Therefore both traffic and parking needs associated with the retail is not expected to fit "normal" traffic generation or parking need requirements.

The standard zoning requirements for retail call for 20 parking spaces. Such a parking demand is very likely too high given that much of the retail activity would involve "internal capture" of activity from on-site residents and office employees, and MBTA commuters. Nonetheless, it is useful to understand the worst-case parking scenario should the full 20-space demand be realized. There are 12 surface parking spaces provided and the remaining eight parking spaces could be provided by either (1) assigning retail employees to parking in the Building B garage, or more likely, (2) accommodating any overflow parking needs in the adjacent ICF/MBTA garage.

4.2.3 Building C

The building program in Building C consists of 15,000 sf of retail space and 8,000 sf of community space. Parking for this building will be provided entirely in the new ICF/MBTA garage.

Having the parking for Building C uses take place in the ICF/MBTA parking garage is a particularly effective way to ensure there is an adequate supply but not an over-supply of parking provided. The

parking demand for the retail use and community use is likely to peak in the evenings and on weekends, when MBTA-related parking demand is lowest.

Weekday, daytime parking demand represents the worst-case scenario for evaluating the adequacy of the parking supply. There are no generic national standards for parking demand related to "community space" but for the purposes of this analysis a conservative estimate of one car per 150 sf, the weekday, daytime parking demand for the community space would be 54 spaces.

Per the zoning regulations, the required parking for the retail space is 60 spaces (50 for patrons and 10 for employees). As a worst-case scenario, this assumes no internal capture of customer trips from on-site residents or office employees which is a very conservative assumption given the complementary nature of the retail planned.

In all, the weekday, daytime parking demand for the retail space and community space would be 120 spaces. This is 75 spaces more than the additional 45 MBTA spaces being created by the ICF phase of the project, but is well within the estimated 300 parking spaces typically available among the MBTA surface parking today.

4.3 Event Activity

To ensure that the parking provided is appropriate, it is important to understand parking activity associated with events, as well as parking activity of typical daily use. Two situations are described below. The first is game day activity associated with the Boston Red Sox. The second is a full capacity event at the Indigo Hotel and restaurant

4.3.1 Red Sox Games

The 2012 Red Sox home schedule has five (non-holiday) weekday daytime games (start times range from 2:10 pm to 4:10 pm) and 41 weekday evening games (start time typically at 7:10 pm). During most days when there are Red Sox games it can be expected that the MBTA parking is at or near capacity where as under normal non-game day condition it is well below capacity.

The primary effect of the Riverside parking demand on the Red Sox parking is limited to the five weekday day games. Worst-case, the Station at Riverside project would utilize a maximum of 138 of the existing MBTA spaces (55 from Building A, 8 from Building B and a net of 75 from building C), but by the time the MBTA parking typically filled for evening games (about 5:30 pm) much of the office parking demand would have lessened and there would effectively be no overflow of the new Station at Riverside project parking competing with the existing Red Sox parking. For the five day games, however, any overflow from the Station at Riverside project would already be parked in the MBTA spaces before Red Sox parkers arrive. But given the low probability of overflow from the Station at Riverside project occurring in the MBTA parking, and given that daytime Red Sox parkers are already constrained by MBTA daily commuter parkers, the effect of the Station at Riverside project parking on the days of the five daytime home games would be negligible.

4.3.2 Indigo Hotel

The Indigo Hotel has a restaurant that could be fully used on some nights, weekends, and holidays during the year. The parking requirement for the restaurant space is 84 parking spaces. The parking for a full event at the restaurant could be easily accommodated by either the parking at the MBTA or the office building parking garage. Many of the 571 office building garage parking spaces can be expected to be available at times when the Indigo restaurant is hosting a full-capacity event.

5.0 SUMMARY OF FINDINGS

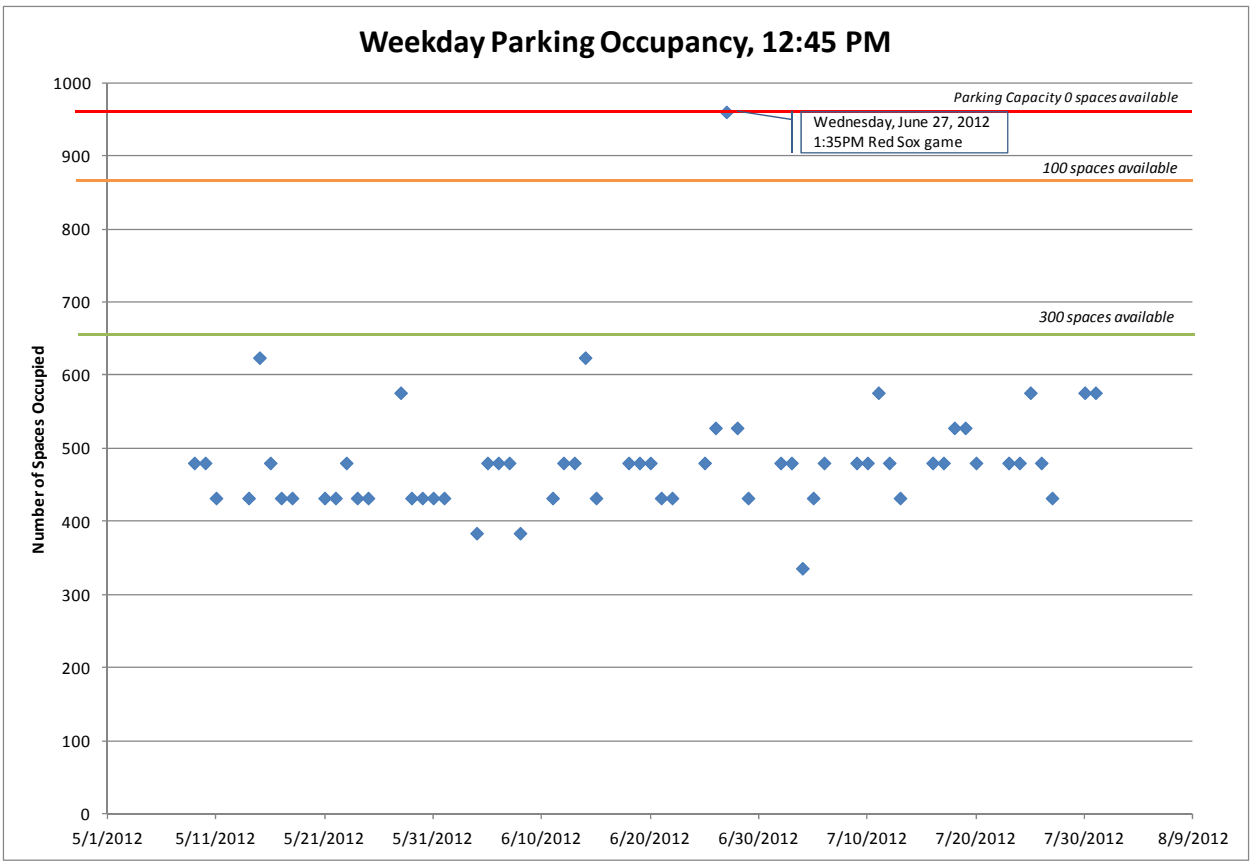
The parking provided for the project is consistent with the objectives of the transit-oriented-design zoning regulations established for the site. It is appropriate given the mix of uses; proximity of high-frequency transit; and differences in parking demand patterns by hour, day of week, and season. It does not provide an over-supply of parking.

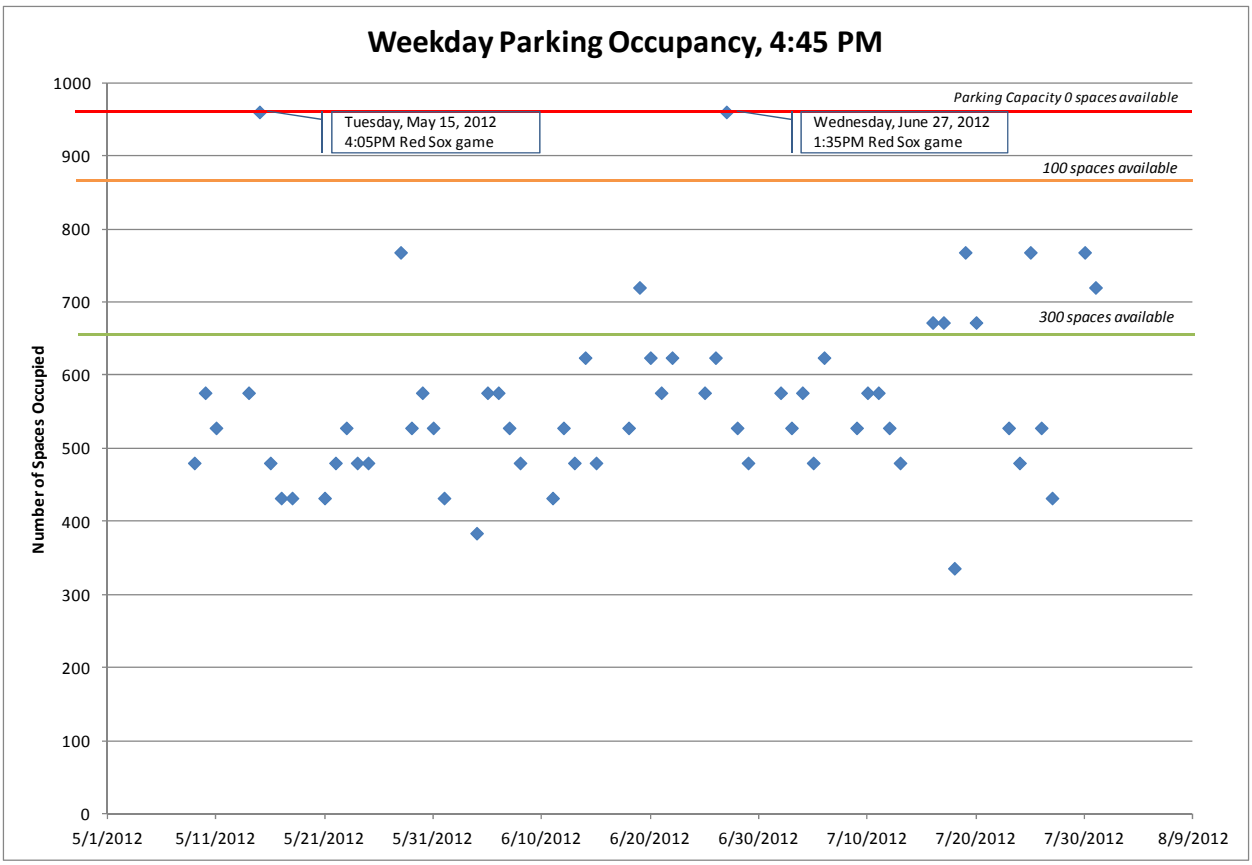
- Sufficient parking is provided for the office building assuming only an 18% transit mode share among commuters. If the transit use is only 10% then the maximum overflow of parking in the MBTA garage would be 75 cars, considerably less than the 300 spaces typically available.

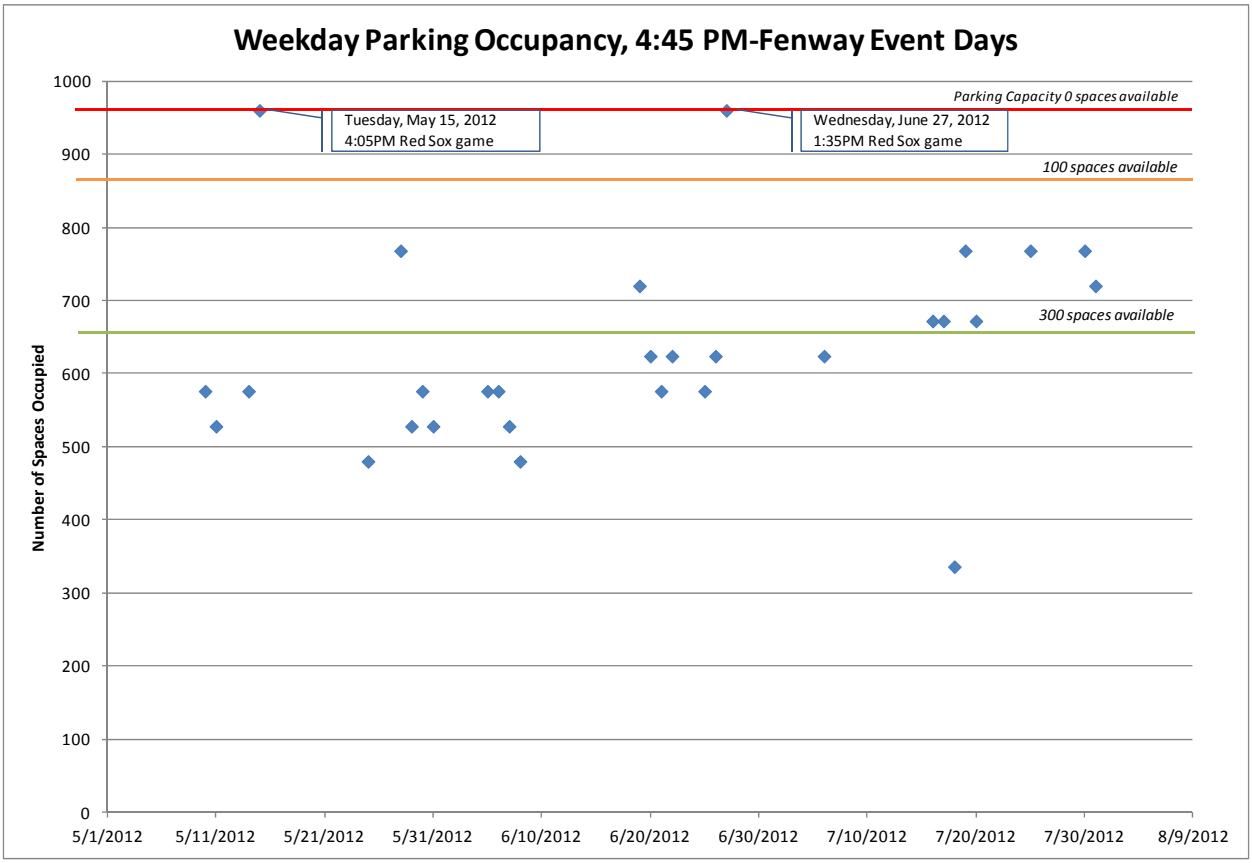
- The residential building provides parking at 1.48 spaces per unit. This is higher than similar projects, but even if there is some excess parking it is not expected to have the adverse impacts of encouraging additional traffic. Any excess parking is likely to be among the less-desirable tandem parking spaces. Any excess parking might also be assigned to retail employees.

- The retail and community space may require up to 100 spaces for weekday, daytime parking. This is 55 spaces more than the additional 45 MBTA spaces being created by the garage project, but considerably less than the 300 spaces that are currently typically available in the MBTA parking lot.

- The parking for the project, being predominately for office employees, is complementary to the parking demand for most Red Sox games. The only conflict would be for the five weekday day games. The conflict is similar to that which exists now between MBTA commuter parking and the day game attendees.


Weekday Parking Occupancy, 12:45 PM
Number of Spaces Occupied
1000
900
800
700
600
500
400
300
200
100
0
Parking Capacity 0 spaces available
100 spaces available
300 spaces available
Wednesday, June 27, 2012
1:35PM Red Sox game
5/1/2012
5/11/2012
5/21/2012
5/31/2012
6/10/2012
6/20/2012
6/30/2012
7/10/2012
7/20/2012
7/30/2012
8/9/2012





Fenway Event Days include Red Sox game days and a soccer game “Football at Fenway”

AutoTURN Truck Turning Movement Analysis

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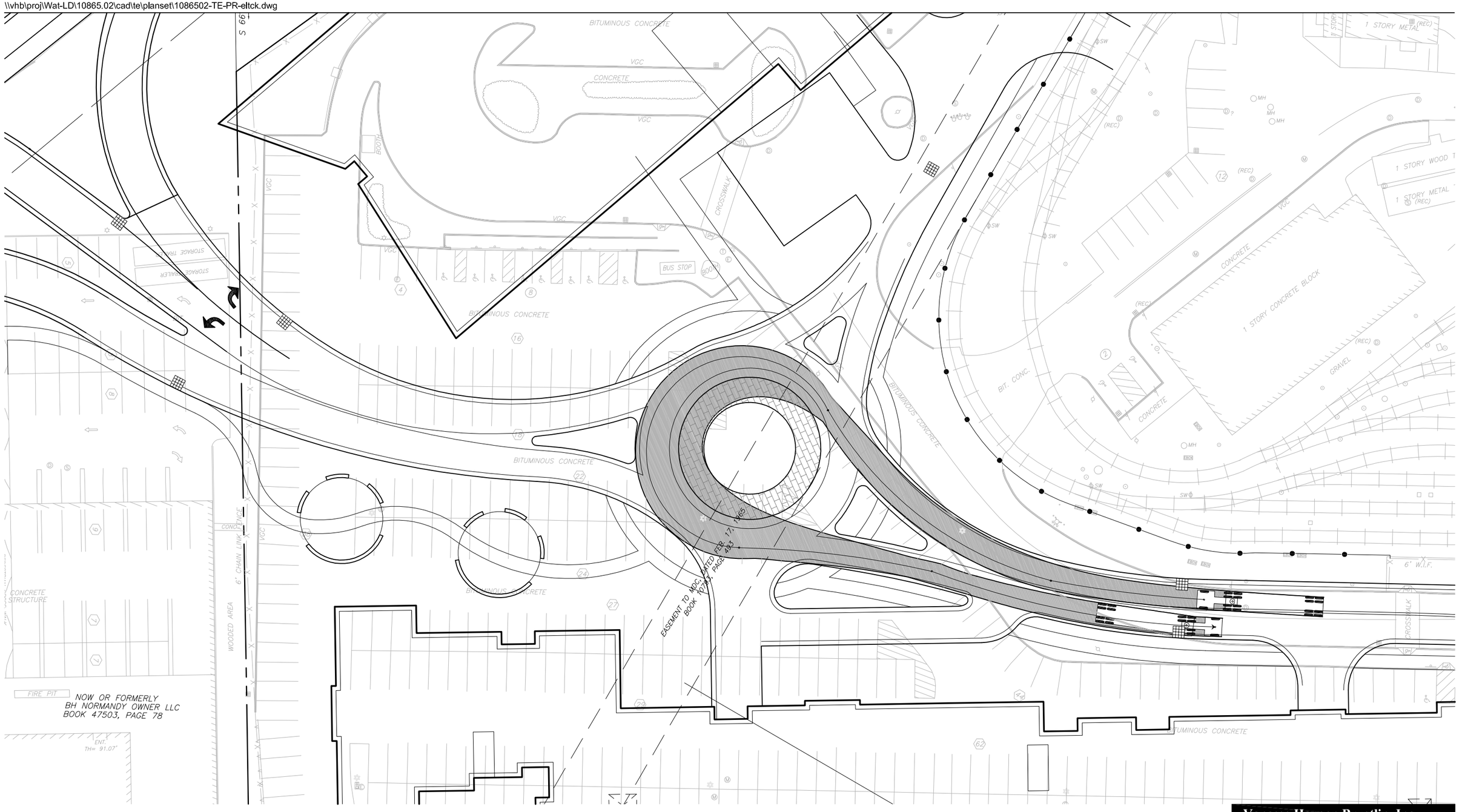

0 20 40 Feet

Vanasse Hangen Brustlin, Inc.

Figure 12 Sept 2012

Truck Turning Template
WB-50 Vehicle
On-Site

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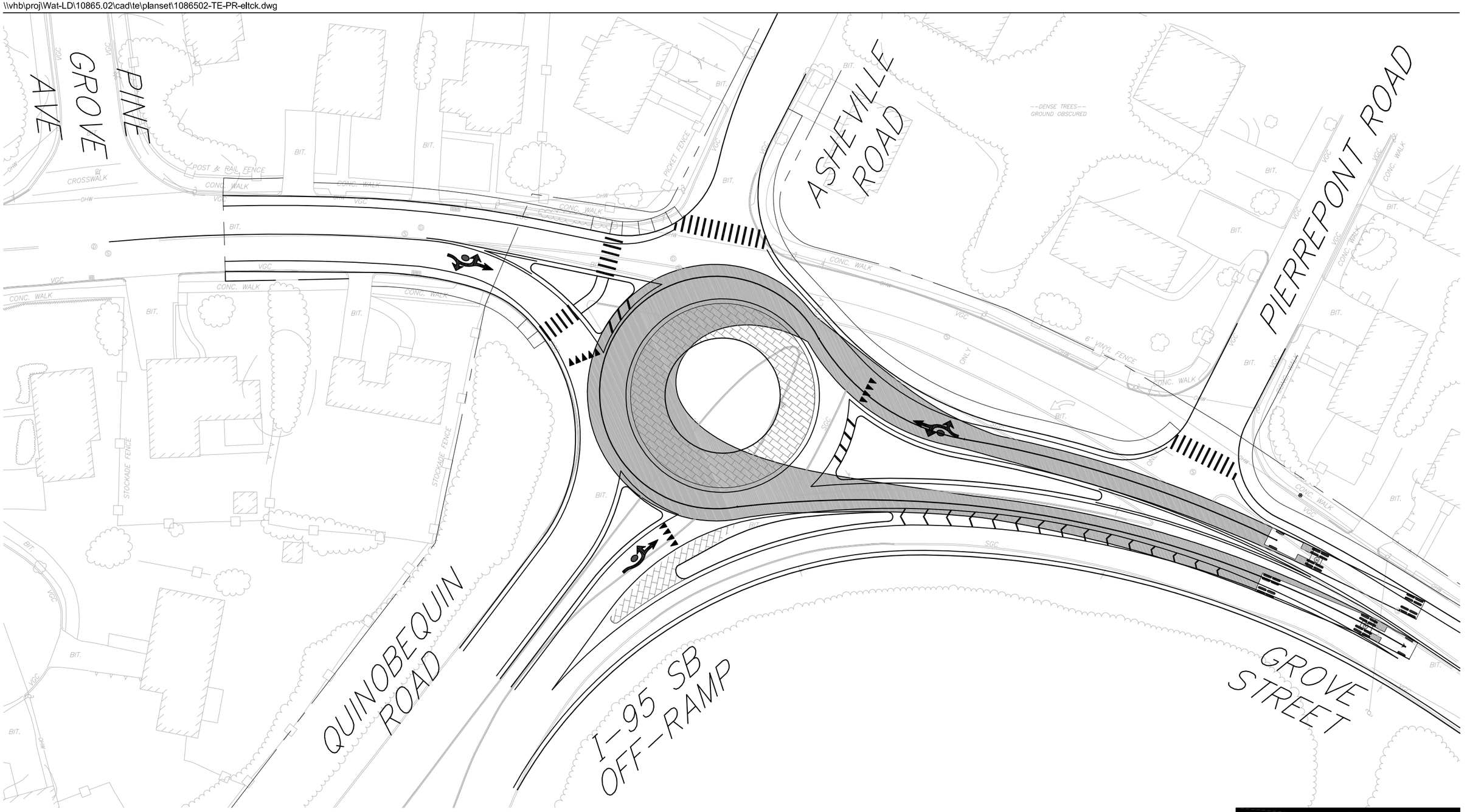

0 20 40 Feet

Vanasse Hangen Brustlin, Inc.

Figure 13 Sept 2012

Truck Turning Template
WB-67 Vehicle
Grove Street
I-95 Southbound Off-Ramp

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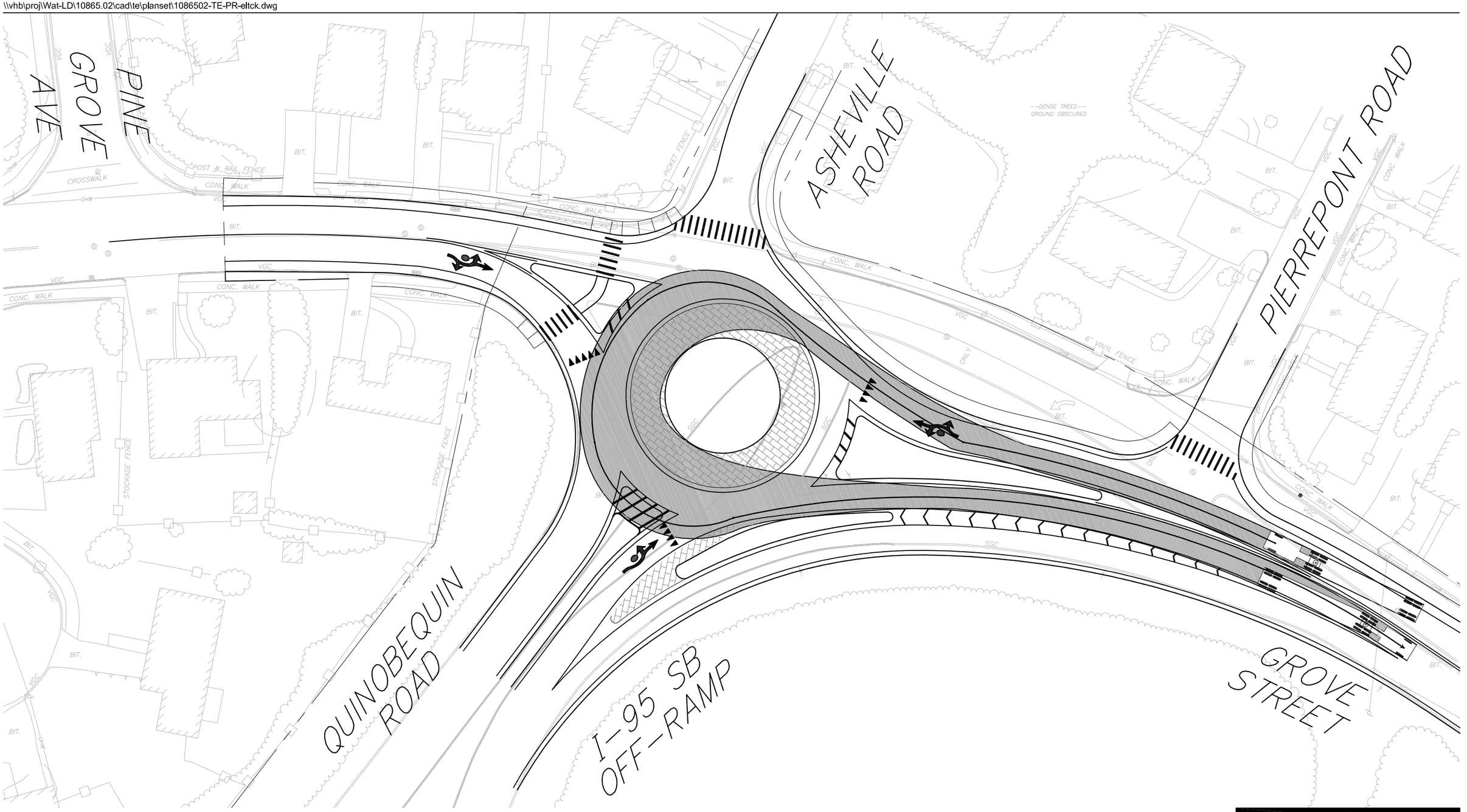

0 20 40 Feet

Vanasse Hangen Brustlin, Inc.

Figure 13 (modified) Sept 2012

Truck Turning Template
WB-67 Vehicle
Grove Street
I-95 Southbound Off-Ramp

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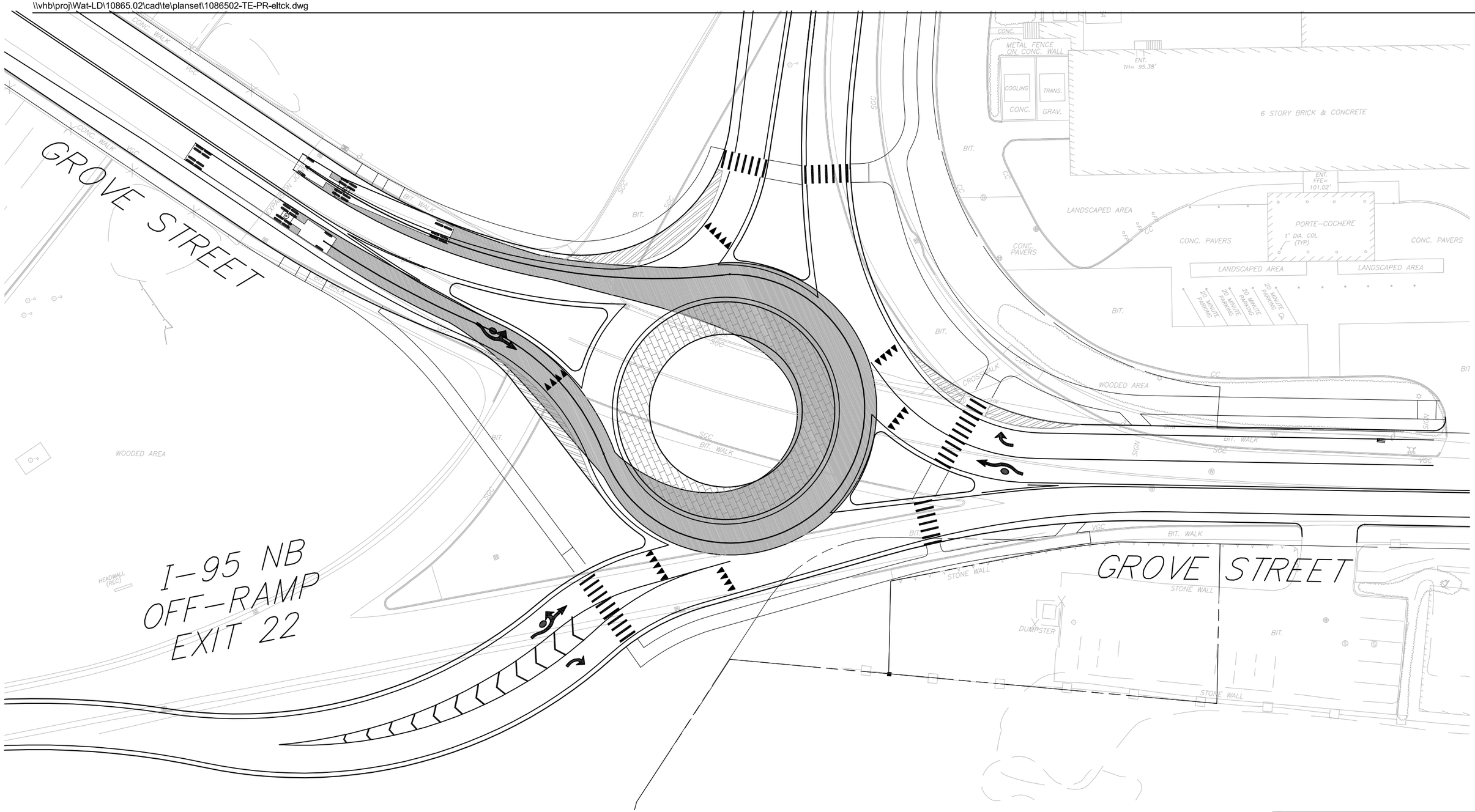

0 20 40 Feet

Vanasse Hangen Brustlin, Inc.

Figure 14 Sept 2012

Truck Turning Template
WB-67 Vehicle
Grove Street
I-95 Northbound Off-Ramp

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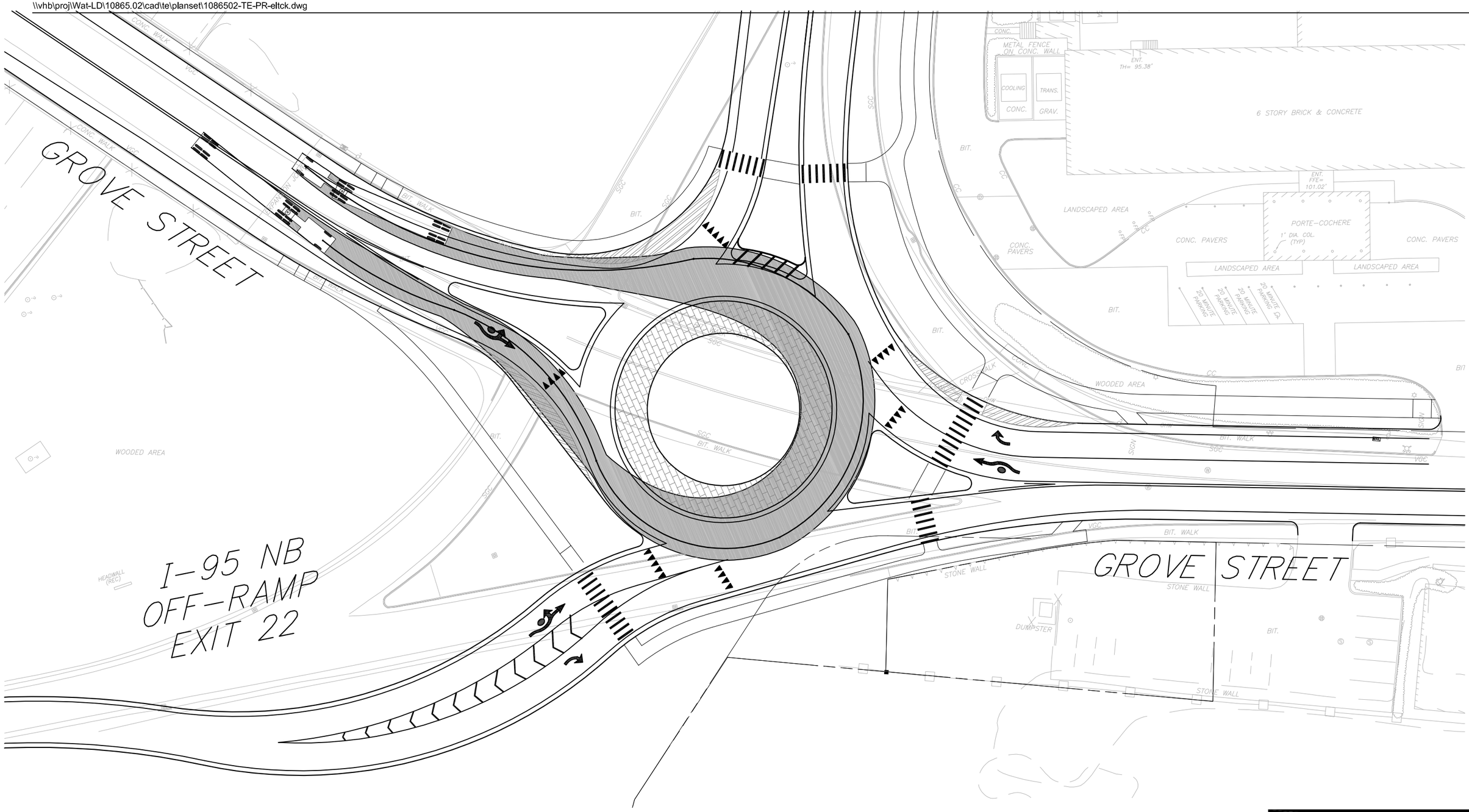

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Vanasse Hangen Brustlin, Inc.

Figure 14 (modified) Sept 2012

Truck Turning Template
WB-67 Vehicle
Grove Street
I-95 Northbound Off-Ramp