

Milton, MA

Milton Village

Mixed-Use Development Alternatives

November 2018

TRAFFIC STUDY (DRAFT)



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Prepared by: **BETA GROUP, INC.**

Prepared for: Town of Milton, Massachusetts

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1.0 EXECUTIVE SUMMARY

At the request of the Town of Milton, BETA Group, Inc. (BETA) has been retained to perform a traffic study for the Milton Village Mixed-Use Development Alternatives including the study intersections of Adams Street with Canton Avenue, Randolph Avenue and High Street; Wharf Street; and Eliot Street, shown in **Figure 1**. This study uses and builds on data and analysis results provided in the *Milton Village Traffic Study*, dated October 2018 by BETA Group, Inc. The evaluation focused on the following:

- Perform trip generation calculations, trip distribution and mode split for the proposed development alternatives provided by the Town of Milton (both with and without rezoning). The four alternatives provided are:
 - Alternative 1A: Existing Zoning (Most Likely)
 - Alternative 1B: Existing Zoning (Not Likely – Off-Site Parking Required)
 - Alternative 2A: Proposed Zoning (Most Likely)
 - Alternative 2B: Proposed Zoning (Less Likely – Off-Site Parking Required)
- Assign development trips onto the existing roadway network and analyze study intersections for a future Build (2028) condition to assess the impacts to operations.
- Develop mitigation strategies to offset impacts from added development trips and re-analyze study intersections.
- Survey existing parking supply and utilization within Milton Village including occupancy, duration and turnover. Analyze future parking needs based on build out parking requirements provided by the Town of Milton.

Conclusions are as follows:

Trip Generation, Distribution, Mode Split and Assignment

Trip Generation calculations were performed using three separate land use types (residential, office and retail), with using six different Land Use Codes based on rates provided in Institute of Transportation Engineers, *Trip Generation*, 10th Edition, 2017. Trip Generation calculations for the AM and PM peak hours result in a total of 209 trips for Alternative 1A; 541 trips for Alternative 1B; 207 trips for Alternative 2A; and 271 trips for Alternative 2B.

Intersection Capacity Analysis of Development Alternatives and Mitigation Strategies

The analysis results depict the overall impacts of traffic growth and new development vehicle trips on the study intersections. Traffic growth alone, over a 10-year horizon, will degrade intersection operations in general, while the added trips from the build-out alternatives will further degrade overall intersection delay, as well as for individual movements. Alternative 1B showed the most significant impact, with three of the four study intersections degrading in overall intersection level of service. In each of the remaining three alternatives, the overall intersection level of service remains unchanged from the No-Build to the Build conditions with the added trips. It is noted that even though the overall intersection level of service remained unchanged, individual movements will degrade in level of service, and increase queue lengths which in some cases, results in movements exceeding capacity.

When mitigation strategies are implemented, significant improvements are seen throughout all four alternatives during both peak hours. The mitigation strategies focused on:

- Improvements to the pedestrian phase at the intersection of Adams Street at Eliot Street.
- The addition of a southbound right-turn lane at the Adams Street at Randolph Avenue intersection.

While some of these improvements show a more significant impact than others, many of these improvements result in study intersections operating at acceptable levels of service. In addition, queues for the movements are also improved, with some queues showing a significant reduction. All four alternatives would operate with overall intersection level of service of LOS D or better after implementation of the mitigation strategies, with the only exception of Adams Street at Wharf Street intersection, which would operate at LOS E during both peak hours under Alternative 1B.

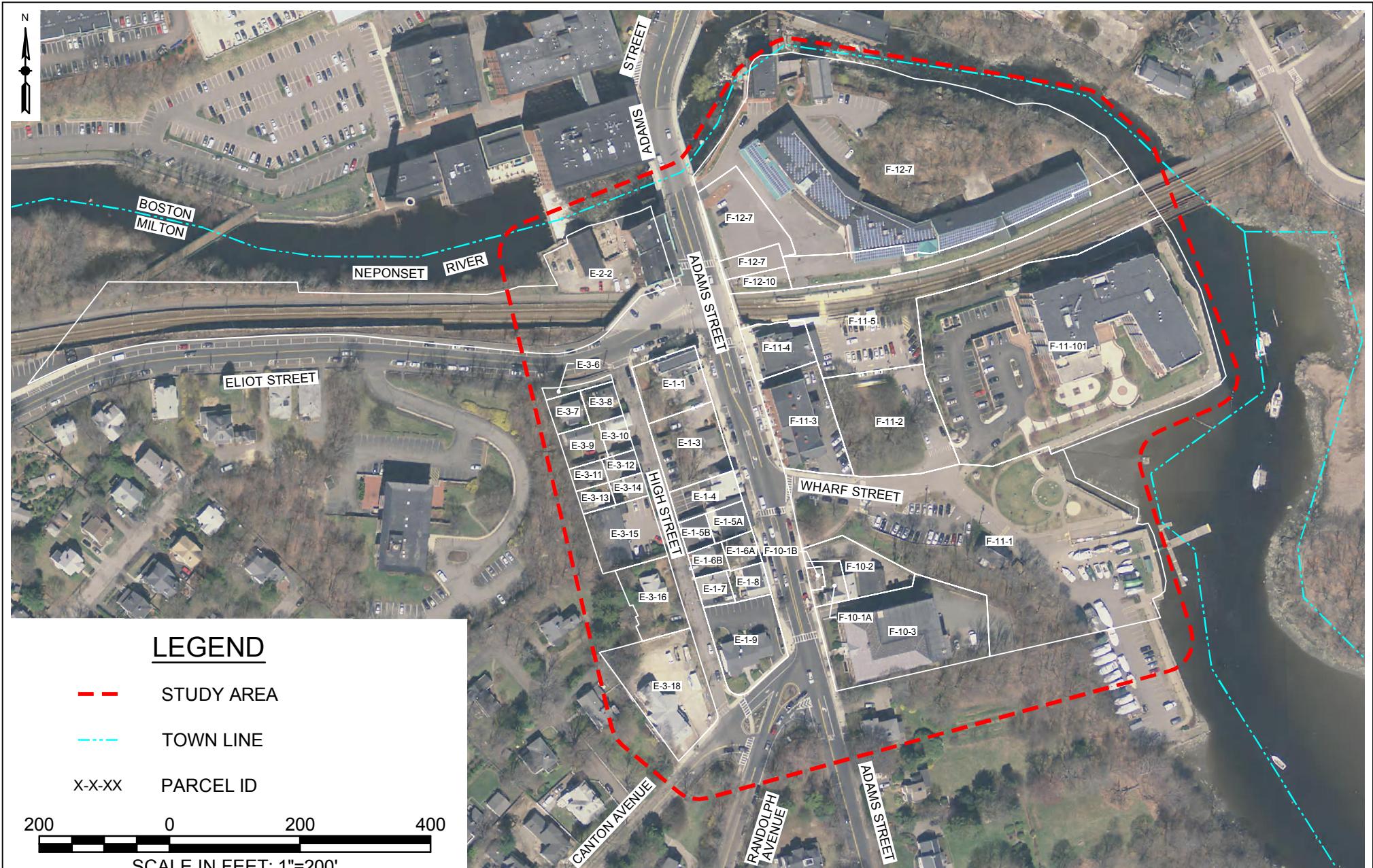
Existing Parking Survey

The parking survey conducted for Milton Village examined a total of 102 on-street parking spaces along Adams Street (Eliot to Randolph Avenue), Eliot Street (Adams Street to #36 Eliot Street), High Street and Wharf Street. The survey included only Town of Milton public parking spaces and excluded service zone parking and the Massachusetts Bay Transit Authority (MBTA) lot. Existing parking supply and demand within Milton Village was surveyed and analyzed for occupancy, duration and turnover for an 11-hour period on a weekday. In the Milton Village study area parking spaces throughout the day are approximately 66% occupied, with the midday peak period experiencing the highest levels of occupancy. Parking duration throughout the day is generally less than the one and two hour limits, with the exception of High Street which experiences higher than allowed durations. Parking turnover results show that parking spaces are utilized on average by approximately five vehicles over the 11-hour period.

In summary, the existing on-street parking provided throughout Milton Village is underutilized and can service more vehicles than it currently does.

Off-site parking is needed for Alternative 1B and Alternative 2B. In Alternative 1B, 500 off-site parking spaces are needed and in Alternative 2B, 25 off-site parking spaces are needed. Given the results of the parking survey, the existing average occupancy of 66% shows that there are approximately 35 available parking spaces that can be utilized. This would satisfy the parking demand under Alternative 2B; however, the 500 needed spaces under Alternative 1B could not be served by Milton Village alone. With only the 102 existing parking spaces within Milton Village, a parking garage appears to be the best alternative to meet the projected parking demand. Furthermore, this would need to be incorporated into the planned redevelopment of parcels in the future build-out of Alternative 1B.

Further discussion and detail of these conclusions are provided below.



2.0 INTRODUCTION

This study provides traffic analysis results for future 2028 design year conditions for the Milton Village area including the intersections of Adams Street with Canton Avenue, Randolph Avenue and High Street; Wharf Street; and Eliot Street. This study uses and builds on data and analysis results provided in the *Milton Village Traffic Study*, dated October 2018 by BETA Group, Inc. The previous study provided traffic analysis results for Existing 2018 conditions in the Milton Village area including the installation of a traffic signal at the intersection of Adams Street at Canton Avenue, Randolph Avenue and High Street. For the purposes of this study, the 2018 Build conditions (signalization and coordination) in the *Milton Village Traffic Study* will be used as the Base (2018) condition throughout this report.

This study evaluates the traffic impacts of the following alternative land use scenarios on roadways and intersections in the study area:

- Alternative 1A: Existing Zoning (Most Likely)
- Alternative 1B: Existing Zoning (Not Likely – Off-Site Parking Required)
- Alternative 2A: Proposed Zoning (Most Likely)
- Alternative 2B: Proposed Zoning (Less Likely – Off-Site Parking Required)

Vehicle and non-vehicle trips were estimated for each alternative. Vehicle trips were distributed and assigned to the study roadway network with the help of Vistro computer software. Intersection capacity analysis was performed for Base (2018) and No-Build (2028) conditions as well as for Build and Build with Mitigation conditions (2028) for each of the alternative land use scenarios.

A parking turnover survey was conducted for on-street parking spaces in the study area between 7:00 AM and 6:00 PM on Thursday, October 18, 2018. The survey data were summarized to determine parking occupancy, turnover and duration for the survey period.

Based on the analysis results, potential transportation improvements/mitigations were identified.

3.0 EXISTING CONDITIONS

3.1 PHYSICAL CHARACTERISTICS

Adams Street Corridor

Adams Street generally runs north-south in the vicinity of the study area and connects Milton with Quincy to the south and Boston (Dorchester) to the north. In the study area Adams Street is the primary connector serving the Lower Mills section of Milton and Dorchester. Adams Street features a single travel lane in each direction, widening at intersections to provide dedicated turn lanes. A significant downhill grade exists for Adams Street traveling northbound. On-street parking is provided along both sides of Adams Street north of the intersection with Randolph Avenue. Pavement markings feature a double yellow centerline and white edge/parking lines. A painted median is provided between Randolph Avenue and Wharf Street to help shift traffic prior to the dedicated turn lanes, with a small section of cobblestone brick inlay. Continuous sidewalks are provided along both sides of Adams Street north of Randolph Avenue and on the east side of Adams Street south of Randolph Avenue.

Adams Street at Randolph Avenue, Canton Avenue and High Street

Adams Street, Randolph Avenue, Canton Avenue and High Street comprise a complex 5-legged intersection. Randolph Avenue intersects Adams Street from the southwest. Canton Avenue intersects Randolph Avenue from the west approximately 150 feet west of the intersection with Adams Street. High Street intersects Canton Avenue from the north, just prior to its intersection with Randolph Avenue. Vehicles exiting High Street, destined for Randolph Avenue and Adams Street, are required to enter Canton Street to complete their route. The intersection currently operates under STOP control; however, as part of the previous Milton Village study, the intersection will be converted to signalized control in the future. For the purpose of this study, the Build (2018) condition from the previous study will now serve as the Base (2018) condition. This intersection will operate under signalized control and run coordinated with the intersection of Adams Street and Eliot Street. The traffic signal will provide five phase operation with a phase for Adams Street northbound and southbound with permissive left turns northbound; an exclusive pedestrian phase for the crosswalk across the north leg of Adams Street; and three additional phases will serve Canton Avenue, Randolph Avenue and High Street, all while the Randolph Avenue approach to Adams Street is green.

Randolph Avenue and Canton Avenue both provide a single travel lane in each direction delineated by double yellow centerlines and white edge lines. Adams Street widens at the intersection with Randolph Avenue to provide a dedicated left turn lane northbound for turns to both Randolph Avenue and Canton Avenue. Randolph Avenue widens at the intersection with Adams Street to provide a left turn and a right turn lane separated by a painted median island. High Street is a one-way roadway southbound and provides a single travel lane. Two landscaped median islands exist within the complex intersection to help channelize traffic. The eastern island (closest to Adams Street) separates traffic entering and exiting Randolph Avenue and consolidate all turning traffic from Adams Street to a single entry point. The western island then separates all entering traffic from Adams Street to Randolph Avenue and Canton Avenue as well as prohibiting High Street vehicles from entering Randolph Avenue directly. This island also delineates the travel of Canton Avenue, requiring vehicles to merge with Randolph Avenue prior to the Adams Street intersection. Pavement marking and arrows help to further direct traffic as they navigate through the intersection. Pavement markings are in fair condition, with some areas faded.

Sidewalks are present along the north side of Randolph Avenue and Canton Avenue and the east side of High Street. Crosswalks are marked across the north leg of High Street, the west leg of Canton Avenue, the westbound departure lane of Canton Avenue from Adams Street and the north leg of Adams Street. The sidewalk along Randolph Avenue continues through the western island and connects to the sidewalk along Canton Avenue utilizing the crosswalks provided across Canton Avenue and the departure lane to Canton Avenue westbound. This requires all Randolph Avenue pedestrians destined for Adams Street to cross at the crosswalk provided across the north leg of the Adam Street and Randolph Avenue intersection and vice versa. Wheelchair ramps are provided for all crosswalks and stop bars are striped across High Street, Canton Avenue and Randolph Avenue.

On-street parking is provided along the west side of High Street and permitted for a small segment along the south side of Randolph Avenue prior to the intersection with Canton Avenue.

Adams Street at Wharf Street

Adams Street and Wharf Street form a T-intersection with Wharf Street intersecting Adams Street from the east and operating under STOP control. Wharf Street provides access to the Milton Yacht Club, a small parking lot for the Milton Trolley Station and a residential complex including condominiums and apartments. Access to the Neponset Riverwalk and the Neponset Trail are also provided from Wharf Street. Wharf Street provides a single travel lane in each direction delineated by a double yellow centerline. Adams Street widens at the intersection to provide a dedicated left turn lane southbound. A slight uphill grade exists for Wharf Street approaching Adams Street. A sidewalk is provided on the north side of Wharf Street and on-street parking provided along the south side. Crosswalks are striped across Wharf Street and the south leg of Adams Street, with wheelchair ramps provided for each crosswalk.

Adams Street at Eliot Street

Adams Street and Eliot Street form a T-intersection under traffic signal control, with Eliot Street intersecting Adams Street from the west. The intersection is partially located on a bridge that spans across the Massachusetts Bay Transportation Authority's Mattapan Trolley Line and provides direct access to the Milton Station Platform. Adams Street widens at the intersection to provide a dedicated left turn lane northbound and two travel lanes southbound. Despite two southbound approach lanes, only one departure lane is provided south of the intersection; vehicles were observed using the right lane to bypass queued traffic southbound. The single northbound lane expands to two departure lanes, with vehicles using both lanes to pass through the intersection. The left lane becomes a dedicated left turn lane at the next signalized intersection, 500 feet to the north, causing a lane trap effect. Eliot Street provides a single travel lane in each direction, widening at the intersection to provide stacking for right turning vehicles, but is not striped for a right turn lane. Pavement markings feature a double yellow centerline and small median island approaching the intersection.

On-street parking is provided on both sides of Eliot Street, terminating just prior to approaching Adams Street allowing right-turning vehicles to queue at the stop bar. A slight downhill grade exists for Eliot Street eastbound. Sidewalks are provided on both sides of Adams Street and Eliot Street. Crosswalks and stop bars are marked across all legs of the intersection with wheelchair ramps provided for each crosswalk. The traffic signal provides four phase operation with a protected northbound left turn phase, a phase for Adams Street northbound and southbound with permissive left turns, an exclusive pedestrian phase and a phase for Eliot Street.

3.2 TRAFFIC VOLUMES

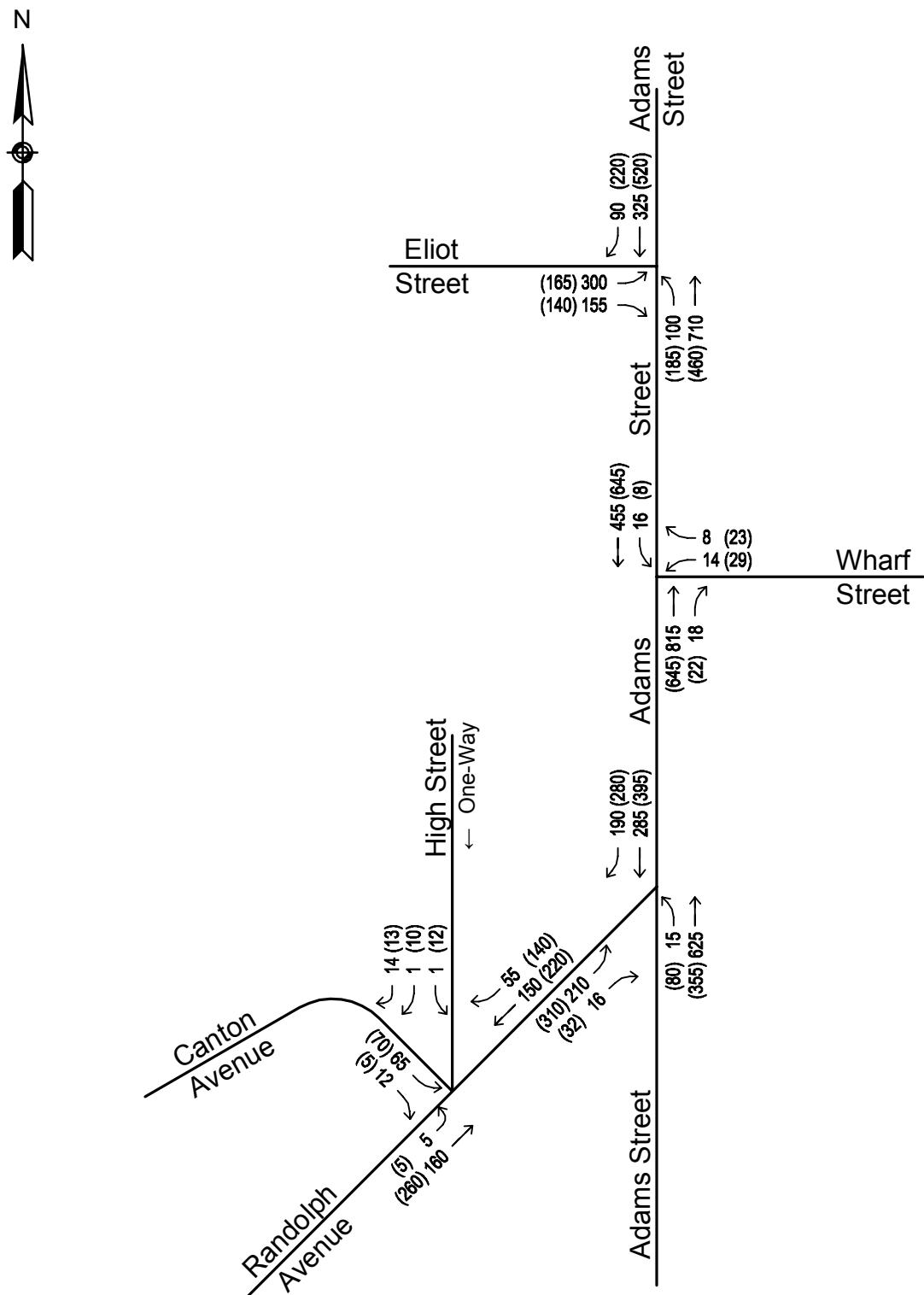
Manual Turning Movement Counts (TMC) were collected at the three study intersections on Thursday, April 26, 2018. The intersection of Adams Street at Randolph Avenue, Canton Avenue and High Street was counted from 7:00 AM to 6:00 PM, while the intersections of Adams Street at Wharf Street and Adams Street at Eliot Street were counted from 7:00 AM to 9:00 AM and from 4:00 PM to 6:00 PM. Passenger cars, heavy vehicles, pedestrians and bicycles were counted. Based on the peak hours of the study intersections, the overall peak hours for the study were assumed to be 7:30-8:30 AM and 5:00-6:00 PM. **Figure 2** provides the 2018 Existing morning and afternoon peak hour vehicular volumes, while **Figure 3** provides the 2018 Existing morning and afternoon pedestrian and bicycle peak hour volumes.

Once the peak hours were determined, the traffic volumes were examined to evaluate the need for seasonal adjustment. A review of the historical traffic growth data maintained by MassDOT Highway Division indicated that the average month traffic volume in April for an urban arterial/collector is approximately 7% higher than the average-month traffic volume. For a more conservative analysis, however, the April data were not adjusted.

Automatic Traffic Recorder (ATR) Counts were collected for Adams Street, Randolph Avenue, Canton Avenue and Eliot Street for a 48-hour period from Wednesday, April 25, 2018 through Thursday, April 26, 2018. Average daily traffic volumes are summarized in **Table 1**.

Table 1 – 2018 Average Daily Traffic Volumes

Location	Weekday ADT	Weekday Morning Peak Hour			Weekday Evening Peak Hour		
		Volume	K Factor	Dir. Dist.	Volume	K Factor	Dir. Dist.
Adams Street				NB			SB
South of Hutchinson Street	11,200	883	7.9%	68%	871	7.8%	51%
Randolph Avenue				NB			NB
South of Hutchinson Street	7,500	415	5.5%	57%	539	7.2%	54%
Canton Avenue				NB			SB
South of Brook Hill Road	2,700	226	8.3%	55%	261	9.6%	68%
Eliot Street				EB			WB
West of High Street	8,600	734	8.5%	76%	723	8.4%	53%
Adams Street				NB			SB
North of Eliot Street	17,250	995	5.8%	66%	1,198	6.9%	55%



Count Date: Thursday, April 26, 2018

AM (PM) Peak Hour Traffic Volumes

AM Peak Hour = 7:30 - 8:30

PM Peak Hour = 5:00 - 6:00

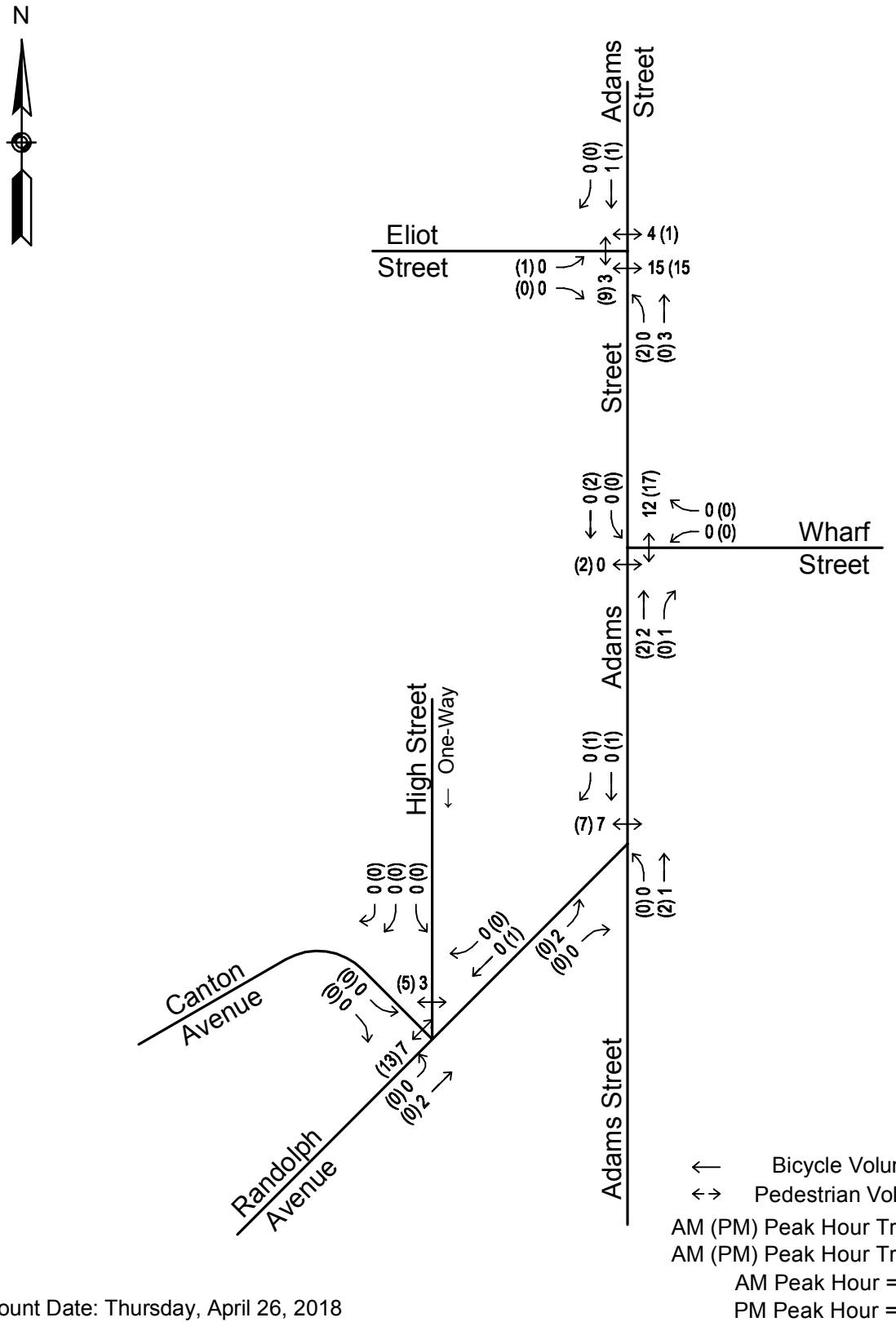


Milton Village Mixed-Use Development Alternatives Traffic Study

Milton, MA

Figure 2

Existing (2018) Peak Hour Turning Movement Volumes



Count Date: Thursday, April 26, 2018

3.3 EXISTING PARKING SURVEY

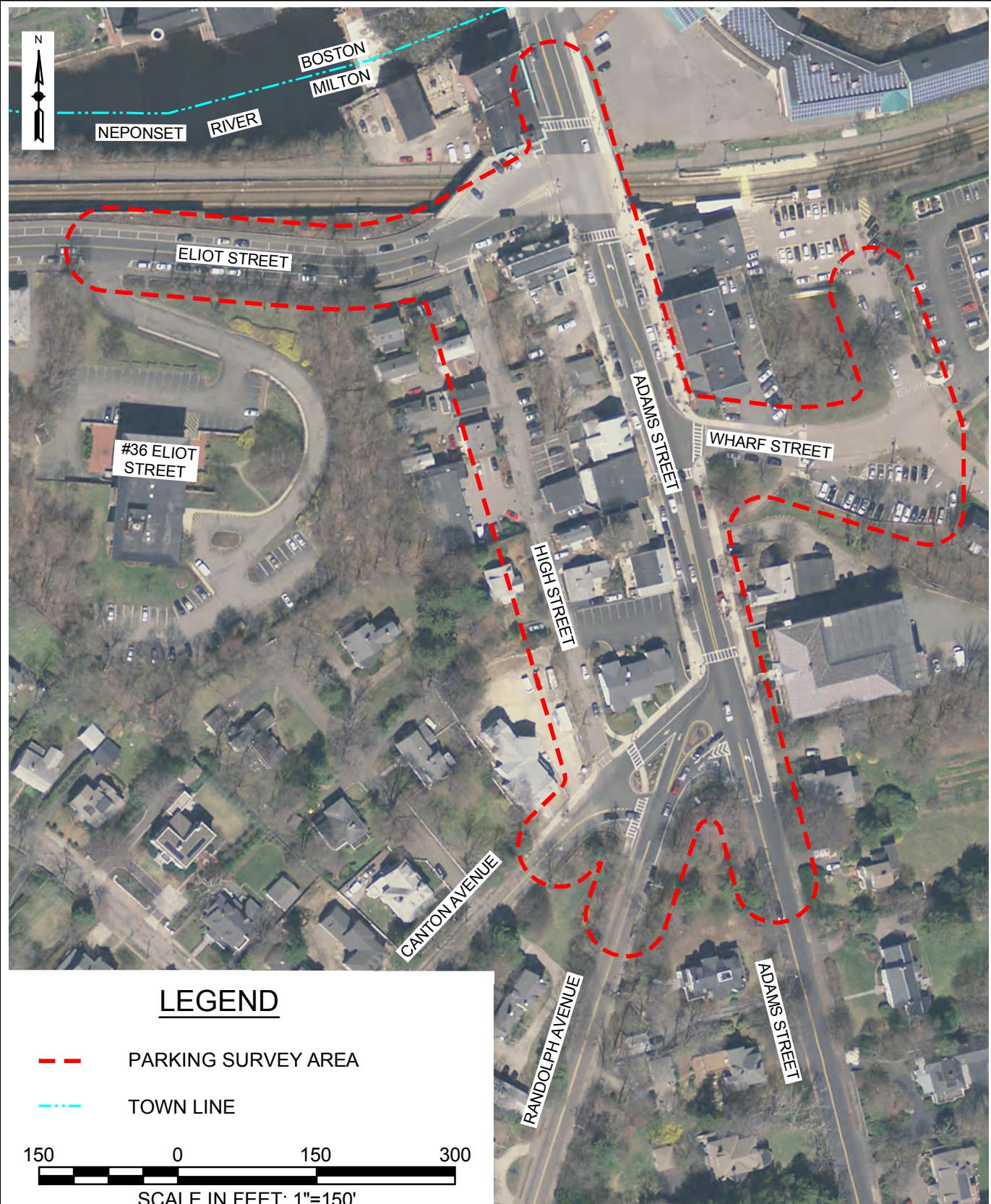
A parking survey was conducted for Milton Village along Adams Street (Eliot to Randolph Avenue), Eliot Street (Adams Street to #36 Eliot Street), High Street and Wharf Street for 30-minute intervals from 7:00 AM to 6:00 PM on Thursday October 18, 2018. It is noted that during the day of the survey, the Milton Farmers Market was held on Wharf Street from 1:00 PM to 6:00 PM. The survey concentrated on public parking spaces only and excluded service zone parking and the Massachusetts Bay Transit Authority (MBTA) lot. Illegally-parked and double-parked vehicles were also accounted for and denoted in the data collection tables to better represent existing parking operations. Existing parking supply and utilization within Milton Village was inventoried and analyzed for occupancy, duration and turnover. The study area for the parking survey is shown in **Figure 4**. Individual space numbering, survey data sheets and calculations are included in the Appendix.

For the purposes of analysis, Adams Street and Eliot Street were broken down by travel direction, with Adams Street spaces split into northbound and southbound and Eliot Street split into eastbound and westbound. A total of 102 parking spaces were inventoried with all of the spaces time-restricted to either one or two hours. A summary of existing spaces, by sections and time restrictions, are shown in **Table 2**.

Table 2 – Existing Parking Supply Characteristics

Street	No. of Spaces	Time Restriction
Adams Street NB (A1-A13)	13	1-HR Parking*
Adams Street SB (A14-A27)	14	1-HR Parking*
Eliot Street EB (E20-E32)	13	2-HR Parking
Eliot Street WB (E1-E19)	19	2-HR Parking
High Street (H1-H11)	11	2-HR Parking (7AM – 7PM)
Wharf Street (W1-W32)	32	2-HR Parking (7AM – 5PM)
Total	102	

* Certain spaces are time restricted to 7AM – 7PM



LEGEND

- PARKING SURVEY AREA**: Indicated by a red dashed line.
- TOWN LINE**: Indicated by a cyan dashed line.

150 0 150 300
SCALE IN FEET: 1"=150'

3.3.1 EXISTING PARKING OCCUPANCY

Parking occupancy within Milton Village was calculated as the percentage of parked vehicles observed for each 30-minute interval to the total number of parking spaces. The data was tabulated by street and section and for an overall total occupancy within Milton Village. In addition, the data was also tabulated for the entire survey time period as well as the AM peak period (7:00 AM – 9:00 AM), the Midday peak period (11:00 AM – 2:00 PM) and the PM peak period (4:00 PM – 6:00 PM). A summary of the daily parking occupancy results are shown in **Table 3**.

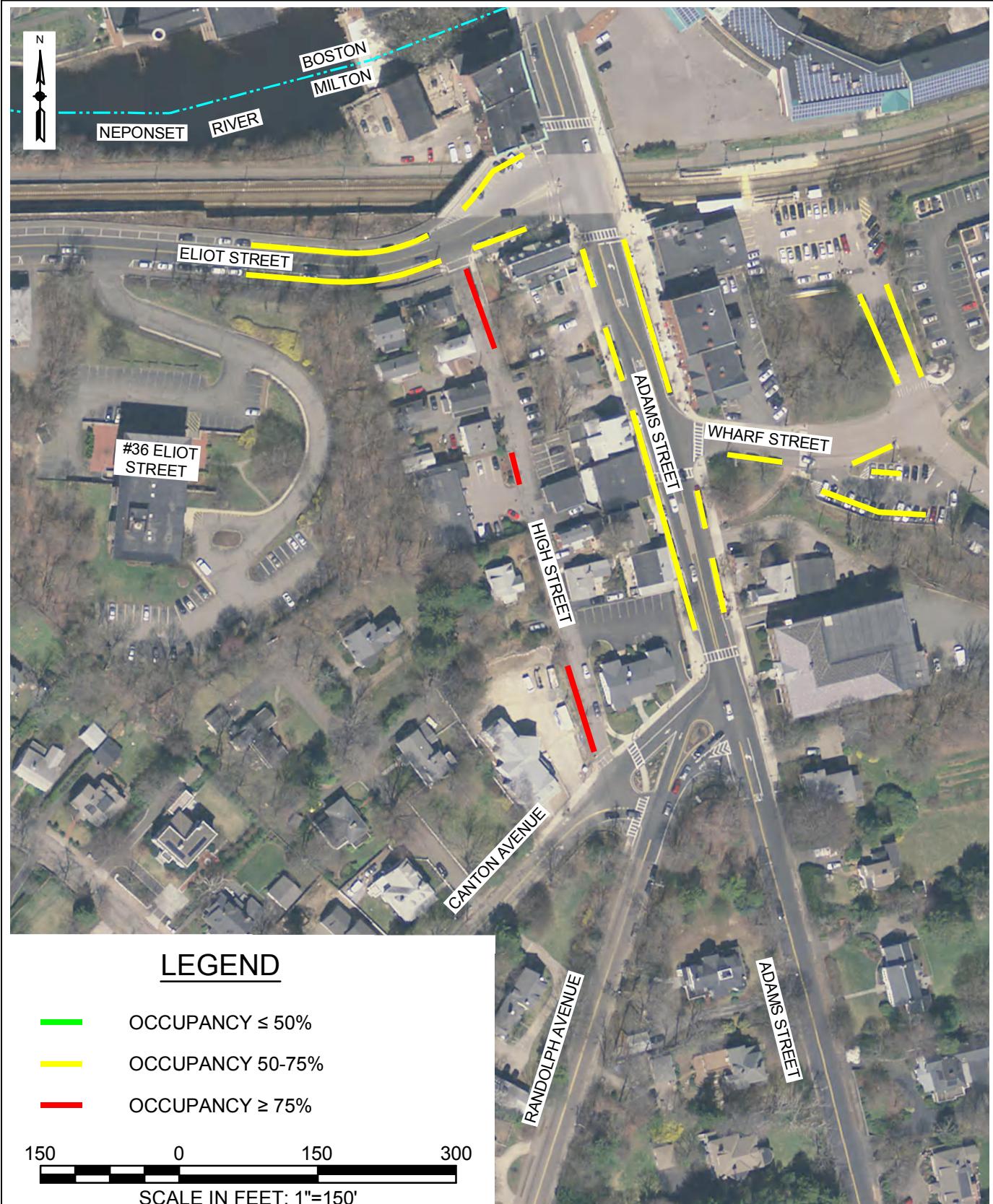
Table 3 – Existing Parking Occupancy

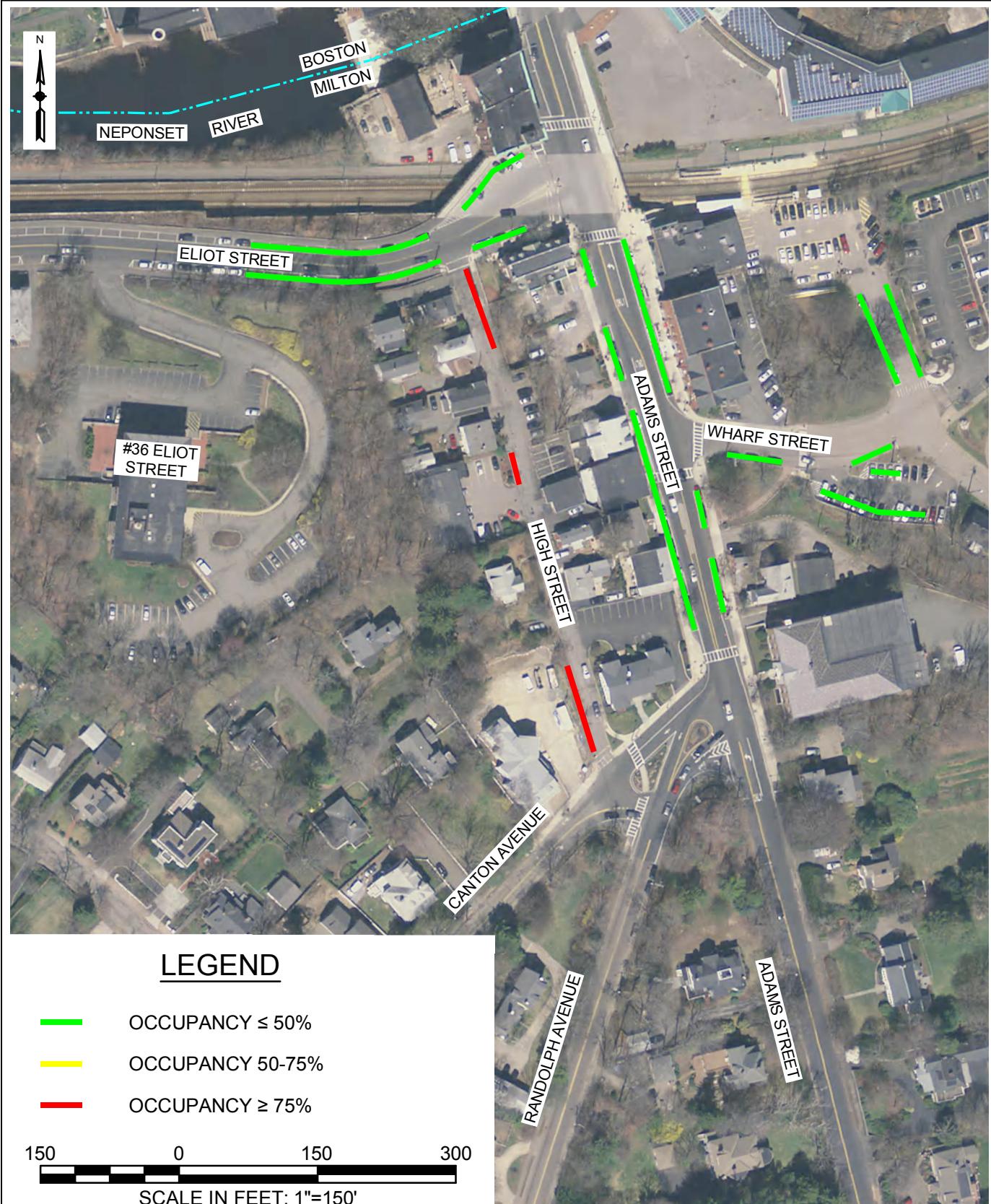
Street	No. of Spaces	Occupancy (% Occupied)			
		Daily (7A-6P)	AM (7A-9A)	Midday (11A-2P)	PM (4P-6P)
Adams Street NB (A1-A13)	13	61.2%	44.2%	75.6%	40.4%
Adams Street SB (A14-A27)	14	59.0%	21.4%	69.0%	60.7%
Eliot Street EB (E20-E32)	13	64.5%	36.5%	83.3%	57.7%
Eliot Street WB (E1-E19)	19	69.1%	30.3%	76.3%	73.7%
High Street (H1-H11)	11	86.2%	77.3%	106.1%	56.8%
Wharf Street (W1-W32)	32	52.2%	11.7%	76.6%	55.5%
Total	102	65.4%	36.9%	81.2%	57.5%

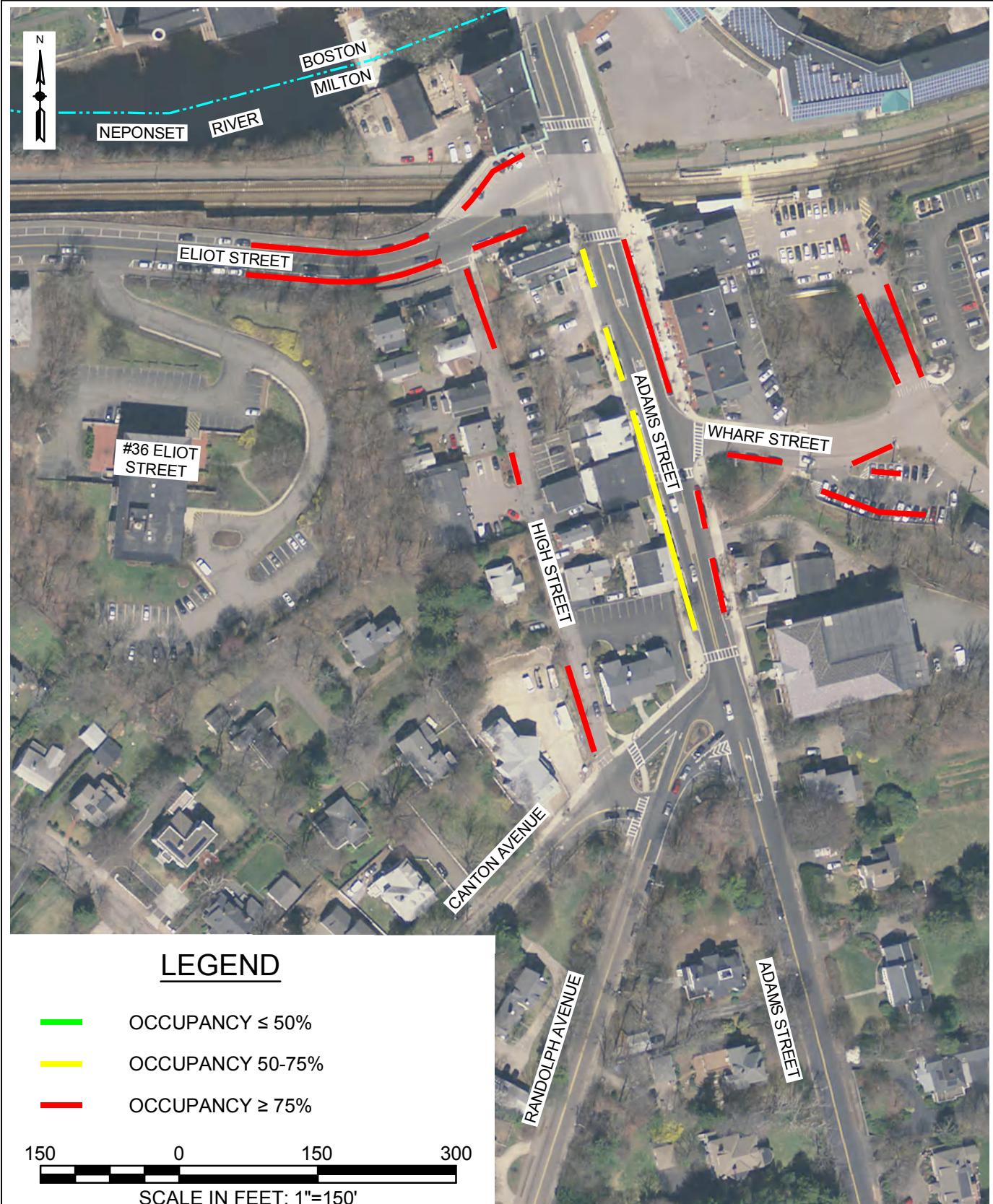
Overall occupancy results show that parking spaces in the study area are approximately 66% occupied, with the midday peak period experiencing the highest levels of occupancy (81%). The data also show that during this midday peak period, High Street parking is over capacity with vehicles parking in unmarked spaces. Overall, the existing parking provides sufficient supply for the observed parking demand within Milton Village. Graphical representations of the parking occupancy by peak periods are shown in **Figure 5** to **Figure 8**.

3.3.2 EXISTING PARKING DURATION

Parking duration was calculated as the duration of time each parked vehicle occupied a space. The calculation assumes that a parked vehicle observed during only one 30-minute interval had a parking duration of 15 minutes and represents the average time in which each vehicle was parked by section. The data was again tabulated by street, section, total duration and peak period. A summary of the parking duration results are shown in **Table 4**.







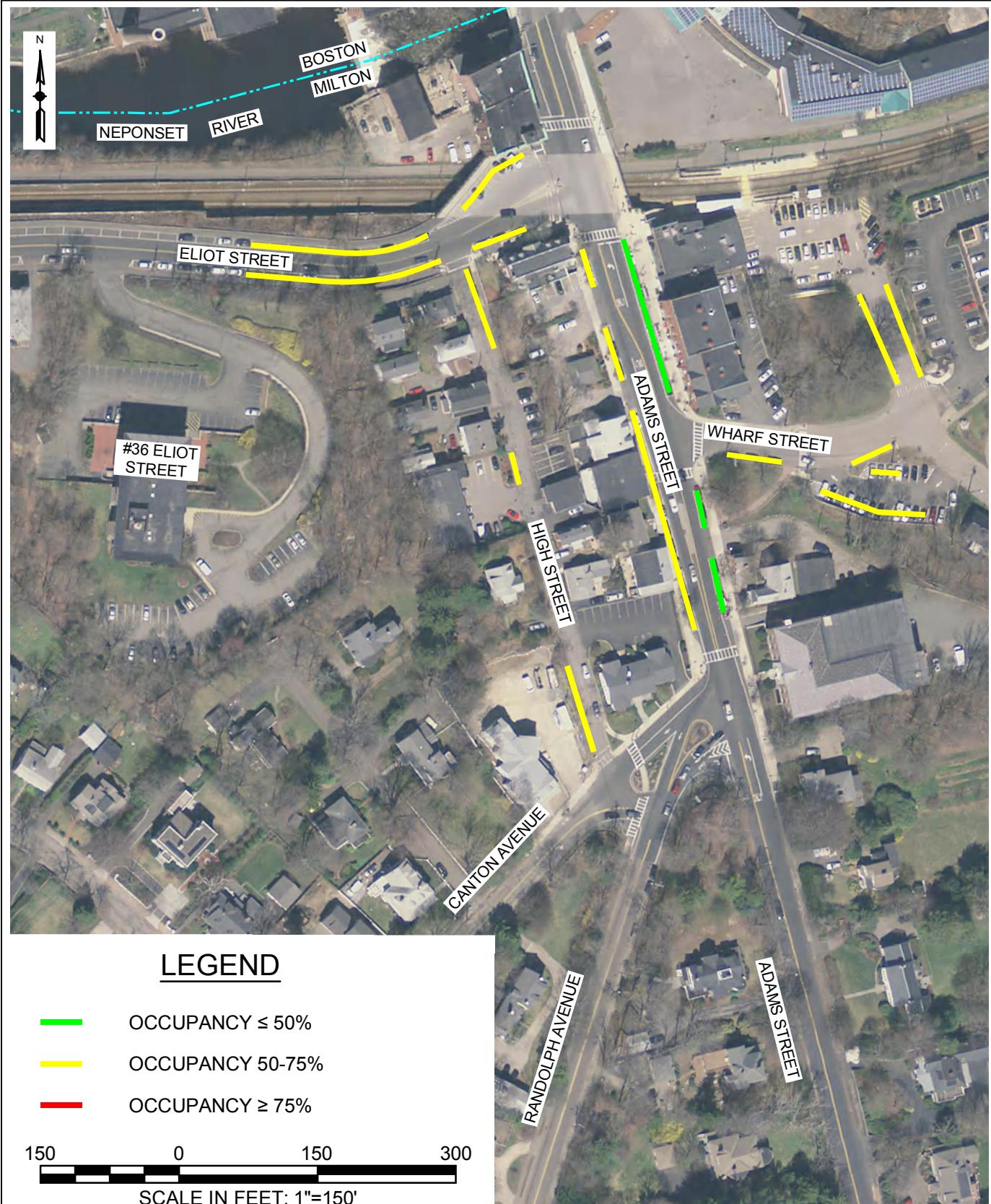


Table 4 – Existing Parking Duration

Street	No. of Spaces	Duration (minutes/vehicle)			
		Daily (7A-6P)	AM (7A-9A)	Midday (11A-2P)	PM (4P-6P)
Adams Street NB (A1-A13)	13	25.0	24.6	26.8	24.2
Adams Street SB (A14-A27)	14	32.4	22.5	29.0	34.0
Eliot Street EB (E20-E32)	13	43.2	20.4	75.0	26.5
Eliot Street WB (E1-E19)	19	47.7	24.6	54.4	36.5
High Street (H1-H11)	11	125.8	46.4	210.0	125.0
Wharf Street (W1-W32)	32	45.7	32.1	45.9	42.6
Total	102	43.1	27.8	47.6	37.0

A more detailed review of the parking duration shows that parking throughout the day is less than the time restriction with the exception of High Street which experiences higher than allowed durations (over two hours). High Street is signed for two-hour parking, yet during the midday and PM peak periods, vehicles are parked for much longer than this restriction. It is noted that while the averages of the remaining streets (Adams, Eliot, Wharf) are well within the time-restrictions, there were several vehicles parking significantly longer than the time-restricted periods. Overall, the existing parking, on average, is within the time restrictions.

3.3.3 EXISTING PARKING TURNOVER

Parking turnover was calculated as the ratio of the total number of parked vehicles accommodated during a given time period in a specified section, to the total number of parking spaces in that area. The calculation provides a closer look into how much usage is seen for each section of parking spaces. The data was again tabulated by street, section, total duration and peak period within Milton Village. A summary of the parking duration results are shown in **Table 5**.

Throughout the day parking spaces are utilized (turnover) on average by approximately five vehicles. Turnover rates between 1.5 and 2.5 are seen during the midday peak period and along Adams Street for the all peak periods. High Street has significantly lower turnover rates (1 or less) which coincide with the parking duration. Since vehicles on High Street park for much longer than is allowed, turnover for these spaces is much lower than other sections of Milton Village.

Table 5 – Existing Parking Turnover

Street	No. of Spaces	Turnover (vehicles/space)			
		Daily (7A-6P)	AM (7A-9A)	Midday (11A-2P)	PM (4P-6P)
Adams Street NB (A1-A13)	13	8.5	1.1	2.5	1.0
Adams Street SB (A14-A27)	14	6.3	0.6	2.1	1.1
Eliot Street EB (E20-E32)	13	5.2	1.1	1.0	1.3
Eliot Street WB (E1-E19)	19	5.0	0.7	1.3	1.2
High Street (H1-H11)	11	2.4	1.0	0.5	0.3
Wharf Street (W1-W32)	32	3.9	0.2	1.5	0.8
Total	102	5.0	0.7	1.5	0.9

In summary, the existing parking provided throughout Milton Village is generally underutilized and can service more vehicles than it currently does. Some contributing factors to this low parking utilization could be the time restrictions on spaces or the proximity of the MBTA's Mattapan trolley stop.

3.4 BASE CONDITION LEVEL OF SERVICE ANALYSIS RESULTS

In order to evaluate existing traffic conditions, a capacity (level of service) analysis was performed. This analysis was performed using methods of the 2000 *Highway Capacity Manual* published by the Transportation Research Board. For intersections, six levels of service, "A"-“F”, have been established with "A" representing very good operation and "F" representing very poor operation. For signalized and unsignalized intersections, level of service is defined in terms of total delay and is computed for individual intersection turning movements. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. Level of service criteria for signalized and unsignalized intersections has been defined as shown in **Table 6**.

Table 6 – Level of Service Criteria

LOS	<u>Signalized</u> Delay (Sec/Veh)	<u>Unsignalized</u> Delay (Sec/Veh)	General Description
A	≤ 10	≤ 10	Free flow
B	> 10 and ≤ 20	> 10 and ≤ 15	Stable flow (slight delays)
C	> 20 and ≤ 35	> 15 and ≤ 25	Stable flow (acceptable delays)
D	> 35 and ≤ 55	> 25 and ≤ 35	Approaching unstable flow (tolerable delay)
E	> 55 and ≤ 80	> 35 and ≤ 50	Unstable flow (intolerable delay)
F	> 80	> 50	Forced flow (jammed)

A level of service analysis was performed for the study intersections using Synchro 9 and a summary of the results of the capacity analysis are shown in **Table 7**. Complete analysis results are included in the Appendix.

Analysis results suggest that the study intersections operate favorably (LOS D or better), with the results showing the following:

Adams Street at Randolph Avenue

- Adams Street northbound left-turn operates at LOS E in the PM peak hour.
- Adams Street northbound left-turn queue exceeds capacity in the PM peak hour.
- Adams Street northbound has a long queue in the AM peak hour.
- Adams Street southbound has a long queue in the PM peak hour.

Adams Street at Canton Avenue and High Street

- Randolph Avenue northeastbound operates at LOS E in the AM peak hour.
- High Street operates at LOS E in both the AM and PM peak hours.
- Canton Avenue operates at LOS E in the PM peak hour.
- Randolph Avenue northeastbound has a long queue in both the AM and PM peak hours.

Adams Street at Eliot Street

- Eliot Street eastbound left-turn operates at LOS E in both the AM and PM peak hours.
- Adams Street northbound has a long queue in the AM peak hour.
- Adams Street southbound has a long queue in the PM peak hour.
- Eliot Street eastbound left-turn has a long queue in the AM peak hour.

All remaining individual movements operate at LOS D or better and provide adequate storage for queues.

Table 7 – Level of Service Summary – Base Conditions (2018)

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	12.9	0.04	4'	24'	E	69.7	0.78	56'	#177'
Adams Street NB TH	C	22.5	0.65	244	#737	C	25.0	0.42	196	326
Adams Street SB TH/R	B	11.0	0.54	134	208	C	32.1	0.88	536	#822
Randolph Avenue EB L	B	10.2	0.44	42	47	A	8.4	0.48	44	401
Overall	B	16.1				C	26.7			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	E	59.7	0.72	133'	#253'	D	54.1	0.70	230'	#493'
High Street SB	E	57.8	0.01	11	35	E	63.0	0.02	25	60
Canton Avenue EB	D	54.0	0.05	62	128	E	60.3	0.05	70	138
Randolph Avenue WB L	A	3.0	0.16	5	19	A	3.5	0.27	6	m20
Randolph Avenue WB TH	A	2.8	0.07	2	9	A	3.5	0.20	3	m13
Overall	C	33.5				C	30.3			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	11.4	0.03	-	2'	A	9.3	0.01	-	1'
Wharf Street WB	D	25.7	0.14	-	12	C	24.9	0.31	-	32
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	14.5	0.27	27'	76'	B	12.9	0.45	21'	130'
Adams Street NB TH	D	42.7	0.94	527	#919	A	9.5	0.44	56	316
Adams Street SB TH	C	26.9	0.44	156	317	C	29.2	0.63	280	#724
Adams Street SB R	C	21.2	0.06	0	38	C	20.3	0.19	21	106
Eliot Street EB L	E	60.4	0.85	240	#446	E	65.3	0.73	157	226
Eliot Street EB R	C	35.0	0.32	55	126	D	41.4	0.22	34	85
Overall	D	39.5				C	26.0			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

4.0 FUTURE CONDITIONS

This section evaluates future transportation operations in the study area both with and without the alternative land use scenarios. Traffic volumes in the study area were projected to year 2028, which reflects a 10-year traffic planning horizon. Two 2028 future year scenarios were analyzed: a No-Build condition and a Build condition. The No-Build scenario provides a future baseline condition for which to compare the potential impacts of the development alternatives.

4.1 BACKGROUND TRAFFIC GROWTH

Future No-Build traffic volume projections typically consist of a general background growth factor and traffic generated from other known specific development projects within the study area. Background growth is typically a function of unspecified development projects, increased economic activity, and population growth. Based on the context of the study area (i.e., a well-developed area with limited additional growth potential), it would appear that little to moderate growth in traffic volumes is anticipated for the future year. A 10-year projection using a 0.5% per year growth rate was used and results in an approximate 5.0% increase from 2018 traffic volumes when projected to 2028. This rate appears reasonable for the study area to represent traffic growth for potential future projects. The existing 2018 peak hour traffic volumes were increased by a factor of 1.05 (0.5% compounded over 10 years) to represent background traffic growth in 2028.

For this study, no specific planned future projects, beyond the alternative land use scenarios discussed below, were identified in the study area. The background traffic growth would account for any small new development projects which may occur over the 10-year analysis period.

Projected No-Build (2028) AM and PM peak hour traffic volumes are shown in **Figure 9**.

4.2 FUTURE “NO-BUILD” LEVEL OF SERVICE ANALYSIS

This No-Build scenario was analyzed for the study intersections with future (2028) volumes under baseline geometry and traffic control. The criteria used for the analysis is the same as in the Base conditions. A summary of the analysis results are shown in **Table 8**.

The analysis results suggest that the study intersections remain relatively unchanged from the Base conditions with the following exceptions:

Adams Street at Randolph Avenue

- The overall intersection degrades from LOS C to LOS D in the PM peak hour.
- Adams Street northbound left-turn degrades from LOS E to LOS F in the PM peak hour.
- Adams Street southbound degrades from LOS C to LOS D in the PM peak hour.
- Adams Street northbound left-turn volume to capacity is greater than 1.0 in the PM peak hour.

Adams Street at Wharf Street

- Wharf Street westbound degrades from LOS C to LOS D in the PM peak hour.

Adams Street at Eliot Street

- Adams Street northbound degrades from LOS D to LOS E in the AM peak hour.
- Adams Street northbound volume to capacity is greater than 1.0 in the AM peak hour.

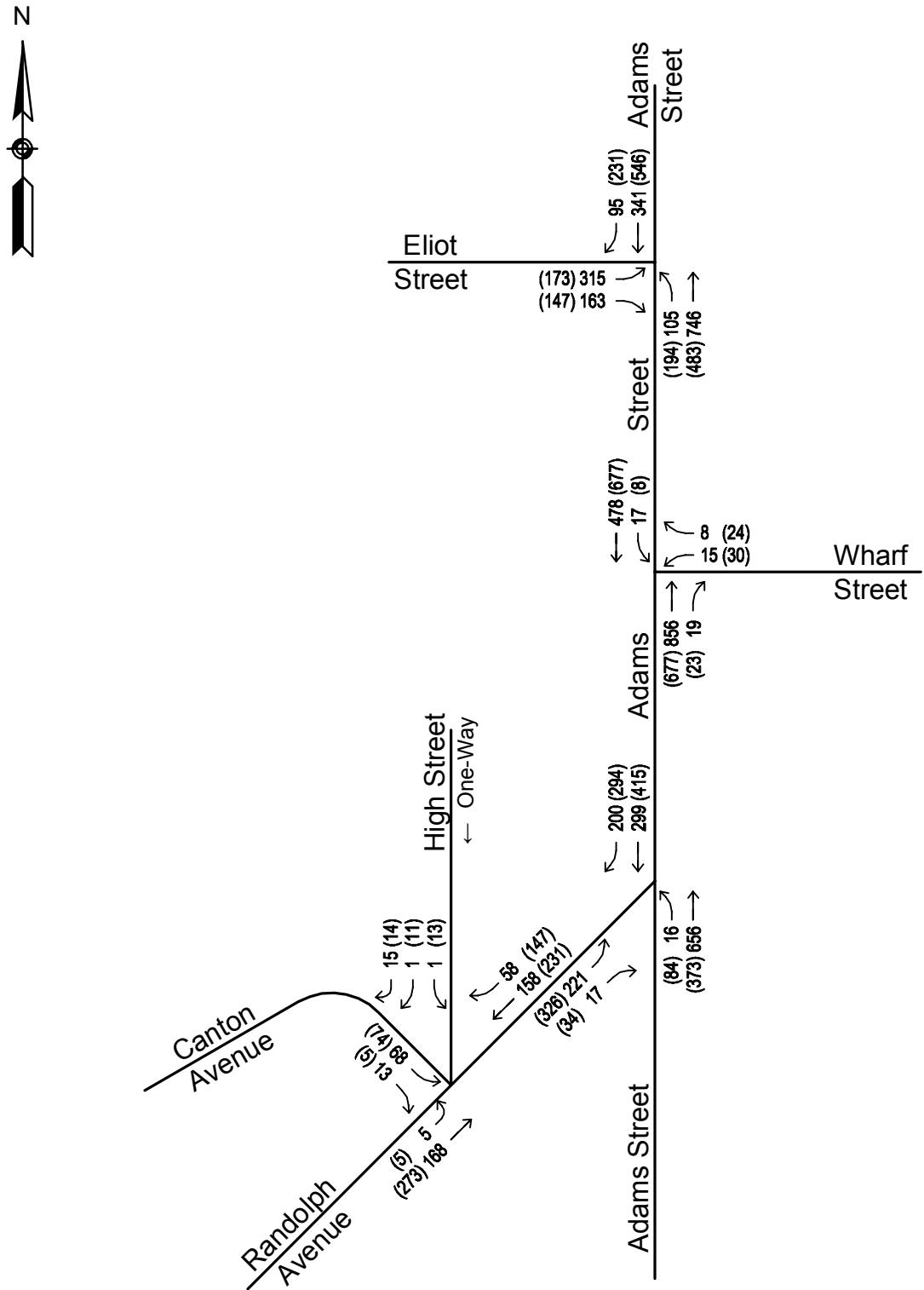


Table 8 – Level of Service Summary – No-Build Conditions (2028)

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	13.8	0.05	4'	25'	F	195.7	1.18	89'	#216'
Adams Street NB TH	C	25.1	0.70	272	#795	C	26.0	0.45	216	344
Adams Street SB TH/R	B	12.6	0.58	134	#237	D	37.4	0.93	575	#892
Randolph Avenue EB L	A	9.8	0.45	43	49	A	8.5	0.50	45	420
Overall	B	17.9				D	36.3			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	E	60.7	0.74	139'	#271'	D	54.1	0.72	239'	#522'
High Street SB	E	57.8	0.01	13	40	E	63.0	0.02	32	73
Canton Avenue EB	D	52.8	0.05	66	129	E	60.3	0.05	77	144
Randolph Avenue WB L	A	3.5	0.18	6	20	A	3.7	0.29	10	m19
Randolph Avenue WB TH	A	3.3	0.08	2	m10	A	3.7	0.22	7	m12
Overall	C	33.9				C	30.5			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	12.0	0.03	-	3'	A	9.5	0.01	-	1'
Wharf Street WB	D	28.4	0.16	-	14	D	27.5	0.34	-	36
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	15.4	0.30	32'	79'	B	16.7	0.50	21'	159'
Adams Street NB TH	E	60.5	1.01	584	#982	A	9.9	0.47	51	330
Adams Street SB TH	C	29.3	0.49	173	334	C	31.8	0.68	313	#778
Adams Street SB R	C	22.5	0.06	0	39	C	21.4	0.21	27	119
Eliot Street EB L	E	56.1	0.83	249	#477	E	65.5	0.74	165	234
Eliot Street EB R	C	33.5	0.33	58	134	D	40.5	0.24	39	93
Overall	D	46.8				C	27.4			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

All remaining individual movements remain relatively unchanged from the Base conditions to the No-Build conditions.

4.3 BUILD CONDITIONS

In order to assess the potential impact of the alternative land use scenarios on traffic conditions in the study area, vehicle trips associated with each development alternative were estimated and distributed onto the roadway network. These vehicle trips were then added to the No-Build traffic volumes to create the 2028 Build traffic volumes for the weekday AM and PM peak hours.

The following alternative land use scenarios were evaluated:

- Alternative 1A: Existing Zoning (Most Likely)
- Alternative 1B: Existing Zoning (Not Likely – Off-Site Parking Required)
- Alternative 2A: Proposed Zoning (Most Likely)
- Alternative 2B: Proposed Zoning (Not Likely – Off-Site Parking Required)

These alternatives focus on two different zoning scenarios, with likely and less likely options. In total four different alternatives were evaluated based on the land use build-outs provided by the Town. **Table 9** to **Table 12** lists these build-outs by Parcel ID and Address. Full build-out tables and draft illustrations are provided in the Appendix.

4.3.1 ALTERNATIVE 1A: EXISTING ZONING (MOST LIKELY)

Alternative 1A utilizes the existing zoning within Milton Village while adding approximately 64,000 square feet of additional office and retail space. This alternative does not provide any additional residential units and no additional off-site parking spaces are needed. A total of five parcels would be redeveloped, with one additional parcel renovated as part of this alternative. A full breakdown of the potential build-out is shown in **Table 9**.

4.3.2 ALTERNATIVE 1B: EXISTING ZONING (NOT LIKELY – OFF-SITE PARKING REQUIRED)

Alternative 1B utilizes the existing zoning within Milton Village while adding approximately 180,000 square feet of additional office and retail space. This alternative does not provide any additional residential units; however, 500 additional off-site parking spaces are needed. A total of five parcels would be redeveloped, with one additional parcel renovated as part of this alternative. A full breakdown of the potential build-out is shown in **Table 10**.

4.3.3 ALTERNATIVE 2A: PROPOSED ZONING (MOST LIKELY)

Alternative 2A utilizes proposed zoning changes within Milton Village and adds approximately 141,000 square feet of additional office, retail and residential space. This alternative provides 123 new residential units and no additional off-site parking spaces are needed. A total of six parcels would be redeveloped, four parcels renovated and three additional parcel outcomes still undecided as part of this alternative. A full breakdown of the potential build-out is shown in **Table 11**.

4.3.4 ALTERNATIVE 2B: PROPOSED ZONING (NOT LIKELY – OFF-SITE PARKING REQUIRED)

Alternative 2B utilizes proposed zoning changes within Milton Village and adds approximately 153,000 square feet of additional office, retail and residential space. This alternative provides 156 new residential units; however, 25 additional off-site parking spaces are needed. A total of six parcels would be redeveloped, four parcels renovated and three additional parcel outcomes still undecided as part of this alternative. A full breakdown of the potential build-out is shown in **Table 12**.

Table 9 – Alternative 1A: Existing Zoning (Most Likely)

Parcel ID	Address	Allowed Use	Land Use		Parking	
			Retail Area	Office Area	Retail	Office
			(70% GSF)	(GSF)	(1/250 GSF)	(1/250 GSF)
F-12-7	2-6 Adams St	Commercial	-	15,700	-	63
F-10-2	90 Adams St	Mixed-Use	-	4,500	-	18
F-10-3	114 Adams St	Renovation	-	14,122	-	0
E-1-3	59 Adams St	Mixed-Use	2,831	8,287	11	33
E-1-4	65-71 Adams St	Mixed-Use	2,575	4,967	10	20
E-1-5A	73-79 Adams St	Mixed-Use				
E-1-5B	26 High St	Mixed-Use				
E-1-9	5 Canton Ave	Mixed-Use	5,724	5,724	23	23

Table 10 – Alternative 1B: Existing Zoning (Not Likely – Off-Site Parking Required)

Parcel ID	Address	Allowed Use	Land Use		Parking	
			Retail Area	Office Area	Retail	Office
			(70% GSF)	(GSF)	(1/250 GSF)	(1/250 GSF)
F-12-7	2-6 Adams St	Commercial	-	44,156	-	177
F-10-2	90 Adams St	Mixed-Use	-	12,656	-	51
F-10-3	114 Adams St	Renovation	-	39,718	-	-
E-1-3	59 Adams St	Mixed-Use	7,962	23,307	32	93
E-1-4	65-71 Adams St	Mixed-Use	7,242	13,970	29	56
E-1-5A	73-79 Adams St	Mixed-Use				
E-1-5B	26 High St	Mixed-Use				
E-1-9	5 Canton Ave	Mixed-Use	16,099	16,099	64	64

Table 11 – Alternative 2A: Proposed Zoning (Most Likely)

Parcel ID	Address	Allowed Use	Land Use			Parking			
			Retail Area (70% GSF)	Office Area (GSF)	Residential (Units)	Retail (2/1000 GSF)	Office (2/1000 GSF)	Residential (1/Unit)	Provided On-Site
F-12-7	2-6 Adams St	Mixed-Use	3,865	-	13	8	-	13	28
E-2-2	1 Eliot St	Renovation	-	-	17	-	-	17	8
F-11-4	40 Adams St	Mixed-Use	2,274	-	6	5	-	6	16
F-11-3	50-64 Adams St	Renovation	-	-	13	-	-	13	16
F-10-2	90 Adams St	Mixed-Use	636	871	8	1	2	8	14
F-10-1B	98 Adams St	Mixed-Use	942	-	4	2	-	4	7
F-10-1A	100-102 Adams St	Mixed-Use							
F-10-3	114 Adams St	Renovation	-	-	10	-	-	10	12
E-1-1	2 Eliot St	Reno/Addition	8,100	-	9	16	-	9	8
E-1-3	59 Adams St	Mixed-Use	2,629	-	11	5	-	11	30
E-1-4	65-71 Adams St	Mixed-Use	2,046	3,233	9	4	6	9	24
E-1-5A	73-79 Adams St	Mixed-Use							
E-1-5B	26 High St	Mixed-Use							
E-1-9	5 Canton Ave	Mixed-Use	4,094	-	10	8	-	10	30
E-3-15	25 High St	Mixed-Use	3,075	-	8	6	-	8	20
E-3-16	33 High St	Mixed-Use	2,262	-	6	5	-	6	12

Table 12 – Alternative 2B: Proposed Zoning (Not Likely – Off-Site Parking Required)

Parcel ID	Address	Allowed Use	Land Use			Parking			
			Retail Area (70% GSF)	Office Area (GSF)	Residential (Units)	Retail (2/1000 GSF)	Office (2/1000 GSF)	Residential (1/Unit)	Provided On-Site
F-12-7	2-6 Adams St	Mixed-Use	5,295	-	16	11	-	16	28
E-2-2	1 Eliot St	Renovation	-	-	22	-	-	22	8
F-11-4	40 Adams St	Mixed-Use	3,115	-	7	6	-	7	16
F-11-3	50-64 Adams St	Renovation	-	-	16	-	-	16	16
F-10-2	90 Adams St	Mixed-Use	871	871	10	2	2	10	14
F-10-1B	98 Adams St	Mixed-Use	1,291	-	5	3	-	5	7
F-10-1A	100-102 Adams St	Mixed-Use							
F-10-3	114 Adams St	Renovation	-	-	13	-	-	13	12
E-1-1	2 Eliot St	Reno/Addition	11,096	-	11	22	-	11	8
E-1-3	59 Adams St	Mixed-Use	3,601	-	14	7	-	14	30
E-1-4	65-71 Adams St	Mixed-Use	2,803	3,233	11	6	6	11	24
E-1-5A	73-79 Adams St	Mixed-Use							
E-1-5B	26 High St	Mixed-Use							
E-1-9	5 Canton Ave	Mixed-Use	5,608	-	13	11	-	13	30
E-3-15	25 High St	Mixed-Use	4,213	-	10	8	-	10	20
E-3-16	33 High St	Mixed-Use	3,098	-	8	6	-	8	12

4.3.5 PROJECT GENERATED TRAFFIC

Vehicle trip generation was developed for the alternative land use scenarios for the weekday AM and PM peak hours. Vehicle trip generation estimates were based on rates provided in Institute of Transportation Engineers, *Trip Generation*, 10th Edition, 2017. Trip generation rates for Land Use Code (LUC) LUC 221 – Multi-Family Housing (Mid-Rise), LUC 231 Mid-Rise Residential with 1st Floor Commercial, LUC 710 General Office Building, LUC 712 Small Office Building, LUC 720 Medical-Dental Office Building and LUC 820 Shopping Center were used and applied to the assumed size of the land use alternative. A breakdown of the vehicle trip generation rates for the AM and PM peak hours are shown in **Table 13**.

Table 13 – Vehicle Trip Generation Rates

Land Use Code	AM Peak Hour			PM Peak Hour		
	Rate	Enter	Exit	Rate	Enter	Exit
221 Multi-Family Housing (Mid-Rise)*	0.36	26%	74%	0.44	26%	39%
231 Mid-Rise Residential with 1 st Floor Commercial*	0.31	41%	59%	0.47	41%	56%
710 General Office Building**	1.16	86%	14%	1.15	86%	84%
712 Small Office Building**	1.92	83%	17%	2.45	83%	68%
720 Medical-Dental Office Building**	2.78	78%	22%	3.46	78%	72%
820 Shopping Center**	0.94	62%	38%	3.81	62%	52%

* Rate calculation is based on number of dwelling units

** Rate calculation is based on 1,000 Square Feet of Gross Floor Area

For retail/commercial land use, the average rate for LUC 820 – Shopping Center was used to represent a general estimate of trip generation. This was done because at this time, there is no specific information on the type of retail/commercial development planned in the future. It is noted that some retail/commercial businesses can have significantly higher trips generation rates than the average rates assumed for this analysis. Uses such as coffee/donut shops and fast-food restaurants have significant vehicle trip generation. In addition, the reduction in trips based on “pass-by trips” is also applicable to retail and commercial land uses. A pass-by trip is defined as a vehicle trip that currently utilizes the roadway directly abutting or feeding the development site and visits the development as opposed to a newly generated trip. These trips are often seen for retail and commercial uses and reduce the overall trips generated by the site by a certain percentage. Pass-by trips percentages provided in Institute of Transportation Engineers, *Trip Generation Handbook*, 3rd Edition, 2017, estimates a 34% pass-by trip rate for LUC 820 and was then applied to all retail generated trips to account for pass-by trips through Milton Village.

The estimated vehicle trips for each land use were adjusted downward to account for trips made by transit, walk, bicycle and work-at-home. US Census Bureau data at the Census Tract level published by the 2009-2013 5-Year American Community Survey Commuting Flows was used to develop identify

mode splits for the project study area. The data shows a mode split of 85% vehicular traffic, 8% transit (including bus and trolley car), 2% pedestrian/bicycle traffic, with an additional 5% of trips that are work from home.

Estimated vehicle trip generation for the alternative land use scenarios are shown in **Table 14**.

4.3.6 TRIP DISTRIBUTION AND ASSIGNMENT

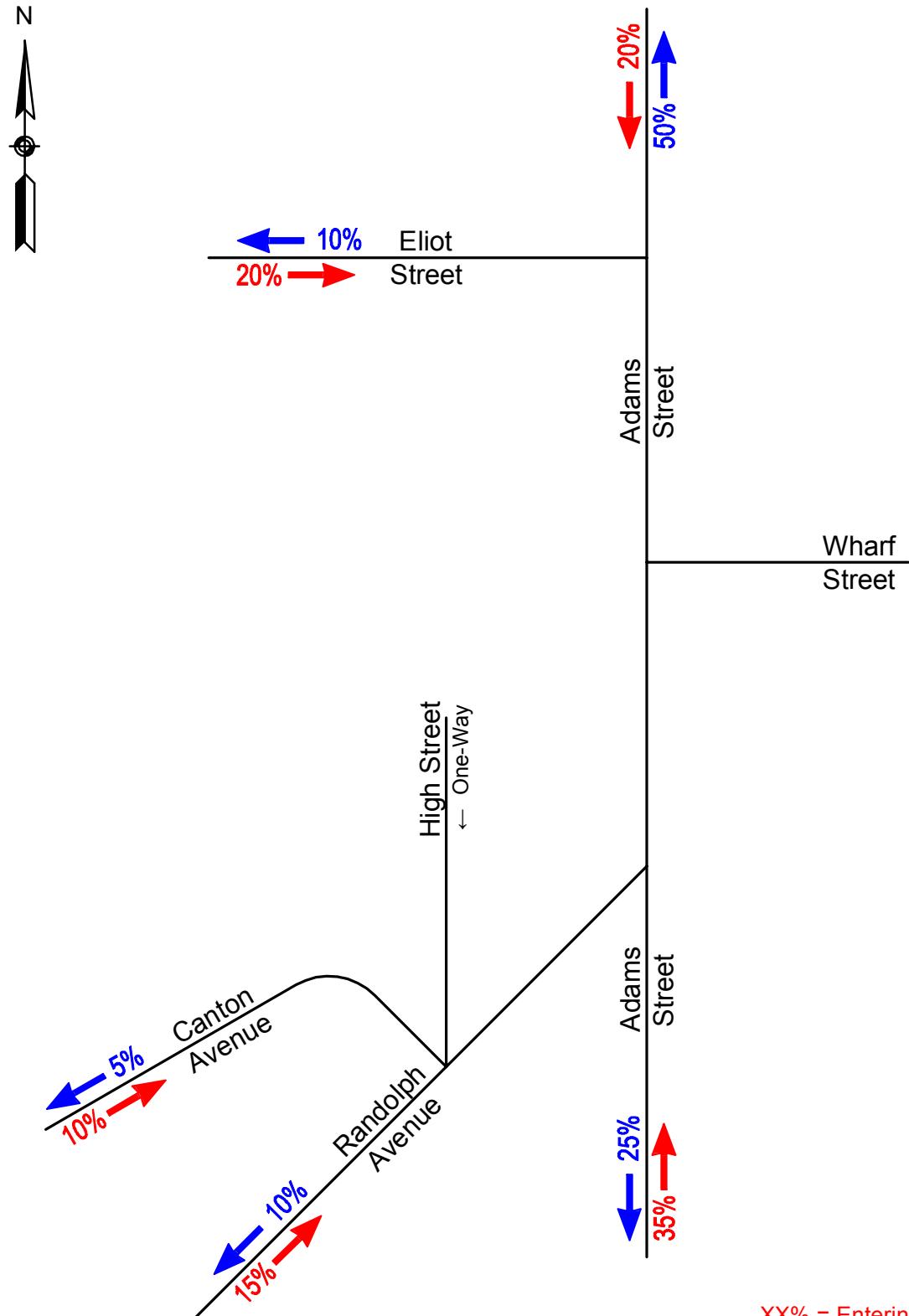
In order to evaluate the potential impacts related to the incremental traffic volumes associated with the alternative land use scenarios, the new vehicle trips were distributed and assigned onto the local roadway network. The estimated project trips were distributed and assigned based on the 2009-2013 5-Year American Community Survey Journey-to Work data, existing peak hour traffic volumes at study intersections and roadway circulation patterns. Vehicle trips were assigned for each of the four alternatives using the land use scenarios provided in **Table 9** to **Table 12**, while also assuming driveway locations for the proposed developments. A Vistro 5 traffic model was developed for Milton Village and used to distribute and assign vehicle trips to the study roadway network. Vistro is an analysis software which incorporates trip generation, distribution and assignment all within a network and analyzes scenarios based on differing land uses and development alternatives. The Vistro network was used to generate, distribute and assign trips; however, due to the complex intersection of Adams Street, Randolph Avenue, Canton Avenue and High Street, Synchro 9 analysis software was used to complete a the capacity analysis. This complex geometry and signal phasing at the intersection lends itself to the use of Synchro for a more detailed analysis of the intersection. The vehicle trip distribution used for analysis is summarized in **Figure 10** and **Figure 11** for the AM and PM peak hours, respectively.

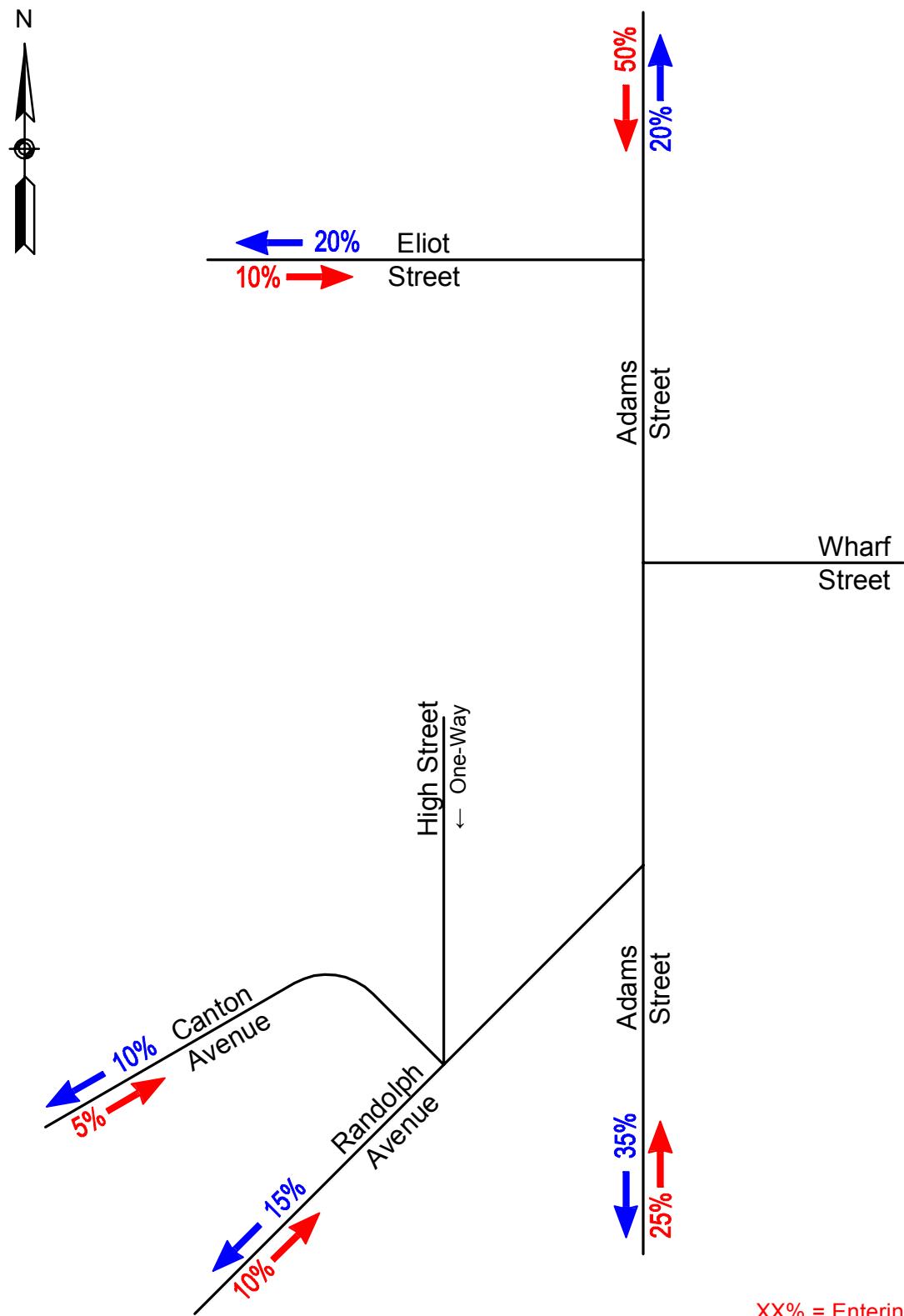
Added site trips for the AM and PM peak hours are shown in **Figure 12** for Alternative 1A, **Figure 13** for Alternative 1B, **Figure 14** for Alternative 2A and **Figure 15** for Alternative 2B.

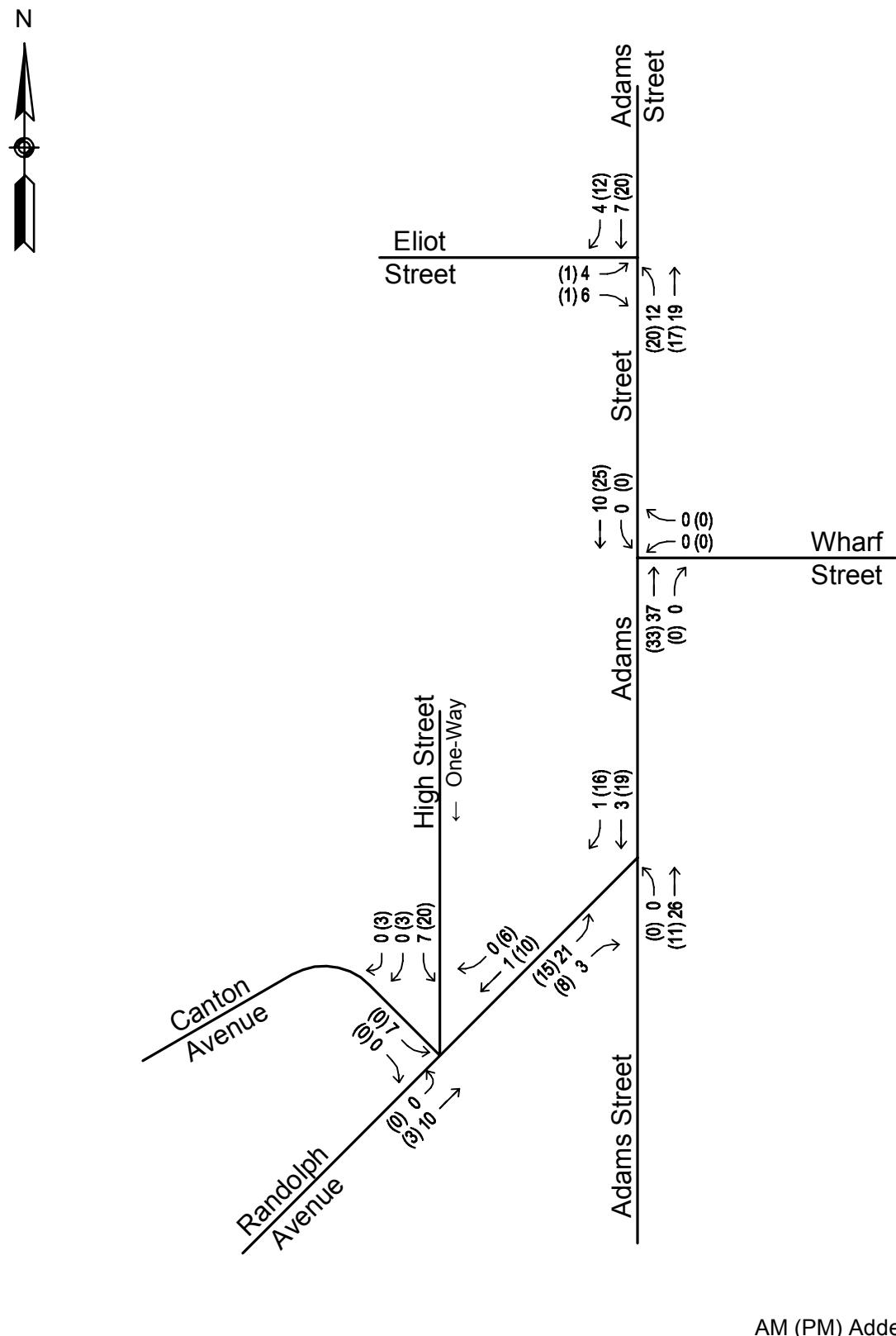
The project vehicle trips were added to the Future No-Build peak hour traffic volume networks to create the 2028 Build traffic volumes for each alternative and are shown in **Figure 16** for Alternative 1A, **Figure 17** for Alternative 1B, **Figure 18** for Alternative 2A and **Figure 19** for Alternative 2B.

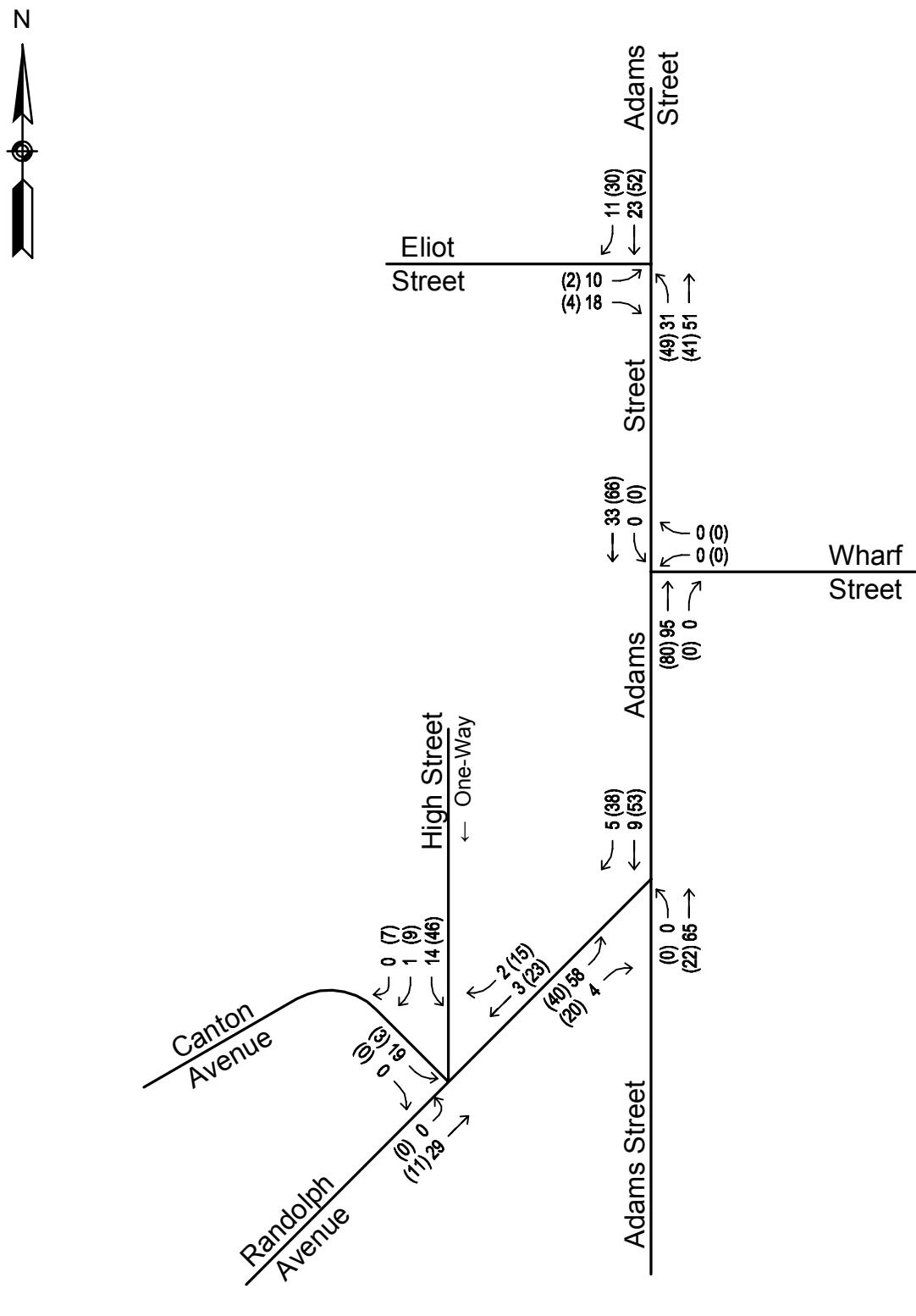
Table 14 – Milton Village Vehicle Trip Generation Summary

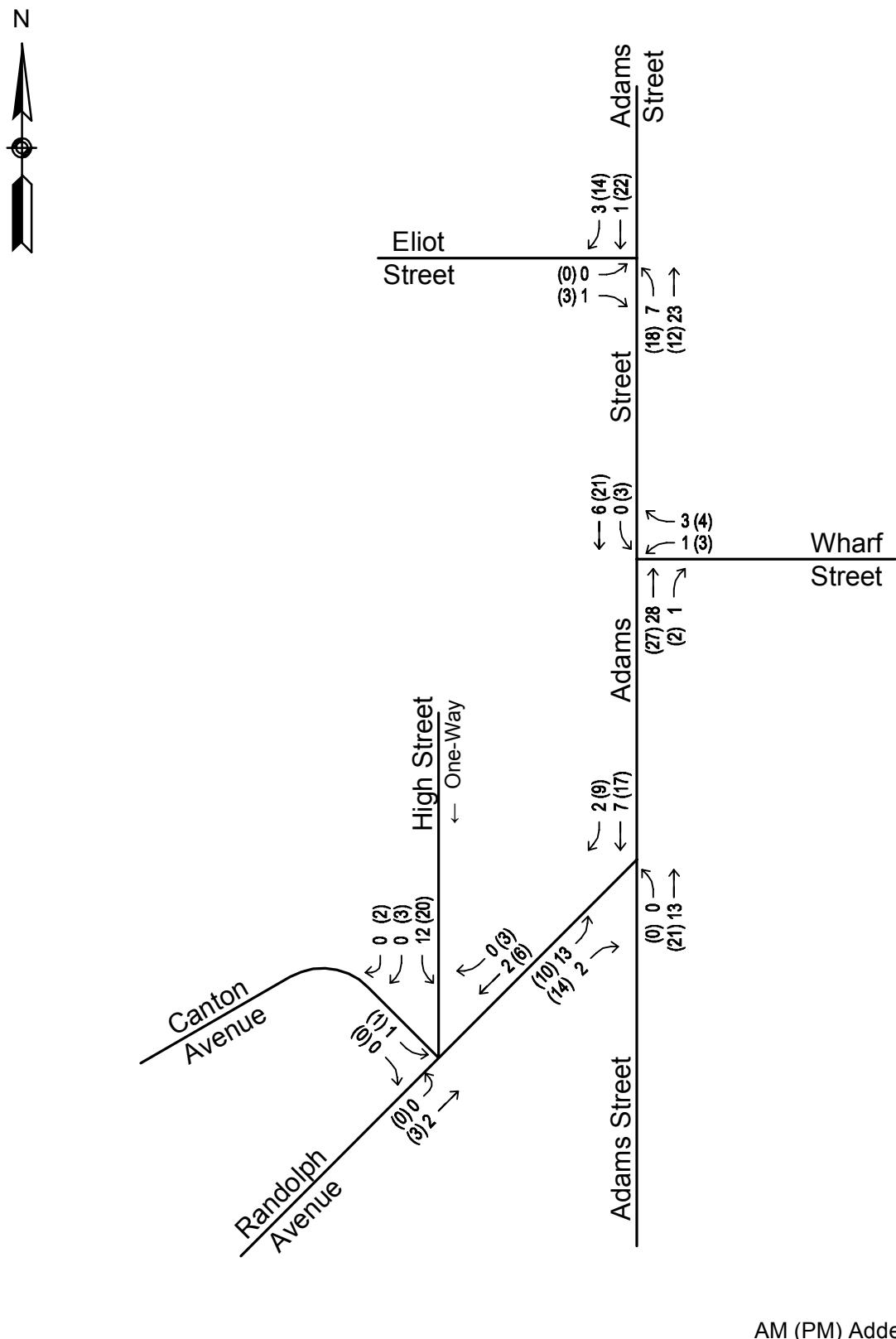
Parcel ID	Address	Allowed Use	Entering						Exiting							
			Alternative 1A		Alternative 1B		Alternative 2A		Alternative 2B		Alternative 1A		Alternative 1B		Alternative 2A	
			AM	PM	AM	PM										
F-12-7	2-6 Adams St	Mixed-Use	18	6	51	16	4	7	5	9	4	20	11	54	4	7
E-2-2	1 Eliot St	Renovation	-	-	-	-	2	4	2	5	-	-	-	-	4	3
F-11-4	40 Adams St	Mixed-Use	-	-	-	-	1	3	2	6	-	-	-	-	2	5
F-11-3	50-64 Adams St	Renovation	-	-	-	-	1	3	1	3	-	-	-	-	3	2
F-10-2	90 Adams St	Mixed-Use	6	3	14	5	2	3	5	4	1	6	3	15	2	5
F-10-1B	98 Adams St	Mixed-Use	-	-	-	-	1	2	1	3	-	-	-	-	1	2
F-10-1A	100-102 Adams St	Mixed-Use					5	11	7	14					1	5
F-10-3	114 Adams St	Renovation	16	5	46	14	1	3	1	3	4	18	10	48	3	2
E-1-1	2 Eliot St	Reno/Addition	-	-	-	-	5	11	7	14	-	-	-	-	5	11
E-1-3	59 Adams St	Mixed-Use	11	6	30	18	4	6	4	8	4	14	9	38	4	5
E-1-4	65-71 Adams St	Mixed-Use	9	6	19	13	6	7	8	9	3	10	7	24	4	8
E-1-5A	73-79 Adams St	Mixed-Use														
E-1-5B	26 High St	Mixed-Use														
E-1-9	5 Canton Ave	Mixed-Use	11	9	26	23	4	7	5	9	4	15	9	38	4	7
E-3-15	25 High St	Mixed-Use	-	-	-	-	2	6	4	8	-	-	-	-	3	6
E-3-16	33 High St	Mixed-Use	-	-	-	-	1	3	2	6	-	-	-	-	2	4
Total Added Trips			71	35	186	89	34	65	47	87	20	83	49	217	41	67
															51	86

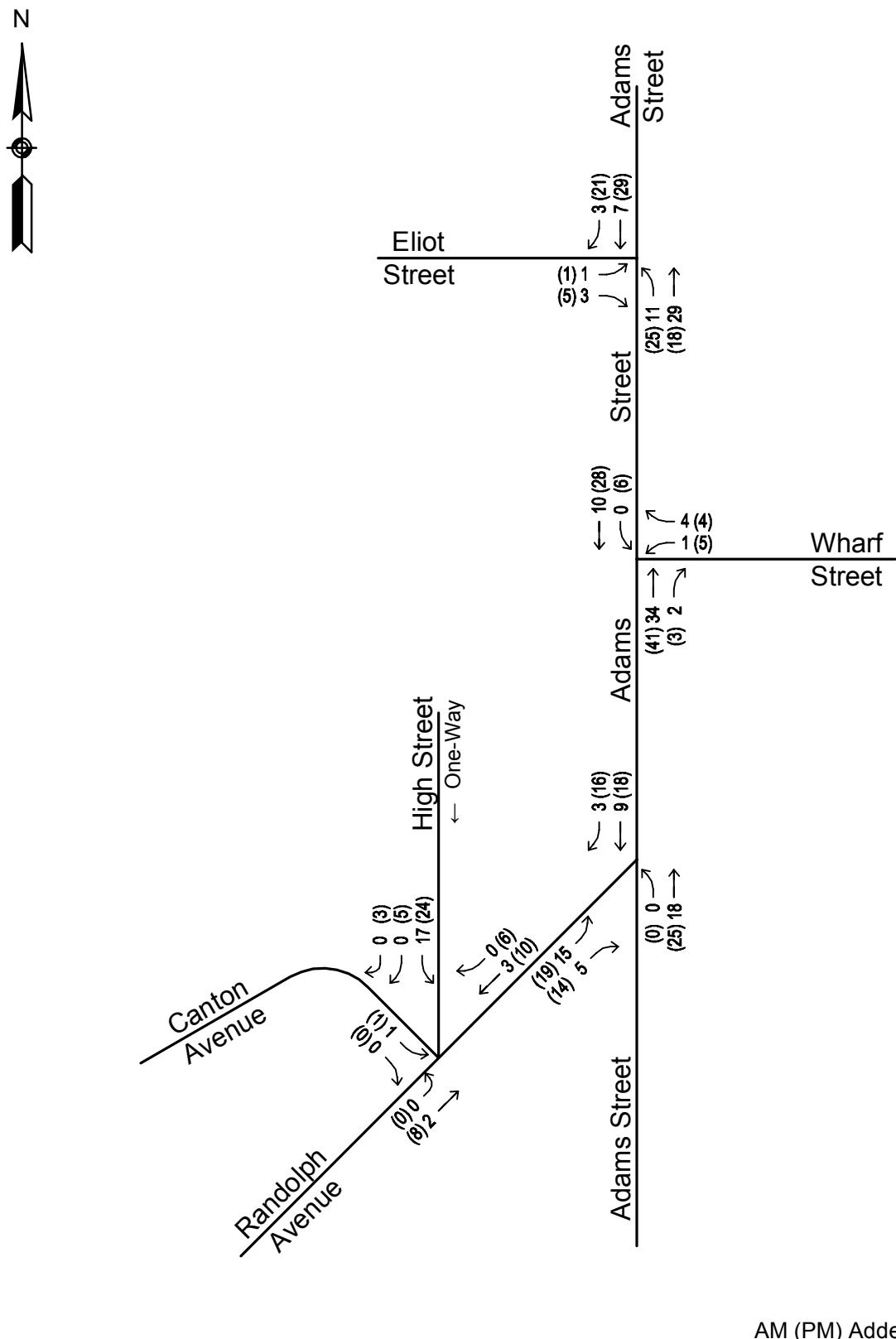


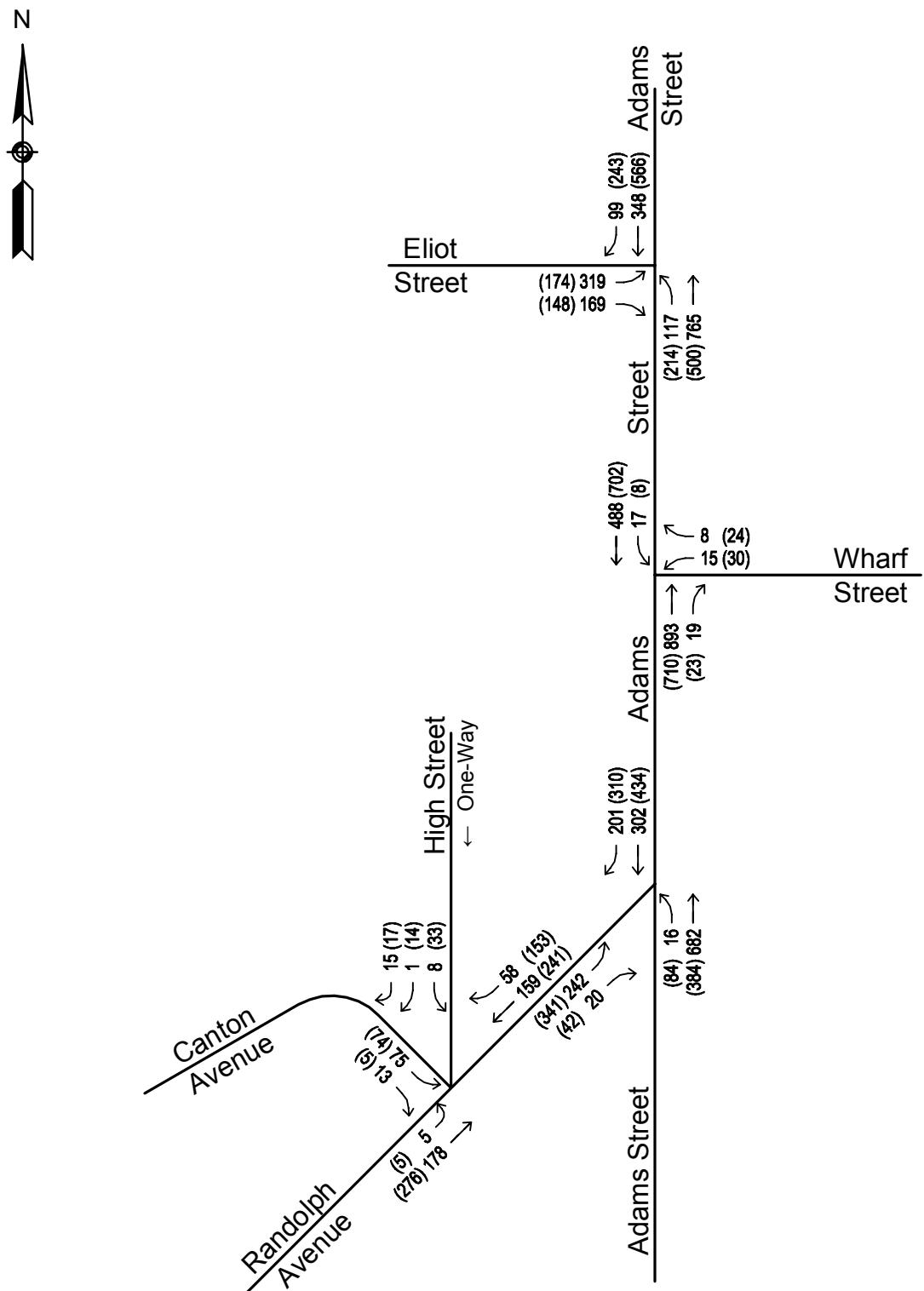




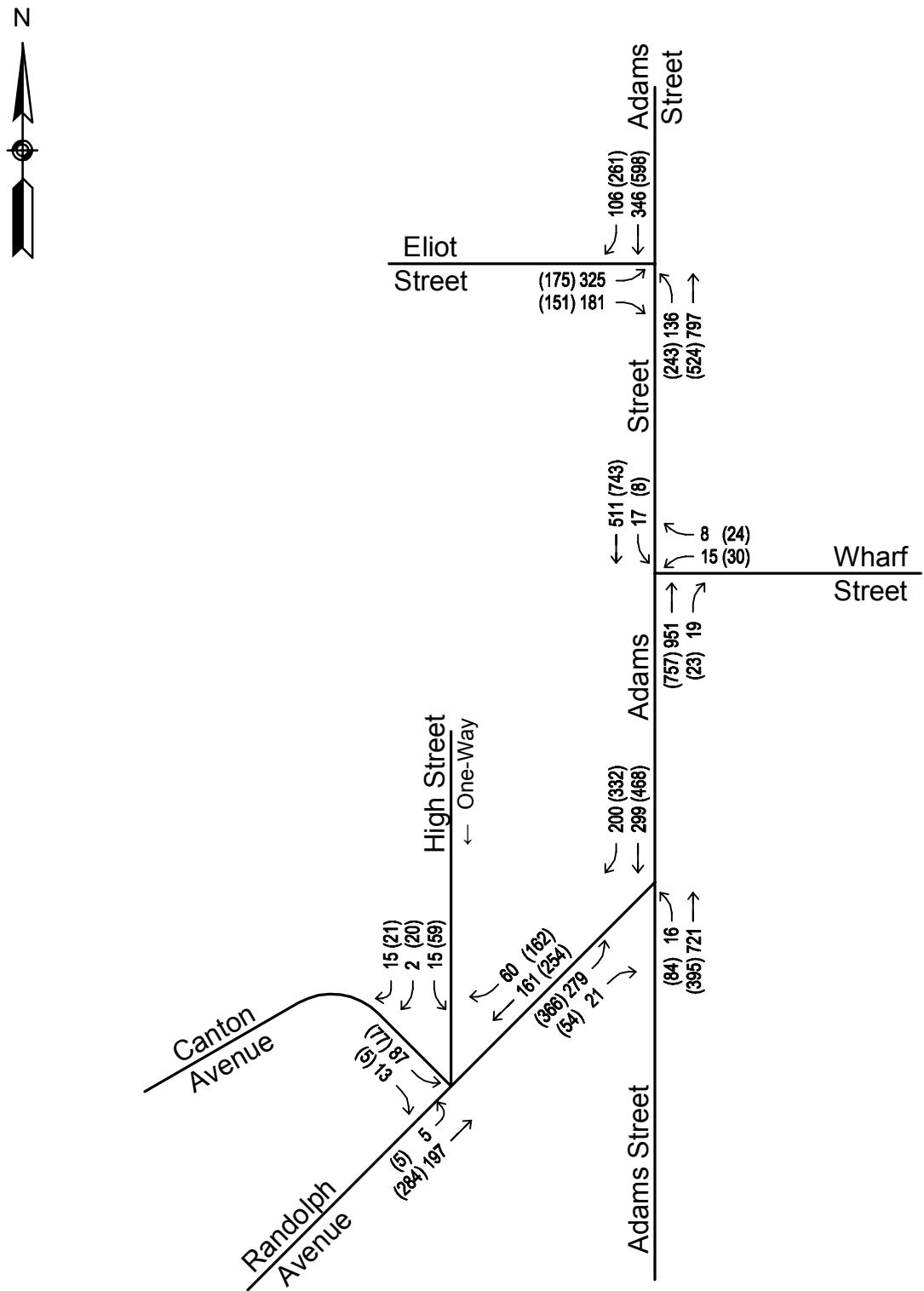








AM (PM) Peak Hour Traffic Volumes
AM Peak Hour = 7:30 - 8:30
PM Peak Hour = 5:00 - 6:00



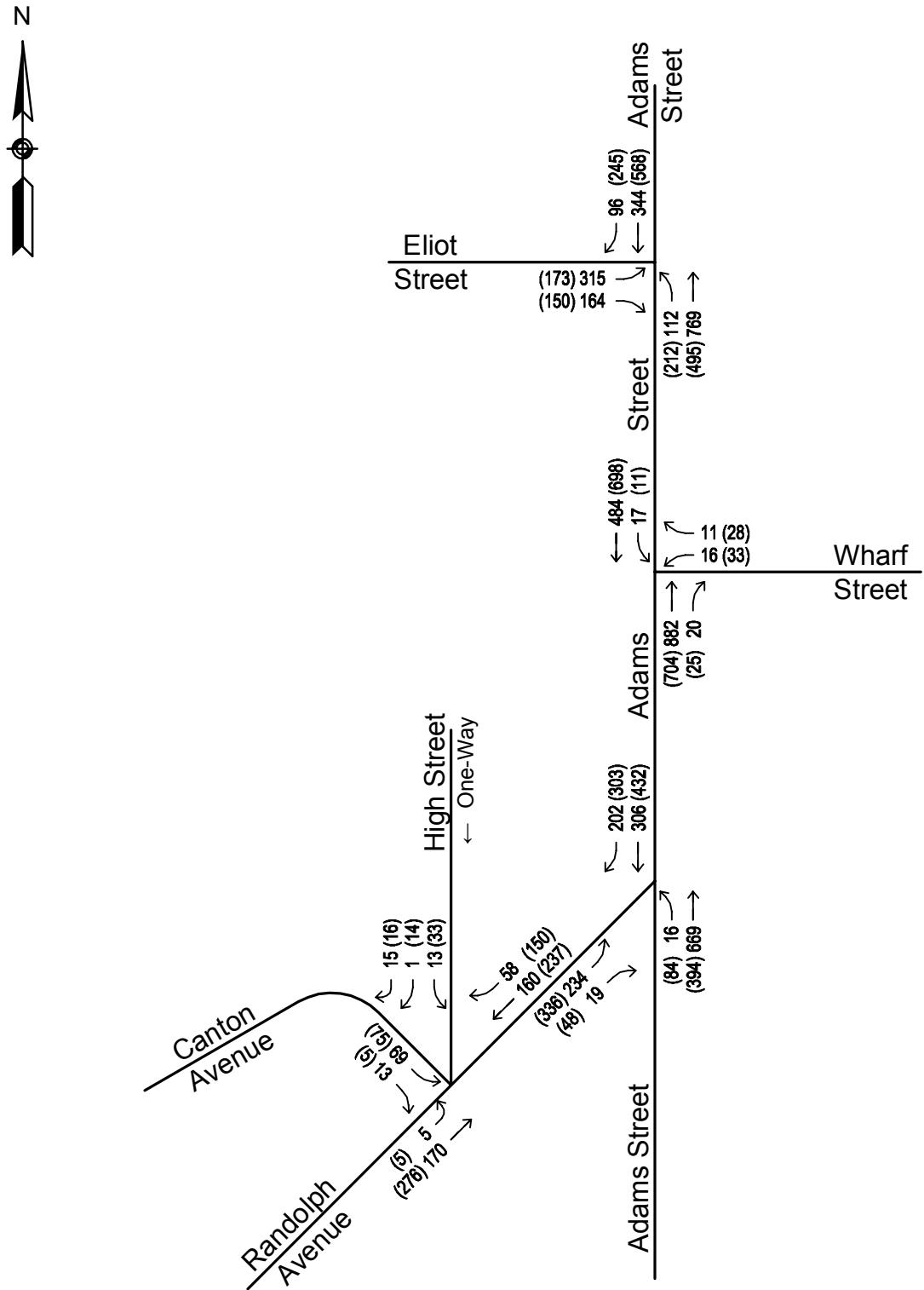
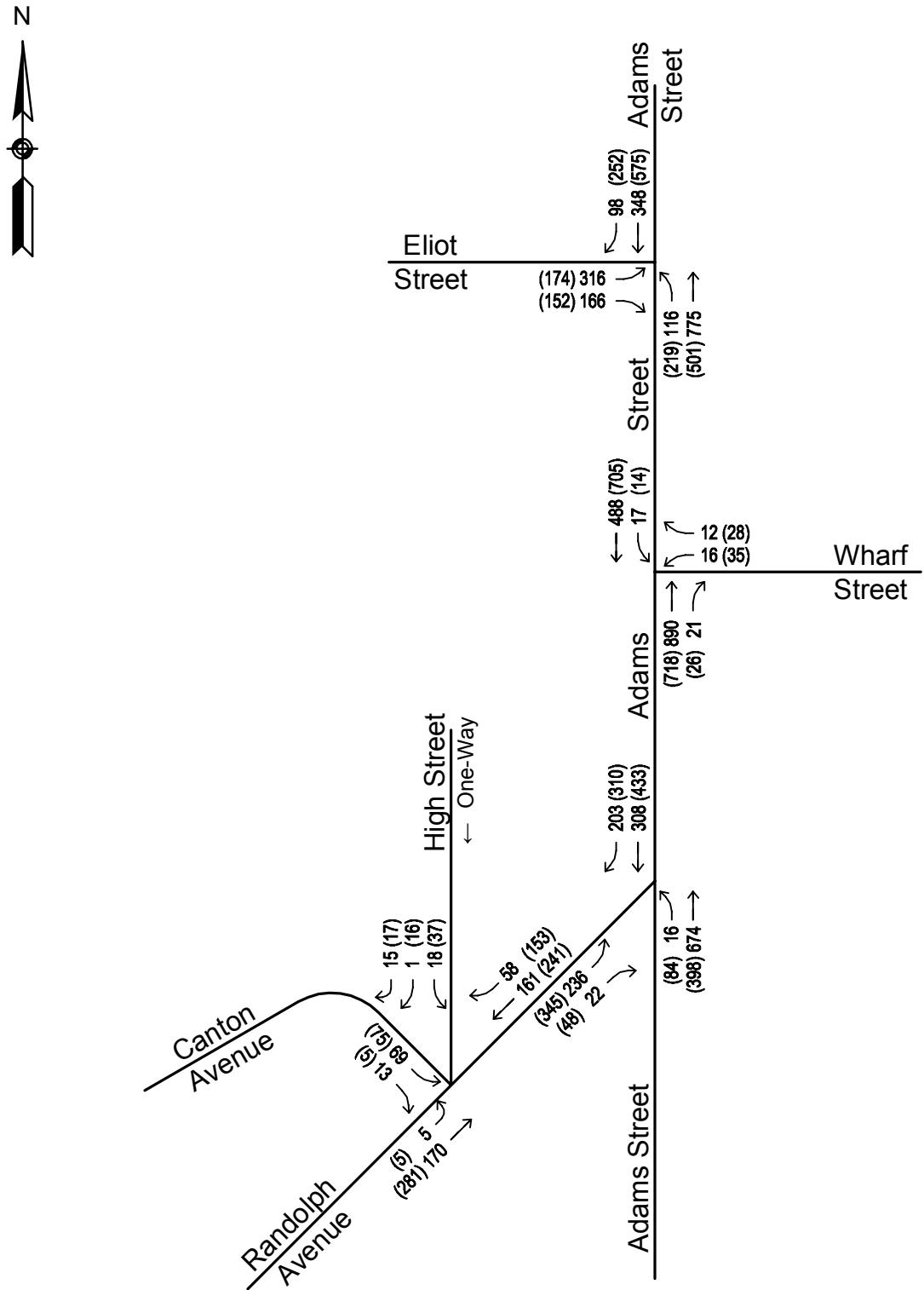


Figure 18
Build (2028) Traffic Volumes
with Added Site Trips -
Alternative 2A



4.4 BUILD CONDITION LEVEL OF SERVICE ANALYSIS RESULTS

Each Build condition alternative was analyzed for the study intersections using the future (2028) traffic volumes with added site trips under baseline geometry and traffic control. The criteria used for the analysis is the same as in the Base conditions.

The Build comparison results by overall intersection Level of Service (LOS) are shown in **Table 15** and **Table 16** and summaries of the changes between No-Build and Build alternatives are discussed in further detail in this section.

Table 15 – Level of Service Comparison: No-Build vs. Build – AM Peak Hour

Intersection	Overall Intersection Level of Service				
	No-Build	Alt. 1A	Alt. 1B	Alt. 2A	Alt. 2B
Adams St/Randolph Ave	B	B	C	B	B
Randolph Ave/Canton Ave/High St	C	C	C	C	C
Adams St/Wharf St*	D	D	E	D	D
Adams St/Eliot St	D	D	E	D	D

* Level of Service based on worst operating movement

Table 16 – Level of Service Comparison: No-Build vs. Build – PM Peak Hour

Intersection	Overall Intersection Level of Service				
	No-Build	Alt. 1A	Alt. 1B	Alt. 2A	Alt. 2B
Adams St/Randolph Ave	D	D	E	D	D
Randolph Ave/Canton Ave/High St	C	C	C	C	C
Adams St/Wharf St*	D	D	E	D	D
Adams St/Eliot St	C	C	C	C	C

* Level of Service based on worst operating movement

4.4.1 ALTERNATIVE 1A: EXISTING ZONING (MOST LIKELY)

A summary of the Build conditions analysis results for Alternative 1A are shown in **Table 17**.

Analysis results suggest that the intersections remain relatively unchanged from the No-Build conditions with the exception of the following:

Adams Street at Randolph Avenue

- Randolph Avenue degrades from LOS A to LOS B in the AM and PM peak hours.

Adams Street at Eliot Street

- Adams Street northbound left-turn degrades from LOS B to LOS C in the PM peak hour.
- Adams Street northbound degrades from LOS A to LOS B in the PM peak hour.
- Adams Street southbound degrades from LOS C to LOS D in the PM peak hour.
- Adams Street northbound left-turn queue exceeds capacity in the PM peak hour.

All remaining individual movements remain relatively unchanged from the No-Build conditions to the Build conditions for Alternative 1A.

4.4.2 ALTERNATIVE 1B: EXISTING ZONING (NOT LIKELY – OFF-SITE PARKING REQUIRED)

A summary of the Build conditions analysis results for Alternative 1B are shown in **Table 18**.

Analysis results suggest that the intersections remain relatively unchanged from the No-Build conditions with the exception of the following:

Adams Street at Randolph Avenue

- The overall intersection degrades from LOS B to LOS C in the AM peak hour and from LOS D to LOS E in the PM peak hour.
- Adams Street southbound degrades from LOS D to LOS E in the PM peak hour.
- Randolph Avenue degrades from LOS A to LOS B in both the AM and PM peak hours.
- Adams Street southbound volume to capacity is greater than 1.0 in the PM peak hour.

Adams Street at Wharf Street

- Wharf Street westbound degrades from LOS D to LOS E in both the AM and PM peak hours.

Adams Street at Eliot Street

- The overall intersection degrades from LOS D to LOS E in the AM peak.
- Adams Street northbound left-turn degrades from LOS B to LOS D in the PM peak hour.
- Adams Street northbound degrades from LOS E to LOS F in the AM peak hour and from LOS A to LOS B in the PM peak hour.
- Adams Street southbound degrades from LOS C to LOS D in the PM peak hour.
- Adams Street northbound left-turn queue exceeds capacity in the PM peak hour.

All remaining individual movements remain relatively unchanged from the No-Build conditions to the Build conditions for Alternative 1B.

4.4.3 ALTERNATIVE 2A: PROPOSED ZONING (MOST LIKELY)

A summary of the Build conditions analysis results for Alternative 2A are shown in **Table 19**.

Analysis results suggest that the intersections remain relatively unchanged from the No-Build conditions with the exception of the following:

Adams Street at Randolph Avenue

- Randolph Avenue degrades from LOS A to LOS B in both the AM and PM peak hours.

Adams Street at Eliot Street

- Adams Street northbound left-turn degrades from LOS B to LOS C in the PM peak hour.
- Adams Street southbound degrades from LOS C to LOS D in the PM peak hour.
- Adams Street northbound left-turn queue exceeds capacity in the PM peak hour.

All remaining individual movements remain relatively unchanged from the No-Build conditions to the Build conditions for Alternative 2A.

4.4.4 ALTERNATIVE 2B: PROPOSED ZONING (NOT LIKELY – OFF-SITE PARKING REQUIRED)

A summary of the Build conditions analysis results for Alternative 2B are shown in **Table 20**.

Analysis results suggest that the intersections remain relatively unchanged from the No-Build conditions with the exception of the following:

Adams Street at Randolph Avenue

- Randolph Avenue degrades from LOS A to LOS B in both the AM and PM peak hours.

Adams Street at Eliot Street

- Adams Street northbound left-turn degrades from LOS B to LOS C in the PM peak hour.
- Adams Street northbound degrades from LOS A to LOS B in the PM peak hour.
- Adams Street southbound degrades from LOS C to LOS D in the PM peak hour.
- Adams Street northbound left-turn queue exceeds capacity in the PM peak hour.

All remaining individual movements remain relatively unchanged from the No-Build conditions to the Build conditions for Alternative 2B.

Table 17 – Level of Service Summary – Build Conditions (2028) – Alternative 1A

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	14.8	0.05	6'	25'	F	>300	1.62	110'	#191'
Adams Street NB TH	C	28.4	0.75	395	#840	C	26.4	0.47	225	356
Adams Street SB TH/R	B	13.8	0.60	143	#246	D	45.0	0.98	633	#970
Randolph Avenue EB L	B	10.8	0.46	45	m59	B	10.2	0.52	56	434
Overall	B	19.9				D	49.7			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	E	60.0	0.75	145'	#290'	D	54.1	0.72	240'	#527'
High Street SB	E	56.6	0.02	22	57	E	63.2	0.04	52	105
Canton Avenue EB	D	52.9	0.06	74	145	E	60.3	0.05	75	143
Randolph Avenue WB L	A	3.6	0.18	6	21	A	3.7	0.30	11	m18
Randolph Avenue WB TH	A	3.4	0.08	2	m9	A	3.7	0.23	6	m12
Overall	C	34.7				C	31.1			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	12.5	0.04	-	3'	A	9.7	0.01	-	1'
Wharf Street WB	D	31.2	0.17	-	15	D	30.6	0.37	-	41
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	15.3	0.34	38'	m84'	C	22.7	0.56	23'	#196'
Adams Street NB TH	E	65.5	1.05	261	#1019	B	10.1	0.48	52	344
Adams Street SB TH	C	30.1	0.50	180	341	D	36.3	0.74	349	#822
Adams Street SB R	C	23.0	0.07	0	39	C	23.4	0.23	32	130
Eliot Street EB L	E	55.5	0.83	252	#477	E	65.3	0.74	167	236
Eliot Street EB R	C	33.1	0.34	60	139	D	38.2	0.23	38	93
Overall	D	48.8				C	29.3			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

Table 18 – Level of Service Summary – Build Conditions (2028) – Alternative 1B

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	16.1	0.06	6'	25'	F	>300	1.65	109'	#189'
Adams Street NB TH	C	34.4	0.83	457	#912	C	27.8	0.49	234	370
Adams Street SB TH/R	B	14.8	0.62	148	#243	E	71.9	1.08	723	#1079
Randolph Avenue EB L	B	11.6	0.50	54	318	B	11.6	0.55	70	449
Overall	C	23.2				E	62.5			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	E	55.9	0.73	159'	#329'	D	55.0	0.74	249'	#547'
High Street SB	E	56.6	0.02	30	75	E	62.2	0.06	106	208
Canton Avenue EB	D	52.9	0.06	90	178	E	60.3	0.05	79	159
Randolph Avenue WB L	A	4.0	0.19	8	23	A	3.8	0.32	12	m17
Randolph Avenue WB TH	A	3.9	0.08	3	m10	A	3.8	0.24	7	m11
Overall	C	34.7				C	32.3			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	13.5	0.04	-	3'	A	9.9	0.01	-	1'
Wharf Street WB	E	38.2	0.21	-	19	E	37.2	0.43	-	50
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	15.4	0.41	46'	m92'	D	38.3	0.65	64'	#339'
Adams Street NB TH	F	84.3	1.10	281	#1079	B	10.3	0.51	54	363
Adams Street SB TH	C	31.1	0.51	183	339	D	45.8	0.84	410	#889
Adams Street SB R	C	23.7	0.07	0	40	C	26.6	0.27	43	148
Eliot Street EB L	D	54.2	0.82	255	#496	E	65.2	0.74	168	236
Eliot Street EB R	C	32.5	0.35	63	149	C	34.9	0.22	37	96
Overall	E	56.7				C	34.2			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

Table 19 – Level of Service Summary – Build Conditions (2028) – Alternative 2A

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	14.5	0.05	6'	25'	F	>300	1.62	110'	#191'
Adams Street NB TH	C	27.1	0.73	376	#817	C	26.7	0.48	233	369
Adams Street SB TH/R	B	13.8	0.61	145	#256	D	42.0	0.97	618	#949
Randolph Avenue EB L	B	11.0	0.46	44	m58	B	10.0	0.51	55	427
Overall	B	19.3				D	48.2			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	E	60.4	0.74	140'	#274'	D	54.1	0.72	240'	#527'
High Street SB	E	56.6	0.02	23	58	E	63.2	0.04	49	98
Canton Avenue EB	D	52.8	0.05	72	132	E	60.3	0.05	71	129
Randolph Avenue WB L	A	3.6	0.18	6	21	A	3.7	0.30	11	m18
Randolph Avenue WB TH	A	3.4	0.08	2	m9	A	3.7	0.22	6	m12
Overall	C	34.3				C	31.3			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	12.3	0.04	-	3'	A	9.7	0.02	-	1'
Wharf Street WB	D	30.2	0.19	-	17	D	31.4	0.41	-	47
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	15.2	0.32	37'	m83'	C	22.8	0.55	23'	#238'
Adams Street NB TH	E	66.8	1.05	263	#1030	A	9.9	0.48	53	334
Adams Street SB TH	C	29.4	0.49	175	337	D	35.9	0.74	348	#825
Adams Street SB R	C	22.6	0.06	0	39	C	23.2	0.23	33	130
Eliot Street EB L	E	56.1	0.83	249	#477	E	65.5	0.74	165	234
Eliot Street EB R	C	33.4	0.33	58	134	D	38.5	0.23	38	93
Overall	D	49.6				C	29.2			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

Table 20 – Level of Service Summary – Build Conditions (2028) – Alternative 2B

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	14.5	0.05	6'	25'	F	>300	1.62	110'	#191'
Adams Street NB TH	C	27.4	0.74	381	#827	C	26.9	0.48	237	373
Adams Street SB TH/R	B	13.9	0.61	146	#261	D	44.4	0.98	632	#963
Randolph Avenue EB L	B	11.5	0.46	47	m62	B	10.4	0.53	58	436
Overall	B	19.5				D	49.1			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	E	60.4	0.74	140'	#274'	D	54.5	0.73	245'	#538'
High Street SB	E	56.7	0.02	32	75	E	63.2	0.04	50	101
Canton Avenue EB	D	52.8	0.05	70	137	E	60.3	0.05	66	121
Randolph Avenue WB L	A	3.6	0.18	6	21	A	3.7	0.30	11	m18
Randolph Avenue WB TH	A	3.4	0.08	2	m9	A	3.7	0.23	6	m12
Overall	C	34.5				C	31.6			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	12.4	0.04	-	3'	A	9.8	0.02	-	2'
Wharf Street WB	D	30.7	0.20	-	18	D	34.7	0.45	-	54
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	15.3	0.34	38'	m84'	C	26.7	0.58	28'	#222'
Adams Street NB TH	E	69.7	1.06	266	#1036	B	10.0	0.48	54	341
Adams Street SB TH	C	29.7	0.50	178	341	D	37.7	0.76	362	#842
Adams Street SB R	C	22.7	0.06	0	39	C	24.0	0.24	35	136
Eliot Street EB L	E	55.8	0.83	250	#479	E	65.3	0.74	167	236
Eliot Street EB R	C	33.3	0.33	58	137	D	37.7	0.23	39	96
Overall	D	50.8				C	30.3			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

5.0 MITIGATION STRATEGIES

Mitigation strategies were developed to reduce impacts from development alternatives on the study intersections. Mitigation first evaluated optimization of signal timing, phasing and coordination to reduce the need of any geometric changes. The exclusive pedestrian phase at the intersection of Eliot Street and Adams Street has significantly longer clearance times to serve the Eliot Street crosswalk than those to cross Adams Street. One of the proposed mitigation strategies is to convert the Eliot Street crossing from an exclusive pedestrian phase into separate concurrent phases, providing a two-stage crossing. This would reduce the required pedestrian clearance time and allocate the extra time back to the vehicular phases at the intersection. The remaining crosswalks across both Adams Street legs of the intersection would continue to operate as exclusive pedestrian phases. As part of this strategy, the small median island would need reconstructing to provide a larger pedestrian refuge area, where pedestrians could wait between the two-stage crossings.

Since optimization of signal timing, phasing and coordination alone do not result in a sufficient improvement to intersection operations, other mitigation strategies were evaluated, including geometric improvements. These geometric improvements focused on smaller modifications to intersections that would provide a significant benefit to operations. Larger scale improvements, such as widening to add travel lanes were not considered as part of the mitigation.

When examining the deficiencies in the capacity analysis results for the Build-Out alternatives, the intersection of Adams Street at Randolph Avenue, Canton Avenue and High Street experiences significant delays and capacity issues. The Adams Street southbound approach to Randolph Avenue shows a relatively even split of traffic between through vehicles on Adams Street and right-turning vehicles destined for Randolph Avenue and Canton Avenue. A second mitigation strategy (in addition to the Eliot Street pedestrian phasing alteration) was analyzed for the addition of a short (approximately 50 feet) right-turn lane southbound. This would require the removal of three parking spaces; however, it would provide much needed benefits for intersection operations. When examining the utilization of these three spaces in question, (A14-A16) the overall occupancy for the 11 hours surveyed was only 58%. This occupancy is skewed partially as four of the 14 vehicles parked significantly longer than the one-hour time restriction posted, some for over four hours. Provided this data and the added benefit a right-turn lane would have on the intersection, this second mitigation strategy was included in the analysis.

Capacity analyses for the study intersections were conducted for each Build-Out alternative using the same criteria for the analysis as in the Base conditions. The mitigation strategies focused on the Eliot Street pedestrian phasing modification and the added southbound right-turn lane at the Randolph Avenue intersection. A summary of the mitigation strategy capacity analysis results for each alternative are discussed in detail below and complete level of service analyses results have been included in the Appendix.

The mitigation strategies comparison results by overall intersection Level of Service (LOS) are shown in **Table 21** and **Table 22** and summaries of the changes between the Build and the Build with Mitigation are discussed in further detail in this section.

Table 21 – Level of Service Comparison: Build vs. Build with Mitigation – AM Peak Hour

Intersection	Overall Intersection Level of Service								
	No-Build	Build (2028)				Build (2028) with Mitigation			
		Alt. 1A	Alt. 1B	Alt. 2A	Alt. 2B	Alt. 1A	Alt. 1B	Alt. 2A	Alt. 2B
Adams St/Randolph Ave	B	B	C	B	B	B	C	B	B
Randolph Ave/Canton Ave/High St	C	C	C	C	C	D	D	C	C
Adams St/Wharf St*	D	D	E	D	D	D	E	D	D
Adams St/Eliot St	D	D	E	D	D	D	D	D	D

* Level of Service based on worst operating movement

Table 22 – Level of Service Comparison: Build vs. Build with Mitigation – PM Peak Hour

Intersection	Overall Intersection Level of Service								
	No-Build	Build (2028)				Build (2028) with Mitigation			
		Alt. 1A	Alt. 1B	Alt. 2A	Alt. 2B	Alt. 1A	Alt. 1B	Alt. 2A	Alt. 2B
Adams St/Randolph Ave	D	D	E	D	D	B	C	B	C
Randolph Ave/Canton Ave/High St	C	C	C	C	C	C	C	C	C
Adams St/Wharf St*	D	D	E	D	D	D	E	D	D
Adams St/Eliot St	C	C	C	C	C	C	D	C	C

* Level of Service based on worst operating movement

5.1.1 ALTERNATIVE 1A: EXISTING ZONING (MOST LIKELY)

A summary of the Build conditions with mitigation analysis results for Alternative 1A are shown in **Table 23**.

Analysis results suggest that the improvements are seen from the Build conditions and include the following:

Adams Street at Randolph Avenue

- The overall intersection improves from LOS D to LOS B in the PM peak hour.
- Adams Street northbound left-turn improves from LOS F to LOS C in the PM peak hour.
- Adams Street southbound improves from LOS D with a single travel lane to LOS C (through) and LOS B (right-turn) in the PM peak hour.
- Randolph Avenue improves from LOS B to LOS A in the PM peak hour.
- Adams Street southbound queues significantly reduce with the addition of the right-turn lane.

Adams Street at Canton Avenue and High Street

- The overall intersection delay increases by one second, causing the intersection to degrade from LOS C to LOS D in the AM peak hour.
- High Street improves from LOS E to LOS D in the PM peak hour.
- Canton Avenue improves from LOS E to LOS D in the PM peak hour.

Adams Street at Eliot Street

- Adams Street northbound improves from LOS E to LOS D in the AM peak hour.
- Adams Street southbound improves from LOS D to LOS C in the PM peak hour.
- Eliot Street left-turn improves from LOS E to LOS D in both the AM and PM peak hours.
- Eliot Street right-turn improves from LOS D to LOS C in the PM peak hour.

All remaining individual movements remain relatively unchanged from the Build conditions to the Build conditions with mitigation for Alternative 1A.

5.1.2 ALTERNATIVE 1B: EXISTING ZONING (NOT LIKELY – OFF-SITE PARKING REQUIRED)

A summary of the Build conditions with mitigation analysis results for Alternative 1B are shown in **Table 24**.

Analysis results suggest that the improvements are seen from the Build conditions and include the following:

Adams Street at Randolph Avenue

- The overall intersection improves from LOS E to LOS C in the PM peak hour.
- Adams Street northbound left-turn improves from LOS F to LOS C in the PM peak hour.
- Adams Street northbound increases by one second, causing the intersection to degrade from LOS C to LOS D in the AM peak hour.
- Adams Street southbound improves from LOS E with a single travel lane to LOS C (through) and LOS C (right-turn) in the PM peak hour.

- Randolph Avenue improves from LOS B to LOS A in the PM peak hour.
- Adams Street southbound queues significantly reduce with the addition of the right-turn lane.

Adams Street at Canton Avenue and High Street

- The overall intersection delay increases by two seconds, causing the intersection to degrade from LOS C to LOS D in the AM peak hour.
- High Street improves from LOS E to LOS D in both the AM and PM peak hours.
- Canton Avenue improves from LOS E to LOS D in the PM peak hour.

Adams Street at Eliot Street

- The overall intersection improves from LOS E to LOS D in the AM peak hour and degrades from LOS C to LOS D in the PM peak hour.
- The overall intersection delay increases by two seconds, causing the intersection to degrade from LOS C to LOS D in the PM peak hour.
- Adams Street northbound improves from LOS F to LOS D in the AM peak hour.
- Eliot Street left-turn degrades from LOS D to LOS E in the AM peak hour and improves from LOS E to LOS D in the PM peak hour.

All remaining individual movements remain relatively unchanged from the Build conditions to the Build conditions with mitigation for Alternative 1B.

5.1.3 ALTERNATIVE 2A: PROPOSED ZONING (MOST LIKELY)

A summary of the Build conditions with mitigation analysis results for Alternative 2A are shown in **Table 25**.

Analysis results suggest that the improvements are seen from the Build conditions and include the following:

Adams Street at Randolph Avenue

- The overall intersection improves from LOS D to LOS B in the PM peak hour.
- Adams Street northbound left-turn improves from LOS F to LOS C in the PM peak hour.
- Adams Street southbound improves from LOS D with a single travel lane to LOS C (through) and LOS B (right-turn) in the PM peak hour.
- Randolph Avenue improves from LOS B to LOS A in the PM peak hour.
- Adams Street southbound queues significantly reduce with the addition of the right-turn lane.

Adams Street at Canton Avenue and High Street

- Randolph Avenue eastbound improves from LOS D to LOS E in the AM peak hour.
- High Street improves from LOS E to LOS D in both the AM and PM peak hours.
- Canton Avenue improves from LOS E to LOS D in the PM peak hour.

Adams Street at Eliot Street

- Adams Street northbound improves from LOS D to LOS E in the AM peak hour.
- Adams Street northbound increases by three seconds, causing the intersection to degrade from LOS A to LOS B in the PM peak hour.
- Adams Street southbound improves from LOS D to LOS C in the PM peak hour.
- Eliot Street left-turn improves from LOS E to LOS D in the PM peak hour.
- Eliot Street right-turn improves from LOS D to LOS C in the PM peak hour.

All remaining individual movements remain relatively unchanged from the Build conditions to the Build conditions with mitigation for Alternative 2A.

5.1.4 ALTERNATIVE 2B: PROPOSED ZONING (NOT LIKELY – OFF-SITE PARKING REQUIRED)

A summary of the Build conditions with mitigation analysis results for Alternative 2B are shown in **Table 26**.

Analysis results suggest that the improvements are seen from the Build conditions and include the following:

Adams Street at Randolph Avenue

- The overall intersection improves from LOS D to LOS C in the PM peak hour.
- Adams Street northbound left-turn improves from LOS F to LOS C in the PM peak hour.
- Adams Street southbound improves from LOS D with a single travel lane to LOS C (through) and LOS C (right-turn) in the PM peak hour.
- Randolph Avenue improves from LOS B to LOS A in the PM peak hour.
- Adams Street southbound queues significantly reduce with the addition of the right-turn lane.

Adams Street at Canton Avenue and High Street

- High Street improves from LOS E to LOS D in both the AM and PM peak hours.
- Canton Avenue improves from LOS E to LOS D in the PM peak hour.
- Randolph Avenue westbound degrades from LOS A to LOS B in both the AM and PM peak hours.

Adams Street at Eliot Street

- Adams Street northbound improves from LOS E to LOS D in the AM peak hour.
- Eliot Street left-turn improves from LOS E to LOS D in the PM peak hour.

All remaining individual movements remain relatively unchanged from the Build conditions to the Build conditions with mitigation for Alternative 2B.

Table 23 – Level of Service Summary – Build Conditions (2028) with Mitigation – Alternative 1A

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	14.8	0.03	6'	26'	C	25.6	0.35	40'	114'
Adams Street NB TH	C	29.2	0.76	395	#878	C	26.0	0.50	199	396
Adams Street SB TH	B	11.3	0.36	91	154	C	22.4	0.60	93	#492
Adams Street SB R	A	7.2	0.22	6	55	B	19.4	0.42	15	136
Randolph Avenue EB L	B	10.6	0.46	45	m59	A	8.2	0.52	46	m365
Overall	B	18.8				B	19.2			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	E	60.0	0.75	145'	#290'	D	51.4	0.77	208'	#407'
High Street SB	E	56.6	0.02	20	52	D	53.1	0.04	47	98
Canton Avenue EB	D	52.9	0.06	79	146	D	51.4	0.05	62	121
Randolph Avenue WB L	A	6.4	0.18	25	43	A	7.5	0.32	27	50
Randolph Avenue WB TH	A	5.8	0.08	9	20	A	7.3	0.24	17	35
Overall	D	35.8				C	30.3			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	12.5	0.04	-	3'	A	9.7	0.01	-	1'
Wharf Street WB	D	31.5	0.18	-	15	D	29.5	0.36	-	39
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	12.0	0.31	36'	m47'	C	28.3	0.61	48'	#216'
Adams Street NB TH	D	48.7	1.00	248	#900	B	13.1	0.50	193	338
Adams Street SB TH	C	29.0	0.49	182	313	C	33.9	0.76	306	#752
Adams Street SB R	C	22.3	0.07	0	36	C	20.7	0.22	20	101
Eliot Street EB L	D	52.7	0.80	250	#496	D	53.0	0.69	139	203
Eliot Street EB R	C	31.2	0.31	57	131	C	32.3	0.18	18	62
Overall	D	40.4				C	27.9			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

Table 24 – Level of Service Summary – Build Conditions (2028) with Mitigation – Alternative 1B

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	15.7	0.04	6'	28'	C	31.2	0.44	42'	#134'
Adams Street NB TH	D	35.3	0.85	429	#1011	C	28.5	0.54	209	409
Adams Street SB TH	B	15.2	0.37	90	197	C	27.4	0.68	118	m#498
Adams Street SB R	B	12.5	0.23	6	87	C	24.3	0.48	29	m151
Randolph Avenue EB L	B	10.8	0.51	52	64	A	9.0	0.53	57	386
Overall	C	23.3				C	22.4			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	E	58.9	0.77	155'	#263'	D	49.4	0.75	213'	#422'
High Street SB	D	54.1	0.02	30	61	D	52.1	0.06	81	151
Canton Avenue EB	D	50.4	0.06	90	170	D	51.5	0.05	64	114
Randolph Avenue WB L	A	8.1	0.20	25	54	A	8.5	0.36	31	53
Randolph Avenue WB TH	A	7.6	0.09	9	24	A	8.1	0.27	20	37
Overall	D	36.8				C	30.7			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	13.5	0.04	-	3'	A	9.9	0.01	-	1'
Wharf Street WB	E	39.5	0.22	-	20	E	35.5	0.42	-	47
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	13.2	0.36	42'	m86'	D	43.9	0.65	137'	#375'
Adams Street NB TH	D	54.9	1.03	253	#987	B	13.5	0.52	205	313
Adams Street SB TH	C	27.2	0.48	172	329	D	54.8	0.93	387	#734
Adams Street SB R	C	21.0	0.07	0	40	C	25.3	0.24	22	93
Eliot Street EB L	E	63.1	0.89	250	#432	D	53.3	0.70	140	205
Eliot Street EB R	C	31.7	0.34	56	122	C	27.6	0.18	22	76
Overall	D	44.5				D	36.6			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

Table 25 – Level of Service Summary – Build Conditions (2028) with Mitigation – Alternative 2A

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	14.6	0.04	5'	28'	C	25.5	0.35	40'	114'
Adams Street NB TH	C	28.4	0.76	360	#919	C	26.3	0.52	205	407
Adams Street SB TH	B	14.2	0.37	90	200	C	22.4	0.60	94	#488
Adams Street SB R	B	11.7	0.23	8	88	B	19.4	0.41	15	134
Randolph Avenue EB L	B	10.1	0.45	42	51	A	8.1	0.51	46	m358
Overall	B	19.6				B	19.3			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	D	54.9	0.71	135'	212'	D	51.4	0.77	208'	#407'
High Street SB	D	54.1	0.02	24	58	D	53.1	0.04	46	99
Canton Avenue EB	D	51.5	0.05	64	120	D	51.4	0.05	63	116
Randolph Avenue WB L	A	7.3	0.19	23	50	A	7.5	0.32	27	50
Randolph Avenue WB TH	A	6.8	0.08	8	23	A	7.2	0.24	17	34
Overall	C	33.6				C	30.5			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	12.4	0.04	-	3'	A	9.7	0.02	-	1'
Wharf Street WB	D	30.7	0.20	-	18	D	30.2	0.40	-	45
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	12.9	0.29	33'	m73'	C	28.3	0.61	47'	#207'
Adams Street NB TH	D	47.3	0.98	232	#915	B	12.9	0.49	187	335
Adams Street SB TH	C	26.9	0.47	168	322	C	33.7	0.76	305	#755
Adams Street SB R	C	20.7	0.06	0	38	C	20.6	0.22	20	103
Eliot Street EB L	E	61.2	0.87	241	#438	D	52.7	0.69	138	202
Eliot Street EB R	C	31.5	0.31	51	113	C	32.4	0.18	18	61
Overall	D	41.1				C	27.8			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

Table 26 – Level of Service Summary – Build Conditions (2028) with Mitigation – Alternative 2B

INTERSECTION	AM Peak Hour					PM Peak Hour				
	LOS	Delay*	v/c	50th % Queue	95th % Queue	LOS	Delay*	v/c	50th % Queue	95th % Queue
Adams Street at Randolph Avenue (Signalized)										
Adams Street NB L	B	14.4	0.04	5'	26'	C	26.4	0.36	40'	115'
Adams Street NB TH	C	28.3	0.76	374	#877	C	27.0	0.53	210	414
Adams Street SB TH	B	12.1	0.37	85	170	C	23.4	0.61	98	#491
Adams Street SB R	A	8.9	0.22	4	65	C	29.9	0.22	0	m87
Randolph Avenue EB L	B	11.1	0.46	44	m58	A	8.2	0.51	47	m369
Overall	B	18.8				C	21.8			
Randolph Avenue at Canton Avenue and High Street (Signalized)										
Randolph Avenue NE	E	55.9	0.72	134'	#258'	D	50.1	0.76	211'	#416'
High Street SB	D	54.2	0.02	28	63	D	53.2	0.04	56	113
Canton Avenue EB	D	51.5	0.05	71	129	D	51.4	0.05	68	125
Randolph Avenue WB L	A	7.1	0.19	24	50	B	15.0	0.33	46	145
Randolph Avenue WB TH	A	6.7	0.08	9	22	B	14.6	0.25	29	94
Overall	C	34.1				C	33.7			
Adams Street at Wharf Street (Unsignalized)										
Adams Street SB L	B	12.5	0.04	-	3'	A	9.8	0.02	-	2'
Wharf Street WB	D	31.4	0.20	-	18	D	33.1	0.44	-	51
Adams Street at Eliot Street (Signalized)										
Adams Street NB L	B	13.8	0.30	36'	m89'	C	32.5	0.62	61'	#214'
Adams Street NB TH	D	45.4	0.99	261	#958	B	13.0	0.50	189	332
Adams Street SB TH	C	26.8	0.48	167	335	D	36.8	0.80	324	#757
Adams Street SB R	C	20.5	0.06	0	39	C	21.7	0.23	21	103
Eliot Street EB L	E	63.2	0.88	245	#415	D	53.0	0.69	139	203
Eliot Street EB R	C	31.7	0.31	51	110	C	31.3	0.19	19	65
Overall	D	40.6				C	29.3			

* Delay is expressed in seconds per vehicle

– 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after 2 cycles.

m – Queue is metered by upstream signal.

6.0 CONCLUSIONS

Upon completion of the Milton Village Mixed-Use Development traffic, conclusions were formulated and are as follows:

Trip Generation and Mode Split

Trip Generation calculations result in a total of 209 trips for Alternative 1A; 541 trips for Alternative 1B; 207 trips for Alternative 2A; and 271 trips for Alternative 2B. These total trips listed account for a pass-by rate for retail use of 34% and a mode split of 85% vehicular traffic, 8% transit (including bus and trolley car), 2% pedestrian/bicycle traffic, with an additional 5% of trips that are work from home.

Intersection Capacity Analysis of Development Alternatives and Mitigation Strategies

The analysis results depict the overall impacts of traffic growth and added trips on the study intersections. Traffic growth alone, over a ten year horizon, will degrade the intersections in general, while the added trips from the build-out alternatives will further degrade overall intersection delays, as well as individual movements at the study intersections. Alternative 1B showed the most significant impact, with three of the four study intersections degrading in overall intersection level of service. In each of the remaining three alternatives, the overall intersection level of service remains unchanged from the No-Build to the Build conditions. It is noted that even though the overall intersection level of service remained unchanged, individual movements will degrade in level of service, increase in queue lengths and in some cases, result in movements exceeding the capacity.

When mitigation strategies are implemented, significant improvements are seen throughout all four alternatives during both peak hours. The mitigation strategies focused on:

- Improvements to the pedestrian phase at the intersection of Adams Street at Eliot Street.
- The addition of a southbound right-turn lane at the Adams Street at Randolph Avenue intersection.

While some of these improvements show a more significant impact than others, many of these improvements result in study intersections operating at acceptable levels of service. In addition, queues for the movements are also improved, with some queues showing a significant reduction. All four alternatives would operate with overall intersection level of service of LOS D or better after implementation of the mitigation strategies, with the only exception of Adams Street at Wharf Street intersection, which would operate at LOS E under Alternative 1B.

Existing Parking Survey

The parking survey conducted for Milton Village examined a total of 102 on-street parking spaces along Adams Street (Eliot to Randolph Avenue), Eliot Street (Adams Street to #36 Eliot Street), High Street and Wharf Street. The survey included only Town of Milton public parking spaces and excluded service zone parking and the Massachusetts Bay Transit Authority (MBTA) lot. Existing parking supply and demand within Milton Village was inventoried and analyzed for occupancy, duration and turnover for a 11-hour period on a weekday. In the Milton Village study area parking spaces throughout the day are approximately 66% occupied, with the midday peak period experiencing the highest levels of occupancy. Parking duration throughout the day is generally less than the one and two hour limits, with the exception of High Street which experiences higher than allowed durations. Parking turnover results show that parking spaces are utilized on average by approximately five vehicles over 11 hours.

In summary, the existing on-street parking provided throughout Milton Village is underutilized and can service more vehicles than it currently does.

Off-site parking is needed for Alternative 1B and Alternative 2B. In Alternative 1B, 500 off-site parking spaces are needed and in Alternative 2B, 25 off-site parking spaces are needed. Given the results of the parking survey, the existing average occupancy of 66% shows that there are approximately 35 available parking spaces that can be utilized. This would satisfy the parking demand under Alternative 2B; however, the 500 needed spaces under Alternative 1B could not be served by Milton Village alone. With only the 102 existing parking spaces within Milton Village a parking garage appears to be the best alternative to meet the projected parking demand. Furthermore, this would need to be incorporated into the planned redevelopment of parcels in the future build-out of Alternative 1B.

A key factor to consider in the needed parking for the Build-out alternatives is the land uses that will utilize this needed parking. For instance, with parking for proposed office buildings, the parking duration that vehicles need could be much longer than the maximum two-hour parking restrictions that currently exist in Milton Village. The same could be said for the residential parking spaces needed. Residential parking may require all-day parking on weekends and overnight. While Milton Village does not have posted time-of-day restrictions for all spaces, most of these spaces are not posted for any type of all day (weekend) or overnight parking. These factors should be considered based on the land uses proposed within Milton Village which may require additional modifications to existing parking. While Milton Village does have available short-term on-street parking capacity, the required duration of needed off-site parking spaces should be taken into consideration.