

TRANSPORTATION IMPACT ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT
172 WOBURN STREET
READING, MASSACHUSETTS

Prepared for:

READING EQUITABLE HOUSING LLC
Acton, Massachusetts

September 2016

Prepared by:

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Dear Reviewer:

This letter shall certify that this *Transportation Impact Assessment* has been prepared under my direct supervision and responsible charge. I am a Registered Professional Engineer (P.E.) in the Commonwealth of Massachusetts (Massachusetts P.E. No. 38871, Civil) and hold Certification as a Professional Traffic Operations Engineer (PTOE) from the Transportation Professional Certification Board, Inc. of the Institute of Transportation Engineers (ITE) (PTOE Certificate No. 993). I am also a Fellow of the Institute of Transportation Engineers (FITE).

Sincerely,

VANASSE & ASSOCIATES, INC.

A handwritten signature in black ink that reads 'Jeffrey S. Dirk'. The signature is written in a cursive style with a large, prominent 'J'.

Jeffrey S. Dirk, P.E., PTOE, FITE
Principal

EXECUTIVE SUMMARY

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in order to determine the potential impacts on the transportation infrastructure associated with the proposed renovation of the former school building located at 172 Woburn Street in Reading, Massachusetts, to accommodate a 20-unit residential apartment community (hereafter referred to as the “Project”). This assessment was prepared in consultation with the Town of Reading and the Massachusetts Department of Transportation (MassDOT); was performed in accordance with MassDOT’s *Transportation Impact Assessment (TIA) Guidelines*; and was conducted pursuant to the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports. Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the Institute of Transportation Engineers (ITE)¹ and without reduction to account for public transportation utilization, the Project is predicted to generate approximately 134 vehicle trips on an average weekday (two-way, 24-hour volume), with 10 vehicle trips expected during the weekday morning peak-hour and 12 vehicle trips expected during the weekday evening peak-hour;
2. The Project will not have a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions);
3. No apparent safety deficiencies were noted with respect to the motor vehicle crash history at the study intersections; and
4. Lines of sight to and from the Project site driveway intersections with Woburn Street were found to exceed the required minimum distance for the intersections to function in a safe manner based on the appropriate approach speed along Woburn Street.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations that follow.

¹*Trip Generation*, 9th Edition; Institute of Transportation Engineers; Washington, DC; 2012.

RECOMMENDATIONS

A detailed transportation improvement program has been developed that is designed to provide safe and efficient access to the Project site and address any deficiencies identified at off-site locations evaluated in conjunction with this study. The following improvements have been recommended as a part of this evaluation and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

Project Access

Access to the Project site will continue to be provided by way of the existing driveways that intersect the south side of Woburn Street parallel to the east and west property lines, respectively. Both driveways will continue to be shared with St. Agnes Church, with the east Project site driveway reconfigured to serve as the entrance drive and the west Project site driveway reconfigured to serve as the exit drive, mirroring traffic circulation within the St. Agnes Church site which has an entrance driveway to the west of the church building and an exit driveway to the east. The following recommendations are offered with respect to the design and operation of the Project site driveways:

- The Project site driveways should be a minimum of 16-feet in width and will convey one-way traffic in a clockwise direction around the apartment building. Both driveways should include appropriate signs (“One-Way”, “Do Not Enter”, etc.) and pavement markings at Woburn Street and within the Project site to reinforce the one-way operation of the driveways and the circulation pattern within the site.
- Vehicles exiting the Project site should be placed under STOP-sign control with a marked STOP-line provided. It is recommended that a STOP-sign and STOP-line be installed on the exit drive from the Project site prior to the merge with the exit drive from St. Agnes Church, with an additional STOP-sign and STOP-line installed on the combined exit driveway in advance of the sidewalk along Woburn Street.
- All signs and pavement markings to be installed within the Project site shall conform to the applicable standards of the *Manual on Uniform Traffic Control Devices (MUTCD)*.²
- Signs and landscaping to be installed along the Project site driveways, internal to the Project site and at the Project site driveway intersections with Woburn Street should be designed and maintained so as not to restrict lines of sight.
- Snow windrows along the Project site frontage on Woburn Street within the sight triangle areas of the Project site driveways shall be promptly removed where such accumulations would exceed 2.5 feet in height.
- On-street parking should be prohibited for a minimum distance of 20-feet on either side of the Project site driveways in order to maintain the required lines of sight for the driveways to operate in a safe manner.

²*Manual on Uniform Traffic Control Devices (MUTCD)*; Federal Highway Administration; Washington, D.C.; 2009.

Transportation Demand Management

The Project site is situated approximately 0.3 miles east and within an approximate 6-minute walking distance of the Reading Commuter Rail Station. This proximity offers a convenient transportation alternative for residents of the Project over the use of single-occupancy vehicles (SOV's). In an effort to encourage use of alternative modes of transportation, the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- Information regarding public transportation services, maps, schedules and fare information will be posted in a central location;
- A “welcome packet” will be provided to new residents of the Project detailing available public transportation services, bicycle and walking alternatives, and commuter options available through MassRIDES’ and their NuRide program which rewards individuals that choose to walk, bicycle, carpool, vanpool or that use public transportation to travel to and from work;
- Residents will be made aware of the Emergency Ride Home (ERH) program available through MassRIDES, which reimburses employees of a participating MassRIDES employer partner worksite that is registered for ERH and that carpool, take transit, bicycle, walk or vanpool to work;
- Pedestrian accommodations will be incorporated within the Project site consisting of a sidewalk linking the building to sidewalk infrastructure along Woburn Street;
- A mail drop will be provided in a central location; and
- Secure bicycle parking will be provided, including both an exterior bicycle rack adjacent to the building entrance and weather protected bicycle parking in a secure area within the building.

With implementation of the above recommendations, safe and efficient access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

INTRODUCTION

Vanasse & Associates, Inc. (VAI) has conducted a Transportation Impact Assessment (TIA) in order to determine the potential impacts on the transportation infrastructure associated with the proposed renovation of the former school building located at 172 Woburn Street in Reading, Massachusetts, to accommodate a 20-unit residential apartment community (hereafter referred to as the “Project”). This study evaluates the following specific areas as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; and identifies and analyzes existing traffic conditions and future traffic conditions, both with and without the Project, along Woburn Street and at the intersections of Woburn Street at Temple Street and the exit driveway from St. Agnes Church and the Project site, and Woburn Street at the entrance driveway to the Project site.

PROJECT DESCRIPTION

As proposed, the Project will entail the renovation of the former school building located at 172 Woburn Street in Reading, Massachusetts, to accommodate a 20-unit residential apartment community. The Project site encompass approximately 1.05 acres of land bounded by Woburn Street to the north; residential properties to the south and east; and St. Agnes Church to the west. Figure 1 depicts the Project site location in relation to the existing roadway network. At present, the Project site contains a three story brick building and associated parking area and appurtenances that will be renovated and rehabilitated to accommodate the Project.

Access to the Project site will continue to be provided by way of the existing driveways that intersect the south side of Woburn Street parallel to the east and west property lines, respectively. Both driveways will continue to be shared with St. Agnes Church, with the east Project site driveway reconfigured to serve as the entrance drive and the west Project site driveway reconfigured to serve as the exit drive, mirroring traffic circulation within the St. Agnes Church site which has an entrance driveway to the west of the church building and an exit driveway to the east.

A total of 66 parking spaces will be provided within the Project site, of which 35 spaces will be designated for use by residents and visitors of the Project (a parking ratio of 1.75 spaces per unit), with the remaining 31 spaces designated for use by St. Agnes Church.

READING



SITE

ST. AGNES CHURCH



Figure 1
Site Location Map

STUDY METHODOLOGY

This study was prepared in consultation with the Town of Reading and the Massachusetts Department of Transportation (MassDOT); was performed in accordance with MassDOT's *Transportation Impact Assessment (TIA) Guidelines* and the standards of the Traffic Engineering and Transportation Planning professions for the preparation of such reports; and was conducted in three distinct stages.

The first stage involved an assessment of existing conditions in the study area and included an inventory of roadway geometrics; pedestrian and bicycle facilities; public transportation services; observations of traffic flow; and collection of daily and peak period traffic counts.

In the second stage of the study, future traffic conditions were projected and analyzed. Specific travel demand forecasts for the Project were assessed along with future traffic demands due to expected traffic growth independent of the Project. A seven-year time horizon was selected for analyses consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines*. The traffic analysis conducted in stage two identifies existing or projected future roadway capacity, traffic safety, and site access issues.

The third stage of the study presents and evaluates measures to address traffic and safety issues, if any, identified in stage two of the study.

EXISTING CONDITIONS

A comprehensive field inventory of existing conditions within the study area was conducted in June 2016. The field investigation consisted of an inventory of existing roadway geometrics; pedestrian and bicycle facilities; public transportation services; traffic volumes; and operating characteristics; as well as posted speed limits and land use information within the study area. The study area for the Project was selected to contain the major roadway providing access to the Project site, Woburn Street, as well as the intersections of Woburn Street at Temple Street and the exit driveway from St. Agnes Church and the Project site, and Woburn Street at the entrance driveway to the Project site. This study area is reflective of the relatively minor increase in traffic that the Project represents (between 10 and 12 vehicle trips predicted during the weekday peak commuter hours).

The following describes the study area roadway and intersections.

Roadway

Woburn Street

- Two-lane roadway under Town jurisdiction
- Traverses study area in a general northeast-southwest direction
- Provides two 11 to 19-foot wide travel lanes separated by a double-yellow centerline with 1-foot wide marked shoulders provided
- Resident permit parking is provided along the south side of the roadway east of the Project site between 6 AM and 10:30 AM, Monday through Friday
- A sidewalk is provided along both sides of the roadway
- “Share the Road” signs are present to designate share use of the roadway by bicycles and motor vehicles
- Illumination is provided by way of street lights mounted on wood poles
- “Prima facie” speed limit is 30 miles per hour (mph)³
- Land use consists of the Project site, St. Agnes Church and residential and properties

³The “prima facie” speed is defined in M.G.L. Chapter 90, Section 17, as the speed which would be deemed reasonable and proper to operate a motor vehicle.

Intersections

Table 1 and Figure 2 summarize lane use, traffic control, and pedestrian and bicycle accommodations at the study area intersections as observed in June 2016.

**Table 1
STUDY AREA INTERSECTION DESCRIPTION**

Intersection	Traffic Control Type^a	No. of Travel Lanes Provided	Shoulder Provided? (Yes/No/Width)	Pedestrian Accommodations? (Yes/No/Description)	Bicycle Accommodations? (Yes/No/Description)
Woburn St./ Temple St./ St. Agnes Church/ Project Site Dwy	S	1 per direction on all legs of the intersection; church/site dwy currently accommodates 2-way travel	Yes – 1-ft along both sides of Woburn St.	Yes – both sides of Woburn St.; a crosswalk is provided across the Woburn St. east leg that includes school zone crossing signs	Yes - Shared travelled-way on Woburn St. ^b with “Share the Road” signs provided
Woburn St./ Project Site Dwy	S	1 per direction on all legs of the intersection; Project site dwy is currently exit only	Yes – 1-ft along both sides of Woburn St.	Yes – both sides of Woburn St.; a crosswalk is provided across the Woburn St. west leg that includes school zone crossing signs	Yes - Shared travelled-way on Woburn St. with “Share the Road” signs provided

^aTS = traffic signal control; S = STOP-sign control; Y = YIELD-sign control; R = rotary/roundabout control; NC = no control present.

^bCombined shoulder and travel lane width equal to or exceed 14 feet.

EXISTING TRAFFIC VOLUMES

In order to determine existing traffic-volume demands and flow patterns within the study area, automatic traffic recorder (ATR) counts, manual turning movement counts (TMCs) and vehicle classification counts were completed in June 2016. The ATR counts were conducted on June 29th and 30th on Woburn Street in the vicinity of the Project site in order to record weekday daily traffic conditions over an extended period, with weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period manual TMCs performed at the study intersections on June 29th. These time periods were selected for analysis purposes as they are representative of the peak traffic volume hours for both the Project and the adjacent roadway network.

Traffic Volume Adjustments

In order to evaluate the potential for seasonal fluctuation of traffic volumes within the study area, MassDOT weekday seasonal factors for Group 6 roadways (urban arterials, collectors and rural arterials) were reviewed.⁴ Based on a review of this data, it was determined that traffic volumes for the month of June are approximately 10.0 percent above average-month conditions and, therefore, were not adjusted downward in order to provide a conservative (above-average) analysis condition. The 2016 Existing traffic volumes are summarized in Table 2, with the weekday morning and evening peak-hour traffic volumes graphically depicted on Figure 3. Note that the peak-hour traffic volumes presented in Table 2 were obtained from the TMCs and are reflected on the aforementioned figure.

⁴MassDOT Traffic Volumes for the Commonwealth of Massachusetts; 2014 Weekday Seasonal Factors, Group 6 – Urban Arterials, Collectors and Rural Arterials.

Legend:

-  Unsignalized Intersection
-  Sidewalk
-  Crosswalk
-  Lane use and Travel Lane Width

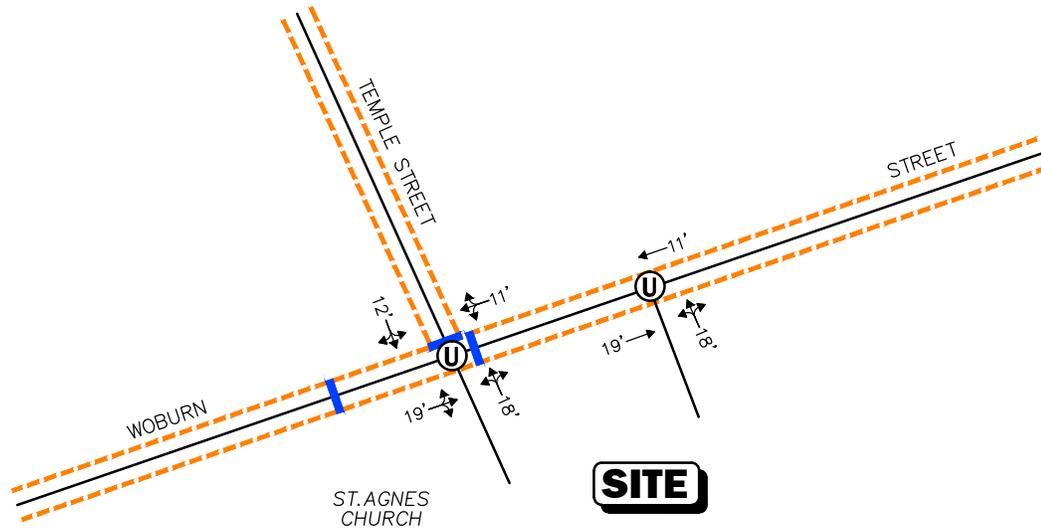


Figure 2

Existing Intersection Lane Use, Travel Lane Width and Pedestrian Facilities

Table 2
2016 EXISTING TRAFFIC VOLUMES

Location	AWT ^a	Weekday Morning Peak-Hour (8:00 – 9:00 AM)			Weekday Evening Peak-Hour (5:00 – 6:00 PM)		
		VPH ^b	K Factor ^c	Directional Distribution	VPH	K Factor	Directional Distribution
Woburn Street, west of Temple Street	7,180	526	7.3	66.5% WB	633	8.8	62.9% EB

^aAverage weekday traffic in vehicles per day.

^bVehicles per hour.

^cPercent of daily traffic occurring during the peak-hour.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound.

As can be seen in Table 2, Woburn Street in the vicinity of the Project site was found to accommodate approximately 7,180 vehicles on an average weekday (two-way, 24-hour volume), with approximately 526 vehicles per hour (vph) during the weekday morning peak-hour and 633 vph during the weekday evening peak-hour.

PEDESTRIAN AND BICYCLE FACILITIES

A comprehensive field inventory of pedestrian and bicycle facilities within the study area was undertaken in June 2016. The field inventory consisted of a review of the location of sidewalks and pedestrian crossing locations along the study roadways and at the study intersections, as well as the location of existing and planned future bicycle facilities. As detailed on Figure 2, sidewalks are currently provided along both sides of Woburn Street and Temple Street, with marked crosswalks provided across Temple Street and Woburn Street east and west of Temple Street, with the east Woburn Street crossing located at the approximate center of the Project site and the west crossing at the entrance to St. Agnes Church. Wheelchair ramps and tactile panels are provided at the Temple Street and the Woburn Street east pedestrian crossings.

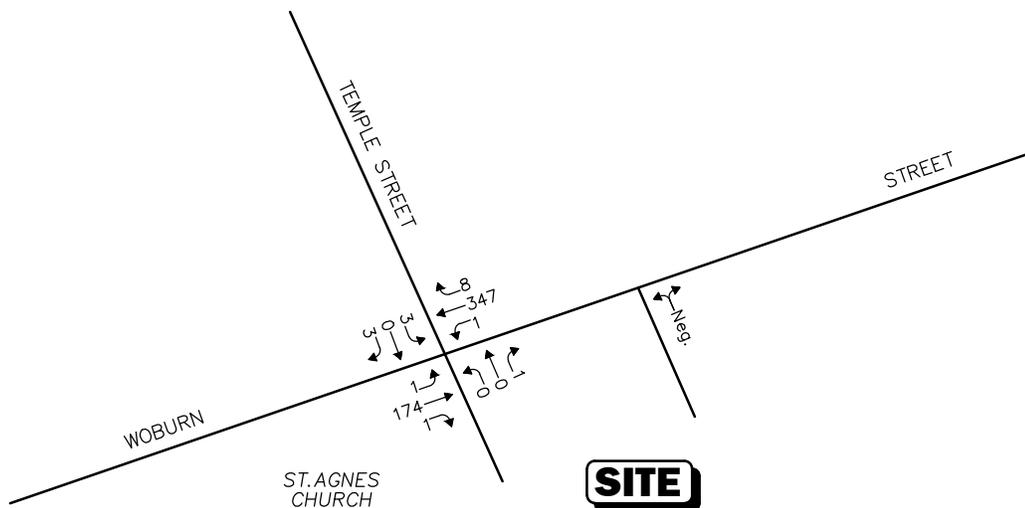
Formal bicycle facilities were not identified within the study area; however, Woburn Street provides sufficient width (combined travel lane and shoulder) to support bicycle travel in a shared travelled-way configuration.⁵ In addition, “Share the Road” signs are posted along Woburn Street within the study area.

PUBLIC TRANSPORTATION

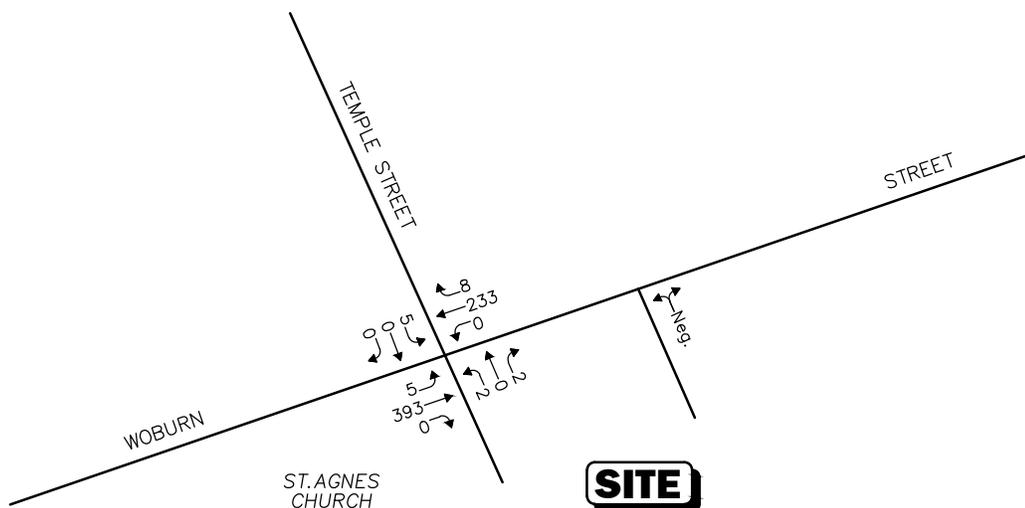
Public transportation services are provided within the study area by the MBTA. Reading Station on the Haverhill Branch of the MBTA Commuter Rail system is located approximately 0.3 miles east of the Project site off Lincoln Street, and provides service to North Station in Boston. In addition, at Reading Station, the MBTA operates fixed-route bus service by way of Route 136/137, *Reading Depot – Malden Station*, which provides service from Reading Station to Wakefield Square, Franklin Square, Oak Grove Station and Malden Station, with Oak Grove

⁵A minimum combined travel lane and paved shoulder width of 14-feet is required to support bicycle travel in a shared travelled-way condition.

WEEKDAY MORNING PEAK HOUR
(8:00-9:00 AM)



WEEKDAY EVENING PEAK HOUR
5:00-6:00 PM



 Neg. = Negligible
 Not To Scale



Figure 3

**2016 Existing
 Peak Hour Traffic Volumes**

Station and Malden Station providing connections to the MBTA Orange Line subway system. The public transportation schedules and fare information is provided in the Appendix.

As detailed in the preceding section, the Project site is linked to the aforementioned public transportation services by way of sidewalks along Woburn Street, with marked crosswalks provided for crossing Lincoln Street at its intersection with Woburn Street.

SPOT SPEED MEASUREMENTS

Vehicle travel speed measurements were performed on Woburn Street in the vicinity of the Project site over a continuous 48-hour period (Wednesday through Thursday, inclusive) in conjunction with the ATR counts. Table 3 summarizes the vehicle travel speed measurements.

**Table 3
WOBURN STREET
VEHICLE TRAVEL SPEED MEASUREMENTS**

	<u>Eastbound</u>	<u>Westbound</u>
Mean Travel Speed (mph)	32	34
85 th Percentile Speed (mph)	36	38
Posted Speed Limit (mph)	-- ^a	-- ^a

^aSpeed limit is not posted.
mph = miles per hour.

As can be seen in Table 3, the mean (average) vehicle travel speed along Woburn Street in the vicinity of the Project site was found to be approximately 33 mph. The average measured 85th percentile vehicle travel speed, or the speed at which 85 percent of the observed vehicles traveled at or below, was found to be approximately 37 mph. The 85th percentile speed is used as the basis of engineering design and in the evaluation of sight distances, and is often used in establishing posted speed limits.

Given that a speed limit is not posted on Woburn Street, the “prima facie” speed limit pursuant to M.G.L. Chapter 90 Section 17 would be 30 mph given the nature of the abutting land use (thickly settled or business district).⁶

⁶The “prima facie” speed is defined in M.G.L. Chapter 90, Section 17, as the speed which would be deemed reasonable and proper to operate a motor vehicle.

MOTOR VEHICLE CRASH DATA

Motor vehicle crash information for the study area intersections was provided by the MassDOT Highway Division Safety Management/Traffic Operations Unit for the most recent five-year period available (2009 through 2013, inclusive) in order to examine motor vehicle crash trends occurring within the study area. The data is summarized by intersection, type, severity, and day of occurrence, and presented in Table 4.

Table 4
MOTOR VEHICLE CRASH DATA SUMMARY^a

	Woburn Street/ Temple Street
Traffic Control Type: ^b	U
<i>Year:</i>	
2009	0
2010	0
2011	1
2012	0
2013	<u>0</u>
Total	1
Average Rate: ^c	0.20
MassDOT Crash Rate: ^d	0.58/0.56
Significant? ^e	No
<i>Type:</i>	
Angle	0
Rear-End	1
Head-On	0
Sideswipe	0
Fixed Object	0
Pedestrian/Bicycle	0
<u>Unknown/Other</u>	<u>0</u>
Total	1
<i>Day of Week:</i>	
Monday through Friday	1
Saturday	0
<u>Sunday</u>	<u>0</u>
Total	1
<i>Severity:</i>	
Property Damage Only	1
Personal Injury	0
<u>Fatality</u>	<u>0</u>
Total	1

^aSource: MassDOT Safety Management/Traffic Operations Unit records, 2009 through 2013.

^bTraffic Control Type: U = unsignalized; TS = traffic signal.

^cCrash rate per million vehicles entering the intersection.

^dStatewide/District crash rate.

^eThe intersection crash rate is significant if it is found to exceed the MassDOT crash rate for the MassDOT Highway Division District in which the Project is located (District 4).

As can be seen in Table 4, the study area intersection (includes both Project site driveways) was found to have experienced an average of less than one (1) reported motor vehicle crash per year over the five-year review period and was found to have a motor vehicle crash rate below both the MassDOT statewide and District averages for an unsignalized intersection for the MassDOT Highway Division District in which the intersection is located (District 4). A review of the MassDOT statewide High Crash Location List indicated that there were no locations within the study area that were included on MassDOT's Highway Safety Improvement Program (HSIP) listing. In addition, no fatal motor vehicle crashes were reported to have occurred at the study area intersection over the five-year review period. ***Based on a review of the MassDOT motor vehicle crash data, no discernible safety deficiencies were apparent at the study intersections.*** The detailed MassDOT Crash Rate Worksheets are provided in the Appendix.

FUTURE CONDITIONS

Traffic volumes in the study area were projected to the year 2023, which reflects a seven-year planning horizon consistent with MassDOT's *Transportation Impact Assessment (TIA) Guidelines*. Independent of the Project, traffic volumes on the roadway network in the year 2023 under No-Build conditions include all existing traffic and new traffic resulting from background traffic growth. Anticipated Project-generated traffic volumes superimposed upon the 2023 No-Build traffic volumes reflect 2023 Build traffic volume conditions with the Project.

FUTURE TRAFFIC GROWTH

Future traffic growth is a function of the expected land development in the immediate area and the surrounding region. Several methods can be used to estimate this growth. A procedure frequently employed estimates an annual percentage increase in traffic growth and applies that percentage to all traffic volumes under study. The drawback to such a procedure is that some turning volumes may actually grow at either a higher or a lower rate at particular intersections.

An alternative procedure identifies the location and type of planned development, estimates the traffic to be generated, and assigns it to the area roadway network. This procedure produces a more realistic estimate of growth for local traffic; however, potential population growth and development external to the study area would not be accounted for in the resulting traffic projections.

To provide a conservative analysis framework, both procedures were used, the salient components of which are described below.

Specific Development by Others

The Reading Planning Department website was reviewed in order to determine if there were any projects planned within the study area that would have an impact on future traffic volumes at the study intersections. Based on this review, the following projects were identified that may result in an increase in traffic within the study area:

- ***Criterion Children Enrichment Facility, Reading, Massachusetts.*** This project consists of the construction of an 8,460 square foot (sf) day care center to be located at 186-190 Summer Avenue in Reading, Massachusetts.

- **Prescott Village, Reading, Massachusetts.** This proposed project is currently before the Zoning Board of Appeals for consideration of the issuance of a Comprehensive Permit for the construction of a 77-unit residential apartment community to be located 2 Prescott Street and 39 Lincoln Street in Reading, Massachusetts. During the public hearing process, the number of proposed apartment units has been reduced to 72; however, for the purpose of this assessment, the original 77-unit proposal is reflected.

Traffic volumes associated with the aforementioned specific development projects by others were obtained from the respective traffic studies⁷ or using trip-generation information available from the Institute of Transportation Engineers (ITE)⁸ for the appropriate land use, and were assigned onto the study area roadway network based on existing traffic patterns where no other information was available. No other developments were identified at this time that are expected to result in an increase in traffic within the study area beyond the general background traffic growth rate.

General Background Traffic Growth

Traffic-volume data compiled by MassDOT from permanent count stations and historic traffic counts in the area were reviewed in order to determine general background traffic growth trends. Based on a review of this data and the growth rate used in another traffic study performed in the area,⁹ a 1.0 percent per year compounded annual background traffic growth rate was used in order to account for future traffic growth and presently unforeseen development within the study area.

Roadway Improvement Projects

MassDOT and the Town of Reading Department of Public Works were contacted in order to determine if there were any planned future roadway improvement projects expected to be complete by 2023 within the study area. Based on these discussions, no roadway improvement projects aside from routine maintenance activities were identified to be planned within the study area at this time.

No-Build Traffic Volumes

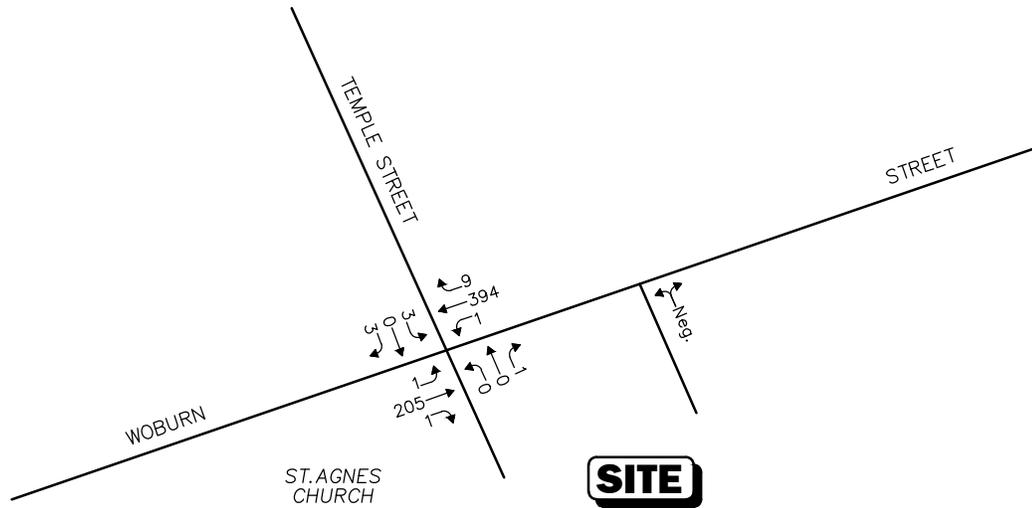
The 2023 No-Build condition peak-hour traffic-volumes were developed by applying the 1.0 percent per year compounded annual background traffic growth rate to the 2016 Existing peak-hour traffic volumes and then superimposing the peak-hour traffic volumes associated with the identified specific development projects by others. The resulting 2023 No-Build weekday morning and evening peak-hour traffic volumes are shown on Figure 4.

⁷*Transportation Impact Assessment, Proposed Residential Development, 2 Prescott Street & 39 Lincoln Street, Reading, Massachusetts; VAI; October 2015.*

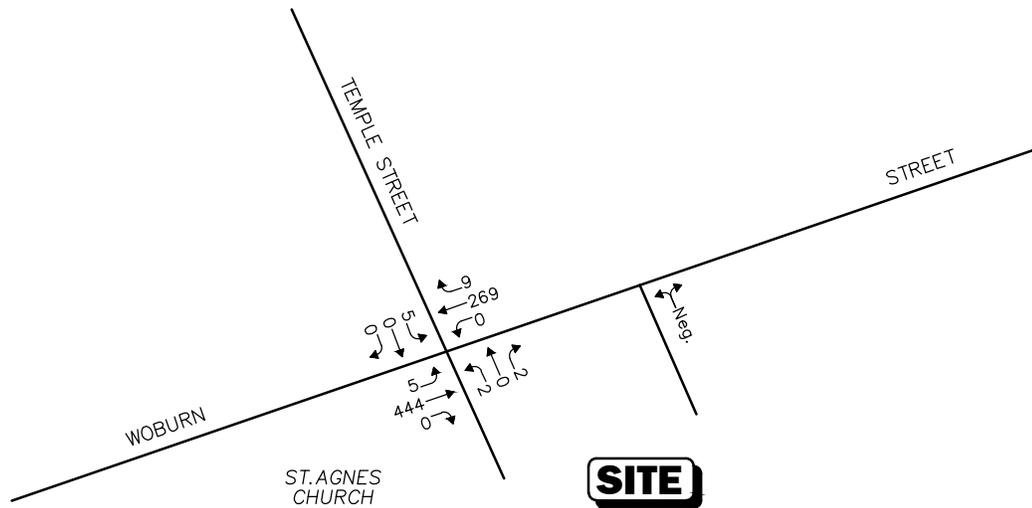
⁸Ibid 1

⁹Ibid 7.

**WEEKDAY MORNING PEAK HOUR
(8:00-9:00 AM)**



**WEEKDAY EVENING PEAK HOUR
5:00-6:00 PM**



 Neg. = Negligible
Not To Scale

Figure 4

**2023 No-Build
Peak Hour Traffic Volumes**

PROJECT-GENERATED TRAFFIC

Design year (2023 Build) traffic volumes for the study area roadways were determined by estimating Project-generated traffic volumes and assigning those volumes on the study roadways. The following sections describe the methodology used to develop the anticipated traffic characteristics of the Project.

As proposed, the Project will entail the construction of a 20-unit residential apartment community. In order to develop the traffic characteristics of the Project, trip-generation statistics published by the ITE¹⁰ for a similar land use as that proposed were used. ITE Land Use Code (LUC) 220, *Apartment*, with the independent variable of number of dwelling units equal to 20, was used to develop the traffic characteristics of the Project.

Given the proximity of the Project site to Reading Station on the MBTA Commuter Rail system (an approximate 6-minute walking distance) and the accompanying MBTA bus lines available at the station, it is expected that a portion of the residents of the Project will use public transportation services, thereby reducing the volume of traffic that may be associated with the Project. In order to provide a conservative (high) analysis condition from which to assess the potential impact of the Project on the transportation infrastructure, a reduction was not applied to the base ITE traffic volume projections for the Project to reflect the use of available public transportation services.

Table 5 summarizes the anticipated traffic characteristics of the Project using the above methodology.

Table 5
TRIP GENERATION SUMMARY

Time Period/Direction	Vehicle Trips
	Proposed Apartment Community (20 Units) ^a
<i>Average Weekday Daily:</i>	
Entering	67
<u>Exiting</u>	<u>67</u>
Total	134
<i>Weekday Morning Peak Hour:</i>	
Entering	2
<u>Exiting</u>	<u>8</u>
Total	10
<i>Weekday Evening Peak Hour:</i>	
Entering	8
<u>Exiting</u>	<u>4</u>
Total	12

^aBased on ITE LUC 220, *Apartment*.

¹⁰Ibid 1.

Project-Generated Traffic Volume Summary

As can be seen in Table 5 and without reduction to account for public transportation utilization, the Project is predicted to generate approximately 134 vehicle trips on an average weekday (two-way, 24-hour volume, or 67 vehicles entering and 67 exiting), with 10 vehicle trips (2 vehicles entering and 8 exiting) expected during the weekday morning peak-hour and 12 vehicle trips (8 vehicles entering and 4 exiting) expected during the weekday evening peak-hour.

Trip Distribution and Assignment

The directional distribution of generated trips to and from the Project site was determined based on a review of Journey-to-Work data obtained from the U.S. Census for persons residing in the Town of Reading, and then refined based on existing traffic patterns within the study area during the commuter peak periods. This methodology is consistent with the residential nature of the Project and commuter traffic patterns during the peak hours. The general trip distribution for the Project is graphically depicted on Figure 5. The additional traffic expected to be generated by the Project was assigned on the study area roadway network as shown on Figure 6.

FUTURE TRAFFIC VOLUMES - BUILD CONDITION

The 2023 Build condition traffic volumes consist of the 2023 No-Build traffic volumes with the additional traffic expected to be generated by the Project added to them. The 2023 Build weekday morning and evening peak-hour traffic-volumes are graphically depicted on Figure 7.

A summary of peak-hour projected traffic-volume increases external to the study area that is the subject of this assessment is shown in Table 6. These volumes are based on the expected increases from the Project.

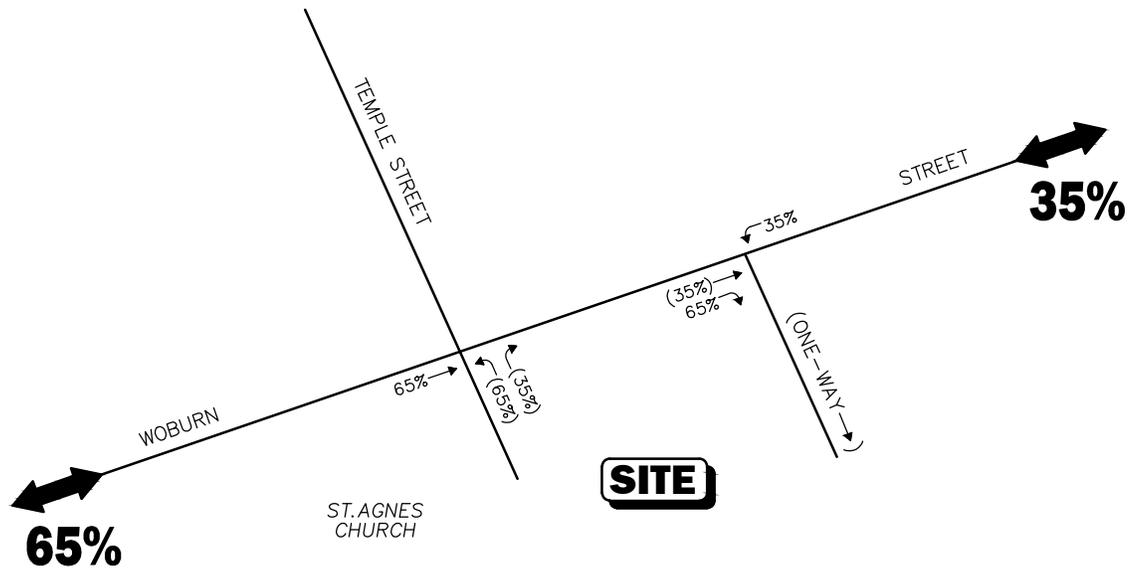
Table 6
PEAK-HOUR TRAFFIC-VOLUME INCREASES

Location/Peak Hour	2016 Existing	2023 No-Build	2023 Build	Traffic Volume Increase Over No-Build	Percent Increase Over No-Build
<i>Woburn Street, east of Temple Street:</i>					
Weekday Morning	534	613	618	5	0.8
Weekday Evening	641	729	738	9	1.2
<i>Woburn Street, west of Temple Street:</i>					
Weekday Morning	526	604	610	6	1.0
Weekday Evening	633	720	728	8	1.1

As shown in Table 6, Project-related traffic-volume increases external to the study area relative to 2023 No-Build conditions are anticipated to range from 0.8 to 1.2 percent during the peak periods, with vehicle increases shown to range from 5 to 9 vehicles. *Such increases are considered nominal when dispersed over the peak-hour and would not result in a material impact (increase) on motorist delays or vehicle queuing outside of the immediate study area that is the subject of this assessment.*

Legend:

XX	Entering
(XX)	Exiting



 Not To Scale

Figure 5

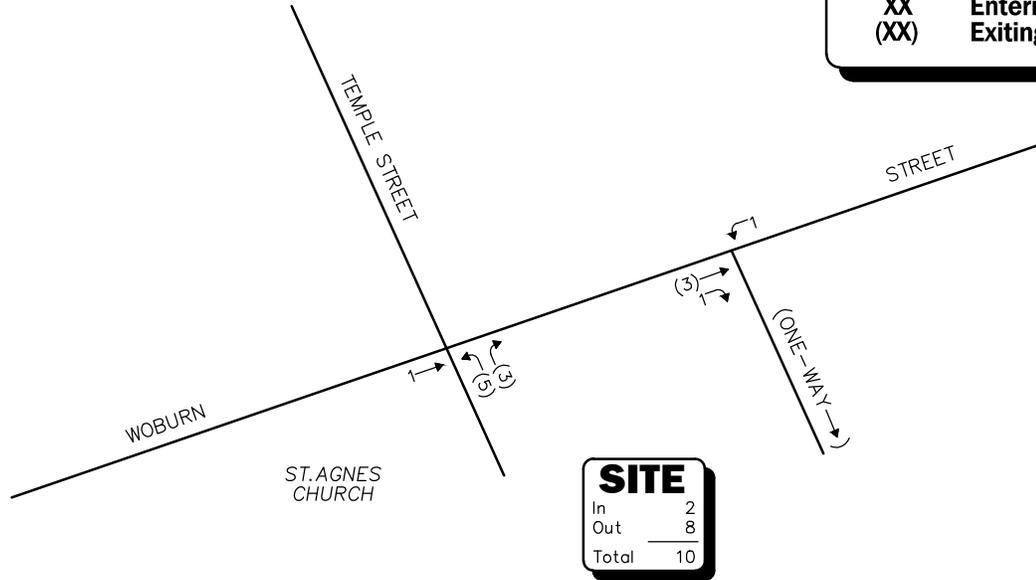
VAi Vanasse & Associates, Inc.
Transportation Engineers & Planners

Trip Distribution Map

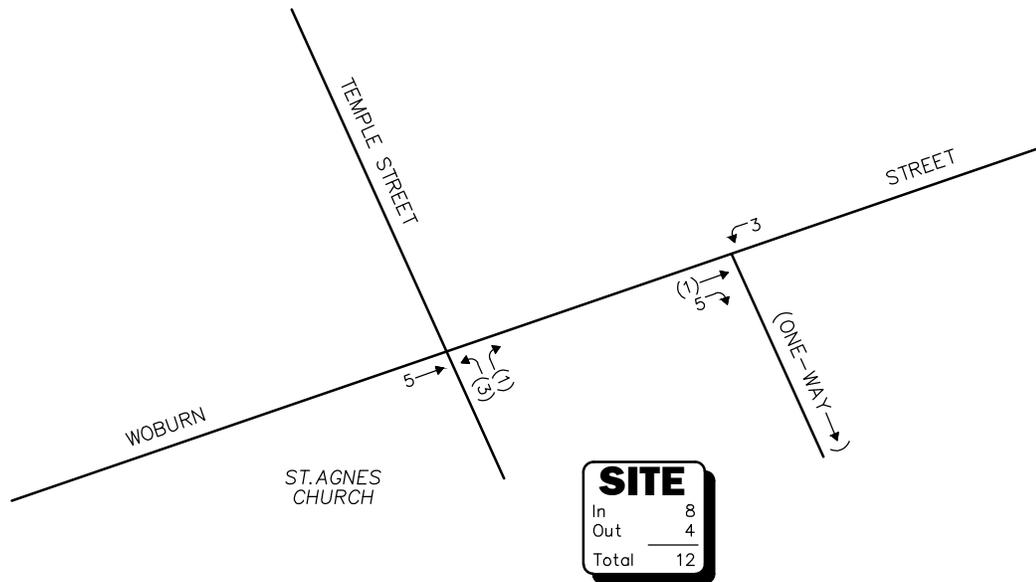
WEEKDAY MORNING PEAK HOUR
(8:00-9:00 AM)

Legend:

XX Entering
(XX) Exiting



WEEKDAY EVENING PEAK HOUR
5:00-6:00 PM

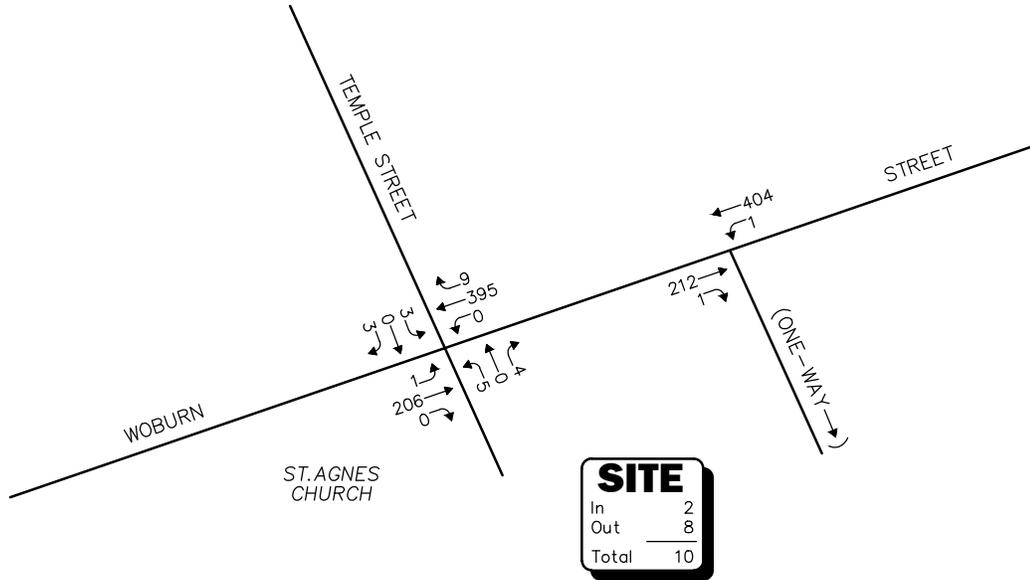


 Not To Scale

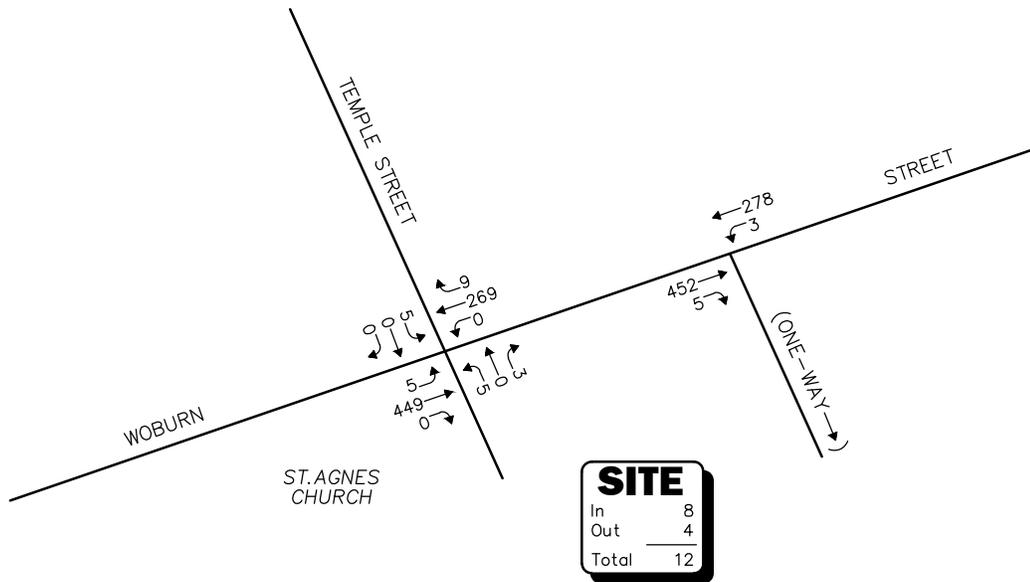
Figure 6

**Project-Generated
 Peak Hour Traffic Volumes**

WEEKDAY MORNING PEAK HOUR
(8:00-9:00 AM)



WEEKDAY EVENING PEAK HOUR
5:00-6:00 PM



Not To Scale



Figure 7

2023 Build
 Peak Hour Traffic Volumes

TRAFFIC OPERATIONS ANALYSIS

Measuring existing and future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity and vehicle queue analyses were conducted under Existing, No-Build and Build traffic volume conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them, with vehicle queue analyses providing a secondary measure of the operational characteristics of an intersection or section of roadway under study.

METHODOLOGY

Levels of Service

A primary result of capacity analyses is the assignment of level of service to traffic facilities under various traffic-flow conditions.¹¹ The concept of level of service is defined as a qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers. A level-of-service definition provides an index to quality of traffic flow in terms of such factors as speed, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Six levels of service are defined for each type of facility. They are given letter designations from A to F, with level-of-service (LOS) A representing the best operating conditions and LOS F representing congested or constrained operating conditions.

Since the level of service of a traffic facility is a function of the traffic flows placed upon it, such a facility may operate at a wide range of levels of service, depending on the time of day, day of week, or period of year.

¹¹The capacity analysis methodology is based on the concepts and procedures presented in the *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

Unsignalized Intersections

The six levels of service for unsignalized intersections may be described as follows:

- *LOS A* represents a condition with little or no control delay to minor street traffic.
- *LOS B* represents a condition with short control delays to minor street traffic.
- *LOS C* represents a condition with average control delays to minor street traffic.
- *LOS D* represents a condition with long control delays to minor street traffic.
- *LOS E* represents operating conditions at or near capacity level, with very long control delays to minor street traffic.
- *LOS F* represents a condition where minor street demand volume exceeds capacity of an approach lane, with extreme control delays resulting.

The levels of service of unsignalized intersections are determined by application of a procedure described in the 2010 *Highway Capacity Manual*.¹² Level of service is measured in terms of average control delay. Mathematically, control delay is a function of the capacity and degree of saturation of the lane group and/or approach under study and is a quantification of motorist delay associated with traffic control devices such as traffic signals and STOP signs. Control delay includes the affects of initial deceleration delay approaching a STOP sign, stopped delay, queue move-up time, and final acceleration delay from a stopped condition. Definitions for level of service at unsignalized intersections are also given in the 2010 *Highway Capacity Manual*. Table 7 summarizes the relationship between level of service and average control delay for two way stop controlled and all-way stop controlled intersections.

**Table 7
LEVEL-OF-SERVICE CRITERIA FOR
UNSIGNALIZED INTERSECTIONS^a**

Level-Of-Service by Volume-to-Capacity Ratio		Average Control Delay (Seconds Per Vehicle)
v/c ≤ 1.0	v/c > 1.0	
A	F	≤10.0
B	F	10.1 to 15.0
C	F	15.1 to 25.0
D	F	25.1 to 35.0
E	F	35.1 to 50.0
F	F	>50.0

^aSource: *Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010; page 19-2.

¹²*Highway Capacity Manual*; Transportation Research Board; Washington, DC; 2010.

Vehicle Queue Analysis

Vehicle queue analyses are a direct measurement of an intersection's ability to process vehicles under various traffic control and volume scenarios and lane use arrangements. The vehicle queue analysis was performed using the Synchro™ intersection capacity analysis software which is based upon the methodology and procedures presented in the 2010 *Highway Capacity Manual*. The Synchro™ vehicle queue analysis methodology is a simulation based model which reports the number of vehicles that experience a delay of six seconds or more at an intersection. For signalized intersections, Synchro™ reports both the average (50th percentile) the 95th percentile vehicle queue. For unsignalized intersections, Synchro™ reports the 95th percentile vehicle queue. Vehicle queue lengths are a function of the capacity of the movement under study and the volume of traffic being processed by the intersection during the analysis period. The 95th percentile vehicle queue is the vehicle queue length that will be exceeded only 5 percent of the time, or approximately three minutes out of sixty minutes during the peak one hour of the day (during the remaining fifty-seven minutes, the vehicle queue length will be less than the 95th percentile queue length).

ANALYSIS RESULTS

Level-of-service and vehicle queue analyses were conducted for 2016 Existing, 2023 No-Build and 2023 Build conditions for the intersections within the study area. The results of the intersection capacity and vehicle queue analyses are summarized in Table 8. The detailed analysis results are presented in the Appendix.

As can be seen in Table 8, all movements at the study area intersections were shown to operate at LOS C or better during both the weekday morning and evening peak hours under 2016 Existing, 2023 No-Build and 2023 Build conditions, where an LOS of "D" or better is generally defined as "acceptable" operating conditions. Project-related impacts were identified as an increase in average motorist delay of less than 4 seconds and a minor change in LOS from "B" to "C" for movements exiting the Project site during the weekday evening peak-hour. No material vehicle queueing reported for any movement.

Table 8
UNSIGNALIZED INTERSECTION LEVEL-OF-SERVICE AND VEHICLE QUEUE SUMMARY

Unsignalized Intersection/Peak Hour/Movement	2016 Existing				2023 No-Build				2023 Build			
	Demand ^a	Delay ^b	LOS ^c	Queue ^d 95 th	Demand	Delay	LOS	Queue 95 th	Demand	Delay	LOS	Queue 95 th
<i>Woburn Street at Temple Street and the West Project Site Driveway</i>												
<i>Weekday Morning:</i>												
Woburn Street EB LT/TH/RT	176	0.0	A	0	207	0.0	A	0	207	0.0	A	0
Woburn Street WB LT/TH/RT	356	0.0	A	0	404	0.0	A	0	404	0.0	A	0
Project Site Driveway NB LT/TH/RT	1	9.4	A	0	1	9.6	A	0	9	13.1	B	0
Temple Street SB LT/TH/RT	6	12.8	B	0	6	13.7	B	0	6	13.7	B	0
<i>Weekday Evening:</i>												
Woburn Street EB LT/TH/RT	398	0.1	A	0	449	0.1	A	0	454	0.1	A	0
Woburn Street WB LT/TH/RT	241	0.0	A	0	278	0.0	A	0	278	0.0	A	0
Project Site Driveway NB LT/TH/RT	4	13.3	B	0	4	14.4	B	0	8	16.6	C	0
Temple Street SB LT/TH/RT	5	17.2	C	0	5	19.5	C	0	5	19.5	C	0
<i>Woburn Street at the East Project Site Driveway</i>												
<i>Weekday Morning:</i>												
Woburn Street EB TH/RT	--	--	--	--	--	--	--	--	213	0.0	A	0
Woburn Street WB LT/TH	--	--	--	--	--	--	--	--	405	0.0	A	0
<i>Weekday Evening:</i>												
Woburn Street EB TH/RT	--	--	--	--	--	--	--	--	457	0.0	A	0
Woburn Street WB LT/TH	--	--	--	--	--	--	--	--	281	0.0	A	0

^aDemand in vehicles per hour.

^bAverage control delay per vehicle (in seconds).

^cLevel-of-Service.

^dQueue length in vehicles.

NB = northbound; SB = southbound; EB = eastbound; WB = westbound; SEB = southeastbound; LT = left-turning movements; TH = through movements; RT = right-turning movements.

SIGHT DISTANCE EVALUATION

Sight distance measurements were performed at the Project site driveway intersections with Woburn Street in accordance with MassDOT and American Association of State Highway and Transportation Officials (AASHTO)¹³ requirements. Both stopping sight distance (SSD) and intersection sight distance (ISD) measurements were performed. In brief, SSD is the distance required by a vehicle traveling at the design speed of a roadway, on wet pavement, to stop prior to striking an object in its travel path. ISD or corner sight distance (CSD) is the sight distance required by a driver entering or crossing an intersecting roadway to perceive an on-coming vehicle and safely complete a turning or crossing maneuver with on-coming traffic. In accordance with AASHTO standards, if the measured ISD is at least equal to the required SSD value for the appropriate design speed, the intersection can operate in a safe manner. Table 9 presents the measured SSD and ISD at the subject intersections.

¹³ *A Policy on Geometric Design of Highway and Streets*, 6th Edition; American Association of State Highway and Transportation Officials (AASHTO); Washington D.C.; 2011.

Table 9
SIGHT DISTANCE MEASUREMENTS^a

Intersection/Sight Distance Measurement	Feet		
	Required Minimum (SSD)	Desirable (ISD) ^b	Measured
<i>Woburn Street at the West Project Site Driveway</i>			
<i>Stopping Sight Distance:</i>			
Woburn Street approaching from the east	305	--	500+
Woburn Street approaching from the west	305	--	394
<i>Intersection Sight Distance:</i>			
Looking to the east from the West Project Site Driveway	305	385/445	500+
Looking to the west from the West Project Site Driveway	305	385/445	361
<i>Woburn Street at the East Project Site Driveway</i>			
<i>Stopping Sight Distance:</i>			
Woburn Street approaching from the east	305	--	350
Woburn Street approaching from the west	305	--	500+

^aRecommended minimum values obtained from *A Policy on Geometric Design of Highways and Streets*, 6th Edition; American Association of State Highway and Transportation Officials (AASHTO); 2011; and based on a 40 mph approach speed on Woburn Street.

^bValues shown are the intersection sight distance for a vehicle turning right/left exiting a roadway under STOP control such that motorists approaching the intersection on the major street should not need to adjust their travel speed to less than 70 percent of their initial approach speed.

As can be seen in Table 9, lines of sight at the Project site driveway intersections were found to exceed the recommended minimum sight distance requirements for a 40 mph approach speed along Woburn Street, which is consistent with the measured 85th percentile vehicle travel speed (37 mph) and is 10 mph above the “prima facie” speed limit (30 mph).

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

VAI has completed a detailed assessment of the potential impacts on the transportation infrastructure associated with the proposed renovation of the former school building located at 172 Woburn Street in Reading, Massachusetts, to accommodate a 20-unit residential apartment community. The following specific areas have been evaluated as they relate to the Project: i) access requirements; ii) potential off-site improvements; and iii) safety considerations; under existing and future conditions, both with and without the Project. Based on this assessment, we have concluded the following with respect to the Project:

1. Using trip-generation statistics published by the ITE¹⁴ and without reduction to account for public transportation utilization, the Project is predicted to generate approximately 134 vehicle trips on an average weekday (two-way, 24-hour volume), with 10 vehicle trips expected during the weekday morning peak-hour and 12 vehicle trips expected during the weekday evening peak-hour;
2. The Project will not have a significant impact (increase) on motorist delays or vehicle queuing over Existing or anticipated future conditions without the Project (No-Build conditions);
3. No apparent safety deficiencies were noted with respect to the motor vehicle crash history at the study intersections; and
4. Lines of sight to and from the Project site driveway intersections with Woburn Street were found to exceed the required minimum distance for the intersections to function in a safe manner based on the appropriate approach speed along Woburn Street.

In consideration of the above, we have concluded that the Project can be accommodated within the confines of the existing transportation infrastructure in a safe and efficient manner with implementation of the recommendations that follow.

¹⁴Ibid 1.

RECOMMENDATIONS

A detailed transportation improvement program has been developed that is designed to provide safe and efficient access to the Project site and address any deficiencies identified at off-site locations evaluated in conjunction with this study. The following improvements have been recommended as a part of this evaluation and, where applicable, will be completed in conjunction with the Project subject to receipt of all necessary rights, permits, and approvals.

Project Access

Access to the Project site will continue to be provided by way of the existing driveways that intersect the south side of Woburn Street parallel to the east and west property lines, respectively. Both driveways will continue to be shared with St. Agnes Church, with the east Project site driveway reconfigured to serve as the entrance drive and the west Project site driveway reconfigured to serve as the exit drive, mirroring traffic circulation within the St. Agnes Church site which has an entrance driveway to the west of the church building and an exit driveway to the east. The following recommendations are offered with respect to the design and operation of the Project site driveways:

- The Project site driveways should be a minimum of 16-feet in width and will convey one-way traffic in a clockwise direction around the apartment building. Both driveways should include appropriate signs (“One-Way”, “Do Not Enter”, etc.) and pavement markings at Woburn Street and within the Project site to reinforce the one-way operation of the driveways and the circulation pattern within the site.
- Vehicles exiting the Project site should be placed under STOP-sign control with a marked STOP-line provided. It is recommended that a STOP-sign and STOP-line be installed on the exit drive from the Project site prior to the merge with the exit drive from St. Agnes Church, with an additional STOP-sign and STOP-line installed on the combined exit driveway in advance of the sidewalk along Woburn Street.
- All signs and pavement markings to be installed within the Project site shall conform to the applicable standards of the *Manual on Uniform Traffic Control Devices (MUTCD)*.¹⁵
- Signs and landscaping to be installed along the Project site driveways, internal to the Project site and at the Project site driveway intersections with Woburn Street should be designed and maintained so as not to restrict lines of sight.
- Snow windrows along the Project site frontage on Woburn Street within the sight triangle areas of the Project site driveways shall be promptly removed where such accumulations would exceed 2.5 feet in height.
- On-street parking should be prohibited for a minimum distance of 20-feet on either side of the Project site driveways in order to maintain the required lines of sight for the driveways to operate in a safe manner.

¹⁵Ibid 2.

Transportation Demand Management

The Project site is situated approximately 0.3 miles east and within an approximate 6-minute walking distance of the Reading Commuter Rail Station. This proximity offers a convenient transportation alternative for residents of the Project over the use of single-occupancy vehicles (SOV's). In an effort to encourage use of alternative modes of transportation, the following Transportation Demand Management (TDM) measures will be implemented as a part of the Project:

- Information regarding public transportation services, maps, schedules and fare information will be posted in a central location;
- A “welcome packet” will be provided to new residents of the Project detailing available public transportation services, bicycle and walking alternatives, and commuter options available through MassRIDES’ and their NuRide program which rewards individuals that choose to walk, bicycle, carpool, vanpool or that use public transportation to travel to and from work;
- Residents will be made aware of the Emergency Ride Home (ERH) program available through MassRIDES, which reimburses employees of a participating MassRIDES employer partner worksite that is registered for ERH and that carpool, take transit, bicycle, walk or vanpool to work;
- Pedestrian accommodations will be incorporated within the Project site consisting of a sidewalk linking the building to sidewalk infrastructure along Woburn Street;
- A mail drop will be provided in a central location; and
- Secure bicycle parking will be provided, including both an exterior bicycle rack adjacent to the building entrance and weather protected bicycle parking in a secure area within the building.

With implementation of the above recommendations, safe and efficient access will be provided to the Project site and the Project can be accommodated within the confines of the existing and improved transportation system.

APPENDIX

PROJECT SITE PLAN
AUTOMATIC TRAFFIC RECORDER COUNTS
MANUAL TURNING MOVEMENT COUNTS
SEASONAL ADJUSTMENT DATA
VEHICLE TRAVEL SPEED DATA
PUBLIC TRANSPORTATION SCHEDULE AND FARE INFORMATION
MASSDOT CRASH RATE WORKSHEETS
SITE-SPECIFIC DEVELOPMENT TRAFFIC-VOLUME NETWORKS
TRIP-GENERATION CALCULATIONS
JOURNEY TO WORK DATA
CAPACITY ANALYSIS WORKSHEETS

PROJECT SITE PLAN

AUTOMATIC TRAFFIC RECORDER COUNTS

Accurate Counts
978-664-2565

Location : Woburn Street
Location : West of Temple Street
City/State: Reading, MA

7379VOL1

Start Time	29-Jun-16 Wed	EB		Hour Totals		WB		Hour Totals		Combined Totals	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
12:00		4	42			3	51				
12:15		0	63			3	48				
12:30		4	45			1	52				
12:45		0	52	8	202	1	45	8	196	16	398
01:00		0	43			0	44				
01:15		0	44			2	51				
01:30		1	42			1	54				
01:45		1	60	2	189	0	60	3	209	5	398
02:00		0	51			1	52				
02:15		1	67			1	53				
02:30		0	57			0	30				
02:45		1	55	2	230	2	45	4	180	6	410
03:00		1	62			0	44				
03:15		1	71			0	57				
03:30		0	55			1	59				
03:45		0	86	2	274	0	52	1	212	3	486
04:00		0	102			1	60				
04:15		1	92			0	45				
04:30		1	77			3	51				
04:45		3	105	5	376	2	33	6	189	11	565
05:00		5	82			4	53				
05:15		6	78			4	67				
05:30		7	109			3	59				
05:45		6	109	24	378	16	51	27	230	51	608
06:00		15	101			20	67				
06:15		18	107			28	42				
06:30		18	88			41	48				
06:45		25	95	76	391	59	50	148	207	224	598
07:00		19	60			55	55				
07:15		37	49			74	55				
07:30		18	49			80	51				
07:45		39	44	113	202	77	42	286	203	399	405
08:00		31	40			66	51				
08:15		46	38			77	42				
08:30		41	45			106	25				
08:45		51	29	169	152	86	42	335	160	504	312
09:00		36	27			71	34				
09:15		34	31			74	27				
09:30		34	28			50	25				
09:45		27	13	131	99	51	21	246	107	377	206
10:00		30	14			51	23				
10:15		39	14			51	15				
10:30		36	12			30	15				
10:45		43	10	148	50	45	19	177	72	325	122
11:00		46	8			54	15				
11:15		41	6			52	11				
11:30		52	6			40	4				
11:45		56	6	195	26	51	6	197	36	392	62
Total		875	2569			1438	2001			2313	4570
Percent		25.4%	74.6%			41.8%	58.2%			33.6%	66.4%

Accurate Counts

978-664-2565

Location : Woburn Street
 Location : West of Temple Street
 City/State : Reading, MA

7379VOL1

Start Time	27-Jun-16		Tue		Wed		Thu		Fri		Sat		Sun		Week Average	
	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB	EB	WB
12:00 AM	*	*	*	*	8	17	12	*	*	*	*	*	*	*	12	10
01:00	*	*	2	3	2	3	9	*	*	*	*	*	*	*	2	6
02:00	*	*	2	4	2	4	5	*	*	*	*	*	*	*	3	4
03:00	*	*	2	1	2	2	7	*	*	*	*	*	*	*	2	4
04:00	*	*	5	7	5	7	7	*	*	*	*	*	*	*	6	6
05:00	*	*	24	27	24	31	27	*	*	*	*	*	*	*	28	27
06:00	*	*	76	88	76	88	174	*	*	*	*	*	*	*	82	161
07:00	*	*	113	286	113	120	335	*	*	*	*	*	*	*	116	310
08:00	*	*	169	335	169	164	361	*	*	*	*	*	*	*	166	348
09:00	*	*	131	246	131	153	249	*	*	*	*	*	*	*	142	248
10:00	*	*	148	177	148	181	205	*	*	*	*	*	*	*	164	191
11:00	*	*	195	197	195	229	195	*	*	*	*	*	*	*	212	196
12:00 PM	*	*	202	196	202	228	229	*	*	*	*	*	*	*	215	212
01:00	*	*	189	209	189	214	192	*	*	*	*	*	*	*	202	200
02:00	*	*	230	180	230	243	188	*	*	*	*	*	*	*	236	184
03:00	*	*	274	212	274	298	213	*	*	*	*	*	*	*	286	212
04:00	*	*	376	189	376	433	187	*	*	*	*	*	*	*	404	188
05:00	*	*	378	230	378	478	216	*	*	*	*	*	*	*	428	223
06:00	*	*	391	207	391	468	195	*	*	*	*	*	*	*	430	201
07:00	*	*	202	203	202	239	177	*	*	*	*	*	*	*	220	190
08:00	*	*	152	160	152	169	149	*	*	*	*	*	*	*	160	154
09:00	*	*	99	107	99	94	119	*	*	*	*	*	*	*	96	113
10:00	*	*	50	72	50	49	58	*	*	*	*	*	*	*	50	65
11:00	*	*	26	36	26	33	32	*	*	*	*	*	*	*	30	34
Lane	0	0	3444	3439	3444	3945	3541	0	0	0	0	0	0	0	3692	3487
Day	0	0	6883	7486	6883	7486	7486	0	0	0	0	0	0	0	7179	7179
AM Peak	-	-	11:00	08:00	11:00	11:00	08:00	-	-	-	-	-	-	-	11:00	08:00
Vol.	-	-	195	355	195	229	351	-	-	-	-	-	-	-	212	348
PM Peak	-	-	18:00	17:00	18:00	17:00	12:00	-	-	-	-	-	-	-	18:00	17:00
Vol.	-	-	391	230	391	478	229	-	-	-	-	-	-	-	430	223
Comb. Total	0	0	6883	7486	6883	7486	7486	0	0	0	0	0	0	0	7179	7179
ADT	ADT 7,184	0	0	0	0	0	0	0	7179	7179						

MANUAL TURNING MOVEMENT COUNTS

Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 1

Groups Printed- Cars - Trucks													
Start Time	Temple St From North			Woburn St From East			Driveway From South			Woburn St From West			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	1	0	0	0	58	2	0	0	0	0	23	0	84
07:15 AM	0	0	0	0	72	5	0	0	0	0	31	0	108
07:30 AM	4	0	0	1	73	2	0	0	0	1	24	0	105
07:45 AM	1	0	0	0	73	9	0	0	0	0	36	0	119
Total	6	0	0	1	276	18	0	0	0	1	114	0	416
08:00 AM	0	0	0	1	72	3	0	0	1	0	29	0	106
08:15 AM	1	0	1	0	83	0	0	0	0	1	55	0	141
08:30 AM	2	0	2	0	97	2	0	0	0	0	40	1	144
08:45 AM	0	0	0	0	95	3	0	0	0	0	50	0	148
Total	3	0	3	1	347	8	0	0	1	1	174	1	539
Grand Total	9	0	3	2	623	26	0	0	1	2	288	1	955
Apprch %	75	0	25	0.3	95.7	4	0	0	100	0.7	99	0.3	
Total %	0.9	0	0.3	0.2	65.2	2.7	0	0	0.1	0.2	30.2	0.1	
Cars	8	0	2	0	618	24	0	0	1	2	288	0	943
% Cars	88.9	0	66.7	0	99.2	92.3	0	0	100	100	100	0	98.7
Trucks	1	0	1	2	5	2	0	0	0	0	0	1	12
% Trucks	11.1	0	33.3	100	0.8	7.7	0	0	0	0	0	100	1.3

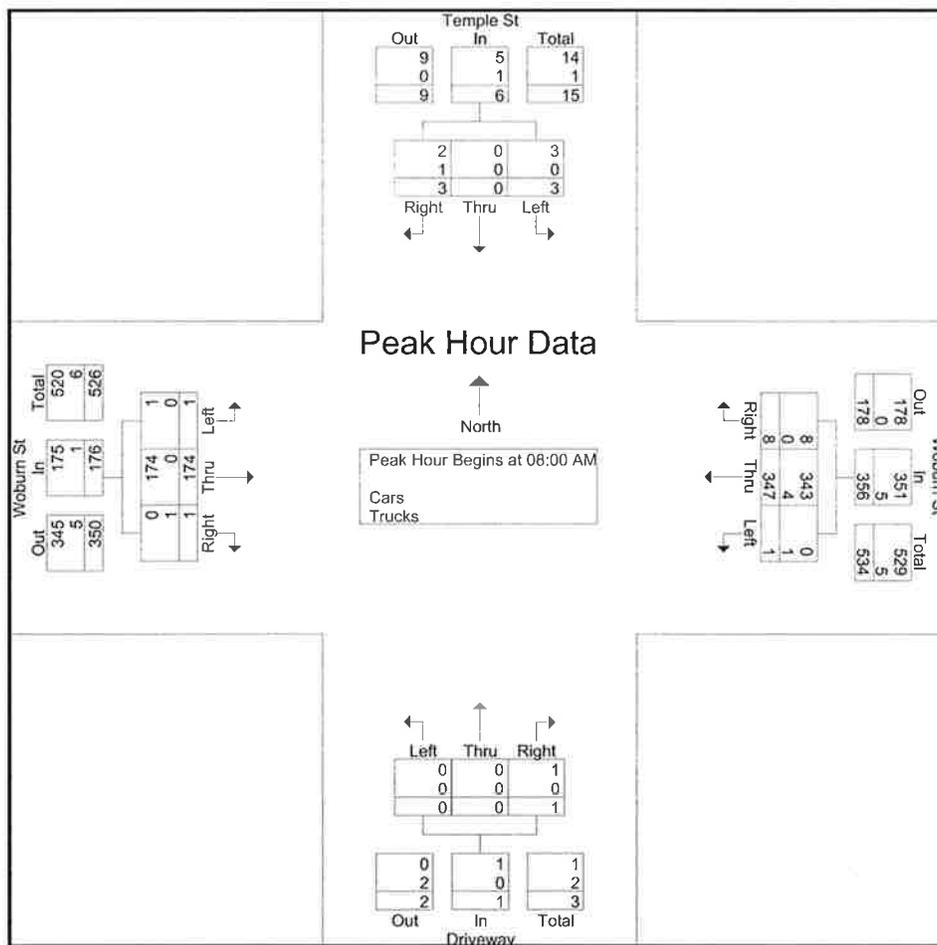
Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 2

Start Time	Temple St From North				Woburn St From East				Driveway From South				Woburn St From West				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	0	0	1	72	3	76	0	0	1	1	0	29	0	29	106
08:15 AM	1	0	1	2	0	83	0	83	0	0	0	0	1	55	0	56	141
08:30 AM	2	0	2	4	0	97	2	99	0	0	0	0	0	40	1	41	144
08:45 AM	0	0	0	0	0	95	3	98	0	0	0	0	0	50	0	50	148
Total Volume	3	0	3	6	1	347	8	356	0	0	1	1	1	174	1	176	539
% App. Total	50	0	50		0.3	97.5	2.2		0	0	100		0.6	98.9	0.6		
PHF	.375	.000	.375	.375	.250	.894	.667	.899	.000	.000	.250	.250	.250	.791	.250	.786	.910
Cars	3	0	2	5	0	343	8	351	0	0	1	1	1	174	0	175	532
% Cars	100	0	66.7	83.3	0	98.8	100	98.6	0	0	100	100	100	100	0	99.4	98.7
Trucks	0	0	1	1	1	4	0	5	0	0	0	0	0	0	1	1	7
% Trucks	0	0	33.3	16.7	100	1.2	0	1.4	0	0	0	0	0	0	100	0.6	1.3



Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 4

Groups Printed- Cars

Start Time	Temple St From North			Woburn St From East			Driveway From South			Woburn St From West			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	1	0	0	0	58	2	0	0	0	0	23	0	84
07:15 AM	0	0	0	0	72	5	0	0	0	0	31	0	108
07:30 AM	3	0	0	0	73	2	0	0	0	1	24	0	103
07:45 AM	1	0	0	0	72	7	0	0	0	0	36	0	116
Total	5	0	0	0	275	16	0	0	0	1	114	0	411
08:00 AM	0	0	0	0	70	3	0	0	1	0	29	0	103
08:15 AM	1	0	1	0	82	0	0	0	0	1	55	0	140
08:30 AM	2	0	1	0	97	2	0	0	0	0	40	0	142
08:45 AM	0	0	0	0	94	3	0	0	0	0	50	0	147
Total	3	0	2	0	343	8	0	0	1	1	174	0	532
Grand Total	8	0	2	0	618	24	0	0	1	2	288	0	943
Apprch %	80	0	20	0	96.3	3.7	0	0	100	0.7	99.3	0	
Total %	0.8	0	0.2	0	65.5	2.5	0	0	0.1	0.2	30.5	0	

Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 7

Groups Printed- Trucks

Start Time	Temple St From North			Woburn St From East			Driveway From South			Woburn St From West			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	1	0	0	1	0	0	0	0	0	0	0	0	2
07:45 AM	0	0	0	0	1	2	0	0	0	0	0	0	3
Total	1	0	0	1	1	2	0	0	0	0	0	0	5
08:00 AM	0	0	0	1	2	0	0	0	0	0	0	0	3
08:15 AM	0	0	0	0	1	0	0	0	0	0	0	0	1
08:30 AM	0	0	1	0	0	0	0	0	0	0	0	1	2
08:45 AM	0	0	0	0	1	0	0	0	0	0	0	0	1
Total	0	0	1	1	4	0	0	0	0	0	0	1	7
Grand Total	1	0	1	2	5	2	0	0	0	0	0	1	12
Apprch %	50	0	50	22.2	55.6	22.2	0	0	0	0	0	100	
Total %	8.3	0	8.3	16.7	41.7	16.7	0	0	0	0	0	8.3	

Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 10

Start Time	Temple St From North				Woburn St From East				Driveway From South				Woburn St From West				Exclu. Total	Inclu. Total	Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds			
07:00 AM	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0	4	0	4
07:15 AM	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	4	0	4
07:30 AM	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	2	1	3
07:45 AM	0	0	0	0	0	0	0	1	0	0	0	3	0	1	0	0	4	1	5
Total	0	0	0	3	0	1	0	4	0	0	0	7	0	1	0	0	14	2	16
08:00 AM	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	3	0	3
08:15 AM	0	0	0	1	0	0	0	2	0	0	0	3	0	0	0	0	6	0	6
08:30 AM	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	4	0	4
08:45 AM	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	3	0	3
Total	0	0	0	6	0	0	0	2	0	0	0	8	0	0	0	0	16	0	16
Grand Total	0	0	0	9	0	1	0	6	0	0	0	15	0	1	0	0	30	2	32
Apprch %	0	0	0		0	100	0		0	0	0		0	100	0				
Total %	0	0	0		0	50	0		0	0	0		0	50	0		93.8	6.2	

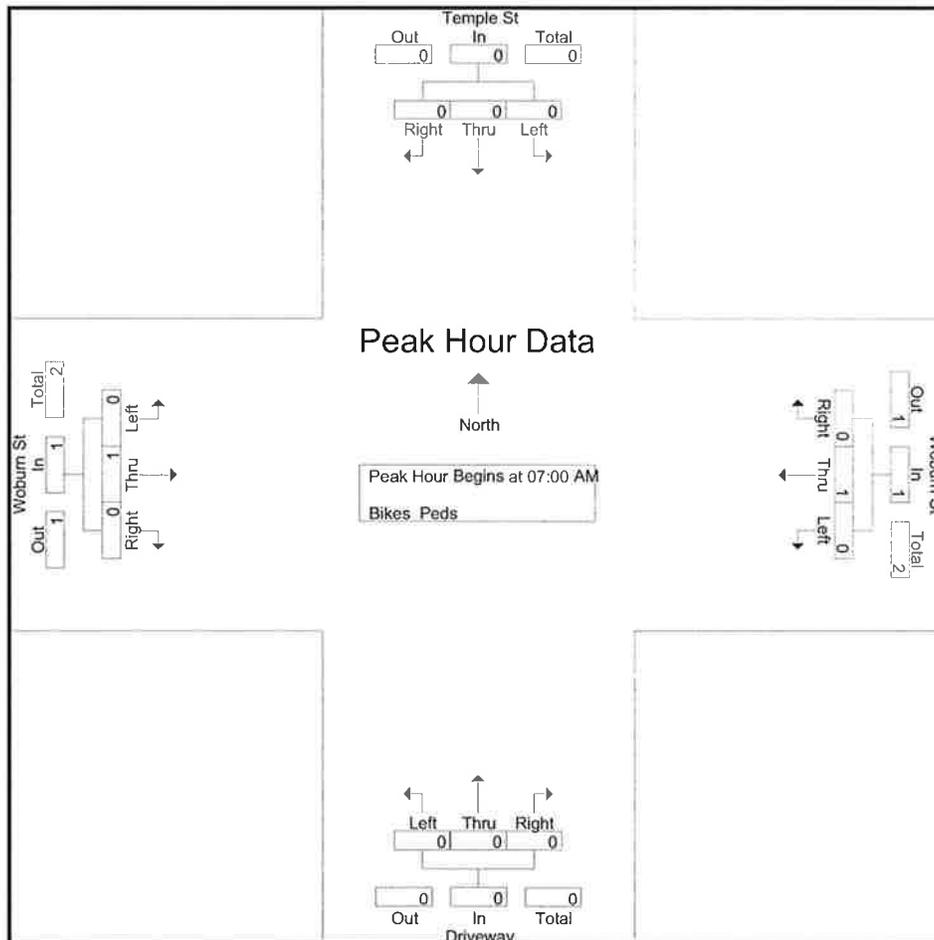
Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 11

Start Time	Temple St From North				Woburn St From East				Driveway From South				Woburn St From West				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Total Volume	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	2
% App. Total	0	0	0	0	0	100	0	100	0	0	0	0	0	100	0	100	100
PHF	.000	.000	.000	.000	.000	.250	.000	.250	.000	.000	.000	.000	.000	.250	.000	.250	.500



Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 1

Start Time	Temple St From North			Woburn St From East			Driveway From South			Woburn St From West			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
04:00 PM	1	0	2	0	60	2	0	0	0	1	96	0	162
04:15 PM	3	0	0	0	41	2	0	0	0	0	90	0	136
04:30 PM	1	0	0	0	42	1	0	0	1	0	76	0	121
04:45 PM	0	0	0	0	41	2	0	0	0	3	97	0	143
Total	5	0	2	0	184	7	0	0	1	4	359	0	562
05:00 PM	2	0	0	0	66	3	0	0	0	2	81	0	154
05:15 PM	1	0	0	0	61	5	1	0	1	2	82	0	153
05:30 PM	0	0	0	0	47	0	1	0	1	0	128	0	177
05:45 PM	2	0	0	0	59	0	0	0	0	1	102	0	164
Total	5	0	0	0	233	8	2	0	2	5	393	0	648
Grand Total	10	0	2	0	417	15	2	0	3	9	752	0	1210
Apprch %	83.3	0	16.7	0	96.5	3.5	40	0	60	1.2	98.8	0	
Total %	0.8	0	0.2	0	34.5	1.2	0.2	0	0.2	0.7	62.1	0	
Cars	10	0	2	0	416	15	2	0	3	9	749	0	1206
% Cars	100	0	100	0	99.8	100	100	0	100	100	99.6	0	99.7
Trucks	0	0	0	0	1	0	0	0	0	0	3	0	4
% Trucks	0	0	0	0	0.2	0	0	0	0	0	0.4	0	0.3

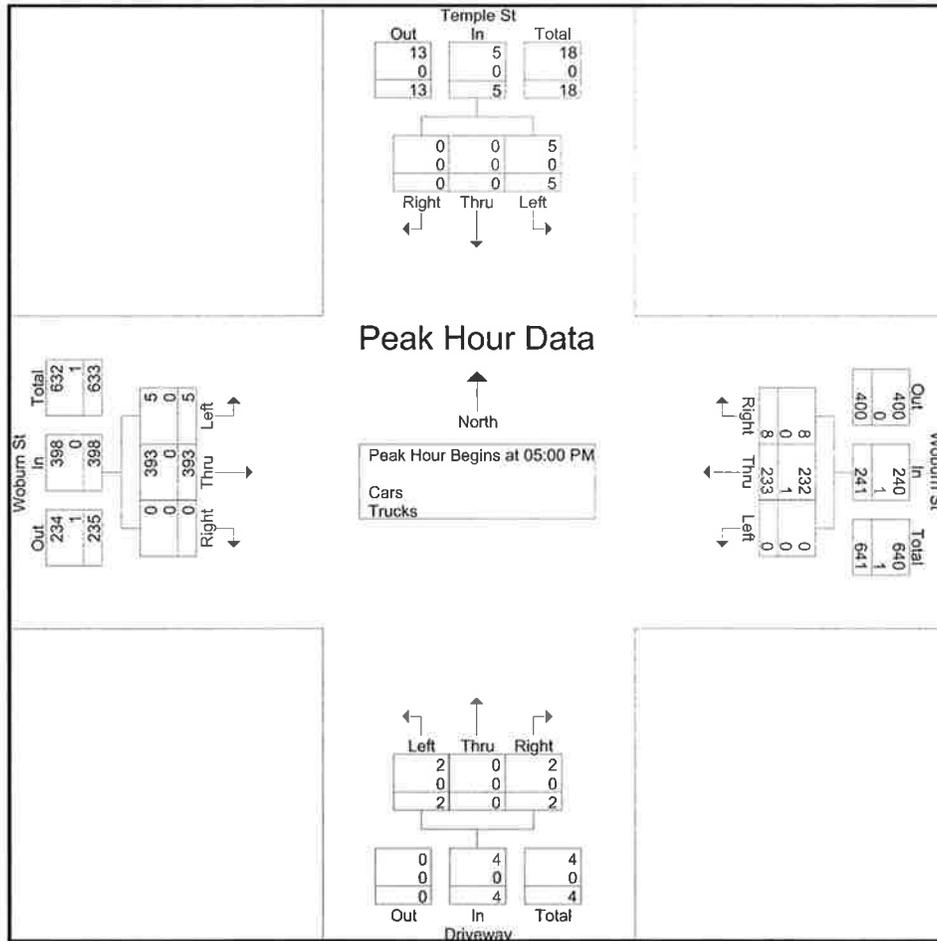
Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 2

Start Time	Temple St From North				Woburn St From East				Driveway From South				Woburn St From West				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 05:00 PM																	
05:00 PM	2	0	0	2	0	66	3	69	0	0	0	0	2	81	0	83	154
05:15 PM	1	0	0	1	0	61	5	66	1	0	1	2	2	82	0	84	153
05:30 PM	0	0	0	0	0	47	0	47	1	0	1	2	0	128	0	128	177
05:45 PM	2	0	0	2	0	59	0	59	0	0	0	0	1	102	0	103	164
Total Volume	5	0	0	5	0	233	8	241	2	0	2	4	5	393	0	398	648
% App. Total	100	0	0	100	0	96.7	3.3	99.6	50	0	50	100	1.3	98.7	0	100	99.8
PHF	.625	.000	.000	.625	.000	.883	.400	.873	.500	.000	.500	.500	.625	.768	.000	.777	.915
Cars	5	0	0	5	0	232	8	240	2	0	2	4	5	393	0	398	647
% Cars	100	0	0	100	0	99.6	100	99.6	100	0	100	100	100	100	0	100	99.8
Trucks	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
% Trucks	0	0	0	0	0	0.4	0	0.4	0	0	0	0	0	0	0	0	0.2



Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 4

Groups Printed- Cars

Start Time	Temple St From North			Woburn St From East			Driveway From South			Woburn St From West			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
04:00 PM	1	0	2	0	60	2	0	0	0	1	95	0	161
04:15 PM	3	0	0	0	41	2	0	0	0	0	89	0	135
04:30 PM	1	0	0	0	42	1	0	0	1	0	75	0	120
04:45 PM	0	0	0	0	41	2	0	0	0	3	97	0	143
Total	5	0	2	0	184	7	0	0	1	4	356	0	559
05:00 PM	2	0	0	0	66	3	0	0	0	2	81	0	154
05:15 PM	1	0	0	0	60	5	1	0	1	2	82	0	152
05:30 PM	0	0	0	0	47	0	1	0	1	0	128	0	177
05:45 PM	2	0	0	0	59	0	0	0	0	1	102	0	164
Total	5	0	0	0	232	8	2	0	2	5	393	0	647
Grand Total	10	0	2	0	416	15	2	0	3	9	749	0	1206
Apprch %	83.3	0	16.7	0	96.5	3.5	40	0	60	1.2	98.8	0	
Total %	0.8	0	0.2	0	34.5	1.2	0.2	0	0.2	0.7	62.1	0	

Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 7

Groups Printed- Trucks

Start Time	Temple St From North			Woburn St From East			Driveway From South			Woburn St From West			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
04:00 PM	0	0	0	0	0	0	0	0	0	0	1	0	1
04:15 PM	0	0	0	0	0	0	0	0	0	0	1	0	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	1	0	1
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	3	0	3
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	1	0	0	0	0	0	0	0	1
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	1	0	0	0	0	0	0	0	1
Grand Total	0	0	0	0	1	0	0	0	0	0	3	0	4
Apprch %	0	0	0	0	100	0	0	0	0	0	100	0	
Total %	0	0	0	0	25	0	0	0	0	0	75	0	

Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 10

Groups Printed- Bikes Peds

Start Time	Temple St From North				Woburn St From East				Driveway From South				Woburn St From West				Exclu. Total	Inclu. Total	Int. Total
	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds			
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
04:30 PM	1	0	0	2	0	1	0	2	0	0	0	0	1	0	0	0	4	3	7
04:45 PM	0	0	0	2	0	0	0	1	0	0	0	0	0	1	0	0	3	1	4
Total	1	0	0	4	0	1	0	3	0	0	0	1	1	1	0	0	8	4	12
05:00 PM	0	0	0	3	0	0	0	2	0	0	0	4	0	0	0	1	10	0	10
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	3
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1
05:45 PM	0	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0	4	0	4
Total	0	0	0	6	0	0	0	3	0	0	0	8	0	0	0	1	18	0	18
Grand Total	1	0	0	10	0	1	0	6	0	0	0	9	1	1	0	1	26	4	30
Apprch %	100	0	0		0	100	0		0	0	0		50	50	0				
Total %	25	0	0		0	25	0		0	0	0		25	25	0		86.7	13.3	

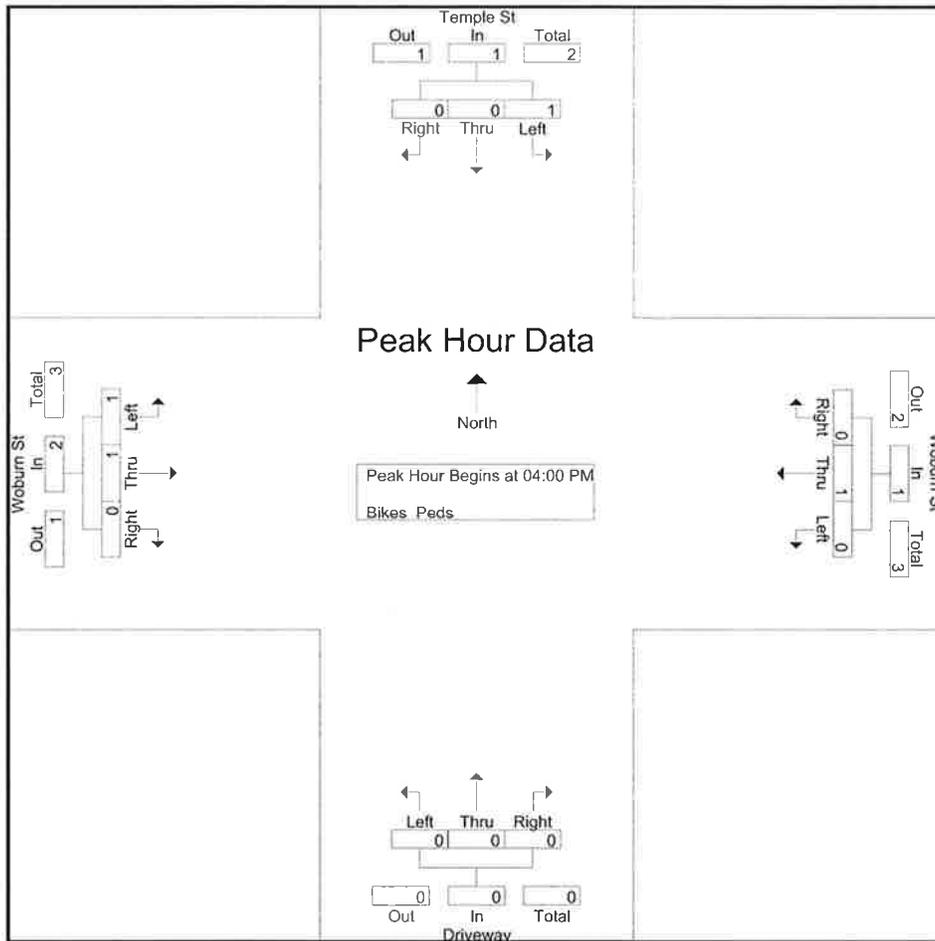
Accurate Counts

978-664-2565

N/S Street : Temple St / Private Dwy
 E/W Street : Woburn Street
 City/State : Reading, MA
 Weather : Cloudy

File Name : 73790001
 Site Code : 73790001
 Start Date : 6/29/2016
 Page No : 11

Start Time	Temple St From North				Woburn St From East				Driveway From South				Woburn St From West				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:30 PM	1	0	0	1	0	1	0	1	0	0	0	0	1	0	0	1	3
04:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Total Volume	1	0	0	1	0	1	0	1	0	0	0	0	1	1	0	2	4
% App. Total	100	0	0		0	100	0		0	0	0		50	50	0		
PHF	.250	.000	.000	.250	.000	.250	.000	.250	.000	.000	.000	.000	.250	.250	.000	.500	.333



SEASONAL ADJUSTMENT DATA

Table 2.1: MassDOT Highway Division's Statewide: 2014 Seasonal Adjustment Factors

2014 Weekday Seasonal Factors													
Factor Group	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Group 2: Rural Major Collector, R5, R6 & R0	1.12	1.12	1.07	0.99	0.91	0.90	0.86	0.86	0.92	0.93	1.01	1.05	
Group 4: I-495 Interstate	1.02	1.00	1.00	0.96	0.92	0.89	0.85	0.83	0.93	0.96	1.01	1.03	
Group 6: Urban Arterials, Collectors, & Rural Arterials, U2, U3, U5, U6, R2,R3	1.03	1.01	0.96	0.92	0.91	0.90	0.92	0.92	0.93	0.92	0.97	0.97	

VEHICLE TRAVEL SPEED DATA

Accurate Counts
978-664-2565

Location : Woburn Street
Location : West of Temple Street
City/State: Reading, MA

7379SPD1

EB

Start Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total
06/29/16	0	0	0	3	4	1	0	0	0	0	0	0	0	0	8
01:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
02:00	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2
03:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2
04:00	0	0	0	1	2	2	0	0	0	0	0	0	0	0	5
05:00	0	2	1	8	8	4	1	0	0	0	0	0	0	0	24
06:00	0	0	0	14	42	18	2	0	0	0	0	0	0	0	76
07:00	1	0	3	24	59	23	2	1	0	0	0	0	0	0	113
08:00	0	3	4	34	93	32	3	0	0	0	0	0	0	0	169
09:00	0	1	5	35	67	21	2	0	0	0	0	0	0	0	131
10:00	1	5	8	30	65	35	4	0	0	0	0	0	0	0	148
11:00	1	0	8	38	111	31	6	0	0	0	0	0	0	0	195
12 PM	1	0	4	43	110	43	1	0	0	0	0	0	0	0	202
13:00	0	1	12	33	100	40	3	0	0	0	0	0	0	0	189
14:00	1	1	2	54	116	51	5	0	0	0	0	0	0	0	230
15:00	5	1	4	52	144	61	7	0	0	0	0	0	0	0	274
16:00	1	0	4	66	210	90	4	1	0	0	0	0	0	0	376
17:00	1	3	9	71	218	72	6	0	0	0	0	0	0	0	378
18:00	1	2	17	82	215	67	7	0	0	0	0	0	0	0	391
19:00	3	3	5	43	97	42	8	1	0	0	0	0	0	0	202
20:00	0	1	6	28	95	20	2	0	0	0	0	0	0	0	152
21:00	2	0	4	29	52	11	1	0	0	0	0	0	0	0	99
22:00	1	0	1	8	26	13	1	0	0	0	0	0	0	0	50
23:00	0	0	1	4	16	5	0	0	0	0	0	0	0	0	26
Total	19	23	98	702	1850	684	65	3	0	0	0	0	0	0	3444

Daily

15th Percentile : 27 MPH
 50th Percentile : 32 MPH
 85th Percentile : 36 MPH
 95th Percentile : 39 MPH

Mean Speed(Average) : 33 MPH
 10 MPH Pace Speed : 26-35 MPH
 Number in Pace : 2552
 Percent in Pace : 74.1%
 Number of Vehicles > 35 MPH : 752
 Percent of Vehicles > 35 MPH : 21.8%

Accurate Counts
978-664-2565

Location : Woburn Street
Location : West of Temple Street
City/State: Reading, MA

7379SPD1

EB

Start Time	1	16	21	26	31	36	41	46	51	56	61	66	71	76	999	Total
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	76	999	Total
06/30/16	0	0	0	3	9	5	0	0	0	0	0	0	0	0	0	17
01:00	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
02:00	0	0	0	0	2	1	1	0	0	0	0	0	0	0	0	4
03:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2
04:00	0	0	0	0	4	2	1	0	0	0	0	0	0	0	0	7
05:00	1	0	1	7	13	9	0	0	0	0	0	0	0	0	0	31
06:00	1	0	0	11	45	25	6	0	0	0	0	0	0	0	0	88
07:00	1	0	1	14	70	30	4	0	0	0	0	0	0	0	0	120
08:00	0	0	2	32	89	38	2	1	0	0	0	0	0	0	0	164
09:00	0	3	6	33	84	25	2	0	0	0	0	0	0	0	0	153
10:00	0	4	18	57	86	15	0	1	0	0	0	0	0	0	0	181
11:00	18	5	4	80	94	24	3	1	0	0	0	0	0	0	0	229
12 PM	2	2	7	49	126	40	2	0	0	0	0	0	0	0	0	228
13:00	4	4	8	54	110	30	4	0	0	0	0	0	0	0	0	214
14:00	2	0	7	59	140	34	1	0	0	0	0	0	0	0	0	243
15:00	2	0	7	60	165	54	10	0	0	0	0	0	0	0	0	298
16:00	3	2	9	108	235	71	4	1	0	0	0	0	0	0	0	433
17:00	5	9	23	92	252	89	8	0	0	0	0	0	0	0	0	478
18:00	1	5	10	111	243	93	5	0	0	0	0	0	0	0	0	468
19:00	2	2	7	51	119	52	6	0	0	0	0	0	0	0	0	239
20:00	0	0	3	46	91	28	1	0	0	0	0	0	0	0	0	169
21:00	0	1	2	30	49	12	0	0	0	0	0	0	0	0	0	94
22:00	0	0	1	6	34	7	1	0	0	0	0	0	0	0	0	49
23:00	0	0	0	7	15	10	1	0	0	0	0	0	0	0	0	33
Total	42	37	116	910	2078	696	62	4	0	0	0	0	0	0	0	3945

Daily

- 15th Percentile : 27 MPH
- 50th Percentile : 32 MPH
- 85th Percentile : 36 MPH
- 95th Percentile : 39 MPH
- Mean Speed(Average) : 32 MPH
- 10 MPH Pace Speed : 26-35 MPH
- Number in Pace : 2988
- Percent in Pace : 75.7%
- Number of Vehicles > 35 MPH : 762
- Percent of Vehicles > 35 MPH : 19.3%

Grand Total	61	60	214	1612	3928	1380	127	7	0	0	0	0	0	0	0	7389
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Overall

- 15th Percentile : 27 MPH
- 50th Percentile : 32 MPH
- 85th Percentile : 36 MPH
- 95th Percentile : 39 MPH
- Mean Speed(Average) : 32 MPH
- 10 MPH Pace Speed : 26-35 MPH
- Number in Pace : 5540
- Percent in Pace : 75.0%
- Number of Vehicles > 35 MPH : 1514
- Percent of Vehicles > 35 MPH : 20.5%

Accurate Counts
978-664-2565

Location : Woburn Street
Location : West of Temple Street
City/State: Reading, MA

7379SPD1

WB

Start Time	1	16	21	26	31	36	41	46	51	56	61	66	71	76	Total
	15	20	25	30	35	40	45	50	55	60	65	70	75	999	
06/29/16	1	0	1	1	4	1	0	0	0	0	0	0	0	0	8
01:00	0	0	2	1	0	0	0	0	0	0	0	0	0	0	3
02:00	1	0	0	1	1	1	0	0	0	0	0	0	0	0	4
03:00	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
04:00	0	0	1	1	3	1	0	0	0	0	0	0	0	0	6
05:00	0	1	0	1	8	14	3	0	0	0	0	0	0	0	27
06:00	0	1	0	20	64	53	8	2	0	0	0	0	0	0	148
07:00	0	1	3	43	134	92	12	1	0	0	0	0	0	0	286
08:00	2	11	14	38	134	118	15	2	1	0	0	0	0	0	335
09:00	1	9	20	51	96	55	13	1	0	0	0	0	0	0	246
10:00	1	2	6	26	69	60	13	0	0	0	0	0	0	0	177
11:00	0	4	6	25	82	70	6	4	0	0	0	0	0	0	197
12 PM	0	2	6	32	81	60	13	2	0	0	0	0	0	0	196
13:00	1	3	3	32	102	48	17	3	0	0	0	0	0	0	209
14:00	3	4	4	32	86	43	7	1	0	0	0	0	0	0	180
15:00	3	2	7	26	106	56	12	0	0	0	0	0	0	0	212
16:00	0	1	3	28	81	55	20	1	0	0	0	0	0	0	189
17:00	2	2	7	25	98	79	17	0	0	0	0	0	0	0	230
18:00	3	2	6	16	98	65	16	1	0	0	0	0	0	0	207
19:00	0	7	20	38	80	44	11	3	0	0	0	0	0	0	203
20:00	1	2	7	17	84	42	7	0	0	0	0	0	0	0	160
21:00	1	1	12	25	38	25	5	0	0	0	0	0	0	0	107
22:00	0	0	2	23	32	12	3	0	0	0	0	0	0	0	72
23:00	0	0	0	8	19	8	1	0	0	0	0	0	0	0	36
Total	20	55	130	511	1500	1002	199	21	1	0	0	0	0	0	3439

Daily

- 15th Percentile : 28 MPH
- 50th Percentile : 33 MPH
- 85th Percentile : 38 MPH
- 95th Percentile : 41 MPH
- Mean Speed(Average) : 34 MPH
- 10 MPH Pace Speed : 31-40 MPH
- Number in Pace : 2502
- Percent in Pace : 72.8%
- Number of Vehicles > 35 MPH : 1223
- Percent of Vehicles > 35 MPH : 35.6%

Accurate Counts

978-664-2565

Location : Woburn Street
 Location : West of Temple Street
 City/State: Reading, MA

7379SPD1

WB

Start Time	1	16	21	26	31	36	41	46	51	56	61	66	71	76	Total
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total
06/30/16	0	0	1	2	7	2	0	0	0	0	0	0	0	0	12
01:00	0	0	2	2	4	1	0	0	0	0	0	0	0	0	9
02:00	0	0	0	2	2	1	0	0	0	0	0	0	0	0	5
03:00	0	0	0	1	4	1	1	0	0	0	0	0	0	0	7
04:00	1	0	0	2	1	2	1	0	0	0	0	0	0	0	7
05:00	0	1	0	5	11	8	2	0	0	0	0	0	0	0	27
06:00	4	4	9	11	64	62	19	1	0	0	0	0	0	0	174
07:00	4	6	6	45	147	104	21	2	0	0	0	0	0	0	335
08:00	4	2	4	55	183	92	21	0	0	0	0	0	0	0	361
09:00	6	5	4	40	98	78	15	3	0	0	0	0	0	0	249
10:00	15	7	23	26	87	41	6	0	0	0	0	0	0	0	205
11:00	6	3	13	31	86	47	9	0	0	0	0	0	0	0	195
12 PM	0	3	14	42	96	63	9	2	0	0	0	0	0	0	229
13:00	3	1	5	31	96	44	9	2	1	0	0	0	0	0	192
14:00	0	1	7	21	92	55	12	0	0	0	0	0	0	0	188
15:00	2	5	7	25	85	65	19	4	1	0	0	0	0	0	213
16:00	1	1	7	26	68	60	23	1	0	0	0	0	0	0	187
17:00	3	0	4	28	99	73	9	0	0	0	0	0	0	0	216
18:00	1	1	6	25	77	68	15	1	0	1	0	0	0	0	195
19:00	5	1	8	32	74	46	9	2	0	0	0	0	0	0	177
20:00	0	0	3	32	62	46	6	0	0	0	0	0	0	0	149
21:00	0	1	6	29	64	17	2	0	0	0	0	0	0	0	119
22:00	0	0	1	13	29	13	2	0	0	0	0	0	0	0	58
23:00	0	0	2	4	16	7	3	0	0	0	0	0	0	0	32
Total	55	42	132	530	1552	996	213	18	2	1	0	0	0	0	3541

Daily

- 15th Percentile : 27 MPH
- 50th Percentile : 33 MPH
- 85th Percentile : 38 MPH
- 95th Percentile : 41 MPH
- Mean Speed(Average) : 33 MPH
- 10 MPH Pace Speed : 31-40 MPH
- Number in Pace : 2548
- Percent in Pace : 72.0%
- Number of Vehicles > 35 MPH : 1230
- Percent of Vehicles > 35 MPH : 34.7%

Grand Total	75	97	262	1041	3052	1998	412	39	3	1	0	0	0	0	6980
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Overall

- 15th Percentile : 27 MPH
- 50th Percentile : 33 MPH
- 85th Percentile : 38 MPH
- 95th Percentile : 41 MPH
- Mean Speed(Average) : 34 MPH
- 10 MPH Pace Speed : 31-40 MPH
- Number in Pace : 5050
- Percent in Pace : 72.3%
- Number of Vehicles > 35 MPH : 2453
- Percent of Vehicles > 35 MPH : 35.1%

Accurate Counts
978-664-2565

Location : Woburn Street
Location : West of Temple Street
City/State: Reading, MA

7379SPD1

EB, WB

Start Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	Total
06/29/16	1	0	1	4	8	2	0	0	0	0	0	0	0	0	16
01:00	0	0	2	2	1	0	0	0	0	0	0	0	0	0	5
02:00	1	0	0	2	2	1	0	0	0	0	0	0	0	0	6
03:00	0	0	0	1	0	2	0	0	0	0	0	0	0	0	3
04:00	0	0	1	2	5	3	0	0	0	0	0	0	0	0	11
05:00	0	3	1	9	16	18	4	0	0	0	0	0	0	0	51
06:00	0	1	0	34	106	71	10	2	0	0	0	0	0	0	224
07:00	1	1	6	67	193	115	14	2	0	0	0	0	0	0	399
08:00	2	14	18	72	227	150	18	2	1	0	0	0	0	0	504
09:00	1	10	25	86	163	76	15	1	0	0	0	0	0	0	377
10:00	2	7	14	56	134	95	17	0	0	0	0	0	0	0	325
11:00	1	4	14	63	193	101	12	4	0	0	0	0	0	0	392
12 PM	1	2	10	75	191	103	14	2	0	0	0	0	0	0	398
13:00	1	4	15	65	202	88	20	3	0	0	0	0	0	0	398
14:00	4	5	6	86	202	94	12	1	0	0	0	0	0	0	410
15:00	8	3	11	78	250	117	19	0	0	0	0	0	0	0	486
16:00	1	1	7	94	291	145	24	2	0	0	0	0	0	0	565
17:00	3	5	16	96	314	151	23	0	0	0	0	0	0	0	608
18:00	4	4	23	98	313	132	23	1	0	0	0	0	0	0	598
19:00	3	10	25	81	177	86	19	4	0	0	0	0	0	0	405
20:00	1	3	13	45	179	62	9	0	0	0	0	0	0	0	312
21:00	3	1	18	54	90	36	6	0	0	0	0	0	0	0	208
22:00	1	0	3	31	58	25	4	0	0	0	0	0	0	0	122
23:00	0	0	1	12	35	13	1	0	0	0	0	0	0	0	62
Total	39	78	228	1213	3350	1686	264	24	1	0	0	0	0	0	6883

Daily	15th Percentile :	27 MPH
	50th Percentile :	32 MPH
	85th Percentile :	37 MPH
	95th Percentile :	39 MPH
	Mean Speed(Average) :	33 MPH
	10 MPH Pace Speed :	31-40 MPH
	Number in Pace :	5036
	Percent in Pace :	73.2%
	Number of Vehicles > 35 MPH :	1975
	Percent of Vehicles > 35 MPH :	28.7%

Accurate Counts

978-664-2565

Location : Woburn Street
 Location : West of Temple Street
 City/State: Reading, MA

7379SPD1

EB, WB

Start Time	1	16	21	26	31	36	41	46	51	56	61	66	71	76	Total
Time	15	20	25	30	35	40	45	50	55	60	65	70	75	999	
06/30/16	0	0	1	5	16	7	0	0	0	0	0	0	0	0	29
01:00	0	0	2	2	7	1	0	0	0	0	0	0	0	0	12
02:00	0	0	0	2	4	2	1	0	0	0	0	0	0	0	9
03:00	0	0	0	1	4	3	1	0	0	0	0	0	0	0	9
04:00	1	0	0	2	5	4	2	0	0	0	0	0	0	0	14
05:00	1	1	1	12	24	17	2	0	0	0	0	0	0	0	58
06:00	5	4	9	22	109	87	25	1	0	0	0	0	0	0	262
07:00	5	6	7	59	217	134	25	2	0	0	0	0	0	0	455
08:00	4	2	6	87	272	130	23	1	0	0	0	0	0	0	525
09:00	6	8	10	73	182	103	17	3	0	0	0	0	0	0	402
10:00	15	11	41	83	173	56	6	1	0	0	0	0	0	0	386
11:00	24	8	17	111	180	71	12	1	0	0	0	0	0	0	424
12 PM	2	5	21	91	222	103	11	2	0	0	0	0	0	0	457
13:00	7	5	13	85	206	74	13	2	1	0	0	0	0	0	406
14:00	2	1	14	80	232	89	13	0	0	0	0	0	0	0	431
15:00	4	5	14	85	250	119	29	4	1	0	0	0	0	0	511
16:00	4	3	16	134	303	131	27	2	0	0	0	0	0	0	620
17:00	8	9	27	120	351	162	17	0	0	0	0	0	0	0	694
18:00	2	6	16	136	320	161	20	1	0	1	0	0	0	0	663
19:00	7	3	15	83	193	98	15	2	0	0	0	0	0	0	416
20:00	0	0	6	78	153	74	7	0	0	0	0	0	0	0	318
21:00	0	2	8	59	113	29	2	0	0	0	0	0	0	0	213
22:00	0	0	2	19	63	20	3	0	0	0	0	0	0	0	107
23:00	0	0	2	11	31	17	4	0	0	0	0	0	0	0	65
Total	97	79	248	1440	3630	1692	275	22	2	1	0	0	0	0	7486

Daily
 15th Percentile : 27 MPH
 50th Percentile : 32 MPH
 85th Percentile : 37 MPH
 95th Percentile : 39 MPH

Mean Speed(Average) : 33 MPH
 10 MPH Pace Speed : 31-40 MPH
 Number in Pace : 5322
 Percent in Pace : 71.1%
 Number of Vehicles > 35 MPH : 1992
 Percent of Vehicles > 35 MPH : 26.6%

Grand Total	136	157	476	2653	6980	3378	539	46	3	1	0	0	0	0	14369
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Overall
 15th Percentile : 27 MPH
 50th Percentile : 32 MPH
 85th Percentile : 37 MPH
 95th Percentile : 39 MPH

Mean Speed(Average) : 33 MPH
 10 MPH Pace Speed : 31-40 MPH
 Number in Pace : 10358
 Percent in Pace : 72.1%
 Number of Vehicles > 35 MPH : 3967
 Percent of Vehicles > 35 MPH : 27.6%

PUBLIC TRANSPORTATION SCHEDULE AND FARE INFORMATIONS

HAVERHILL LINE Train Schedule Effective May 23, 2016

Monday to Friday Inbound to Boston

AM

ZONE	STATION	200	202	204	206	286	288	208	290	210	212	214	216	218	292	220	294	296	222	288	224	226	228
	Bikes Allowed																						
7	Haverhill	5:05	5:40	6:10	6:40	-	-	7:35	-	9:06	10:44	12:18	1:53	3:30	-	B 4:30	-	6:09	-	7:45	9:10	10:50	
7	Bradford	5:07	5:42	6:12	6:42	-	-	7:37	-	9:08	10:46	12:20	1:55	3:32	-	4:40	-	6:19	-	7:47	9:12	10:52	
6	Lawrence	5:16	5:51	6:21	6:51	-	-	7:46	-	9:16	10:54	12:28	2:03	3:40	-	4:55	-	6:39	-	7:55	9:20	11:00	
5	Andover	5:23	5:58	6:28	6:58	-	-	7:53	-	9:23	11:01	12:35	2:10	3:47	-	5:02	-	6:46	-	8:02	9:27	11:07	
4	Ballardvale	5:29	6:04	6:34	7:04	-	-	7:59	-	9:28	11:06	12:40	2:15	3:52	-	5:07	-	6:51	-	8:07	9:32	11:12	
3	North Wilmington	5:36	6:11	6:41	-	-	-	7:30	8:00	9:35	11:13	12:47	2:22	-	-	-	-	8:07	-	9:35	11:15	11:26	
2	Reading	5:49	6:24	6:54	-	-	-	7:36	8:06	9:42	11:20	12:54	2:29	-	4:50	-	5:38	6:55	-	8:07	9:46	11:26	
2	Wakefield	5:52	6:27	6:57	-	-	-	7:39	8:09	9:50	11:28	13:02	2:37	-	4:55	-	5:43	7:00	-	8:12	9:51	11:31	
2	Greenwood	5:54	6:29	6:59	-	-	-	7:41	8:11	9:52	11:30	13:04	2:39	-	4:58	-	5:46	7:03	-	8:15	9:54	11:34	
1	Melrose Highlands	5:56	6:31	7:01	-	-	-	7:43	8:13	9:54	11:32	13:06	2:41	-	5:00	-	5:48	7:05	-	8:17	9:56	11:36	
1	Melrose/Cedar Park	5:58	6:33	7:03	-	-	-	7:45	8:15	9:56	11:34	13:08	2:43	-	5:01	-	5:49	7:06	-	8:18	9:57	11:38	
1A	Malden Center	L 6:02	L 6:37	L 7:07	-	-	-	L 7:49	L 8:19	L 9:59	L 11:37	L 13:11	L 2:46	-	L 5:06	-	L 5:54	L 7:11	-	L 8:23	L 10:03	L 11:43	
1A	NORTH STATION	6:15	6:50	7:20	7:38	8:00	8:30	8:35	9:00	10:11	11:49	12:3	2:58	4:28	5:17	5:43	6:05	7:22	7:25	8:34	10:15	11:55	

Trains in purple box indicate peak period trains.

Monday to Friday Outbound from Boston

AM

ZONE	STATION	285	287	201	289	203	205	207	209	211	213	283	215	217	219	221	229
	Bikes Allowed																
1A	NORTH STATION	6:43	7:10	7:35	9:15	10:55	12:30	2:02	3:15	3:50	4:30	4:48	5:15	5:35	6:05	6:55	7:29
1A	Malden Center	6:54	7:21	7:45	9:25	11:05	12:41	2:13	3:26	4:01	4:41	4:59	5:26	5:46	6:16	6:36	7:20
1	Wyoming Hill	6:57	7:24	7:48	9:29	11:09	12:44	2:16	3:30	4:05	4:45	5:03	-	5:50	6:20	6:40	7:34
1	Melrose/Cedar Park	6:59	7:26	7:50	9:31	11:11	12:46	2:18	3:32	4:07	4:47	5:05	-	5:52	6:22	6:42	7:36
1	Melrose Highlands	6:59	7:26	7:50	9:31	11:11	12:46	2:18	3:32	4:07	4:47	5:05	-	5:52	6:22	6:42	7:36
2	Greenwood	7:05	7:32	7:56	9:37	11:17	12:52	2:24	3:39	4:14	4:54	5:12	-	5:59	6:29	6:49	7:39
2	Wakefield	7:09	7:36	8:00	9:41	11:21	12:56	2:28	3:43	4:18	4:58	5:16	5:36	6:03	6:33	6:53	7:42
2	Reading	7:15	7:42	8:06	9:47	11:27	13:02	2:34	3:49	4:24	5:04	5:22	5:42	6:09	6:39	6:59	7:46
3	North Wilmington	-	-	8:12	9:53	11:33	13:08	2:40	3:55	4:30	5:11	5:29	5:49	6:16	6:46	7:06	7:52
4	Ballardvale	-	-	8:19	10:00	11:40	13:15	2:42	3:57	4:32	5:18	5:36	5:56	6:23	6:53	7:13	7:58
5	Andover	-	-	8:24	10:05	11:45	13:20	2:45	4:00	4:35	5:24	5:42	6:02	6:29	6:59	7:19	8:04
6	Lawrence	-	-	8:31	10:12	11:52	13:27	2:48	4:03	4:38	5:30	5:48	6:08	6:35	7:05	7:25	8:10
7	Bradford	-	-	L 8:40	L 10:21	L 12:01	L 13:36	L 3:08	L 4:23	L 4:58	L 5:50	L 6:18	L 6:45	L 7:15	L 7:35	L 8:07	L 8:46
7	Haverhill	-	-	8:42	10:23	12:03	13:38	3:10	4:25	5:00	6:00	6:21	6:48	7:18	7:38	8:17	8:48

Trains in purple box indicate peak period trains.

PM

ZONE	STATION	291	213	283	215	217	285	219	221	297	223	225	227	229
	Bikes Allowed													
1A	NORTH STATION	3:50	4:30	4:48	5:15	5:35	6:05	6:25	6:55	7:20	7:40	9:20	11:00	12:10
1A	Malden Center	4:01	4:41	4:59	5:26	5:46	6:16	6:36	7:06	7:31	7:51	9:31	11:11	12:21
1	Wyoming Hill	4:05	4:45	5:03	-	5:50	6:20	6:40	7:10	7:34	7:54	9:34	11:14	12:24
1	Melrose/Cedar Park	4:07	4:47	5:05	-	5:52	6:22	6:42	7:12	7:36	7:56	9:36	11:16	12:26
1	Melrose Highlands	4:11	4:51	5:09	-	5:56	6:26	6:46	7:16	7:39	7:59	9:39	11:19	12:29
2	Greenwood	4:14	4:54	5:12	-	5:59	6:29	6:49	7:19	7:42	8:02	9:42	11:22	12:32
2	Wakefield	4:18	4:58	5:16	5:36	6:03	6:33	6:53	7:23	7:46	8:06	9:46	11:26	12:36
2	Reading	4:24	5:04	5:22	5:42	6:09	6:39	6:59	7:29	7:52	8:12	9:52	11:32	12:42
3	North Wilmington	-	5:11	5:29	5:49	6:16	6:46	7:06	7:36	7:59	8:18	9:58	11:38	12:48
4	Ballardvale	-	5:18	5:36	5:56	6:23	6:53	7:13	7:43	8:05	8:25	10:05	11:45	12:55
5	Andover	-	5:24	5:42	6:02	6:29	6:59	7:19	7:41	8:03	8:30	10:10	11:50	13:00
6	Lawrence	-	5:30	5:48	6:08	6:35	7:05	7:25	7:47	8:37	10:17	11:57	13:07	
7	Bradford	-	L 5:50	L 6:18	L 6:45	L 7:15	L 7:35	L 8:07	L 8:40	L 8:46	L 10:26	L 12:06	L 13:16	
7	Haverhill	-	6:00	6:21	6:48	7:18	7:38	8:17	8:47	8:48	10:28	12:08	13:18	

AM

Keep in Mind

- This schedule will be effective from **May 23, 2016, and will replace the schedule of December 14, 2015.**
- Holiday Service:**
- Saturday service:** Presidents' Day, 4th of July
- Sunday service:** New Year's Day, Memorial Day, Labor Day, Thanksgiving Day, Christmas Day.
- For additional holiday travel information and service modifications, please check MBTA.com or call 617-222-3200.

Saturday & Sunday Inbound to Boston

AM

ZONE	STATION	1200	1202	2202	1204	1206	1208	1210	2210	1212	1214	1216	1218	1220	1222	1224	1226	1228
	Bikes Allowed																	
7	Haverhill	6:15	10:25	11:15	4:15	7:20	10:10	10:10	10:10	10:10	10:10	10:10	10:10	10:10	10:10	10:10	10:10	10:10
7	Bradford	6:18	10:28	11:18	4:18	7:23	10:13	10:13	10:13	10:13	10:13	10:13	10:13	10:13	10:13	10:13	10:13	10:13
6	Lawrence	6:27	10:37	11:27	4:27	7:32	10:22	10:22	10:22	10:22	10:22	10:22	10:22	10:22	10:22	10:22	10:22	10:22
5	Andover	6:32	10:42	11:32	4:32	7:38	10:28	10:28	10:28	10:28	10:28	10:28	10:28	10:28	10:28	10:28	10:28	10:28
4	Ballardvale	6:37	10:47	11:37	4:37	7:42	10:32	10:32	10:32	10:32	10:32	10:32	10:32	10:32	10:32	10:32	10:32	10:32
3	North Wilmington	6:44	10:54	11:44	4:44	7:49	10:39	10:39	10:39	10:39	10:39	10:39	10:39	10:39	10:39	10:39	10:39	10:39
2	Reading	6:50	11:00	11:50	4:50	7:55	10:45	10:45	10:45	10:45	10:45	10:45	10:45	10:45	10:45	10:45	10:45	10:45
2	Wakefield	6:55	11:05	11:55	4:55	8:00	10:50	10:50	10:50	10:50	10:50	10:50	10:50	10:50	10:50	10:50	10:50	10:50
2	Greenwood	6:59	11:09	11:59	4:59	8:04	10:54	10:54	10:54	10:54	10:54	10:54	10:54	10:54	10:54	10:54	10:54	10:54
1	Melrose Highlands	7:02	11:12	12:02	5:02	8:07	10:57	10:57	10:57	10:57	10:57	10:57	10:57	10:57	10:57	10:57	10:57	10:57
1	Melrose/Cedar Park	7:04	11:14	12:04	5:04	8:09	10:59	10:59	10:59	10:59	10:59	10:59	10:59	10:59	10:59	10:59	10:59	10:59
1	Wyoming Hill	7:06	11:16	12:06	5:06	8:11	11:01	11:01	11:01	11:01	11:01	11:01	11:01	11:01	11:01	11:01	11:01	11:01
1A	Malden Center	L 8:10	L 11:20	L 12:10	L 2:10	L 5:10	L 8:15	L 11:05										
1A	North Station	8:21	11:3															



Commuter Rail Fares and Passes

Commuter Rail fares are based on a "Zone" and "Interzone" system, with Zone 1A servicing core stations within the City of Boston and immediate area and Zones 1 through 10 servicing communities in and around Greater Boston. Each Commuter Rail station's zone is identified in the chart below.

Zone Fares

"Zone fares" are based on direct travel from any outer Commuter Rail station (Zones 1 through 10) to a Zone 1A station, including North Station, South Station and Back Bay. Your fare or pass is based on the Zone you boarded.

For example, if you board the Lowell Line at Lowell Station (Zone 6) and disembark at Anderson/Woburn Station (Zone 2), you would travel in five zones and would buy one single-ride Interzone 5 ticket.

Interzone Fares

"Interzone fares" are based on travel between Commuter Rail stations outside of Zone 1A. Interzone fares and passes are not valid for travel to Zone 1A stations, including North Station, South Station and Back Bay Station. Interzone monthly pass and ticket fares are based on TOTAL zones "travelled" in.

For example, if your commute includes boarding the Lowell Line at Lowell Station (Zone 6) and getting off the train at Anderson/Woburn Station (Zone 2), you would pass through three zones and would buy one single ride Interzone 5 ticket.

ZONE	RIDE FARE	MONTHLY PASS	10-RIDE PASS ¹	CASH-ON-BOARD	
1A	\$2.25 ²	\$84.50 ³	\$22.50	\$5.25	Buy Now
1	\$6.25 ²	\$200.25 ⁴	\$62.50	\$9.25	Buy Now
Interzone 1 ⁷	\$2.75	\$90.25 ⁶			Buy Now
2	\$6.75 ²	\$217.75 ⁴	\$67.50	\$9.75	Buy Now
Interzone 2 ⁷	\$3.25	\$110.25 ⁶			Buy Now

3	\$7.50 ²	\$244.25 ⁴	\$75.00	\$10.50	Buy Now
Interzone 3 ⁷	\$3.50	\$119.75 ⁶			Buy Now
4	\$8.25 ²	\$263.00 ⁴	\$82.50	\$11.25	Buy Now
Interzone 4 ⁷	\$4.00	\$130.25 ⁶			Buy Now
5	\$9.25 ²	\$291.50 ⁴	\$92.50	\$12.25	Buy Now
Interzone 5 ⁷	\$4.50	\$148.00 ⁶			Buy Now
6	\$10.00 ²	\$318.00 ⁵	\$100.00	\$13.00	Buy Now
Interzone 6 ⁷	\$5.00	\$167.00 ⁶			Buy Now
7	\$10.50 ²	\$336.50 ⁵	\$105.00	\$13.50	Buy Now
Interzone 7 ⁷	\$5.50	\$183.75 ⁶			Buy Now
8	\$11.50 ²	\$363.00 ⁵	\$115.00	\$13.50	Buy Now
Interzone 8 ⁷	\$6.00	\$202.75 ⁶			Buy Now
9	\$12.00 ²	\$379.50 ⁵	\$120.00	\$15.00	Buy Now
Interzone 9 ⁷	\$6.50	\$221.50 ⁶			Buy Now
10	\$12.50 ²	\$398.25 ⁵	\$125.00	\$15.50	Buy Now
Interzone 10 ⁷	\$6.50	\$221.50 ⁶			Buy Now

Seniors and Persons with Disabilities

50% Off Rides

(Blind persons ride for free) Percentage off based on Commuter Rail single-ride fares noted above. Requires a Senior/TAP ID or Mass Commission for the Blind ID. 10-Ride Tickets available based on 10 half fares.

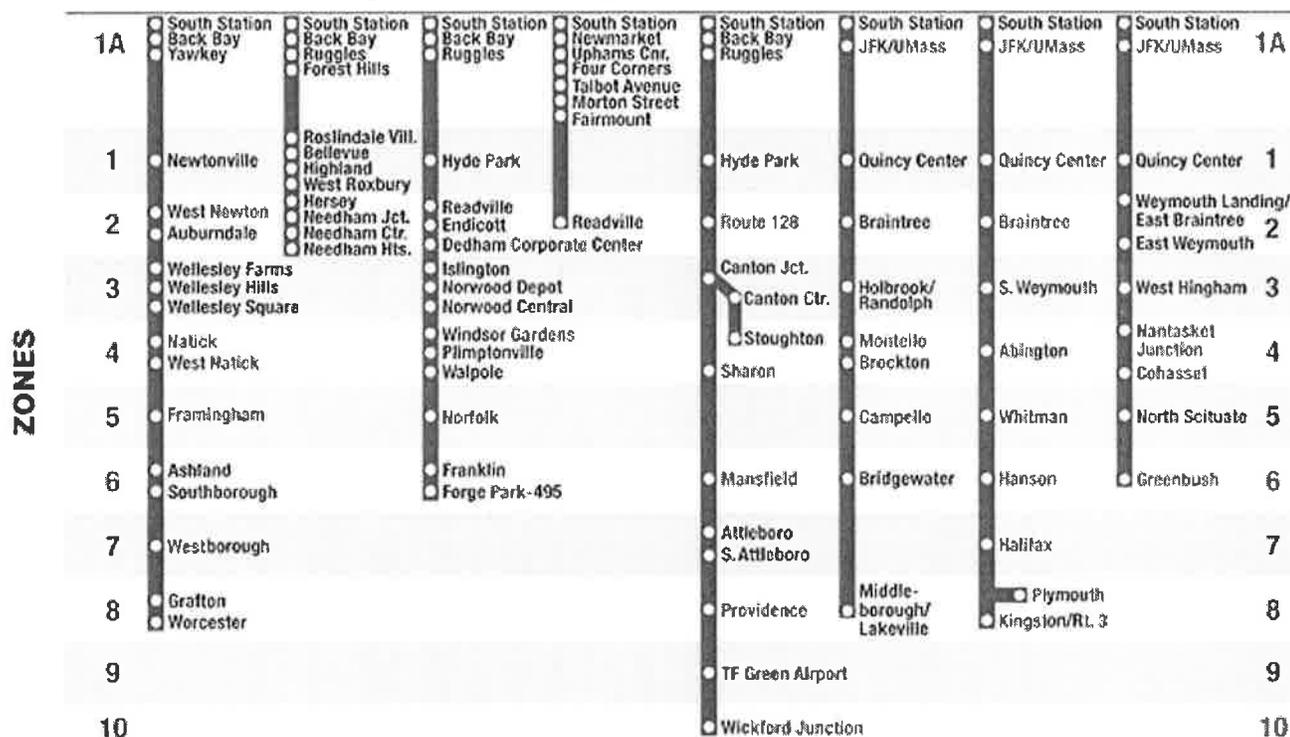
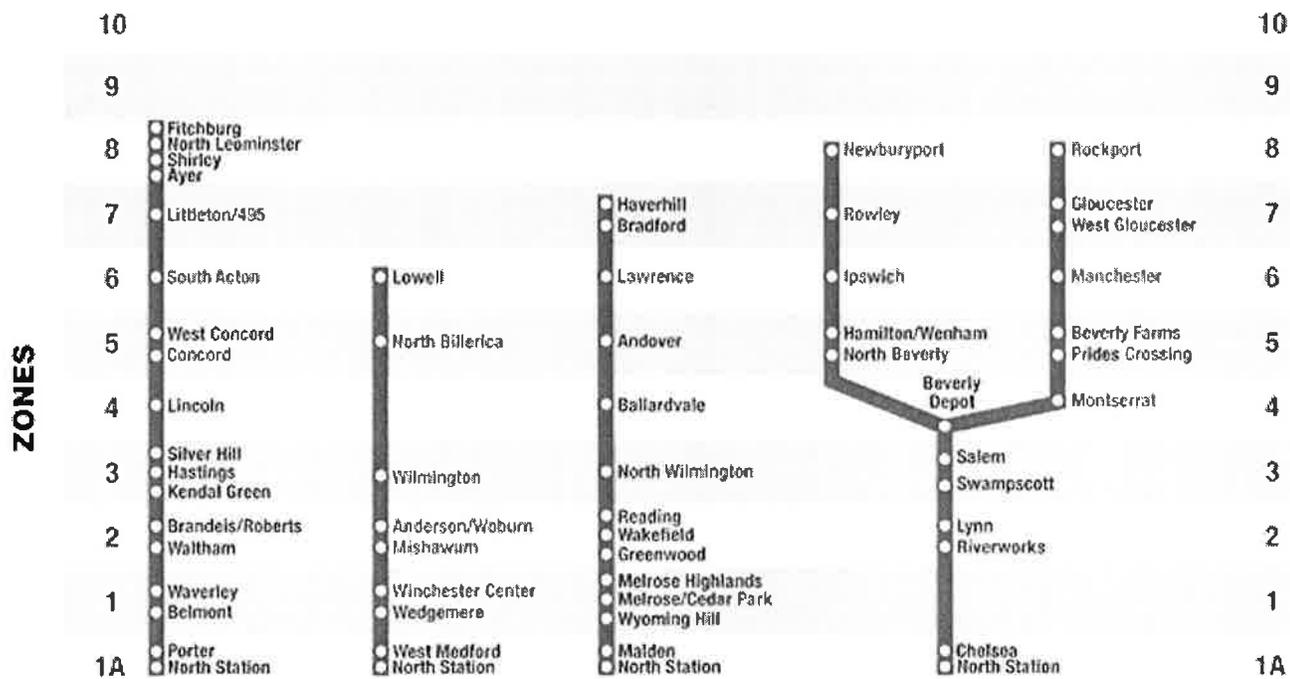
Children 11 years old and under

Free

Children 11 years old and under ride free when accompanied by an adult with a limit of two children for each adult.

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Commuter Rail Zone Chart



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¹ 10-Ride Ticket is available only on the mTicket mobile app.

² A \$3.00 surcharge will be added to tickets purchased onboard all trains departing from North Station, South Station and Back Bay Station. Customers boarding Mondays through Fridays at a commuter rail station with an MBTA ticket vending machine or an accessible ticket vendor will be charged a \$3.00 surcharge when purchasing tickets onboard. For a list of these stations, click here.

³ Zone passes valid on Local Bus, Subway, and Inner Harbor Ferry.

⁴ Zone passes valid on Local Bus, Subway, Express Bus, and Inner Harbor Ferry.

⁵ Zone passes valid on Local Bus, Subway, Express Bus, and Ferries.

⁶ Interzone passes valid on Local bus.

⁷ Interzone tickets and passes are not available on our automated ticket vending machines. Interzone tickets and passes are sold on our mTicketing app, at ticket sales offices, and at retail sales outlets. For a list of sales locations, [click here](#).

[Back to top](#)

schedule change

136•137

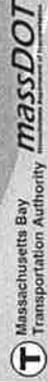
Summer June 25, 2016 - September 2, 2016

Reading Depot- Malden Center Station

New fares effective July 1, 2016

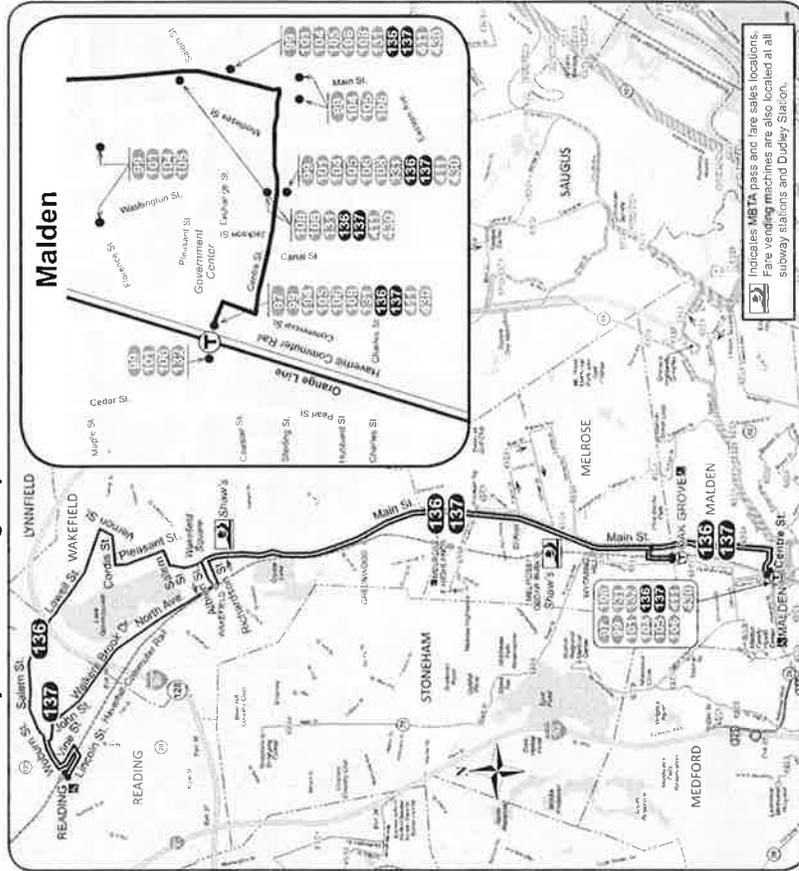
Serving

- Wakefield Square
- Greenwood Station
- Oak Grove Station
- Maiden Square
- Franklin Square, Melrose
- Orange Line
- Haverhill Commuter Rail



Information 617-222-3200 • 1-800-392-6100
(TTY) 617-222-5146 • www.mbta.com

Route 136/137 Reading Depot - Malden Center Station



MASSDOT CRASH RATE WORKSHEETS

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Reading COUNT DATE : Jun-16

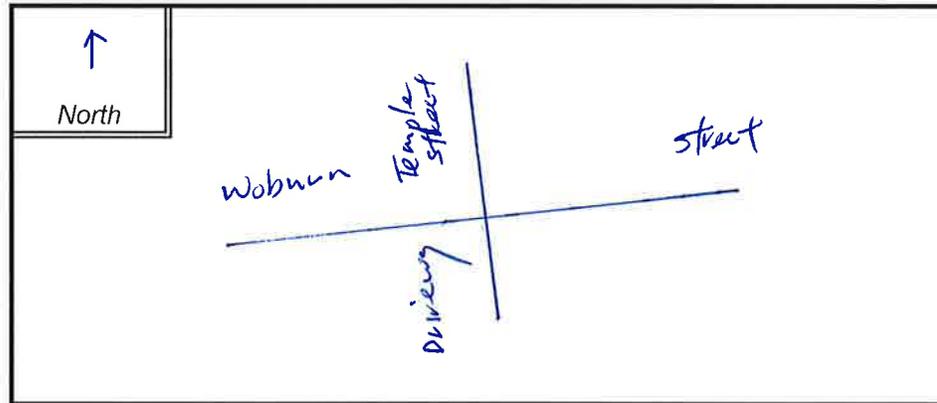
DISTRICT : 4 UNSIGNALIZED : SIGNALIZED :

~ INTERSECTION DATA ~

MAJOR STREET : Woburn Street

MINOR STREET(S) : Temple Street

**INTERSECTION
 DIAGRAM**
 (Label Approaches)



PEAK HOUR VOLUMES

APPROACH :	1	2	3	4	5	Total Peak Hourly Approach Volume
DIRECTION :	EB	WB	NB	SB		
PEAK HOURLY VOLUMES (PM) :	398	241	4	5		648

" K " FACTOR : INTERSECTION ADT (V) = TOTAL DAILY APPROACH VOLUME :

TOTAL # OF CRASHES : # OF YEARS : AVERAGE # OF CRASHES PER YEAR (A) :

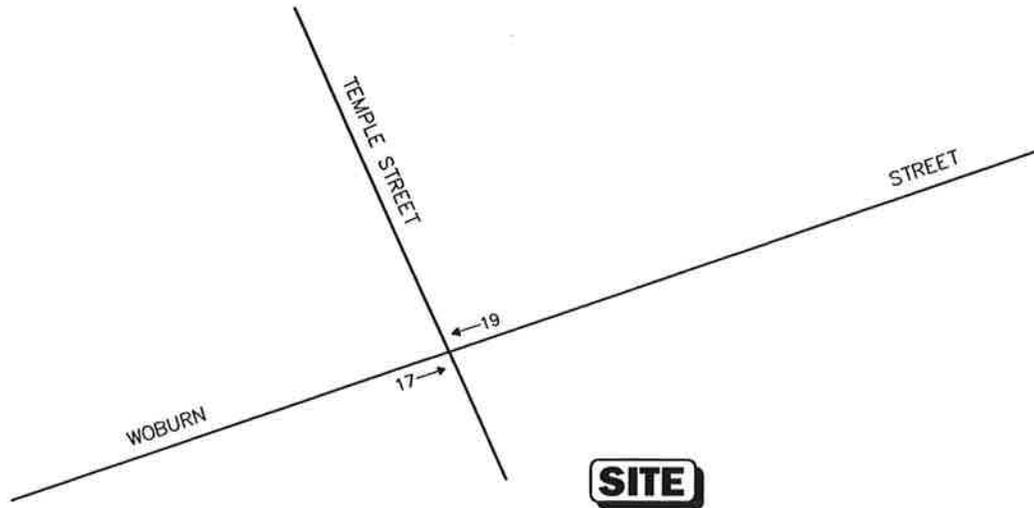
CRASH RATE CALCULATION : RATE = $\frac{(A * 1,000,000)}{(V * 365)}$

Comments : Below District 4 crash rate of 0.56 for unsignalized intersection

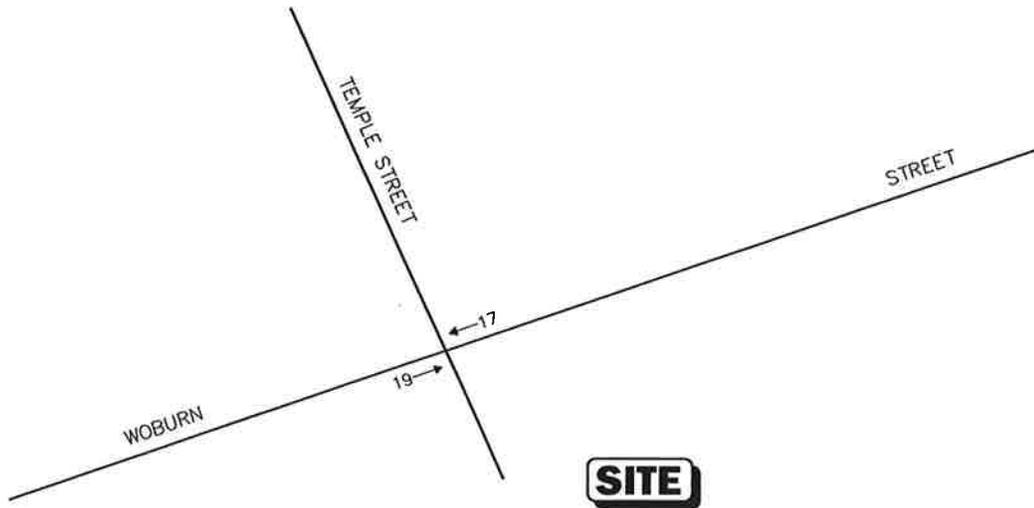
Project Title & Date: Transportation Impact Assessment - 7/14/16

SITE-SPECIFIC DEVELOPMENT TRAFFIC-VOLUME NETWORKS

WEEKDAY MORNING PEAK HOUR
(8:00-9:00 AM)



WEEKDAY EVENING PEAK HOUR
5:00-6:00 PM



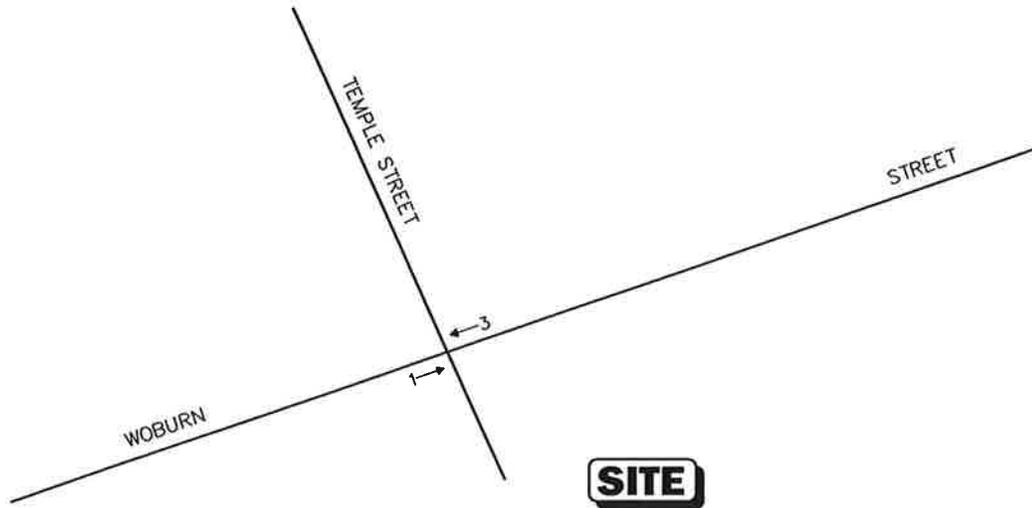
 Not To Scale

VAi Vanasse & Associates, Inc.
Transportation Engineers & Planners

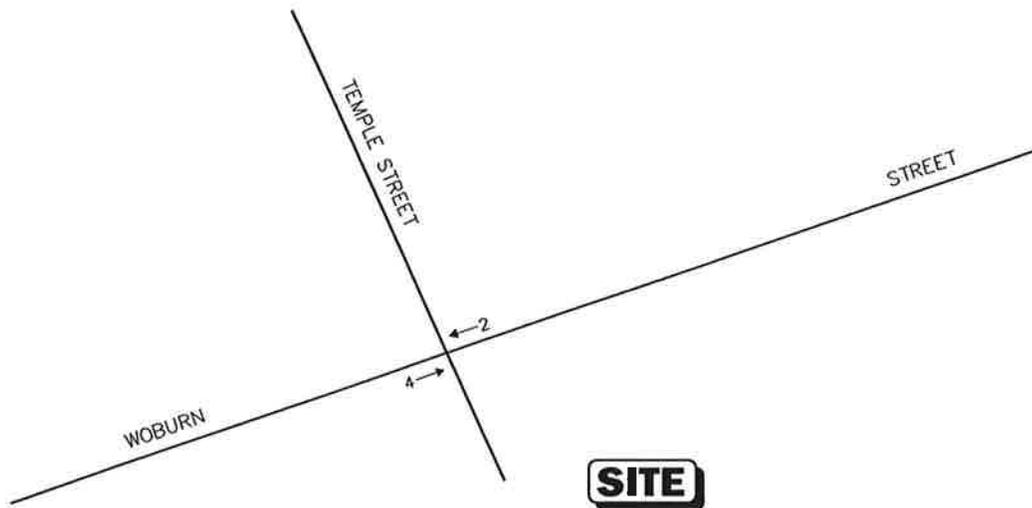
Figure A-1

**Criterion Child Enrichment Facility
Peak Hour Traffic Volumes**

WEEKDAY MORNING PEAK HOUR
(8:00-9:00 AM)



WEEKDAY EVENING PEAK HOUR
5:00-6:00 PM



 Not To Scale



Figure A-2

**Proposed Prescott Street
Residential Development
Peak Hour Traffic Volumes**

TRIP-GENERATION CALCULATIONS

**Institute of Transportation Engineers (ITE)
Trip Generation, 9th Edition
Land Use Code (LUC) 220 - Apartment**

Average Vehicle Trips Ends vs: Dwelling Units
Independent Variable (X): 20

AVERAGE WEEKDAY DAILY

$$T = 6.65 * (X)$$

$$T = 6.65 * 20$$

$$T = 133.00$$

$$T = 134 \text{ vehicle trips}$$

with 50% (67 vpd) entering and 50% (67 vpd) exiting.

WEEKDAY MORNING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 0.51 * (X)$$

$$T = 0.51 * 20$$

$$T = 10.20$$

$$T = 10 \text{ vehicle trips}$$

with 20% (2 vph) entering and 80% (8 vph) exiting.

WEEKDAY EVENING PEAK HOUR OF ADJACENT STREET TRAFFIC

$$T = 0.62 * (X)$$

$$T = 0.62 * 20$$

$$T = 12.40$$

$$T = 12 \text{ vehicle trips}$$

with 65% (8 vph) entering and 35% (4 vph) exiting.

JOURNEY TO WORK DATA

2010 Journey to Work Data

Residence		Workplace		West	East
Number	MCD	County	MCD	Woburn Street	Lincoln Street
2,028	Reading town	Suffolk County	Boston city	1041	1041
1,973	Reading town	Middlesex County	Reading town	986	987
804	Reading town	Middlesex County	Woburn city	804	
570	Reading town	Middlesex County	Cambridge city	285	285
441	Reading town	Middlesex County	Burlington town	441	
424	Reading town	Middlesex County	Wilmington town	318	106
371	Reading town	Essex County	Andover town	278	93
362	Reading town	Middlesex County	Stoneham town	181	181
340	Reading town	Middlesex County	Wakefield town	340	
330	Reading town	Middlesex County	Winchester town	330	
239	Reading town	Middlesex County	Medford city	120	119
232	Reading town	Middlesex County	Lexington town	232	
230	Reading town	Middlesex County	Waltham city	230	
213	Reading town	Middlesex County	Somerville city	107	106
208	Reading town	Middlesex County	North Reading town	104	104
186	Reading town	Middlesex County	Billerica town	186	
147	Reading town	Essex County	Danvers town	147	
134	Reading town	Middlesex County	Newton city	134	
133	Reading town	Essex County	Lynn city	133	
132	Reading town	Essex County	Peabody city	132	
131	Reading town	Middlesex County	Watertown Town city	131	
130	Reading town	Middlesex County	Everett city	66	64
129	Reading town	Essex County	Beverly city	32	97
126	Reading town	Suffolk County	Chelsea city	63	63
107	Reading town	Middlesex County	Hopkinton town	107	
106	Reading town	Middlesex County	Bedford town	106	
				7,034	3,246
				68%	32%

10,280

CAPACITY ANALYSIS WORKSHEETS

Woburn Street at Temple Street and the West Project Site Driveway
Woburn Street at the East Project Site Driveway

Woburn Street at Temple Street and the West Project Site Driveway

2016 Existing Wkdy AM Peak

3: Driveway/Temple Street & Woburn Street /Woburn Street

7/11/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	1	174	1	1	347	8	0	0	1	3	0	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	11	12	12	16	12	12	12	12
Satd. Flow (prot)	0	2142	0	0	1809	0	0	1863	0	0	1484	0
Flt Permitted											0.976	
Satd. Flow (perm)	0	2142	0	0	1809	0	0	1863	0	0	1484	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		731			775			464			356	
Travel Time (s)		16.6			17.6			10.5			8.1	
Peak Hour Factor	0.79	0.79	0.79	0.90	0.90	0.90	0.25	0.25	0.25	0.38	0.38	0.38
Heavy Vehicles (%)	0%	0%	100%	100%	1%	0%	0%	0%	0%	0%	0%	33%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	222	0	0	396	0	0	4	0	0	16	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other
 Control Type: Unsignalized
 Intersection Capacity Utilization 29.4% ICU Level of Service A
 Analysis Period (min) 15

2016 Existing Wkdy AM Peak

3: Driveway/Temple Street & Woburn Street /Woburn Street

7/11/2016

Intersection

Intersection Delay, s/veh 0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	174	1	1	347	8	0	0	1	3	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	90	90	90	25	25	25	38	38	38
Heavy Vehicles, %	0	0	100	100	1	0	0	0	0	0	0	33
Mvmt Flow	1	220	1	1	386	9	0	0	4	8	0	8

Major/Minor	Major1		Major2			Minor1			Minor2			
Conflicting Flow All	394	0	0	222	0	0	619	620	221	617	616	390
Stage 1	-	-	-	-	-	-	223	223	-	392	392	-
Stage 2	-	-	-	-	-	-	396	397	-	225	224	-
Follow-up Headway	2.2	-	-	3.1	-	-	3.5	4	3.3	3.5	4	3.597
Pot Capacity-1 Maneuver	1176	-	-	932	-	-	404	407	824	405	409	596
Stage 1	-	-	-	-	-	-	784	723	-	637	610	-
Stage 2	-	-	-	-	-	-	633	607	-	782	722	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1176	-	-	932	-	-	398	406	824	402	408	596
Mov Capacity-2 Maneuver	-	-	-	-	-	-	398	406	-	402	408	-
Stage 1	-	-	-	-	-	-	783	722	-	636	609	-
Stage 2	-	-	-	-	-	-	624	606	-	777	721	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	9.4	12.8
HCM LOS			A	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	824	1176	-	-	932	-	-	480
HCM Lane V/C Ratio	0.005	0.001	-	-	0.001	-	-	0.033
HCM Control Delay (s)	9.4	8.065	0	-	8.867	0	-	12.8
HCM Lane LOS	A	A	A		A	A		B
HCM 95th %tile Q(veh)	0.015	0.003	-	-	0.004	-	-	0.102

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

2016 Existing Wkdy PM Peak

3: Driveway/Temple Street & Woburn Street /Woburn Street

7/11/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	5	393	0	0	233	8	2	0	2	5	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	11	12	12	16	12	12	12	12
Satd. Flow (prot)	0	2151	0	0	1829	0	0	1928	0	0	1805	0
Flt Permitted		0.999						0.984			0.950	
Satd. Flow (perm)	0	2151	0	0	1829	0	0	1928	0	0	1805	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		731			775			464			356	
Travel Time (s)		16.6			17.6			10.5			8.1	
Peak Hour Factor	0.78	0.78	0.78	0.87	0.87	0.87	0.50	0.50	0.25	0.63	0.63	0.63
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	510	0	0	277	0	0	12	0	0	8	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other
 Control Type: Unsignalized
 Intersection Capacity Utilization 34.7% ICU Level of Service A
 Analysis Period (min) 15

2016 Existing Wkdy PM Peak

3: Driveway/Temple Street & Woburn Street /Woburn Street

7/11/2016

Intersection

Intersection Delay, s/veh 0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	5	393	0	0	233	8	2	0	2	5	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	87	87	87	50	50	25	63	63	63
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	6	504	0	0	268	9	4	0	8	8	0	0

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	277	0	0	504	0	0	789	794	504	793	789	272
Stage 1	-	-	-	-	-	-	517	517	-	272	272	-
Stage 2	-	-	-	-	-	-	272	277	-	521	517	-
Follow-up Headway	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1298	-	-	1071	-	-	311	323	572	309	325	772
Stage 1	-	-	-	-	-	-	545	537	-	738	688	-
Stage 2	-	-	-	-	-	-	738	685	-	542	537	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1298	-	-	1071	-	-	310	321	572	303	323	772
Mov Capacity-2 Maneuver	-	-	-	-	-	-	310	321	-	303	323	-
Stage 1	-	-	-	-	-	-	542	534	-	734	688	-
Stage 2	-	-	-	-	-	-	738	685	-	531	534	-

Approach	EB		WB		NB		SB
HCM Control Delay, s	0.1		0		13.3		17.2
HCM LOS					B		C

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	446	1298	-	-	1071	-	-	303
HCM Lane V/C Ratio	0.027	0.005	-	-	-	-	-	0.026
HCM Control Delay (s)	13.3	7.787	0	-	0	-	-	17.2
HCM Lane LOS	B	A	A		A			C
HCM 95th %tile Q(veh)	0.083	0.015	-	-	0	-	-	0.081

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

2023 No-Build Wkdy AM Peak

3: Driveway/Temple Street & Woburn Street /Woburn Street

7/11/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	1	205	1	1	394	9	0	0	1	3	0	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	11	12	12	16	12	12	12	12
Satd. Flow (prot)	0	2143	0	0	1809	0	0	1863	0	0	1484	0
Flt Permitted											0.976	
Satd. Flow (perm)	0	2143	0	0	1809	0	0	1863	0	0	1484	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		731			775			464			356	
Travel Time (s)		16.6			17.6			10.5			8.1	
Peak Hour Factor	0.79	0.79	0.79	0.90	0.90	0.90	0.25	0.25	0.25	0.38	0.38	0.38
Heavy Vehicles (%)	0%	0%	100%	100%	1%	0%	0%	0%	0%	0%	0%	33%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	261	0	0	449	0	0	4	0	0	16	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	32.0%
Analysis Period (min)	15
	ICU Level of Service A

2023 No-Build Wkdy AM Peak

3: Driveway/Temple Street & Woburn Street /Woburn Street

7/11/2016

Intersection

Intersection Delay, s/veh 0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	205	1	1	394	9	0	0	1	3	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	90	90	90	25	25	25	38	38	38
Heavy Vehicles, %	0	0	100	100	1	0	0	0	0	0	0	33
Mvmt Flow	1	259	1	1	438	10	0	0	4	8	0	8

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	448	0	0	261	0	0	712	713	260	710	708	443
Stage 1	-	-	-	-	-	-	263	263	-	445	445	-
Stage 2	-	-	-	-	-	-	449	450	-	265	263	-
Follow-up Headway	2.2	-	-	3.1	-	-	3.5	4	3.3	3.5	4	3.597
Pot Capacity-1 Maneuver	1123	-	-	896	-	-	350	360	784	351	362	555
Stage 1	-	-	-	-	-	-	747	694	-	596	578	-
Stage 2	-	-	-	-	-	-	593	575	-	745	694	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1123	-	-	896	-	-	344	359	784	349	361	555
Mov Capacity-2 Maneuver	-	-	-	-	-	-	344	359	-	349	361	-
Stage 1	-	-	-	-	-	-	746	693	-	595	577	-
Stage 2	-	-	-	-	-	-	584	574	-	740	693	-

Approach	EB		WB		NB		SB
HCM Control Delay, s	0		0		9.6		13.7
HCM LOS					A		B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	784	1123	-	-	896	-	-	429
HCM Lane V/C Ratio	0.005	0.001	-	-	0.001	-	-	0.037
HCM Control Delay (s)	9.6	8.209	0	-	9.023	0	-	13.7
HCM Lane LOS	A	A	A		A	A		B
HCM 95th %tile Q(veh)	0.015	0.003	-	-	0.004	-	-	0.114

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

2023 No-Build Wkdy PM Peak

3: Driveway/Temple Street & Woburn Street /Woburn Street

7/11/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	5	444	0	0	269	9	2	0	2	5	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	11	12	12	16	12	12	12	12
Satd. Flow (prot)	0	2151	0	0	1829	0	0	1928	0	0	1805	0
Flt Permitted		0.999						0.984			0.950	
Satd. Flow (perm)	0	2151	0	0	1829	0	0	1928	0	0	1805	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		731			775			464			356	
Travel Time (s)		16.6			17.6			10.5			8.1	
Peak Hour Factor	0.78	0.78	0.78	0.87	0.87	0.87	0.50	0.50	0.25	0.63	0.63	0.63
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	575	0	0	319	0	0	12	0	0	8	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other
 Control Type: Unsignalized
 Intersection Capacity Utilization 37.4% ICU Level of Service A
 Analysis Period (min) 15

Intersection

Intersection Delay, s/veh 0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	5	444	0	0	269	9	2	0	2	5	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	87	87	87	50	50	25	63	63	63
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	6	569	0	0	309	10	4	0	8	8	0	0

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	320	0	0	569	0	0	896	902	569	900	896	314
Stage 1	-	-	-	-	-	-	582	582	-	314	314	-
Stage 2	-	-	-	-	-	-	314	320	-	586	582	-
Follow-up Headway	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1251	-	-	1013	-	-	263	280	525	262	282	731
Stage 1	-	-	-	-	-	-	502	502	-	701	660	-
Stage 2	-	-	-	-	-	-	701	656	-	500	502	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	1251	-	-	1013	-	-	262	278	525	257	280	731
Mov Capacity-2 Maneuver	-	-	-	-	-	-	262	278	-	257	280	-
Stage 1	-	-	-	-	-	-	498	498	-	696	660	-
Stage 2	-	-	-	-	-	-	701	656	-	489	498	-

Approach	EB		WB		NB		SB
HCM Control Delay, s	0.1		0		14.4		19.5
HCM LOS					B		C

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	393	1251	-	-	1013	-	-	257
HCM Lane V/C Ratio	0.031	0.005	-	-	-	-	-	0.031
HCM Control Delay (s)	14.4	7.893	0	-	0	-	-	19.5
HCM Lane LOS	B	A	A		A			C
HCM 95th %tile Q(veh)	0.094	0.015	-	-	0	-	-	0.095

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

2023 Build Wkdy AM Peak

3: Driveway/Temple Street & Woburn Street /Woburn Street

7/14/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	1	206	0	0	395	9	5	0	4	3	0	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	11	12	12	16	12	12	12	12
Satd. Flow (prot)	0	2153	0	0	1813	0	0	1931	0	0	1484	0
Flt Permitted								0.973			0.976	
Satd. Flow (perm)	0	2153	0	0	1813	0	0	1931	0	0	1484	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		731			196			464			356	
Travel Time (s)		16.6			4.5			10.5			8.1	
Peak Hour Factor	0.79	0.79	0.79	0.90	0.90	0.90	0.92	0.92	0.92	0.38	0.38	0.38
Heavy Vehicles (%)	0%	0%	0%	0%	1%	0%	2%	2%	2%	0%	0%	33%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	262	0	0	449	0	0	9	0	0	16	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	31.3%
ICU Level of Service	A
Analysis Period (min)	15

Intersection												
Intersection Delay, s/veh	0.5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	206	0	0	395	9	5	0	4	3	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	79	79	79	90	90	90	92	92	92	38	38	38
Heavy Vehicles, %	0	0	0	0	1	0	2	2	2	0	0	33
Mvmt Flow	1	261	0	0	439	10	5	0	4	8	0	8
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	449	0	0	261	0	0	711	712	261	709	707	444
Stage 1	-	-	-	-	-	-	263	263	-	444	444	-
Stage 2	-	-	-	-	-	-	448	449	-	265	263	-
Follow-up Headway	2.2	-	-	2.2	-	-	3.518	4.018	3.318	3.5	4	3.597
Pot Capacity-1 Maneuver	1122	-	-	1315	-	-	348	358	778	352	363	554
Stage 1	-	-	-	-	-	-	742	691	-	597	579	-
Stage 2	-	-	-	-	-	-	590	572	-	745	694	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1122	-	-	1315	-	-	343	358	778	350	363	554
Mov Capacity-2 Maneuver	-	-	-	-	-	-	343	358	-	350	363	-
Stage 1	-	-	-	-	-	-	741	690	-	596	579	-
Stage 2	-	-	-	-	-	-	582	572	-	740	693	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0			13.1			13.7		
HCM LOS	B			B			B			B		
Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	456	1122	-	-	1315	-	-	429				
HCM Lane V/C Ratio	0.021	0.001	-	-	-	-	-	0.037				
HCM Control Delay (s)	13.1	8.212	0	-	0	-	-	13.7				
HCM Lane LOS	B	A	A	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.066	0.003	-	-	0	-	-	0.114				
Notes												
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined												

2023 Build Wkdy PM Peak

3: Driveway/Temple Street & Woburn Street /Woburn Street

7/11/2016

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (vph)	5	449	0	0	269	9	5	0	3	5	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	16	12	12	11	12	12	16	12	12	12	12
Satd. Flow (prot)	0	2151	0	0	1829	0	0	1943	0	0	1805	0
Flt Permitted		0.999						0.970			0.950	
Satd. Flow (perm)	0	2151	0	0	1829	0	0	1943	0	0	1805	0
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		731			175			464			356	
Travel Time (s)		16.6			4.0			10.5			8.1	
Peak Hour Factor	0.78	0.78	0.78	0.87	0.87	0.87	0.92	0.92	0.92	0.63	0.63	0.63
Heavy Vehicles (%)	0%	0%	0%	0%	0%	0%	2%	2%	2%	0%	0%	0%
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	582	0	0	319	0	0	8	0	0	8	0
Sign Control		Free			Free			Stop			Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 37.6%

ICU Level of Service A

Analysis Period (min) 15

Intersection

Intersection Delay, s/veh 0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	5	449	0	0	269	9	5	0	3	5	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	78	78	78	87	87	87	92	92	92	63	63	63
Heavy Vehicles, %	0	0	0	0	0	0	2	2	2	0	0	0
Mvmt Flow	6	576	0	0	309	10	5	0	3	8	0	0

Major/Minor	Major1		Major2		Minor1		Minor2					
Conflicting Flow All	320	0	0	576	0	0	902	908	576	904	902	314
Stage 1	-	-	-	-	-	-	588	588	-	314	314	-
Stage 2	-	-	-	-	-	-	314	320	-	590	588	-
Follow-up Headway	2.2	-	-	2.2	-	-	3.518	4.018	3.318	3.5	4	3.3
Pot Capacity-1 Maneuver	1251	-	-	1007	-	-	259	275	517	260	280	731
Stage 1	-	-	-	-	-	-	495	496	-	701	660	-
Stage 2	-	-	-	-	-	-	697	652	-	497	499	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1251	-	-	1007	-	-	258	273	517	257	278	731
Mov Capacity-2 Maneuver	-	-	-	-	-	-	258	273	-	257	278	-
Stage 1	-	-	-	-	-	-	492	493	-	696	660	-
Stage 2	-	-	-	-	-	-	697	652	-	490	496	-

Approach	EB		WB		NB		SB
HCM Control Delay, s	0.1		0		16.6		19.5
HCM LOS					C		C

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	318	1251	-	-	1007	-	-	257
HCM Lane V/C Ratio	0.027	0.005	-	-	-	-	-	0.031
HCM Control Delay (s)	16.6	7.893	0	-	0	-	-	19.5
HCM Lane LOS	C	A	A		A			C
HCM 95th %tile Q(veh)	0.084	0.015	-	-	0	-	-	0.095

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Woburn Street at the East Project Site Driveway

2023 Build Wkdy AM Peak
6: Site Drive & Woburn Street

7/11/2016

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	212	1	1	404	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	1861	0	0	1863	0	1863
Fit Permitted						
Satd. Flow (perm)	1861	0	0	1863	0	1863
Link Speed (mph)	30			30	30	
Link Distance (ft)	196			580	259	
Travel Time (s)	4.5			13.2	5.9	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)						
Lane Group Flow (vph)	231	0	0	440	0	0
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other
 Control Type: Unsignalized
 Intersection Capacity Utilization 25.4% ICU Level of Service A
 Analysis Period (min) 15

2023 Build Wkdy AM Peak
6: Site Drive & Woburn Street

7/11/2016

Intersection

Intersection Delay, s/veh 0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	212	1	1	404	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	230	1	1	439	0	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	232
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1336
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1336
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0	0
HCM LOS			A

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	0	-	-	1336	-
HCM Lane V/C Ratio	+	-	-	0.001	-
HCM Control Delay (s)	0	-	-	7.697	0
HCM Lane LOS	A			A	A
HCM 95th %tile Q(veh)	+	-	-	0.002	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

2023 Build Wkdy PM Peak
6: Site Drive & Woburn Street

7/11/2016

						
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	452	5	3	278	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Satd. Flow (prot)	1861	0	0	1863	0	1863
Flt Permitted						
Satd. Flow (perm)	1861	0	0	1863	0	1863
Link Speed (mph)	30			30	30	
Link Distance (ft)	175			601	144	
Travel Time (s)	4.0			13.7	3.3	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Shared Lane Traffic (%)						
Lane Group Flow (vph)	496	0	0	305	0	0
Sign Control	Free			Free	Stop	

Intersection Summary

Area Type: Other

Control Type: Unsignalized

Intersection Capacity Utilization 27.4%

ICU Level of Service A

Analysis Period (min) 15

2023 Build Wkdy PM Peak
6: Site Drive & Woburn Street

7/11/2016

Intersection

Intersection Delay, s/veh 0

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	452	5	3	278	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	491	5	3	302	0	0

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	497
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1067
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1067
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	0
HCM LOS			A

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	0	-	-	1067	-
HCM Lane V/C Ratio	+	-	-	0.003	-
HCM Control Delay (s)	0	-	-	8.384	0
HCM Lane LOS	A			A	A
HCM 95th %tile Q(veh)	+	-	-	0.009	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined