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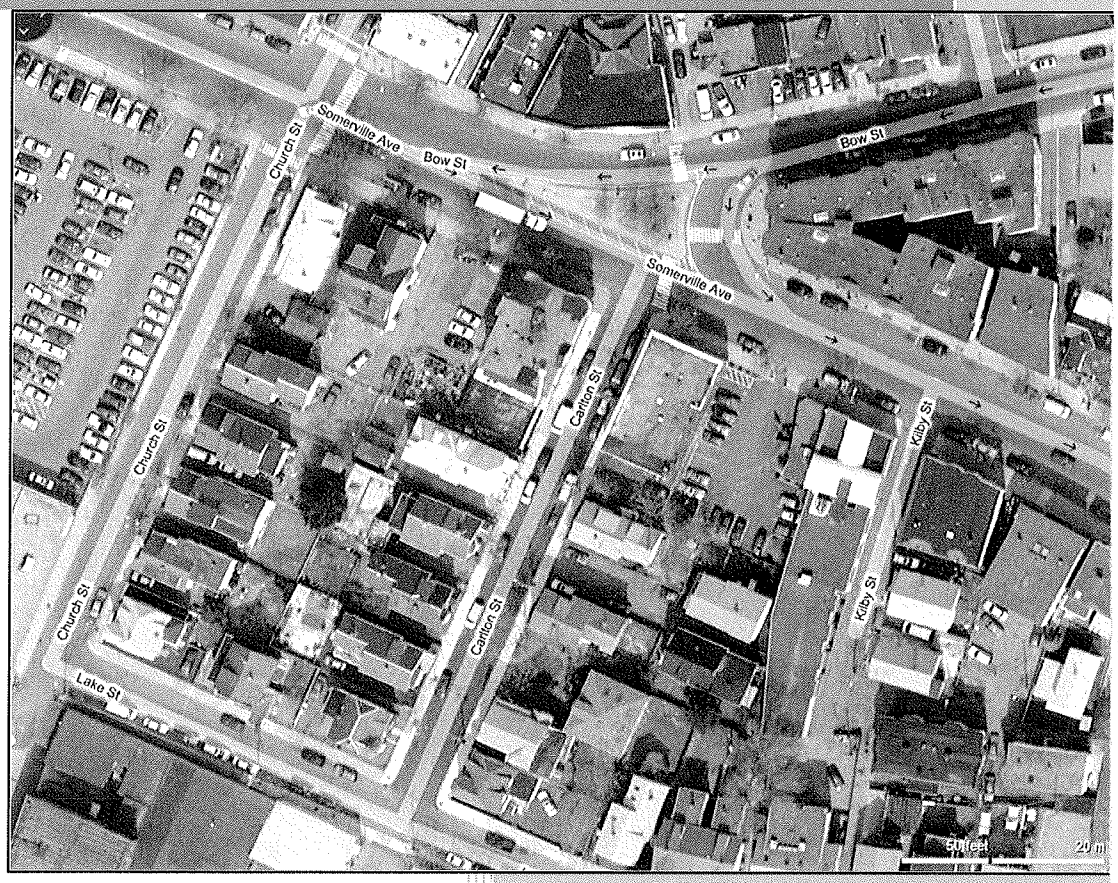
380-390 Somerville Avenue



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1.0 Executive Summary

Fort Hill Infrastructure (FHI) has evaluated the potential traffic impacts associated with the redevelopment of 380-390 Somerville Avenue in Somerville, Massachusetts. The study evaluates traffic operating conditions in the project site vicinity under existing and future conditions with and without the proposed development. The evaluation assesses the traffic impacts of the proposed new development based on its projected occupancy.

Based on the evaluation of the project, which is documented in the following sections, it can be concluded that while the project is expected to add a small amount of traffic to the roadway system, there will be relatively minimal impacts to the traffic operations of the adjacent roadway network and study area intersections.

The recent roadway reconstruction project and the future Green Line Station have and will contribute to improved traffic operations and enhance safety in the vicinity of the project and elsewhere in Union Square. These improvements have improved signage, pavement markings, encouraged increased bicycle use, improved pedestrian accessibility and aesthetics, and will provide for increased public transportation.

All customer trips and loading deliveries will utilize the new driveways on Church Street and Carlton Street. The majority of site trips will not pass by abutting residential homes located to the south of the proposed project since the project includes two new driveways. To further minimize traffic impacts to the abutting residents of Carlton Street, Lake Street and Church Street, a one-way circulation system has been devised to the rear of the proposed building, allowing for retail customers, employees, deliveries and trash pick-up to occur without the need to circle the block comprising of Carlton Street, Lake Street and Church Street.

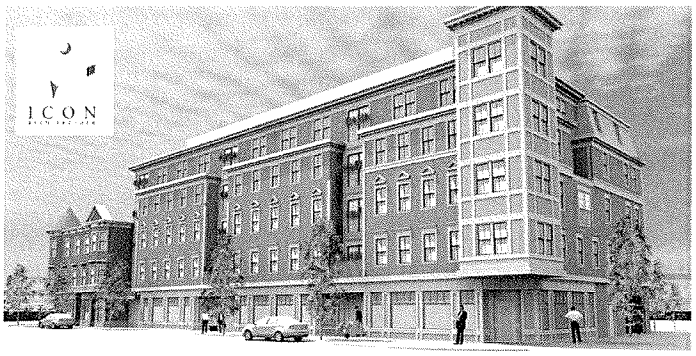
2.0 Introduction

This study provides an analysis of traffic impacts, traffic circulation, and access/egress characteristics associated with the proposed redevelopment of 380-390 Somerville Avenue, Somerville (Figure 1). Located on the south side of Somerville Avenue the site is comprised of 3 adjacent parcels, which are currently occupied by a total of 15 dwelling units and 3 retail spaces. With the site redesign 30 residential dwelling units and ground floor retail space will be created, along with 37 parking spaces.

This study includes analysis and evaluation of traffic volumes, roadway site access interface, traffic circulation, and safety considerations. This traffic study was prepared in general accordance with the guidelines set forth by the Institute of Transportation Engineers, as well as input and direction from the City's Traffic Engineer relating to content and scope.

2.1 Project Description

The project is located on Somerville Avenue spanning the short block between Church Street and Carlton Street in the Union Square neighborhood of Somerville, Massachusetts. The developer wishes to combine the three (3) existing parcels located at 380, 388, and 390 Somerville Avenue. Selective demolition and removal of the 15 existing dwelling units and 3 existing retail spaces will occur.



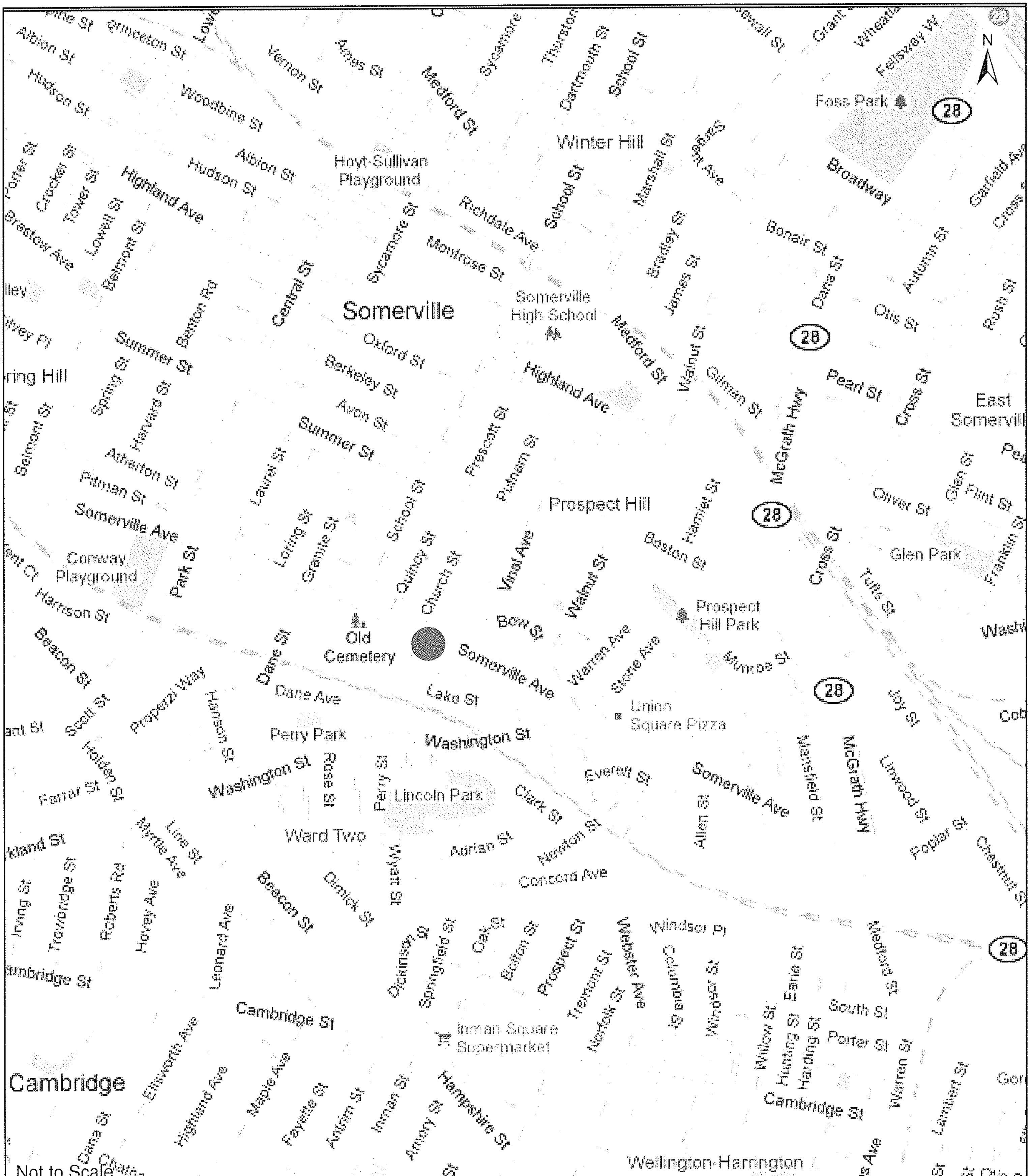
The proposed project will result in 30 residential dwelling units and approximately 6,565 square feet of ground floor retail space. The project will include 37 off-street parking spaces, 30 below grade tenant parking spaces for the residential units and 7 at grade parking spaces for use by the retail units. The building will front Somerville Avenue with vehicular access and egress to the parking spaces gained via Carlton Street and Church Street.

The project will require the appropriate City permit(s) with approval from the Zoning Board of Appeals.

2.2 Project Study Area

The study area, agreed to in collaboration with the City Traffic Engineer, is primarily dictated by two nearby intersections (Figure 2). Both intersections are currently unsignalized.
The intersections within the study area are:

- Somerville Avenue at Church Street, and
- Somerville Avenue at Carlton Street/Bow Street

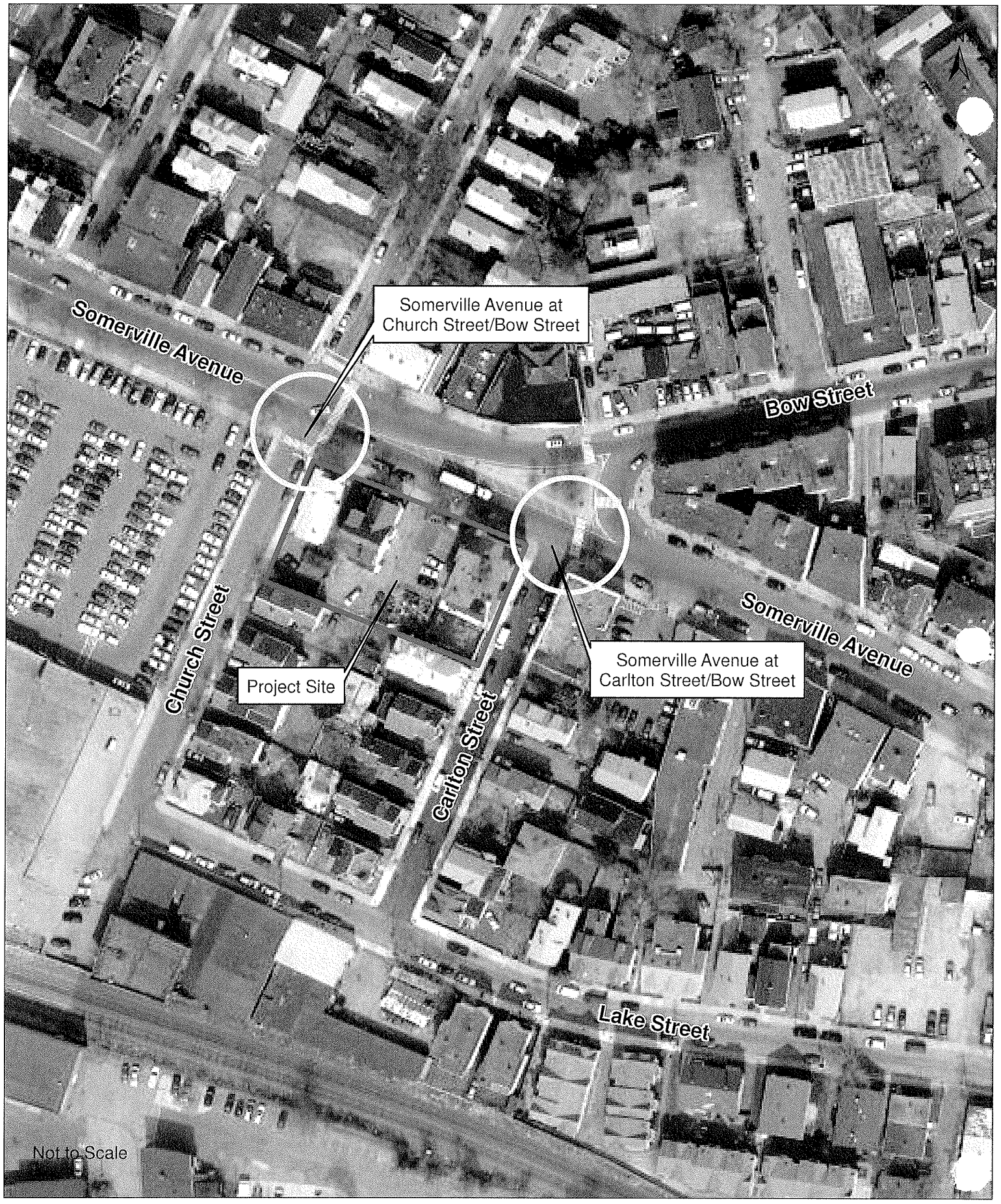


80-390 Somerville Avenue

Site

Project Location

Figure 1



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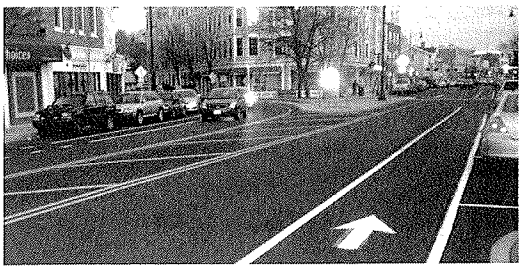
Study Area

Figure 2

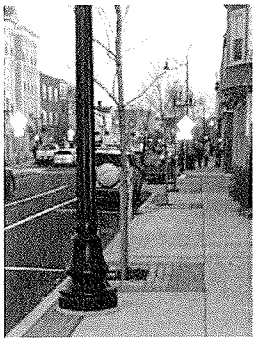
3.0 Existing Conditions

3.1 Roadway Segments

Somerville Avenue



Commencing at Porter Square where it intersects with Route 2A (Massachusetts Avenue) and terminating at Route 28 (McGrath Highway), Somerville Avenue passes through the city of Somerville in a roughly northeast-southeast direction and is approximately 1.5 miles in length. Somerville Avenue generally provides one vehicular travel lane in each direction and one bicycle travel lane in each direction with additional turn lanes at certain intersections, while a short section of the street, the section immediately in front of the project site to the heart of Union Square, is one-way with one-travel lane, opening to two lanes after Carlton Street, heading towards Route 28. Travelling in the opposite direction through Union Square, traffic is diverted for a short distance from Somerville Avenue on to Bow Street, before reconnecting with Somerville Avenue at Church Street. The posted speed limit is 30 miles per hour (mph).



Reconstruction work was just completed on the majority of Somerville Avenue, from Porter Square to Union Square, part of a $20.7 million state funded three-year reconstruction project. The project entailed full depth roadway construction, sidewalk reconstruction with granite curbing and wheelchair ramps, installation of a new roadway drainage system, a separate sewer line, replacement of old traffic signal equipment and signalization of intersections, new decorative street lighting poles, planting of new trees, installation of streetscape amenities, signing, pavement markings and landscaping.

Church Street

Church Street borders the western boundary of the project site, connecting Lake Street with Summer Street. From Lake Street to Somerville Avenue it provides for two-way traffic with on-street resident permit parking on the east side of the street only. Land uses along this section of the street are exclusively residential on the east side, while on the west side a supermarket and its parking lot exist. From Summer Street to Somerville Avenue Church Street is one-way southbound, with resident permit parking on both sides of the street. Land uses along this section of Church Street are exclusively residential. Sidewalks are located on both sides of Church Street. The pavement is in good condition though pavement markings are generally absent. Stop lines and crosswalks are located at Church Street's intersection with Somerville Avenue.

Carlton Street

Carlton Street borders the eastern boundary of the project site, connecting Somerville Avenue with Lake Street. It provides for two-way traffic with on-street resident permit parking on both sides of the street. Sidewalks are located on both sides of the street. The pavement is in good condition though pavement markings are generally absent. A crosswalk is located at the street's intersection with Lake Street and a

stop line and crosswalk are located at the street's intersection with Somerville Avenue. Carlton Street provides for northbound right turns onto Somerville Avenue eastbound. Mixed use properties (including those on the project site) can be found where the street intersects with Somerville Avenue, elsewhere along the street are one- and two-family residential properties.

Bow Street

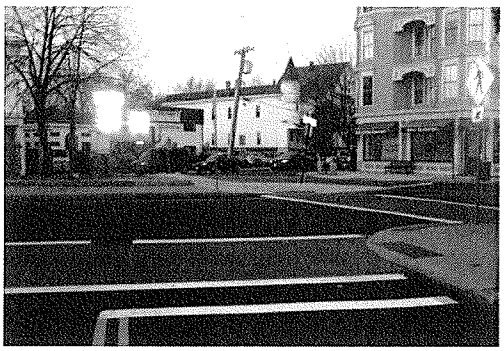
Bow Street terminates opposite the project site, at the point where Somerville Avenue becomes a one-way street in the southbound direction. Commencing just south of the project site in the heart of Union Square, Bow Street provides a circuitous connection for vehicles traveling northwest bound on Somerville Avenue, connecting Somerville Avenue with itself. Bow Street is a variable width one-way street with two travel lanes until its intersection with Summer Street, where it then becomes one travel lane until its intersection with Somerville Avenue. Sidewalks are located on both sides of Bow Street as is on-street parking, which is a mix of both metered spaces and resident permit parking spaces. The pavement and pavement markings are in good condition. A variety of land uses exist along Bow Street, with residential retail, restaurant and commercial uses all present.

3.2 Intersections

Somerville Avenue at Church Street

Somerville Avenue/Bow Street and Church Street meet at a four-way unsignalized intersection. The northbound and southbound Church Street approaches are under STOP control and have a crosswalk at each approach. The Somerville Avenue westbound approach (which is a continuation of the Bow Street westbound approach) functions as a shared through lane and a left turn lane. The Somerville Avenue eastbound approach functions as a shared through lane and a right turn lane, with Somerville Avenue becoming one-way towards Union Square after (east of) the intersection. Both the Somerville Avenue eastbound and westbound approaches have one travel lane in each direction, while a crosswalk is provided crossing Somerville Avenue on the west side of the intersection.

Somerville Avenue at Carlton Street/Bow Street



Somerville Avenue and Carlton Street meet at a three-way unsignalized intersection with Bow Street intersecting Somerville Avenue just east of the intersection. The Somerville Avenue eastbound approach has a single one-way travel lane towards Union Square, before the Bow Street u-turn approach joins Somerville Avenue from the north to form two one-way travel lanes toward Union Square. Somerville Avenue eastbound serves as a shared through/right turn lane, allowing for right turns on to Carlton Street. The Bow Street u-turn is offset from Carlton Street, separated by an unsignalized crosswalk. Crosswalks are located across Carlton Street, Somerville Avenue, and Bow Street. There is a landscaped island serving as a refuge between the Somerville Avenue and Bow Street crosswalks. Metered on-street parking can be found on the south side of the Somerville Avenue eastbound approach to the intersection, and on both sides of Somerville Avenue immediately beyond the intersection.

3.3 Traffic Safety

As part of this study, reported accident data for study area intersections were obtained from MassDOT's Accident Record System (ARS), for the most recent three-year period data available, 2006 through 2008 (Table 1).

Table 1 – Summary of Accident Data (2006-2008)

Intersection/ Driveway	2006	2007	2008	3 Year Total	3 Year AVG.
Somerville Avenue at Church Street	2	2	1	5	1.67
Somerville Avenue at Carlton Street/Bow Street	2	1	1	4	1.33

A review of MassDOT's accident data indicated a total of 9 reported accidents in the study area during the three analysis years. Of the 9 total accidents , 4 (44%) were found to be rear end type accidents, with 4 (44%) more found to be angle type crashes. One accident was a single vehicle crash. There were on fatal accidents reported in this data.

As part of this safety review, the "crash rates" for the study intersections were also determined. The crash rate takes into account the amount of traffic that enters the intersection, and relates the number of accidents at this location to the amount of traffic that passes through the location. It is another measure for identifying potentially hazardous locations as compared to simple annual accident averages.

The City of Somerville falls within MassDOT's new District 6, however, from 2006-2008 Somerville was part of MassDOT's District 4. Therefore, the crash rates of the study area were compared to the District 4 crash rates for unsignalized intersections which is 0.59 crashes per million entering vehicles. Fort Hill also compared the study area crash rates to the state average crash rate for unsignalized intersections which is 0.62 crashes per million entering vehicles.

Intersections experiencing crash rates greater than the above average are potentially experiencing an unusually high number or higher than expected number of accidents relative to traffic volumes at that particular location and may warrant further investigations or improvements.

The crash rate calculated for the intersection of Somerville Avenue at Church Street was found to be 0.52, while the crash rate calculated for the intersection of Somerville Avenue at Carlton Street was found to be 0.54, both below the District 4 and state average crash rates. Thus, the conclusion is drawn that crash related issues are not apparent at these locations. In addition, with the recent Somerville Avenue Reconstruction Project completed, the new pavement markings and signage present at the two locations should contribute to improved safety. MassDOT's intersection crash rate worksheets are included in the Appendix A.

3.4 Traffic Volumes

Turning Movement Count (TMC) data of existing traffic volume conditions in the study area were collected on Wednesday, October 6, 2010.

3.4.1 Peak Hour Traffic Volumes

Data collected at the intersections consisted of manual turning movement counts (TMC) during the weekday morning peak period (7:00AM – 9:00AM) and weekday evening peak period (4:30PM – 6:30PM).

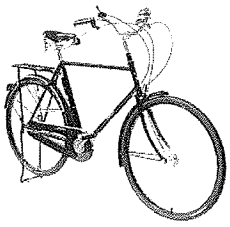
While individual intersections within a study network may experience peak traffic flow at different time periods, review of the data indicated that the weekday morning peak hour generally occurs between 7:30AM and 8:30AM and the weekday evening peak hour generally between 4:45PM and 5:45PM. During these peak periods Somerville Avenue was observed to carry approximately 650 during the morning peak hour and 775 during the evening peak hour.

To determine the 2010 existing traffic volume, seasonal adjustment factors were used, with the data adjusted downward by 1.76% to offset a 1.76% increase in volumes associated with the month of October (Figure 3). The Turning Movement Count (TMC) data collected as a part of the traffic study are included in Appendix B.

3.5 Alternative Transportation

The Massachusetts Bay Transportation Authority (MBTA) serves the City of Somerville with fixed route bus service. Along Somerville Avenue and in nearby Union Square, the Route 83, Route 85, Route 86, Route 87, Route 91 and the CT2 provide service throughout Somerville, as well as the neighboring communities of Arlington and Cambridge, and further afield to Boston and Brookline (Route 86). These bus routes also provide important connections to MBTA subway service located at Porter Square, Sullivan Square, Central Square, Kendall Square and Lechmere, to name but a few stations.

In addition to the extensive bus service serving the site, the extension of the MBTA Green Line subway service to Union Square is also scheduled to occur within the next five years. The proposed Union Square station stop at Prospect Street in Union Square is less than a half mile from the project site which will provide direct access to the MBTA's rapid transit system (including light rail).



Also, the reconstruction of Somerville Avenue included the addition of bicycle travel lanes in both the eastbound and westbound directions. This recent improvement will help encourage the use of bicycles as a means of alternative transportation in the City of Somerville.

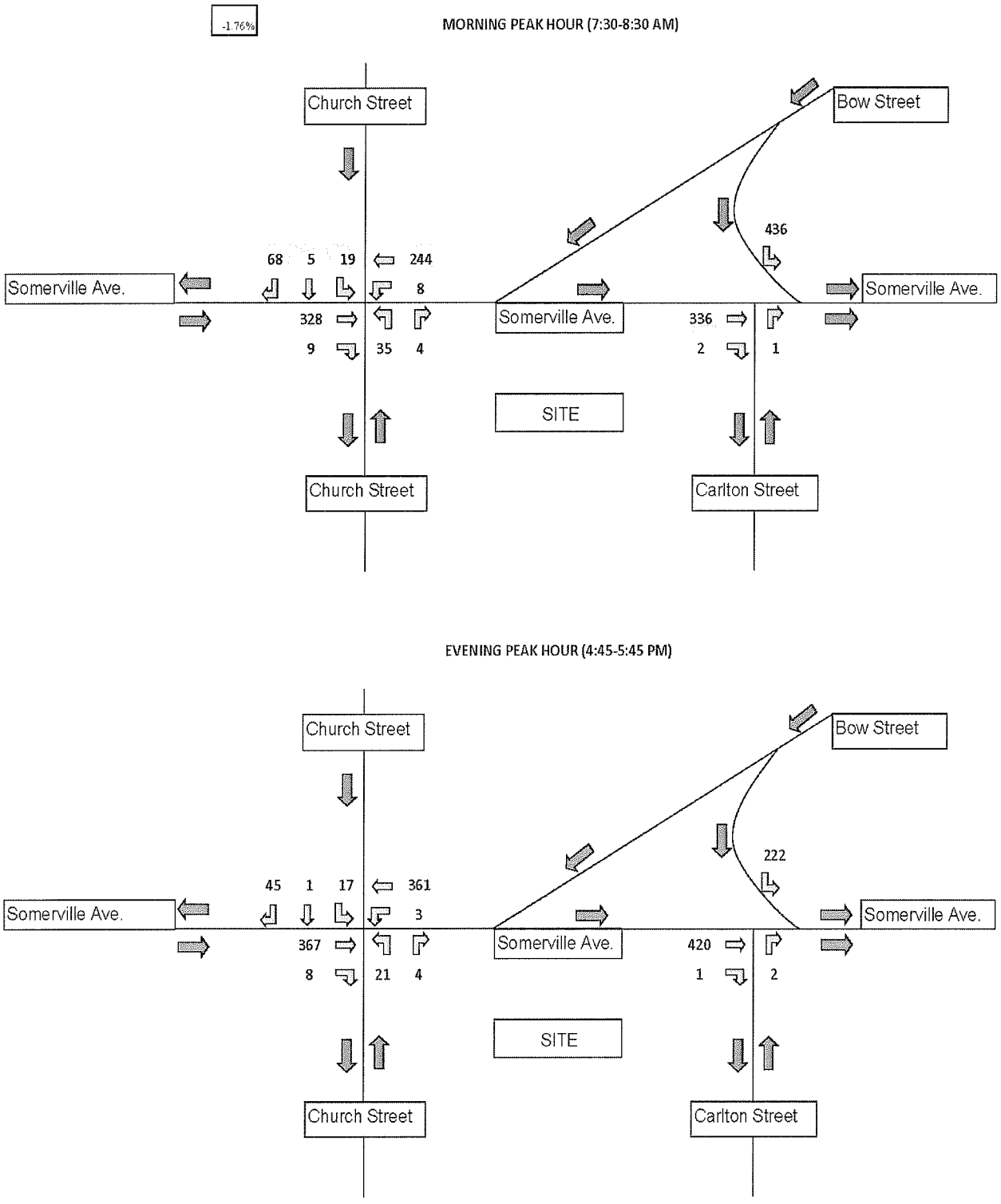


Figure 3 – Existing 2010 Traffic Volume

4.0 Future Conditions

Traffic volumes and roadway conditions in the study area were reviewed for the year 2015 which represents a five-year planning horizon consistent with state requirements for traffic impact studies. Independent of the proposed development, traffic volumes on the roadway network in 2015 will include existing traffic, new traffic resulting from general (background) growth, and traffic growth related to other known development projects in the area. This represents "No-Build" traffic conditions. "Build" traffic conditions include No-Build conditions plus traffic associated with the proposed development. Since the reconstruction of Somerville Avenue was just completed, the roadway system for 2015 is assumed to remain unchanged from current conditions.

4.1 2015 No-Build Traffic Volumes

To develop a background growth rate for use in this analysis, area traffic volumes were reviewed. Most recent information shows traffic volume either remaining steady or declining. However, for a somewhat conservative analytical approach a 1.0% annual growth rate was used and cumulatively applied to the seasonally adjusted existing peak hour traffic volumes for five (5) years to obtain growth in traffic volume.

Further, in developing the No-Build traffic conditions, the Somerville Planning Department was contacted for any additional development projects that are anticipated within the build-out time frame of five (5) years in the vicinity of the proposed project, which could impact the analysis intersections. At this time, information on any additional projects was not provided by the Planning Department and it is assumed that any other developments are relatively small in size or more remote from the project site. The background growth rate is assumed to account for traffic near the site due to these developments.

Based on the above, the 2015 No-Build traffic volume network was developed by adding the five-year background traffic volume growth of 1.0 percent per year to the seasonally adjusted 2010 existing traffic volume network. The 2015 No-Build traffic volumes projected for the weekday morning and evening peak hours are shown in Figure 4.

4.2 Project Trip Generation

To evaluate the traffic impacts of the proposed development it is necessary to determine the amount of traffic expected to be generated by the proposed uses. For comparison purposes the trip generation of the proposed uses is compared to the trip generation associated with the previous/existing uses. The trip generation calculations are based on data compiled in Trip Generation (8th edition), an informational report published by the Institute of Transportation Engineers (ITE). Trip Generation is a tool for planners, transportation professionals, zoning boards, and others who are interested in estimating the number of vehicle trips generated by a proposed development or land use. This document is based on more than 4,250 trip generation studies submitted to the Institute by public agencies, developers, consulting firms, and associations.

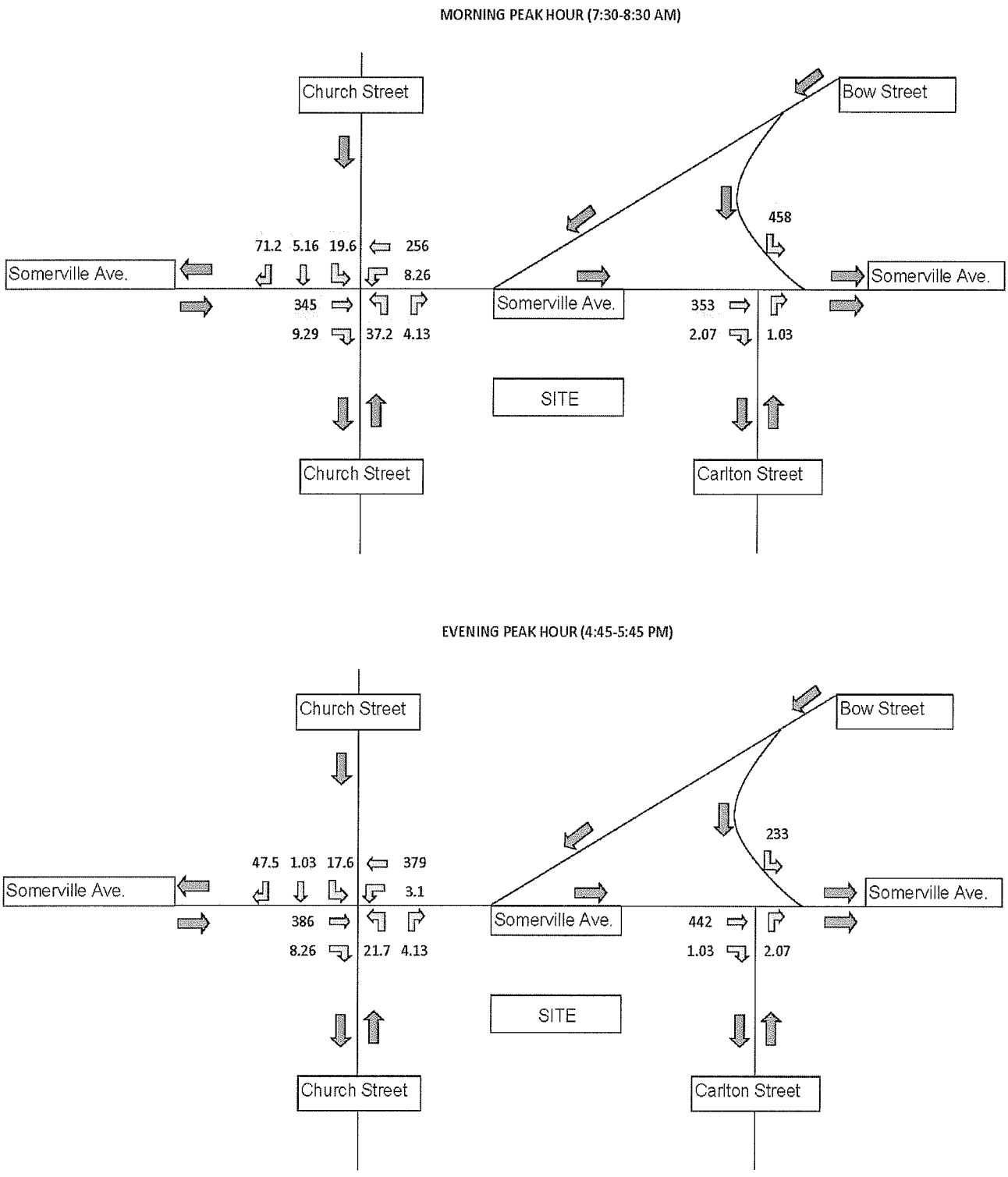


Figure 4 – 2015 No-Build Traffic Volume

4.2 Project Trip Generation (Continued)

The volumes anticipated to be generated during the peak hours, as well as the daily volumes, for the proposed uses can be found in Table 2, as can the peak hour and daily volumes for the former uses at the site. Without knowing the retail tenants that will occupy the development, and therefore to be conservative with trip generation estimates, Land Use Code 820 (LUC 820), Shopping Centre, was used for estimating trips associated with the proposed retail component of the development. For the residential component of the project, Land Use Code 220 (LUC 220), Apartments, was used. LUC 220 is also conservative since it provides higher trip generation estimates then other residential land use codes, such as condominiums.

The estimated number of new trips generated by the proposed development during a weekday is 253, with 11 new trips during the morning peak hour, and 24 new trips during the evening peak hour. These trip estimates assume that all new trips will be by vehicle. In order to provide for a very conservative approach, no 'mode split' deductions have been taken to account for travel by bus, train, bicycle, walking, or any other non-vehicular means of transportation.

Table 2 – Summary of Estimated Site Generated Trips

Day	Time Period	Direction	Existing Use			Proposed Use			Net Change
			Retail Uses* (LUC 820)	Residential Uses** (LUC 220)	Total	Retail Uses* (LUC 820)	Residential Uses** (LUC 220)	Total	
	Daily/AM/PM	In/Out	2,450	15		15,180	27,484		
Weekday	Daily	In	52.6	38.3	*90.9*	141.0	76.5	*217.5*	*126.6*
		Out	52.6	38.3	*90.9*	141.0	76.5	*217.5*	*126.6*
			105.2	76.5	*181.7*	281.9	153.0	*434.9*	***253.2***
	AM Peak Hour (of Adjacent St.)	In	1.5	1.4	*2.9*	4.0	2.8	*6.8*	*3.9*
		Out	1.0	5.5	*6.5*	2.7	11.0	*13.7*	*7.2*
			2.5	6.9	*9.4*	6.6	13.8	*20.5*	***11.1***
	PM Peak Hour (of Adjacent St.)	In	4.5	5.9	*10.3*	12.0	11.7	*23.7*	*13.4*
		Out	4.7	3.2	*7.8*	12.5	6.3	*18.8*	*11.0*
			9.1	9.0	*18.1*	24.5	18.0	*42.5*	***24.3***

** Used Land Use Code 820 (LUC 820) as a conservative estimate to account for any and all possible retail uses.*
*** Used Land Use Code 220 (LUC 220) as a conservative estimate to account for any and all possible residential uses.*

4.2.1 Project Trip Distribution & Trip Assignment

Upon determining the number of trips projected to be generated by the development, these trips are then assigned to the study area intersections based on existing trip distribution patterns (Figure 5). Directional distribution of generated trips to and from the site is estimated to largely follow existing traffic patterns. In general, it is expected that most of the site traffic will arriving/departing via Somerville Avenue to/from points west of the project and Somerville Avenue and Bow Street to/from points east of the project.

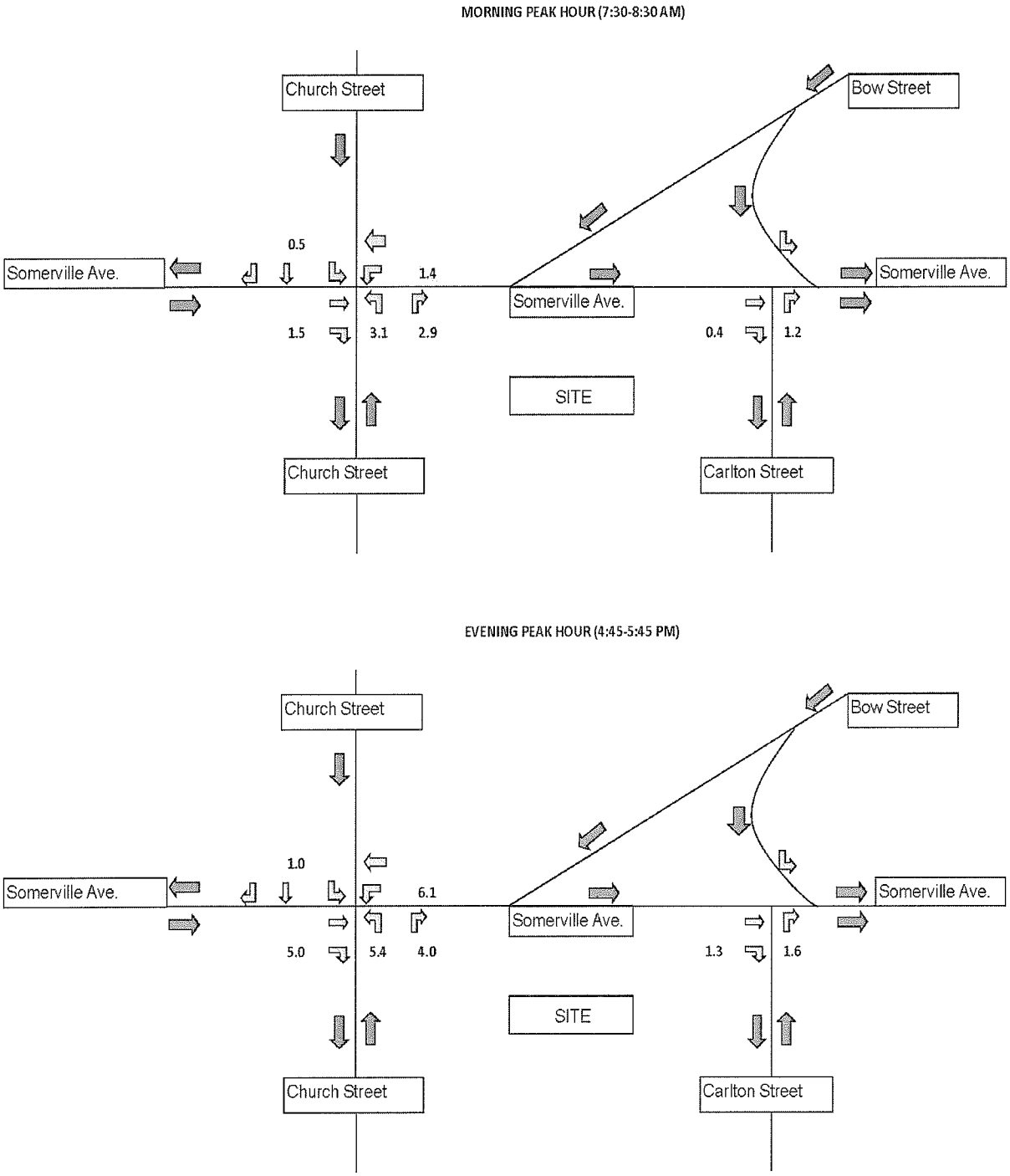


Figure 5 – Net Site Generated Trips

4.3 2015 Build Condition

Future Build conditions represent the No-Build condition with traffic associated with the potential new development added. When calculating traffic volumes associated with the new development, those traffic volumes associated with the old/existing uses are subtracted to establish the net increase in volumes.

4.3.1 2015 Build Condition Traffic Volumes

The combined net site traffic and No-Build traffic volumes represent the 2015 Build Condition traffic flow networks (Figure 6).

4.4 Traffic Operations Analysis

To determine any potential impacts the development might have on roadway operations, intersection operating levels of service were determined for Existing (2010), as well as 2015 No-Build and 2015 Build traffic conditions.

4.4.1 Level of Service Criteria

The study intersections were examined with regards to flow rates, capacity and delay characteristics to determine the Level of Service (LOS) provided under Existing as well as 2015 No-Build and 2015 Build traffic conditions. Level of Service is an indicator of operating conditions which occur on a given roadway feature while accommodating varying levels of traffic volumes. It is a qualitative measure that accounts for a number of operational factors including roadway geometry, speed, traffic composition, peak hour factors, travel delay, freedom to maneuver and driver expectation. When all of these measures are assessed and a Level of Service is assigned to a roadway or intersection, it is equivalent to presenting an "index" to the operational qualities of the section under study.

Level of Service is defined in the 2000 Highway Capacity Manual, published by the Transportation Research Board. Operating levels of service are reported on a scale of A to F, based on the control delay ranges they fall under, with A representing the best operating conditions and F representing the worst. These are presented in Table 3 for unsignalized intersections. Depending upon the type of facility being analyzed, level of service A represents free-flow or uncongested conditions with little or no delay to motorists, while level of service F represents long delays with traffic demands sometimes exceeding roadway capacity. In practice, any given roadway/intersection may operate at a wide LOS range depending upon time of day, day of week or period of year.

For unsignalized intersections, the operating level of service is based on travel delays. Delays are generally calculated as a function of traffic volume, peaking characteristics of traffic flow, percentage of heavy vehicles in the traffic stream, type of traffic control, number of travel lanes and land use, intersection approach grades, pedestrian activity, and signal timing, phasing, and progression where applicable. For unsignalized intersections, it is assumed that through movements on the main street have the right of way and are not delayed by side street traffic. Consequently, for unsignalized intersections, average delay values apply only to the minor street intersection approaches or to left turns from the major street into the minor street, which must yield to on-coming traffic.

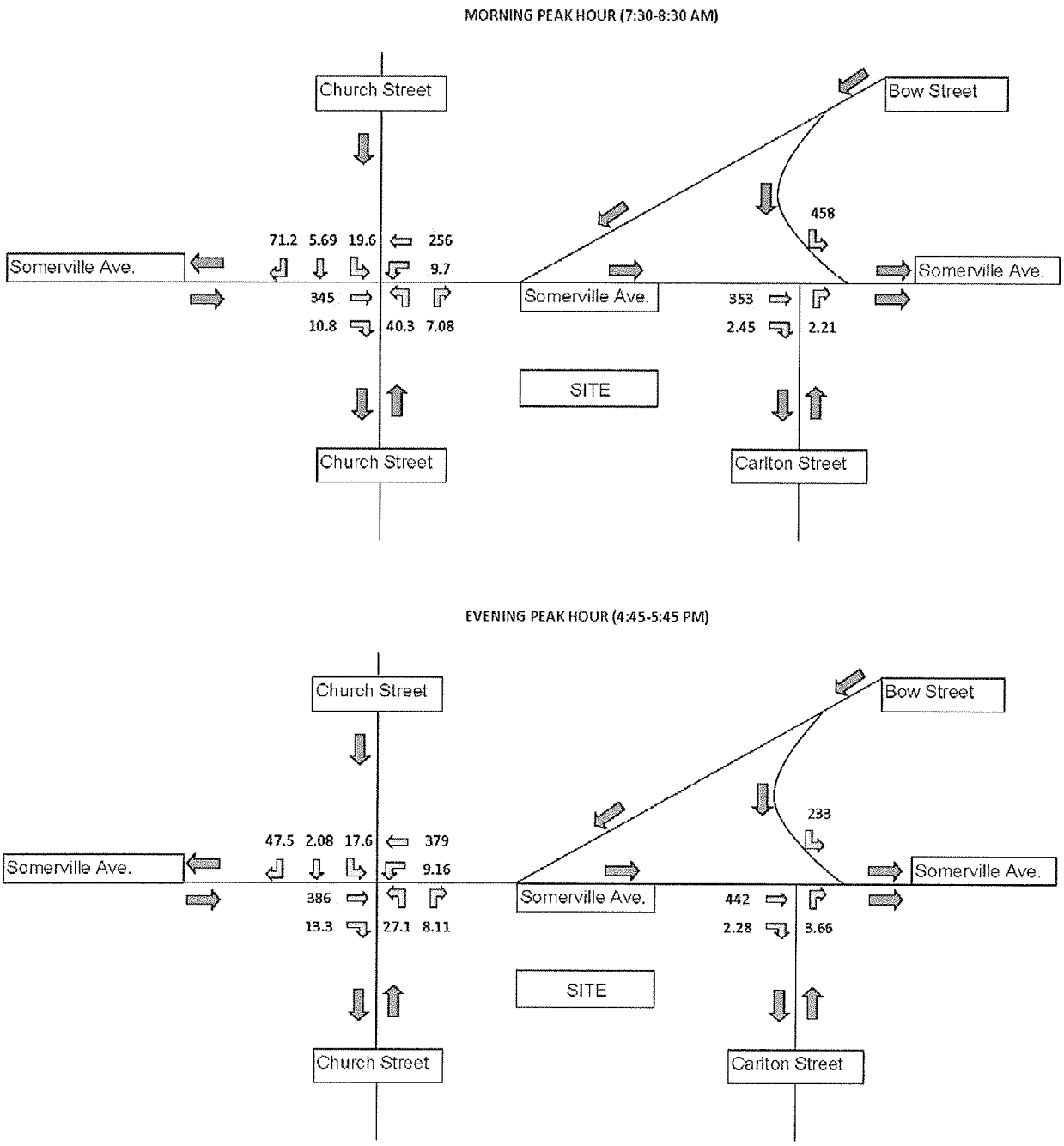


Figure 6 – 2015 Build Traffic Volume

4.4.1 Level of Service Criteria (Continued)

Table 3 - Level of Service (LOS) Criteria

Level of Service	Unsignalized Intersections Control Delay Range (seconds)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Transportation Research Board, Highway Capacity Manual, Washington D.C. 2000

The study intersections were evaluated as per techniques published in the 2000 Highway Capacity Manual (HCM). SYNCHRO traffic analyses software models that follow the procedures established in the HCM were used to analyze the study intersections. Using existing roadway features and intersection controls, traffic operations at the study area intersections were evaluated for existing as well as future conditions.

4.4.2 Level of Service Results

Analysis results are presented in Table 4 for the study intersections. The Level of Service analyses indicated that the Church Street NB approach is currently operating at a LOS D and LOS E in the morning and evening peak hours respectively. The Level of Service analyses indicate that the Church Street NB approach will continue to operate at a LOS D and LOS E in the future AM and PM peak hours respectively. All other approaches operate at LOS C or better and will continue to operate as such in the future as well.

Table 4 – Summary of Estimated Peak Hour Levels of Service (LOS)

		2010			2015 No-Build			2015 Build		
Intersection	Movement	V/C	Delay	LOS	V/C	Delay	LOS	V/C	Delay	LOS
				AM PEAK HOUR						
Somerville Ave & Church Street	Somerville Ave WB LT	0.01	0.6	A	0.01	0.6	A	0.02	0.7	A
	Church St NB LT/RT	0.34	30	D	0.39	33.5	D	0.44	35.4	E
	Church St SB LT/THR/RT	0.25	14.3	B	0.27	14.8	B	0.28	15.2	C
Somerville Ave & Carlton Street	Carlton St NB RT	0.01	11.6	B	0.01	11.8	B	0.01	11.9	B
				PM PEAK HOUR						
Somerville Ave & Church Street	Somerville Ave WB LT	0.01	0.3	A	0.01	0.3	A	0.03	0.8	A
	Church St NB LT/RT	0.35	41.2	E	0.39	46.8	E	0.54	57.8	F
	Church St SB LT/THR/RT	0.25	18.7	C	0.27	19.8	C	0.31	21.8	C
Somerville Ave & Carlton Street	Carlton St NB RT	0.01	12.5	B	0.01	12.7	B	0.02	12.8	B

With the addition of the project, the LOS for the Church Street NB approach is estimated to change from to a LOS E and LOS F in the morning and evening peak hours respectively. However, the delay associated with the changes in LOS represents only 2 seconds of additional delay (from 33 to 35 seconds) in the morning peak hour, hardly significant. In addition, the delay in the evening peak hour only increases by an estimated 11 seconds (from 46.8 to 57.8 seconds).

Furthermore, for conservative purposes, the estimation of site generated trips assumed all associated trips in and out of the proposed mixed-use development will use an automobile. This represents a 'worst case' scenario in terms of the expected mode splits (i.e. 100% by car, 0% by train, 0% by bus, 0% by bicycle, and 0% walking). With ample choices of alternative transportation in the Union Square neighborhood, in particular with the newly constructed bicycle lanes and the Union Square Green Line Station, it is highly likely that not all trips will be made by vehicle.

In addition, the estimated trip generation conservatively used Land Use Code (LUC 220) Apartments for the residential use and Land Use Code (820) Shopping Center for the retail component, both of which estimate higher trips for other uses in the same category such as condominiums or town houses and specialty retail shops.

Because of the conservative measures (discussed above), the increased delay will likely never be realized. If a fraction of the future tenants/visitors/customers bike, walk, or use public transportation, then the net trips associated with the project will be less than estimated resulting in less of an increase to delay. Therefore, if a small fraction of users use non-vehicular mode of transportation, the likely result will be no change to the LOS letter grade between 2015 No-Build to 2015 Build conditions.

5.0 Conclusions/Recommendations

Based on the evaluation of the project, which is documented in the previous sections, it can be concluded that while the project is expected to add a small amount of traffic to the roadway system, there will be relatively minimal impacts to the traffic operations of the adjacent roadway network and study area intersections.

The recent roadway reconstruction project and the future Green Line Station have and will contribute to improved traffic operations and enhance safety in the vicinity of the project and elsewhere in Union Square. These improvements have improved signage, pavement markings, encouraged increased bicycle use, improved pedestrian accessibility and aesthetics, and will provide for increased public transportation.

All customer trips and loading deliveries will utilize the new driveways on Church Street and Carlton Street. The majority of site trips will not pass by abutting residential homes located to the south of the proposed project since the project includes two new driveways. To further minimize traffic impacts to the abutting residents of Carlton Street, Lake Street and Church Street, a one-way circulation system has been devised to the rear of the proposed building, allowing for retail customers, employees, deliveries and trash pick-up to occur without the need to circle the block comprising of Carlton Street, Lake Street and Church Street.

APPENDIX

A. MassDOT Crash Rate Worksheets

B. Turning Movement Count (TMC) Data

C. SYNCHRO Traffic Analyses Output
    a. 2010 Existing AM and PM Peak Hour
    b. 2015 No-Build AM and PM Peak Hour
    c. 2015 Build AM and PM Peak Hour

MassDOT

CRASH RATE WORKSHEET

CITY/TOWN : Somerville COUNT DATE : 11/18/10 *MHD USE ONLY*

PROJECT DESCRIPTION: 380-390 Somerville Avenue

DISTRICT : 6 (formerly 4) UNSIGNALIZED : X SIGNALIZED : Source #

JOB NO. 10-052

~ INTERSECTION DATA ~

MAJOR STREET : Somerville Avenue RIN #

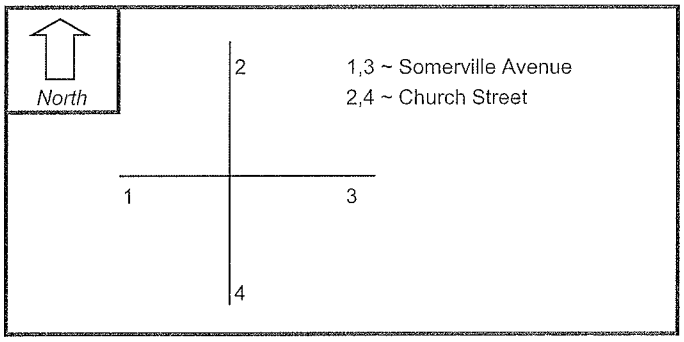
MINOR STREET(S) : Church Street RIN #

RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	6
DIRECTION :	EB	SB	WB	NB		
VOLUMES (**AM** / PM):	361	101	256	71		

"K" FACTOR : 0.09 APPROACH ADT : 8767 ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 5 # OF YEARS : 3 AVERAGE # OF ACCIDENTS (A) : 1.67

CRASH RATE CALCULATION : 0.52

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT*365)}$$

Comments : Lesser of AM/PM volumes were used to have higher crash rate.

2010 STATEWIDE AVERAGE:	2010 DISTRICT 6 (formerly 4) AVERAGE
0.62 FOR UNSIGNALIZED INTERSECTIONS	0.59 FOR UNSIGNALIZED INTERSECTIONS
0.82 FOR SIGNALIZED INTERSECTIONS	0.78 FOR SIGNALIZED INTERSECTIONS

MassDOT

CRASH RATE WORKSHEET

CITY/TOWN : Somerville | COUNT DATE : 10/06/10 | *MHD USE ONLY*

PROJECT DESCRIPTION: 380-390 Somerville Avenue

DISTRICT : 6 (formerly 4) | UNSIGNALIZED : X | SIGNALIZED : | Source #

JOB NO. 10-052

~ INTERSECTION DATA ~

MAJOR STREET : Somerville Avenue | RIN #

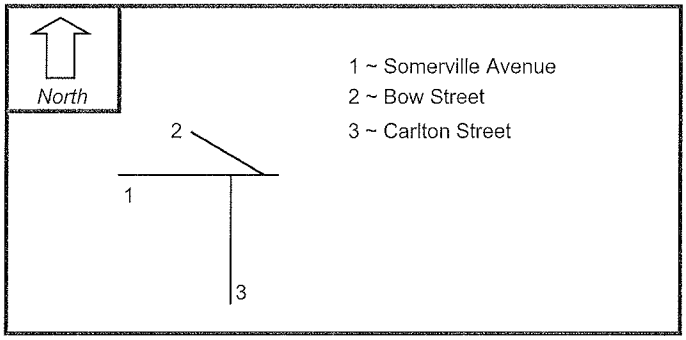
MINOR STREET(S) : Bow Street | RIN #

Carlton Street | RIN #

RIN #

RIN #

INTERSECTION DIAGRAM (Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	6
DIRECTION :	EB	SB	WB	NB		
VOLUMES (AM / **PM**):	408	201	0	2		

"K" FACTOR : 0.09 | APPROACH ADT : 6789 | ADT = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 4 | # OF YEARS : 3 | AVERAGE # OF ACCIDENTS (A) : 1.33

CRASH RATE CALCULATION : 0.54

$$RATE = \frac{(A * 1{,}000{,}000)}{(ADT*365)}$$

Comments : Lesser of AM/PM volumes were used to have higher crash rate.

2010 STATEWIDE AVERAGE:	2010 DISTRICT 6 (formerly 4) AVERAGE
0.62 FOR UNSIGNALIZED INTERSECTIONS	0.59 FOR UNSIGNALIZED INTERSECTIONS
0.82 FOR SIGNALIZED INTERSECTIONS	0.78 FOR SIGNALIZED INTERSECTIONS

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N / S: Church Street
E / W: Somerville Avenue
City, State: Somerville, Massachusetts
Client: Fort Hill / T. Blake

File Name : AM Peak - Somerville @ Church
Site Code : 1
Start Date : 10/6/2010
Page No : 1

Groups Printed- PCs and Peds - Heavy Vehicles - Bicycles

	Church Street From North					Somerville Avenue From East					Church Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:15 AM	9	2	8	3	22	0	46	2	0	48	0	0	5	3	8	3	82	0	3	88	166
07:30 AM	10	1	7	2	20	0	38	1	0	39	1	0	10	5	16	1	75	0	4	80	155
07:45 AM	24	1	7	1	33	0	60	1	0	61	1	0	6	5	12	1	84	0	4	89	195
Total	43	4	22	6	75	0	144	4	0	148	2	0	21	13	36	5	241	0	11	257	516
08:00 AM	18	0	4	1	23	0	57	4	0	61	2	0	10	11	23	4	71	0	3	78	185
08:15 AM	20	2	2	4	28	0	69	2	0	71	1	0	17	6	24	2	92	0	5	99	222
08:30 AM	7	2	6	2	17	0	62	1	0	63	0	0	3	9	12	2	87	0	6	95	187
08:45 AM	9	0	6	6	21	0	65	1	1	67	3	0	7	8	18	4	91	0	6	101	207
Total	54	4	18	13	89	0	253	8	1	262	6	0	37	34	77	12	341	0	20	373	801
09:00 AM	7	1	6	1	15	0	51	0	0	51	2	0	5	9	16	3	98	0	5	106	188
Grand Total	104	9	46	20	179	0	448	12	1	461	10	0	63	56	129	20	680	0	36	736	1505
Apprch %	58.1	5	25.7	11.2		0	97.2	2.6	0.2		7.8	0	48.8	43.4		2.7	92.4	0	4.9		
Total %	6.9	0.6	3.1	1.3	11.9	0	29.8	0.8	0.1	30.6	0.7	0	4.2	3.7	8.6	1.3	45.2	0	2.4	48.9	
and Peds	100	9	39	19	167	0	419	9	1	429	8	0	61	55	124	19	620	0	35	674	1394
Cs and Peds	96.2	100	84.8	95	93.3	0	93.5	75	100	93.1	80	0	96.8	98.2	96.1	95	91.2	0	97.2	91.6	92.6
Heavy Vehicles	3	0	0	0	3	0	25	2	0	27	2	0	2	0	4	0	35	0	0	35	69
% Heavy Vehicles	2.9	0	0	0	1.7	0	5.6	16.7	0	5.9	20	0	3.2	0	3.1	0	5.1	0	0	4.8	4.6
Bicycles	1	0	7	1	9	0	4	1	0	5	0	0	0	1	1	1	25	0	1	27	42
% Bicycles	1	0	15.2	5	5	0	0.9	8.3	0	1.1	0	0	0	1.8	0.8	5	3.7	0	2.8	3.7	2.8

	Church Street From North					Somerville Avenue From East					Church Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 09:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:15 AM																					
08:15 AM	**20**	**2**	2	4	**28**	0	**69**	**2**	0	**71**	1	0	**17**	6	**24**	2	92	0	5	99	**222**
08:30 AM	7	2	6	2	17	0	62	1	0	63	0	0	3	**9**	12	2	87	0	6	95	187
08:45 AM	9	0	6	**6**	21	0	65	1	**1**	67	**3**	0	7	8	18	**4**	91	0	6	101	207
09:00 AM	7	1	6	1	15	0	51	0	0	51	2	0	5	9	16	3	**98**	0	5	**106**	188
Total Volume	43	5	20	13	81	0	247	4	1	252	6	0	32	32	70	11	368	0	22	401	804
% App. Total	53.1	6.2	24.7	16		0	98	1.6	0.4		8.6	0	45.7	45.7		2.7	91.8	0	5.5		
PHF	.538	.625	.833	.542	.723	.000	.895	.500	.250	.887	.500	.000	.471	.889	.729	.688	.939	.000	.917	.946	.905

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Site Code : 1
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Page No : 1

Groups Printed- Heavy Vehicles - Bicycles

	Church Street From North					Somerville Avenue From East					Church Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:15 AM	1	0	0	0	1	0	3	0	0	3	0	0	0	0	0	0	7	0	0	7	11
07:30 AM	1	0	0	0	1	0	3	1	0	4	0	0	1	0	1	0	5	0	0	5	11
07:45 AM	0	0	2	0	2	0	6	0	0	6	0	0	0	0	0	0	4	0	0	4	12
Total	2	0	2	0	4	0	12	1	0	13	0	0	1	0	1	0	16	0	0	16	34
08:00 AM	0	0	0	1	1	0	3	1	0	4	0	0	0	1	1	0	9	0	0	9	15
08:15 AM	1	0	2	0	3	0	3	0	0	3	0	0	1	0	1	0	7	0	0	7	14
08:30 AM	1	0	0	0	1	0	6	0	0	6	0	0	0	0	0	0	4	0	0	4	11
08:45 AM	0	0	0	0	0	0	3	1	0	4	2	0	0	0	2	1	10	0	0	11	17
Total	2	0	2	1	5	0	15	2	0	17	2	0	1	1	4	1	30	0	0	31	57
09:00 AM	0	0	3	0	3	0	2	0	0	2	0	0	0	0	0	0	14	0	1	15	20
Grand Total	4	0	7	1	12	0	29	3	0	32	2	0	2	1	5	1	60	0	1	62	111
Apprch %	33.3	0	58.3	8.3		0	90.6	9.4	0		40	0	40	20		1.6	96.8	0	1.6		
Total %	3.6	0	6.3	0.9	10.8	0	26.1	2.7	0	28.8	1.8	0	1.8	0.9	4.5	0.9	54.1	0	0.9	55.9	
Heavy Vehicles	3	0	0	0	3	0	25	2	0	27	2	0	2	0	4	0	35	0	0	35	6
% Heavy Vehicles	75	0	0	0	25	0	86.2	66.7	0	84.4	100	0	100	0	80	0	58.3	0	0	56.5	62.2
Bicycles	1	0	7	1	9	0	4	1	0	5	0	0	0	1	1	1	25	0	1	27	42
% Bicycles	25	0	100	100	75	0	13.8	33.3	0	15.6	0	0	0	100	20	100	41.7	0	100	43.5	37.8

	Church Street From North					Somerville Avenue From East					Church Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 09:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:15 AM																					
08:15 AM	1	0	2	0	3	0	3	0	0	3	0	0	1	0	1	0	7	0	0	7	14
08:30 AM	1	0	0	0	1	0	6	0	0	6	0	0	0	0	0	0	4	0	0	4	11
08:45 AM	0	0	0	0	0	0	3	1	0	4	2	0	0	0	2	1	10	0	0	11	17
09:00 AM	0	0	3	0	3	0	2	0	0	2	0	0	0	0	0	0	14	0	1	15	20
Total Volume	2	0	5	0	7	0	14	1	0	15	2	0	1	0	3	1	35	0	1	37	62
% App. Total	28.6	0	71.4	0		0	93.3	6.7	0		66.7	0	33.3	0		2.7	94.6	0	2.7		
PHF	.500	.000	.417	.000	.583	.000	.583	.250	.000	.625	.250	.000	.250	.000	.375	.250	.625	.000	.250	.617	.775

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Bow & Somerville
City, State: Somerville, Massachusetts
Client: Fort Hill / T. Blake

File Name : AM Peak - Somerville @ Bow
Site Code : 2
Start Date : 10/6/2010
Page No : 1

Groups Printed- PCs and Peds - Heavy Vehicles - Bicycles

	From North					Bow Street From East					Carlton Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:15 AM	0	0	0	0	0	0	36	71	3	110	1	0	0	3	4	1	86	0	0	87	201
07:30 AM	0	0	0	0	0	0	30	80	0	110	1	0	0	1	2	0	74	0	0	74	186
07:45 AM	0	0	0	0	0	0	47	119	3	169	0	0	0	2	2	0	91	0	0	91	262
Total	0	0	0	0	0	0	113	270	6	389	2	0	0	6	8	1	251	0	0	252	649
08:00 AM	0	0	1	0	1	0	47	106	3	156	1	0	0	2	3	1	86	0	0	87	247
08:15 AM	0	0	0	0	0	0	60	101	4	165	0	0	0	5	5	1	78	0	0	79	249
08:30 AM	0	0	0	0	0	0	55	118	1	174	0	0	0	1	1	0	87	0	0	87	262
08:45 AM	0	0	0	0	0	0	67	95	5	167	0	0	0	3	3	0	91	0	0	91	261
Total	0	0	1	0	1	0	229	420	13	662	1	0	0	11	12	2	342	0	0	344	1019
09:00 AM	0	0	0	0	0	0	48	67	2	117	0	0	0	7	7	0	99	0	0	99	223
Grand Total	0	0	1	0	1	0	390	757	21	1168	3	0	0	24	27	3	692	0	0	695	1891
Apprch %	0	0	100	0		0	33.4	64.8	1.8		11.1	0	0	88.9		0.4	99.6	0	0		
Total %	0	0	0.1	0	0.1	0	20.6	40	1.1	61.8	0.2	0	0	1.3	1.4	0.2	36.6	0	0	36.8	
and Peds	0	0	1	0	1	0	363	742	15	1120	3	0	0	3	6	3	658	0	0	661	1788
s and Peds	0	0	100	0	100	0	93.1	98	71.4	95.9	100	0	0	12.5	22.2	100	95.1	0	0	95.1	94.6
Heavy Vehicles	0	0	0	0	0	0	27	15	1	43	0	0	0	1	1	0	34	0	0	34	78
% Heavy Vehicles	0	0	0	0	0	0	6.9	2	4.8	3.7	0	0	0	4.2	3.7	0	4.9	0	0	4.9	4.1
Bicycles	0	0	0	0	0	0	0	0	5	5	0	0	0	20	20	0	0	0	0	0	25
% Bicycles	0	0	0	0	0	0	0	0	23.8	0.4	0	0	0	83.3	74.1	0	0	0	0	0	1.3

	From North					Bow Street From East					Carlton Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 09:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:45 AM																					
07:45 AM	0	0	0	0	0	0	47	**119**	3	169	0	0	0	2	2	0	**91**	0	0	**91**	**262**
08:00 AM	0	0	**1**	0	**1**	0	47	106	3	156	**1**	0	0	2	3	**1**	86	0	0	87	247
08:15 AM	0	0	0	0	0	0	**60**	101	4	165	0	0	0	**5**	**5**	1	78	0	0	79	249
08:30 AM	0	0	0	0	0	0	55	118	1	**174**	0	0	0	1	1	0	87	0	0	87	262
Total Volume	0	0	1	0	1	0	209	444	11	664	1	0	0	10	11	2	342	0	0	344	1020
% App. Total	0	0	100	0		0	31.5	66.9	1.7		9.1	0	0	90.9		0.6	99.4	0	0		
PHF	.000	.000	.250	.000	.250	.000	.871	.933	.688	.954	.250	.000	.000	.500	.550	.500	.940	.000	.000	.945	.973

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Groups Printed- Heavy Vehicles - Bicycles

	From North					Bow Street From East					Carlton Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:15 AM	0	0	0	0	0	0	3	0	0	3	0	0	0	1	1	0	5	0	0	5	9
07:30 AM	0	0	0	0	0	0	3	1	0	4	0	0	0	1	1	0	4	0	0	4	9
07:45 AM	0	0	0	0	0	0	4	1	2	7	0	0	0	1	1	0	2	0	0	2	10
Total	0	0	0	0	0	0	10	2	2	14	0	0	0	3	3	0	11	0	0	11	28
08:00 AM	0	0	0	0	0	0	4	1	1	6	0	0	0	2	2	0	4	0	0	4	12
08:15 AM	0	0	0	0	0	0	3	2	1	6	0	0	0	5	5	0	2	0	0	2	13
08:30 AM	0	0	0	0	0	0	3	4	0	7	0	0	0	1	1	0	4	0	0	4	12
08:45 AM	0	0	0	0	0	0	4	3	1	8	0	0	0	3	3	0	4	0	0	4	15
Total	0	0	0	0	0	0	14	10	3	27	0	0	0	11	11	0	14	0	0	14	52
09:00 AM	0	0	0	0	0	0	3	3	1	7	0	0	0	7	7	0	9	0	0	9	23
Grand Total	0	0	0	0	0	0	27	15	6	48	0	0	0	21	21	0	34	0	0	34	103
Apprch %	0	0	0	0		0	56.2	31.2	12.5		0	0	0	100		0	100	0	0		
Total %	0	0	0	0	0	0	26.2	14.6	5.8	46.6	0	0	0	20.4	20.4	0	33	0	0	33	
Heavy Vehicles	0	0	0	0	0	0	27	15	1	43	0	0	0	1	1	0	34	0	0	34	78
% Heavy Vehicles	0	0	0	0	0	0	100	100	16.7	89.6	0	0	0	4.8	4.8	0	100	0	0	100	75.7
Bicycles	0	0	0	0	0	0	0	0	5	5	0	0	0	20	20	0	0	0	0	0	25
% Bicycles	0	0	0	0	0	0	0	0	83.3	10.4	0	0	0	95.2	95.2	0	0	0	0	0	24.3

	From North					Bow Street From East					Carlton Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:15 AM to 09:00 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:15 AM																					
08:15 AM	0	0	0	0	0	0	3	2	1	6	0	0	0	5	5	0	2	0	0	2	13
08:30 AM	0	0	0	0	0	0	3	4	0	7	0	0	0	1	1	0	4	0	0	4	12
08:45 AM	0	0	0	0	0	0	4	3	1	8	0	0	0	3	3	0	4	0	0	4	15
09:00 AM	0	0	0	0	0	0	3	3	1	7	0	0	0	7	7	0	9	0	0	9	23
Total Volume	0	0	0	0	0	0	13	12	3	28	0	0	0	16	16	0	19	0	0	19	63
% App. Total	0	0	0	0		0	46.4	42.9	10.7		0	0	0	100		0	100	0	0		
PHF	.000	.000	.000	.000	.000	.000	.813	.750	.750	.875	.000	.000	.000	.571	.571	.000	.528	.000	.000	.528	.685

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Site Code : 3
Start Date : 10/6/2010
Page No : 1

Groups Printed- PCs and Peds - Heavy Vehicles - Bicycles

	Church Street From North					Somerville Avenue From East					Church Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:30 PM	14	0	5	9	28	0	83	2	0	85	0	0	7	8	15	2	74	0	9	85	213
04:45 PM	11	0	4	9	24	0	88	2	0	90	0	0	4	17	21	1	96	0	10	107	242
Total	25	0	9	18	52	0	171	4	0	175	0	0	11	25	36	3	170	0	19	192	455
05:00 PM	16	1	5	8	30	0	84	0	0	84	3	0	7	15	25	1	97	0	6	104	243
05:15 PM	7	0	4	15	26	0	95	1	0	96	0	0	5	26	31	2	97	0	10	109	262
05:30 PM	12	0	4	9	25	0	100	0	0	100	1	0	5	13	19	4	84	0	14	102	246
05:45 PM	13	2	3	17	35	0	70	0	0	70	2	0	3	24	29	0	90	0	15	105	239
Total	48	3	16	49	116	0	349	1	0	350	6	0	20	78	104	7	368	0	45	420	990
06:00 PM	15	0	6	15	36	0	87	2	0	89	2	0	6	18	26	0	96	0	14	110	261
06:15 PM	9	0	4	9	22	0	71	0	0	71	4	0	4	17	25	1	83	0	3	87	205
Grand Total	97	3	35	91	226	0	678	7	0	685	12	0	41	138	191	11	717	0	81	809	1911
Apprch %	42.9	1.3	15.5	40.3		0	99	1	0		6.3	0	21.5	72.3		1.4	88.6	0	10		
Total %	5.1	0.2	1.8	4.8	11.8	0	35.5	0.4	0	35.8	0.6	0	2.1	7.2	10	0.6	37.5	0	4.2	42.3	
's and Peds	95	3	35	81	214	0	640	6	0	646	11	0	41	136	188	9	675	0	80	764	1812
Cs and Peds	97.9	100	100	89	94.7	0	94.4	85.7	0	94.3	91.7	0	100	98.6	98.4	81.8	94.1	0	98.8	94.4	94.8
reavy Vehicles	1	0	0	0	1	0	21	0	0	21	1	0	0	0	1	0	21	0	0	21	44
% Heavy Vehicles	1	0	0	0	0.4	0	3.1	0	0	3.1	8.3	0	0	0	0.5	0	2.9	0	0	2.6	2.3
Bicycles	1	0	0	10	11	0	17	1	0	18	0	0	0	2	2	2	21	0	1	24	55
% Bicycles	1	0	0	11	4.9	0	2.5	14.3	0	2.6	0	0	0	1.4	1	18.2	2.9	0	1.2	3	2.9

	Church Street From North					Somerville Avenue From East					Church Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:15 PM																					
05:15 PM	7	0	4	15	26	0	95	1	0	96	0	0	5	**26**	**31**	2	**97**	0	10	109	**262**
05:30 PM	12	0	4	9	25	0	**100**	0	0	**100**	1	0	5	13	19	4	84	0	14	102	246
05:45 PM	13	**2**	3	**17**	35	0	70	0	0	70	**2**	0	3	24	29	0	90	0	**15**	105	239
06:00 PM	**15**	0	**6**	15	**36**	0	87	**2**	0	89	2	0	**6**	18	26	0	96	0	14	**110**	261
Total Volume	47	2	17	56	122	0	352	3	0	355	5	0	19	81	105	6	367	0	53	426	1008
% App. Total	38.5	1.6	13.9	45.9		0	99.2	0.8	0		4.8	0	18.1	77.1		1.4	86.2	0	12.4		
PHF	.783	.250	.708	.824	.847	.000	.880	.375	.000	.888	.625	.000	.792	.779	.847	.375	.946	.000	.883	.968	.962

Innovative Data, LLC
50 Alden Avenue
Belchertown, Massachusetts
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N / S: Church Street
E / W: Somerville Avenue
City, State: Somerville, Massachusetts
Client: Fort Hill / T. Blake

File Name : PM Peak - Somerville @ Church
Site Code : 3
Start Date : 10/6/2010
Page No : 1

Groups Printed- Heavy Vehicles - Bicycles

	Church Street From North					Somerville Avenue From East					Church Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:30 PM	0	0	0	0	0	0	6	1	0	7	0	0	0	0	0	0	4	0	0	4	11
04:45 PM	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	1	4	0	0	5	7
Total	0	0	0	0	0	0	8	1	0	9	0	0	0	0	0	1	8	0	0	9	18
05:00 PM	0	0	0	1	1	0	11	0	0	11	0	0	0	0	0	1	4	0	0	5	17
05:15 PM	1	0	0	4	5	0	7	0	0	7	0	0	0	0	0	0	4	0	0	4	16
05:30 PM	0	0	0	1	1	0	4	0	0	4	0	0	0	0	0	0	8	0	0	8	13
05:45 PM	1	0	0	1	2	0	3	0	0	3	0	0	0	1	1	0	6	0	0	6	12
Total	2	0	0	7	9	0	25	0	0	25	0	0	0	1	1	1	22	0	0	23	58
06:00 PM	0	0	0	1	1	0	2	0	0	2	1	0	0	1	2	0	7	0	0	7	12
06:15 PM	0	0	0	2	2	0	3	0	0	3	0	0	0	0	0	0	5	0	1	6	11
Grand Total	2	0	0	10	12	0	38	1	0	39	1	0	0	2	3	2	42	0	1	45	99
Apprch %	16.7	0	0	83.3		0	97.4	2.6	0		33.3	0	0	66.7		4.4	93.3	0	2.2		
Total %	2	0	0	10.1	12.1	0	38.4	1	0	39.4	1	0	0	2	3	2	42.4	0	1	45.5	
Heavy Vehicles	1	0	0	0	1	0	21	0	0	21	1	0	0	0	1	0	21	0	0	21	4
% Heavy Vehicles	50	0	0	0	8.3	0	55.3	0	0	53.8	100	0	0	0	33.3	0	50	0	0	46.7	44.4
Bicycles	1	0	0	10	11	0	17	1	0	18	0	0	0	2	2	2	21	0	1	24	55
% Bicycles	50	0	0	100	91.7	0	44.7	100	0	46.2	0	0	0	100	66.7	100	50	0	100	53.3	55.6

	Church Street From North					Somerville Avenue From East					Church Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	1	1	0	**11**	0	0	**11**	0	0	0	0	0	**1**	4	0	0	5	**17**
05:15 PM	**1**	0	0	**4**	**5**	0	7	0	0	7	0	0	0	0	0	0	4	0	0	4	16
05:30 PM	0	0	0	1	1	0	4	0	0	4	0	0	0	0	0	0	**8**	0	0	**8**	13
05:45 PM	1	0	0	1	2	0	3	0	0	3	0	0	0	**1**	**1**	0	6	0	0	6	12
Total Volume	2	0	0	7	9	0	25	0	0	25	0	0	0	1	1	1	22	0	0	23	58
% App. Total	22.2	0	0	77.8		0	100	0	0		0	0	0	100		4.3	95.7	0	0		
PHF	.500	.000	.000	.438	.450	.000	.568	.000	.000	.568	.000	.000	.000	.250	.250	.250	.688	.000	.000	.719	.853

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Bow & Somerville
City, State: Somerville, Massachusetts
Client: Fort Hill / T. Blake

File Name : PM Peak - Somerville @ Bow
Site Code : 4
Start Date : 10/6/2010
Page No : 1

Groups Printed- PCs and Peds - Heavy Vehicles - Bicycles

	From North					Bow Street From East					Carlton Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:30 PM	0	0	0	0	0	0	87	53	0	140	0	0	0	0	0	0	80	0	1	81	221
04:45 PM	0	0	0	0	0	0	95	55	1	151	0	0	0	0	0	0	113	0	4	117	268
Total	0	0	0	0	0	0	182	108	1	291	0	0	0	0	0	0	193	0	5	198	489
05:00 PM	0	0	0	0	0	0	85	56	0	141	0	0	0	0	0	0	104	0	3	107	248
05:15 PM	0	0	0	0	0	0	102	66	0	168	1	0	0	0	1	1	106	0	4	111	280
05:30 PM	0	0	0	0	0	0	108	49	0	157	1	0	0	0	1	0	105	0	1	106	264
05:45 PM	0	0	0	0	0	0	59	30	0	89	0	0	0	0	0	0	84	0	0	84	173
Total	0	0	0	0	0	0	354	201	0	555	2	0	0	0	2	1	399	0	8	408	965
06:00 PM	0	0	0	0	0	0	87	45	0	132	0	0	0	0	0	0	92	0	0	92	224
06:15 PM	0	0	0	0	0	0	65	37	0	102	0	0	0	0	0	0	84	0	0	84	186
Grand Total	0	0	0	0	0	0	688	391	1	1080	2	0	0	0	2	1	768	0	13	782	1864
Apprch %	0	0	0	0		0	63.7	36.2	0.1		100	0	0	0		0.1	98.2	0	1.7		
Total %	0	0	0	0	0	0	36.9	21	0.1	57.9	0.1	0	0	0	0.1	0.1	41.2	0	0.7	42	
and Peds	0	0	0	0	0	0	671	384	1	1056	2	0	0	0	2	1	746	0	12	759	1817
's and Peds	0	0	0	0	0	0	97.5	98.2	100	97.8	100	0	0	0	100	100	97.1	0	92.3	97.1	97.5
Heavy Vehicles	0	0	0	0	0	0	17	7	0	24	0	0	0	0	0	0	22	0	0	22	46
% Heavy Vehicles	0	0	0	0	0	0	2.5	1.8	0	2.2	0	0	0	0	0	0	2.9	0	0	2.8	2.5
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.7	0.1	0.1

	From North					Bow Street From East					Carlton Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	0	0	0	0	0	95	55	1	151	0	0	0	0	0	0	**113**	0	4	**117**	268
05:00 PM	0	0	0	0	0	0	85	56	0	141	0	0	0	0	0	0	104	0	3	107	248
05:15 PM	0	0	0	0	0	0	102	**66**	0	**168**	**1**	0	0	0	**1**	**1**	106	0	4	111	**280**
05:30 PM	0	0	0	0	0	0	**108**	49	0	157	1	0	0	0	1	0	105	0	1	106	264
Total Volume	0	0	0	0	0	0	390	226	1	617	2	0	0	0	2	1	428	0	12	441	1060
% App. Total	0	0	0	0		0	63.2	36.6	0.2		100	0	0	0		0.2	97.1	0	2.7		
PHF	.000	.000	.000	.000	.000	.000	.903	.856	.250	.918	.500	.000	.000	.000	.500	.250	.947	.000	.750	.942	.946

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Bow & Somerville
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File Name : PM Peak - Somerville @ Bow
Site Code : 4
Start Date : 10/6/2010
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Groups Printed- Heavy Vehicles - Bicycles

	From North					Bow Street From East					Carlton Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:30 PM	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	5
04:45 PM	0	0	0	0	0	0	2	3	0	5	0	0	0	0	0	0	4	0	0	4	9
Total	0	0	0	0	0	0	5	3	0	8	0	0	0	0	0	0	6	0	0	6	14
05:00 PM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	4	0	1	5	9
05:15 PM	0	0	0	0	0	0	4	2	0	6	0	0	0	0	0	0	2	0	0	2	8
05:30 PM	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	0	3	0	0	3	6
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
Total	0	0	0	0	0	0	10	3	0	13	0	0	0	0	0	0	11	0	1	12	25
06:00 PM	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	5
06:15 PM	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	0	2	3
Grand Total	0	0	0	0	0	0	17	7	0	24	0	0	0	0	0	0	22	0	1	23	47
Apprch %	0	0	0	0		0	70.8	29.2	0		0	0	0	0		0	95.7	0	4.3		
Total %	0	0	0	0	0	0	36.2	14.9	0	51.1	0	0	0	0	0	0	46.8	0	2.1	48.9	
Heavy Vehicles	0	0	0	0	0	0	17	7	0	24	0	0	0	0	0	0	22	0	0	22	4
% Heavy Vehicles	0	0	0	0	0	0	100	100	0	100	0	0	0	0	0	0	100	0	0	95.7	97..
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
% Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	4.3	2.1

	From North					Bow Street From East					Carlton Street From South					Somerville Avenue From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:30 PM to 06:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 04:45 PM																					
04:45 PM	0	0	0	0	0	0	2	3	0	5	0	0	0	0	0	0	4	0	0	4	9
05:00 PM	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	4	0	1	5	9
05:15 PM	0	0	0	0	0	0	4	2	0	6	0	0	0	0	0	0	2	0	0	2	8
05:30 PM	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	0	3	0	0	3	6
Total Volume	0	0	0	0	0	0	12	6	0	18	0	0	0	0	0	0	13	0	1	14	32
% App. Total	0	0	0	0		0	66.7	33.3	0		0	0	0	0		0	92.9	0	7.1		
PHF	.000	.000	.000	.000	.000	.000	.750	.500	.000	.750	.000	.000	.000	.000	.000	.000	.813	.000	.250	.700	.889

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	328	9	8	244	0	35	0	4	19	5	68
Peak Hour Factor	0.92	0.91	0.56	0.50	0.90	0.92	0.53	0.92	0.50	0.68	0.63	0.72
Hourly flow rate (vph)	0	360	16	16	271	0	66	0	8	28	8	94
Pedestrians		49			31			49			8	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		4			3			4			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	279			426			868	729	448	719	737	328
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	279			426			868	729	448	719	737	328
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			67	100	99	91	98	86
cM capacity (veh/h)	1287			1098			201	331	574	315	327	682

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	377	287	74	130
Volume Left	0	16	66	28
Volume Right	16	0	8	94
cSH	1700	1098	217	518
Volume to Capacity	0.22	0.01	0.34	0.25
Queue Length 95th (ft)	0	1	36	25
Control Delay (s)	0.0	0.6	30.0	14.3
Lane LOS		A	D	B
Approach Delay (s)	0.0	0.6	30.0	14.3
Approach LOS			D	B

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	37.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL	SWR
Lane Configurations											
Sign Control		Free			Free		Stop			Yield	
Grade		0%			0%		0%			0%	
Volume (veh/h)	0	336	2	0	0	0	0	1	436	0	205
Peak Hour Factor	0.92	0.94	0.50	0.92	0.92	0.92	0.92	0.25	0.93	0.92	0.87
Hourly flow rate (vph)	0	357	4	0	0	0	0	4	469	0	236
Pedestrians		11			11		10			10	
Lane Width (ft)		12.0			0.0		12.0			12.0	
Walking Speed (ft/s)		4.0			4.0		4.0			4.0	
Percent Blockage		1			0		1			1	
Right turn flare (veh)											
Median type							None			None	
Median storage veh)											
Upstream signal (ft)											
pX, platoon unblocked											
vC, conflicting volume	10			371			380	379	382	381	21
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol	10			371			380	379	382	381	21
tC, single (s)	4.1			4.1			7.1	6.5	7.1	6.5	6.3
tC, 2 stage (s)											
tF (s)	2.2			2.2			3.5	4.0	3.5	4.0	3.4
p0 queue free %	100			100			100	99	16	100	77
cM capacity (veh/h)	1609			1177			431	547	560	542	1024

Direction, Lane #	EB 1	NB 1	SW 1	SW 2
Volume Total	361	4	469	236
Volume Left	0	0	469	0
Volume Right	4	0	0	236
cSH	1700	547	560	1024
Volume to Capacity	0.21	0.01	0.84	0.23
Queue Length 95th (ft)	0	1	218	22
Control Delay (s)	0.0	11.6	36.0	9.6
Lane LOS		B	E	A
Approach Delay (s)	0.0	11.6	27.2	
Approach LOS		B	D	

Intersection Summary			
Average Delay	17.9		
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	367	8	3	361	0	21	0	4	17	1	45
Peak Hour Factor	0.92	0.96	0.50	0.38	0.92	0.75	0.53	0.92	0.33	0.85	0.25	0.72
Hourly flow rate (vph)	0	382	16	8	392	0	40	0	12	20	4	62
Pedestrians		111			71			111			41	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		9			6			9			3	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	433			509			1085	950	572	923	958	544
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	433			509			1085	950	572	923	958	544
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			68	100	97	90	98	87
cM capacity (veh/h)	1098			968			124	228	447	201	225	476

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	398	400	52	86
Volume Left	0	8	40	20
Volume Right	16	0	12	62
cSH	1700	968	150	348
Volume to Capacity	0.23	0.01	0.35	0.25
Queue Length 95th (ft)	0	1	35	24
Control Delay (s)	0.0	0.3	41.2	18.7
Lane LOS		A	E	C
Approach Delay (s)	0.0	0.3	41.2	18.7
Approach LOS			E	C

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	41.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL	SWR
Lane Configurations											
Sign Control		Free			Free		Stop			Yield	
Grade		0%			0%		0%			0%	
Volume (veh/h)	0	420	1	0	0	0	0	2	222	0	383
Peak Hour Factor	0.92	0.95	0.25	0.92	0.92	0.92	0.92	0.50	0.86	0.92	0.90
Hourly flow rate (vph)	0	442	4	0	0	0	0	4	258	0	426
Pedestrians		1			1		12			12	
Lane Width (ft)		12.0			0.0		12.0			12.0	
Walking Speed (ft/s)		4.0			4.0		4.0			4.0	
Percent Blockage		0			0		1			1	
Right turn flare (veh)											
Median type							None			None	
Median storage veh)											
Upstream signal (ft)											
pX, platoon unblocked											
vC, conflicting volume	12			458			457	468	459	470	13
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol	12			458			457	468	459	470	13
tC, single (s)	4.1			4.1			7.1	6.5	7.1	6.5	6.2
tC, 2 stage (s)											
tF (s)	2.2			2.2			3.5	4.0	3.5	4.0	3.3
p0 queue free %	100			100			100	99	48	100	60
cM capacity (veh/h)	1604			1092			298	486	495	482	1053

Direction, Lane #	EB 1	NB 1	SW 1	SW 2
Volume Total	446	4	258	426
Volume Left	0	0	258	0
Volume Right	4	0	0	426
cSH	1700	486	495	1053
Volume to Capacity	0.26	0.01	0.52	0.40
Queue Length 95th (ft)	0	1	74	50
Control Delay (s)	0.0	12.5	19.9	10.7
Lane LOS		B	C	B
Approach Delay (s)	0.0	12.5	14.2	
Approach LOS		B	B	

Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	51.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	345	9	8	256	0	37	0	4	20	5	71
Peak Hour Factor	0.92	0.91	0.56	0.50	0.90	0.92	0.53	0.92	0.50	0.68	0.63	0.72
Hourly flow rate (vph)	0	379	16	16	284	0	70	0	8	29	8	99
Pedestrians		49			31			49			8	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		4			3			4			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	292			444			904	761	467	751	769	341
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	292			444			904	761	467	751	769	341
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			63	100	99	90	97	85
cM capacity (veh/h)	1272			1081			188	317	561	300	314	670

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	395	300	78	136
Volume Left	0	16	70	29
Volume Right	16	0	8	99
cSH	1700	1081	202	503
Volume to Capacity	0.23	0.01	0.39	0.27
Queue Length 95th (ft)	0	1	42	27
Control Delay (s)	0.0	0.6	33.5	14.8
Lane LOS		A	D	B
Approach Delay (s)	0.0	0.6	33.5	14.8
Approach LOS			D	B

Intersection Summary			
Average Delay	5.3		
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL	SWR
Lane Configurations											
Sign Control		Free			Free		Stop			Yield	
Grade		0%			0%		0%			0%	
Volume (veh/h)	0	353	2	0	0	0	0	1	458	0	216
Peak Hour Factor	0.92	0.94	0.50	0.92	0.92	0.92	0.92	0.25	0.93	0.92	0.87
Hourly flow rate (vph)	0	376	4	0	0	0	0	4	492	0	248
Pedestrians		11			11		10			10	
Lane Width (ft)		12.0			0.0		12.0			12.0	
Walking Speed (ft/s)		4.0			4.0		4.0			4.0	
Percent Blockage		1			0		1			1	
Right turn flare (veh)											
Median type							None			None	
Median storage veh)											
Upstream signal (ft)											
pX, platoon unblocked											
vC, conflicting volume	10			390			399	398	401	400	21
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol	10			390			399	398	401	400	21
tC, single (s)	4.1			4.1			7.1	6.5	7.1	6.5	6.3
tC, 2 stage (s)											
tF (s)	2.2			2.2			3.5	4.0	3.5	4.0	3.4
p0 queue free %	100			100			100	99	10	100	76
cM capacity (veh/h)	1609			1159			413	534	545	530	1024

Direction, Lane #	EB 1	NB 1	SW 1	SW 2
Volume Total	380	4	492	248
Volume Left	0	0	492	0
Volume Right	4	0	0	248
cSH	1700	534	545	1024
Volume to Capacity	0.22	0.01	0.90	0.24
Queue Length 95th (ft)	0	1	267	24
Control Delay (s)	0.0	11.8	46.0	9.6
Lane LOS		B	E	A
Approach Delay (s)	0.0	11.8	33.8	
Approach LOS		B	D	

Intersection Summary			
Average Delay	22.3		
Intersection Capacity Utilization	60.2%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: Somerville Ave & Church Street

380 - 390 Somerville Ave
2015 PM No Build

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	386	8	3	379	0	22	0	4	18	1	47
Peak Hour Factor	0.92	0.96	0.50	0.38	0.92	0.75	0.53	0.92	0.33	0.85	0.25	0.72
Hourly flow rate (vph)	0	402	16	8	412	0	42	0	12	21	4	65
Pedestrians		111			71			111			41	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		9			6			9			3	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	453			529			1127	990	592	962	998	564
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	453			529			1127	990	592	962	998	564
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			64	100	97	89	98	86
cM capacity (veh/h)	1080			951			115	216	435	189	214	464

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	418	420	54	90
Volume Left	0	8	42	21
Volume Right	16	0	12	65
cSH	1700	951	138	333
Volume to Capacity	0.25	0.01	0.39	0.27
Queue Length 95th (ft)	0	1	41	27
Control Delay (s)	0.0	0.3	46.8	19.8
Lane LOS		A	E	C
Approach Delay (s)	0.0	0.3	46.8	19.8
Approach LOS			E	C

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	41.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL	SWR
Lane Configurations											
Sign Control		Free			Free		Stop			Yield	
Grade		0%			0%		0%			0%	
Volume (veh/h)	0	442	1	0	0	0	0	2	233	0	403
Peak Hour Factor	0.92	0.95	0.25	0.92	0.92	0.92	0.92	0.50	0.86	0.92	0.90
Hourly flow rate (vph)	0	465	4	0	0	0	0	4	271	0	448
Pedestrians		1			1		12			12	
Lane Width (ft)		12.0			0.0		12.0			12.0	
Walking Speed (ft/s)		4.0			4.0		4.0			4.0	
Percent Blockage		0			0		1			1	
Right turn flare (veh)											
Median type							None			None	
Median storage veh)											
Upstream signal (ft)											
pX, platoon unblocked											
vC, conflicting volume	12			481			480	491	482	493	13
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol	12			481			480	491	482	493	13
tC, single (s)	4.1			4.1			7.1	6.5	7.1	6.5	6.2
tC, 2 stage (s)											
tF (s)	2.2			2.2			3.5	4.0	3.5	4.0	3.3
p0 queue free %	100			100			100	99	43	100	57
cM capacity (veh/h)	1604			1070			278	471	477	467	1053

Direction, Lane #	EB 1	NB 1	SW 1	SW 2
Volume Total	469	4	271	448
Volume Left	0	0	271	0
Volume Right	4	0	0	448
cSH	1700	471	477	1053
Volume to Capacity	0.28	0.01	0.57	0.43
Queue Length 95th (ft)	0	1	87	54
Control Delay (s)	0.0	12.7	22.0	10.9
Lane LOS		B	C	B
Approach Delay (s)	0.0	12.7	15.1	
Approach LOS		B	C	

Intersection Summary			
Average Delay	9.1		
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	345	11	10	256	0	40	0	7	20	6	71
Peak Hour Factor	0.92	0.91	0.56	0.50	0.90	0.92	0.53	0.92	0.50	0.68	0.63	0.72
Hourly flow rate (vph)	0	379	20	20	284	0	75	0	14	29	10	99
Pedestrians		49			31			49			8	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		4			3			4			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	292			448			915	770	469	766	780	341
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	292			448			915	770	469	766	780	341
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			98			59	100	97	90	97	85
cM capacity (veh/h)	1272			1077			184	312	559	289	308	670

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	399	304	89	138
Volume Left	0	20	75	29
Volume Right	20	0	14	99
cSH	1700	1077	205	491
Volume to Capacity	0.23	0.02	0.44	0.28
Queue Length 95th (ft)	0	1	51	28
Control Delay (s)	0.0	0.7	35.4	15.2
Lane LOS		A	E	C
Approach Delay (s)	0.0	0.7	35.4	15.2
Approach LOS			E	C

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL	SWR
Lane Configurations											
Sign Control		Free			Free		Stop			Yield	
Grade		0%			0%		0%			0%	
Volume (veh/h)	0	353	3	0	0	0	0	2	458	0	217
Peak Hour Factor	0.92	0.94	0.50	0.92	0.92	0.92	0.92	0.25	0.93	0.92	0.87
Hourly flow rate (vph)	0	376	6	0	0	0	0	8	492	0	249
Pedestrians		11			11		10			10	
Lane Width (ft)		12.0			0.0		12.0			12.0	
Walking Speed (ft/s)		4.0			4.0		4.0			4.0	
Percent Blockage		1			0		1			1	
Right turn flare (veh)											
Median type							None			None	
Median storage veh)											
Upstream signal (ft)											
pX, platoon unblocked											
vC, conflicting volume	10			392			400	399	404	402	21
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol	10			392			400	399	404	402	21
tC, single (s)	4.1			4.1			7.1	6.5	7.1	6.5	6.3
tC, 2 stage (s)											
tF (s)	2.2			2.2			3.5	4.0	3.5	4.0	3.4
p0 queue free %	100			100			100	99	9	100	76
cM capacity (veh/h)	1609			1157			412	533	540	528	1024

Direction, Lane #	EB 1	NB 1	SW 1	SW 2
Volume Total	382	8	492	249
Volume Left	0	0	492	0
Volume Right	6	0	0	249
cSH	1700	533	540	1024
Volume to Capacity	0.22	0.01	0.91	0.24
Queue Length 95th (ft)	0	1	274	24
Control Delay (s)	0.0	11.9	47.9	9.6
Lane LOS		B	E	A
Approach Delay (s)	0.0	11.9	35.1	
Approach LOS		B	E	

Intersection Summary			
Average Delay	23.1		
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Volume (veh/h)	0	386	13	9	379	0	27	0	8	18	2	47
Peak Hour Factor	0.92	0.96	0.50	0.38	0.92	0.75	0.53	0.92	0.33	0.85	0.25	0.72
Hourly flow rate (vph)	0	402	26	24	412	0	51	0	24	21	8	65
Pedestrians		111			71			111			41	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		9			6			9			3	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	453			539			1166	1026	597	1011	1039	564
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	453			539			1166	1026	597	1011	1039	564
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			97			52	100	94	87	96	86
cM capacity (veh/h)	1080			943			105	202	433	168	199	464

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	428	436	75	94
Volume Left	0	24	51	21
Volume Right	26	0	24	65
cSH	1700	943	139	307
Volume to Capacity	0.25	0.03	0.54	0.31
Queue Length 95th (ft)	0	2	66	32
Control Delay (s)	0.0	0.8	57.8	21.8
Lane LOS		A	F	C
Approach Delay (s)	0.0	0.8	57.8	21.8
Approach LOS			F	C

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	46.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SWL2	SWL	SWR
Lane Configurations											
Sign Control		Free			Free		Stop			Yield	
Grade		0%			0%		0%			0%	
Volume (veh/h)	0	442	2	0	0	0	0	4	233	0	409
Peak Hour Factor	0.92	0.95	0.25	0.92	0.92	0.92	0.92	0.50	0.86	0.92	0.90
Hourly flow rate (vph)	0	465	8	0	0	0	0	8	271	0	454
Pedestrians		1			1		12			12	
Lane Width (ft)		12.0			0.0		12.0			12.0	
Walking Speed (ft/s)		4.0			4.0		4.0			4.0	
Percent Blockage		0			0		1			1	
Right turn flare (veh)											
Median type							None			None	
Median storage veh)											
Upstream signal (ft)											
pX, platoon unblocked											
vC, conflicting volume	12			485			482	493	486	497	13
vC1, stage 1 conf vol											
vC2, stage 2 conf vol											
vCu, unblocked vol	12			485			482	493	486	497	13
tC, single (s)	4.1			4.1			7.1	6.5	7.1	6.5	6.2
tC, 2 stage (s)											
tF (s)	2.2			2.2			3.5	4.0	3.5	4.0	3.3
p0 queue free %	100			100			100	98	43	100	57
cM capacity (veh/h)	1604			1067			274	470	471	465	1053

Direction, Lane #	EB 1	NB 1	SW 1	SW 2
Volume Total	473	8	271	454
Volume Left	0	0	271	0
Volume Right	8	0	0	454
cSH	1700	470	471	1053
Volume to Capacity	0.28	0.02	0.57	0.43
Queue Length 95th (ft)	0	1	89	55
Control Delay (s)	0.0	12.8	22.5	11.0
Lane LOS		B	C	B
Approach Delay (s)	0.0	12.8	15.3	
Approach LOS		B	C	

Intersection Summary			
Average Delay	9.3		
Intersection Capacity Utilization	52.9%	ICU Level of Service	A
Analysis Period (min)	15		