

## TECHNICAL MEMORANDUM

---

---

**REF:** MAX-2007080.02/NHX-2009548.01

**DATE:** October 21, 2009

**TO:** Mr. William Deignan  
Transportation Program Manager  
Community Development Department  
City of Cambridge  
344 Broadway  
Cambridge, Massachusetts 02139

**FROM:** Mr. John W. Diaz, P.E., P.T.O.E.  
Mr. Jason Plourde, P.E.  
Ms. Heather L. Monticup

**RE:** Lafayette Square – Post-Construction Evaluation  
Cambridge, Massachusetts

---

---

### INTRODUCTION

Greenman-Pedersen, Inc. (GPI) has been retained by the City of Cambridge's Community Development Department to prepare an evaluation of the recently completed reconstruction of Lafayette Square, which is formed by the intersection of Massachusetts Avenue, Main Street, Columbia Street, and Sidney Street. The improvements were part of the Massachusetts Avenue Rehabilitation project which encompassed Massachusetts Avenue between the intersection with Memorial Drive to the southeast and the intersection with Main Street to the northwest. The project area that was evaluated within this memorandum is depicted in Figure 1 and includes the following major intersections:

- Massachusetts Avenue at Sidney Street and Sidney Street Extension
- Main Street at Columbia Street and Sidney Street Extension
- Massachusetts Avenue at Pearl Street
- Sidney Street at Green Street
- Main Street at Windsor Street
- Columbia Street at Bishop Allen Drive

## LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

The study also contains observations of a travel lane drop and driver and cyclist behavior in the block between Vassar Street and 77 Massachusetts Avenue at Massachusetts Institute of Technology (MIT).

The primary objective of this study is to provide a “before and after” comparison of transportation operations within the Lafayette Square area. The study evaluates the operations of the traffic signals, signage, and pavement markings after the construction project and compares the use of the area by vehicles, bicyclists, and pedestrians. Pre-construction conditions are based on previous traffic and bicycle counts conducted by Vollmer Associates LLP in October and November 2004 as well as information from the *Functional Design Report (FDR) for the Massachusetts Avenue Rehabilitation Project*<sup>1</sup> which was finalized in 1999. Post-construction conditions are evaluated based on field observations and new traffic counts completed in April 2009.

**Figure 1**  
**Study Area**



## **PROJECT HISTORY**

Lafayette Square is a multi-modal transportation hub within the City of Cambridge. The area is heavily utilized by pedestrians, bicyclists, and transit users. Lafayette Square is located in relatively close proximity to two Massachusetts Bay Transportation Authority (MBTA) Red Line stations. It is approximately 1,100 feet (less than 0.25 miles) from the Central Square Station and approximately 3,900 feet (less than 0.75 miles) from Kendall Square/Massachusetts Institute of Technology (MIT) Station. The MBTA provides a bus route (CT1) that stops adjacent to Lafayette Square near Sidney Street. In addition to the pedestrian and cyclist traffic, there is heavy vehicular traffic through the area, particularly along the Massachusetts Avenue corridor.

The design of the roadway improvements along Massachusetts Avenue, as well as the community process, began in the 1980s. The construction of needed sewer and stormwater improvements began in the summer of 2000 and major reconstruction of the roadway by the state began in early 2005. All improvements were completed in the summer of 2008. The City of Cambridge, with input at community meetings and workshops, established the following overall goals of the project:

- Make the Lafayette Square intersections easy for all users to navigate.
- Provide safe pedestrian crossings.
- Improve accessibility and safety for cyclists.
- Make Lafayette Square more attractive and create a new community plaza.
- Create a design that acknowledges Lafayette Square's historic street patterns.
- Minimize impacts on parking and loading.

The Massachusetts Highway Department (MassHighway) provided the major funding for this project as well as primary construction management. The City of Cambridge provided partial funding for the project, supplemented by a contribution from Forest City Development, and additional construction supervision.

### **Pre-Construction Conditions**

Figure 2 illustrates the pre-construction conditions within the Lafayette Square Study area. Prior to the reconstruction of Lafayette Square, facilities for pedestrians, transit users, and cyclists were non-existent or in poor condition.

---

<sup>1</sup> *Functional Design Report; Massachusetts Avenue Rehabilitation Project; Cambridge, Massachusetts;* Pennoni Associates, Inc. in association with Rizzo Associates, Inc.

**Figure 2**  
**Pre-Construction Conditions**



### ***Pedestrians***

Prior to the implementation of the improvements, there were marked crosswalks at the three intersections that made up Lafayette Square – Main Street at Massachusetts Avenue, Main Street at Columbia Street, and Massachusetts Avenue at Columbia Street. All crosswalks were faded and pedestrian controls included “Walk/Don’t Walk” indications which did not meet current standards of the Manual on Uniform Traffic Control Devices (MUTCD)<sup>2</sup> of the solid upraised hand/walking person and did not have countdown pedestrian signal heads. Although there was a raised island for pedestrian refuge, a large majority of the pedestrian activity occurred along Massachusetts Avenue and crossings of Main Street and Columbia Street along the northern side of Massachusetts Avenue were long and offered little protection or refuge for pedestrians, and required multiple crossings. Most sidewalks and curb cuts had poor pavement conditions and did not necessarily meet Americans with Disabilities Act (ADA)/Architectural Access Board (AAB) regulations. Although there were marked crosswalks at the remaining study area intersections, most were faded.

### ***Cyclists***

There were no marked bicycle lanes or facilities for cyclists along this section of Massachusetts Avenue from Lafayette Square to the southeast, thus making the area less than ideal for cycling. This stretch of roadway travels through the MIT campus, connects to the Charles River path

---

<sup>2</sup> *Manual on Uniform Traffic Control Devices*; Federal Highway Administration; Washington, DC; November 2003.

system and to the City of Boston over the Massachusetts Avenue Bridge. Therefore, it experiences a large volume of cyclist traffic with no defined space for cyclists.

### ***Transit Users***

The MBTA maintained bus routes along Massachusetts Avenue that stop adjacent to Lafayette Square near Sidney Street include the CT1 and #1 routes.

### ***Parking and Vehicle Circulation***

In general, on-street parking was provided along both sides of Massachusetts Avenue, Main Street, and along the minor streets in designated areas within the project limits. All parking was controlled by the use of meters.

Lafayette Square was made up of skewed angle street approaches and channelized turn lanes that produced a wide paved area through the intersections. Although the three Lafayette Square intersections were signalized, the vehicular connection from Main Street to Sidney Street southbound was prohibited. This forced traffic coming from Kendall Square and going to the BU Bridge to use Pearl Street, which has more residences than Sidney Street. Making a direct connection from Main Street to Sidney Street was intended to keep some of this traffic off more residential streets. The Main Street right-turn merge onto Massachusetts Avenue westbound was unsignalized and under STOP-control, causing motorists to look over their shoulders to see on-coming traffic. Sidney Street was a one-way southbound roadway that intersected Massachusetts Avenue at an unsignalized intersection, approximately 100 feet east of the Lafayette Square traffic signals.

### **Post-Construction Conditions**

The reconstructed Lafayette Square provides enhanced facilities for bicyclists and pedestrians , a new plaza, and maintains all of the vehicle moves as before, in addition to the connection from Main Street to Sidney Street. Figure 3 below illustrates the improvements within the Massachusetts Avenue/Main Street/Columbia Street/Sidney Street intersections.

**Figure 3**  
**Post-Construction Conditions** (*provided by the City of Cambridge*)



The following are highlights of the improvements:

- The closing of a segment of Main Street between Massachusetts Avenue and Columbia Street and the taking of an adjacent gas station created space for a significant pedestrian plaza. This area includes pedestrian amenities such as tables, chairs, benches, and trash receptacles. In addition, there are numerous raised, granite planters with significant landscaping.
- The Sidney Street Extension, a 120-foot two-way connector roadway (Sidney Street Extension) between Main Street and Sidney Street, facilitates the vehicular connection from Main Street to Sidney Street. This improvement allowed two-way traffic flow on Sidney Street where it was previously a one-way roadway in the eastbound direction. The project included the taking of a gas station on this site which was funded by the state.



## LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

- The Massachusetts Avenue intersection with Sidney Street and Sidney Street Extension and the Main Street intersection with Columbia Street and Sidney Street Extension are signalized with a new traffic signal system running under one traffic controller. This allows for better timing coordination between the two closely spaced intersections. The signal controller operates under five vehicle phases with a sixth phase for fire vehicle pre-emption.
- The closing of Main Street provides for fewer and shorter crosswalks and lower wait times for pedestrians through Lafayette Square.
- Bus accommodations remained the same and there was no need to eliminate any stops.
- A minimum 5-foot wide bicycle lane in each direction is provided along the southern portion of Massachusetts Avenue, the Sidney Street Extension, and continues along a portion of Main Street.
- Sidewalks, wheelchair ramps, and driveway aprons meet current ADA/AAB design standards and were constructed to provide a continuous path of travel for pedestrians.
- New pavement markings were striped and signs were installed.
- A landscaped area between the roadway and concrete sidewalks is provided along Massachusetts Avenue that includes additional trees and brick paving.
- New street lights were installed.
- One southbound travel lane was removed between Lafayette Square and Albany Street to match the cross-section of roadway in Central Square.
- The Massachusetts Avenue cross-section between Albany Street and Sidney Street/Sidney Street Extension consists of a 5.5-foot wide bicycle facility and one 12-foot wide travel lane southbound with two 11.5-foot wide travel lanes, a 5.5-foot wide bicycle facility, and an 8-foot wide parking lane northbound.
- The improvements provide a net gain of 5 parking spaces in the area. Although 8 spaces were removed, 13 spaces were added.
- Pedestrian signal phases concurrent with vehicle operations were provided at the Massachusetts Avenue intersection with Sidney Street and Sidney Street Extension as well as at the Main Street intersection with Columbia Street and Sidney Street Extension. Countdown pedestrian signal heads were provided for all crossings providing additional guidance to pedestrians.
- Pictures of Lafayette Square before and after the implementation of the improvements are shown in Figure 4.



**LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY**

Cambridge, Massachusetts

**Figure 4**  
**Before and After Photos (provided by the City of Cambridge)**

**LAFAYETTE SQUARE RECONSTRUCTION**

*Before & After*



**City of Cambridge**  
Community Development Department  
Environmental & Transportation Planning

*With the removal of the gas station, and a portion of Main St. closed, roadway space has been reduced making pedestrian crossings shorter and more comfortable.*



**Before**



**After**

*Sidney Street was extended through the former gas station site (left) to make a direct connection from Main Street to Sidney Street and allow cars and bikes to get around the plaza.*



**Before**



**After**

*With the closure of Main Street and the introduction of the plaza, cars and bikes can still make all the same movements but must go around the park to reach their destinations.*



**Before**



**After**

*The plaza adds green space, a place for pedestrians to rest and enjoy, and a new community gathering spot.*



**Before**



**After**



### **Data Collection**

Traffic data for the pre-construction condition was obtained from a traffic counts completed by Vollmer Associates LLP in October and November 2004. In addition, the City of Cambridge provided bicycle count data for Lafayette Square prepared by Vollmer Associates LLP in October 2004 and pedestrian count data for the Lafayette Square area prepared by Vanasse Hangen Brustlin, Inc. in December 1998. The vehicular count data summaries from 2004, as well as bicycle and pedestrian count information, are presented in the Appendix.

In order to evaluate potential changes resulting from the reconfiguration of the Lafayette Square area, new manual vehicular turning movement counts (TMCs) and pedestrian counts were conducted in April 2009 within the study area. The study area replicated those counts taken in 2004. Manual traffic counts were completed during a weekday between 7-9 AM and 4-6 PM. Vehicles, pedestrians, and bicyclists were observed at the following locations:

- Massachusetts Avenue at Sidney Street and Sidney Street Extension
- Main Street at Columbia Street and Sidney Street Extension
- Massachusetts Avenue at Pearl Street
- Sidney Street at Green Street
- Main Street at Windsor Street
- Columbia Street at Bishop Allen Drive

Automatic Traffic Recorder (ATR) counts were conducted over a 48-hour period in April 2009 and in May 2009 at the following locations to determine daily traffic levels and trends:

- Massachusetts Avenue between State Street and Village Street
- Columbia Street north of Bishop Allen Drive
- Windsor Street north of School Street
- Sidney Street between Green Street and Franklin Street

The FDR for the Massachusetts Avenue Rehabilitation Project focused on the operations along the Massachusetts Avenue corridor rather than Lafayette Square, and did not include the same intersections as set forth in this study. The intent of this study is to analyze the post-construction operations of the study area intersections as they exist today, and to determine if vehicle traffic has changed in routing and/or volume.

**COMPARISON OF PRE- AND POST-CONSTRUCTION**

**Traffic-Volume Changes**

ATR counts were conducted throughout the study area on Wednesday, April 29, 2009 and on Thursday, April 30, 2009, with the Windsor Street ATR counts conducted on Tuesday, May 5, 2009 and on Wednesday, May 6, 2009. These daily traffic levels have been compared to the available daily traffic levels collected previously in October and November 2004 to assess any changes in traffic levels through the Lafayette Square area during the five year period. Table 1 provides a comparison of daily traffic volumes along the various roadways within the study area. Figure 5 compares the pre-construction daily traffic-count data with the 2009 daily traffic volumes. The traffic-count data are provided in the Appendix.

**Table 1**  
**Average Daily Traffic-Volume Comparison <sup>1</sup>**

<b>Location</b>	<b>2004 ADT <sup>2</sup></b>	<b>2009 ADT <sup>3</sup></b>	<b>% Change</b>
Massachusetts Avenue between State Street and Village Street	17,676	13,551	(23%)
Columbia Street north of Bishop Allen Drive	6,531	5,722	(12%)
Windsor Street north of School Street	5,334	4,564	(14%)
Sidney Street between Green Street and Franklin Street	NA	6,091	--

<sup>1</sup> In vehicles per day.

<sup>2</sup> October/November 2004 ADT counts.

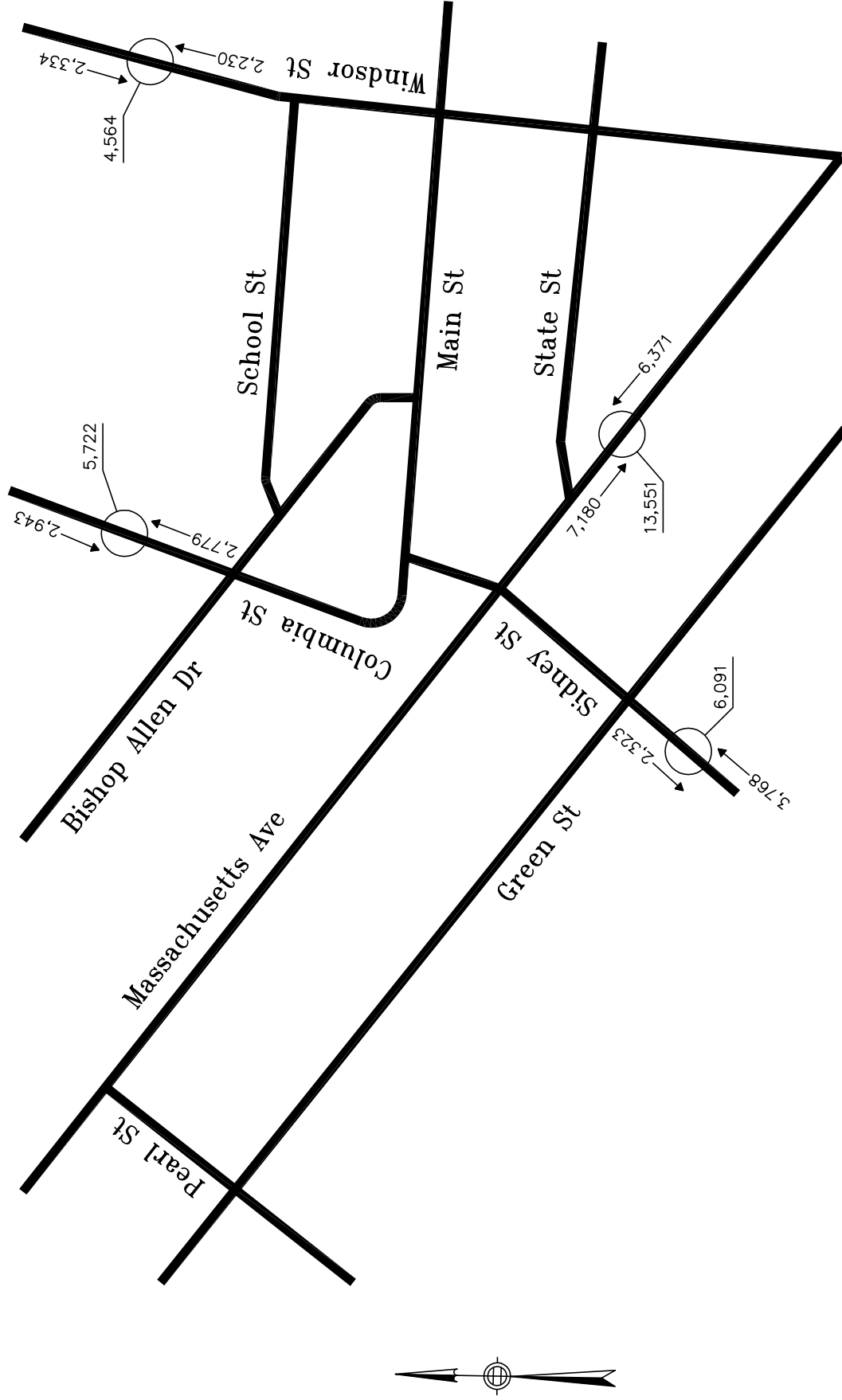
<sup>3</sup> April/May 2009 ADT counts.

NA = Not Available.

As indicated in Table 1, traffic levels within the Lafayette Square area have declined since 2004. This trend in declining traffic has also been observed along other areas of Massachusetts Avenue. Recent traffic data collected by the Central Transportation Planning Staff (CTPS) along Massachusetts Avenue near the Harvard Bridge have shown a similar decline of approximately 15 percent between 2002 and 2008. This reduction in vehicle traffic is likely the result of 10 years of major roadway reconstruction which have included detours and poor roadway conditions. Other factors such as increased environmental awareness, movement to other modes

LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts



Not To Scale

Figure 5  
Lafayette Square Post-Construction  
2009 ATR Volumes

## LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

of travel, and economic factors including increased operating costs of motor vehicles have also likely contributed to the lower volume of vehicular traffic.

Peak-hour TMCs were conducted at the study intersections in April 2009. In order to assess the critical commuting peak hours, a comparison of the 2004 and 2009 TMCs was completed and is summarized in Table 2.

**Table 2**  
**Peak-Hour Traffic-Volume Comparison <sup>1</sup>**

Location	2004 TMCs <sup>2</sup>		2009 TMCs <sup>3</sup>		% Change	
	AM	PM	AM	PM	AM	PM
Massachusetts Avenue at Main Street, Columbia Street, and Sidney Street:						
Massachusetts Avenue at Main Street	1,010	1,110	NA	NA	NA	NA
Massachusetts Avenue at Columbia Street (Sidney Street Ext.) and Sidney Street	1,142	1,281	1,214	1,485	6%	16%
Main Street at Columbia Street and Sidney Street Ext.	781	779	546	587	(30%)	(25%)
Total Cordon Count	1,546	1,703	1,240	1,520	(20%)	(11%)
Massachusetts Avenue at Pearl Street	1,287	1,535	896	1,106	(30%)	(28%)
Sidney Street at Green Street	NA	NA	697	577	NA	NA
Main Street at Windsor Street	894	1,088	890	1,061	0%	(2%)
Columbia Street at Bishop Allen Drive	768	856	575	833	(25%)	(3%)

<sup>1</sup> In vehicles per hour.

<sup>2</sup> October 2004 TMCs.

<sup>3</sup> April 2009 TMCs.

NA = Not Available.

As indicated in Table 2, all peak-hour traffic levels have decreased, with the exception of the Massachusetts Avenue intersection with Sidney Street. This increase in traffic volumes can be attributed to the realignment of Main Street and Columbia Street to intersect Massachusetts Avenue from the north-east opposite Sidney Street via the newly constructed Sidney Street Extension. In 2004, Lafayette Square was made up of three intersections; Massachusetts Avenue at Main Street and Columbia Street, Massachusetts Avenue at Columbia Street, and

Massachusetts Avenue at Sidney Street. Currently in 2009 with the realignment, there are two intersections; Massachusetts Avenue at Sidney Street and Sidney Street Extension, and Main Street at Columbia Street and Sidney Street Extension. Traffic from Main Street and Columbia Street now must use the Sidney Street Extension due to the closure of Main Street between Massachusetts Avenue and Columbia Street. When the 2004 volumes from the three intersections that formerly formed Lafayette Square are added, Lafayette Square totals 1,546 entering vehicles during the weekday AM peak hour and 1,703 entering vehicles during the weekday PM peak hour. Overall, this is a decrease of 306 vehicles during the AM peak hour and 183 vehicles during the weekday PM peak hour from that which is currently being observed at the reconfigured Lafayette Square. This reduction in vehicle traffic is likely the result of 10 years of major roadway reconstruction which have included detours and poor roadway conditions. Other factors such as increased environmental awareness, movement to other modes of travel, and economic factors including increased operating costs of motor vehicles have also likely contributed to the lower volume of vehicular traffic. The decrease in traffic volumes are mostly realized on the Massachusetts Avenue southbound approach as well as on the Main Street and Columbia Street right turns onto Massachusetts Avenue. An increase in traffic volumes are seen between the Columbia Street through movements onto Sidney Street as well as the Sidney Street eastbound approach which now allows two-way traffic flow.

### **Bicycle Ridership**

As part of the traffic data collection efforts, bicycle traffic was observed. In order to evaluate the changes in bicycle ridership through Lafayette Square, the total number of bicycles entering Lafayette Square was examined during the weekday peak periods observed. These data were gathered by establishing boundaries and totaling the number of bicycles observed to cross the boundaries. These boundaries were located at the following borders of Lafayette Square and as shown on Figure 6:

- Columbia Street north of Main Street
- Main Street east of Columbia Street
- Massachusetts Avenue east of Columbia Street (2004)/Sidney Street Extension (2009)
- Sidney Street south of Massachusetts Avenue (2009)
- Massachusetts Avenue west of Main Street (2004)/Sidney Street Extension (2009)

## LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

**Figure 6**  
**Bicycle Count Location/Boundary –**  
**Pre- and Post-Construction (provided by the City of Cambridge) Conditions**



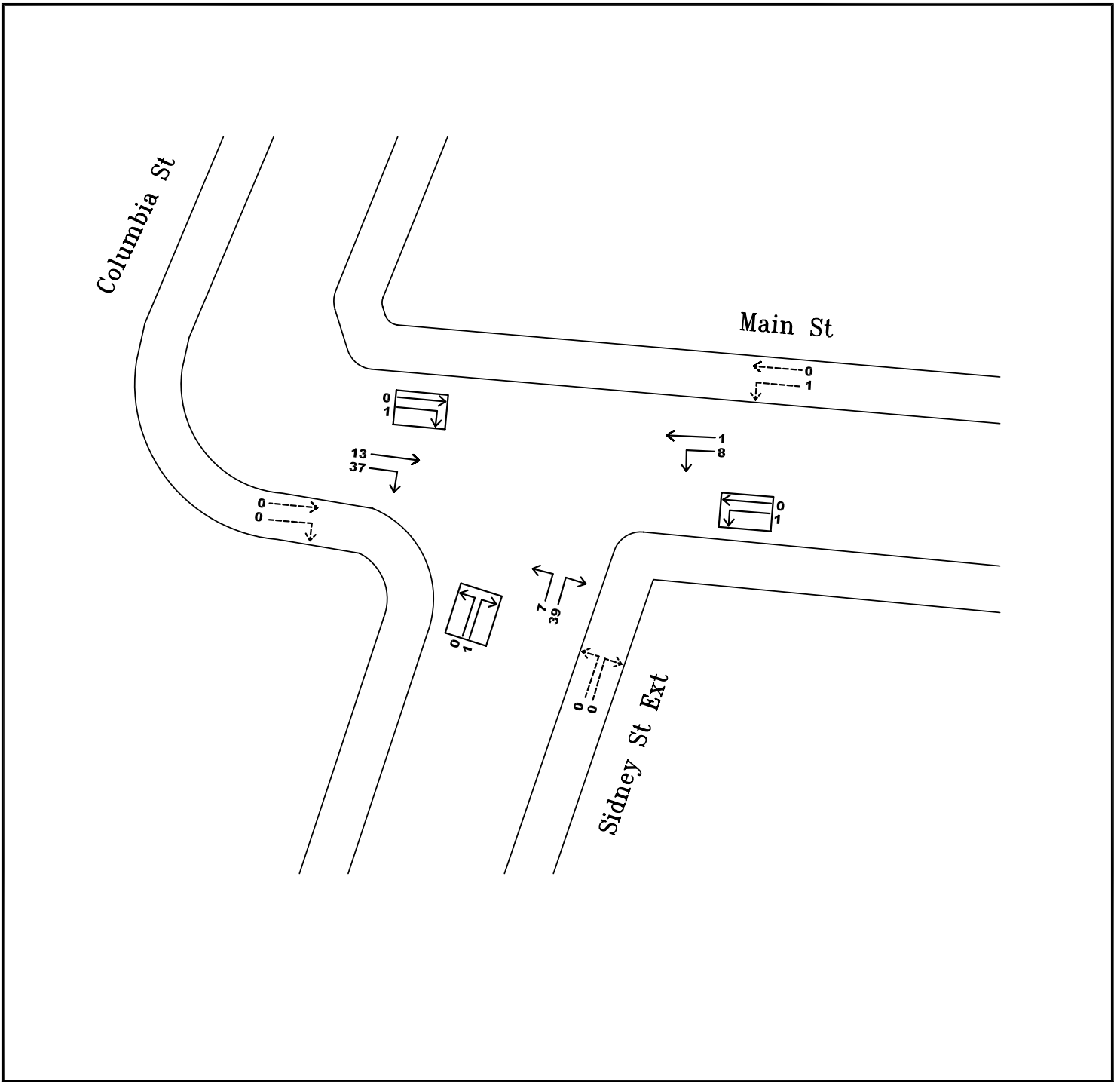
Table 3 provides a comparison of the total number of bicycles entering and exiting Lafayette Square during the weekday AM and weekday PM peak hours during the 2004 and 2009 observations. Figures 7 through 18 summarize the bicycle traffic through the study area, while available pre-construction bicycle volumes and movements are presented in the Appendix.

**Table 3**  
**Bicycle Ridership Comparison (2004-2009) <sup>1</sup>**

Time Period	2004	2009	% Change
Weekday AM Peak Hour	104	227	118%
Weekday PM Peak Hour	165	302	83%

<sup>1</sup> In bicycles per hour.

Based on a comparison of pre- and post-construction conditions, it appears that bicycle ridership through the area has more than doubled during the weekday AM peak hour and almost doubled during the weekday PM peak hour. It should be noted that the observations in 2004 were conducted in October and the observations in 2009 were conducted in April, so the time of the



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Main St., Sidney St. and Columbia St.**

**Count Date: April 29th, 2009**

**Peak Hour: 8:00-9:00am (109 Bicycles)**

**Weather: Clear**



**KEY**

00 Bicycle Count

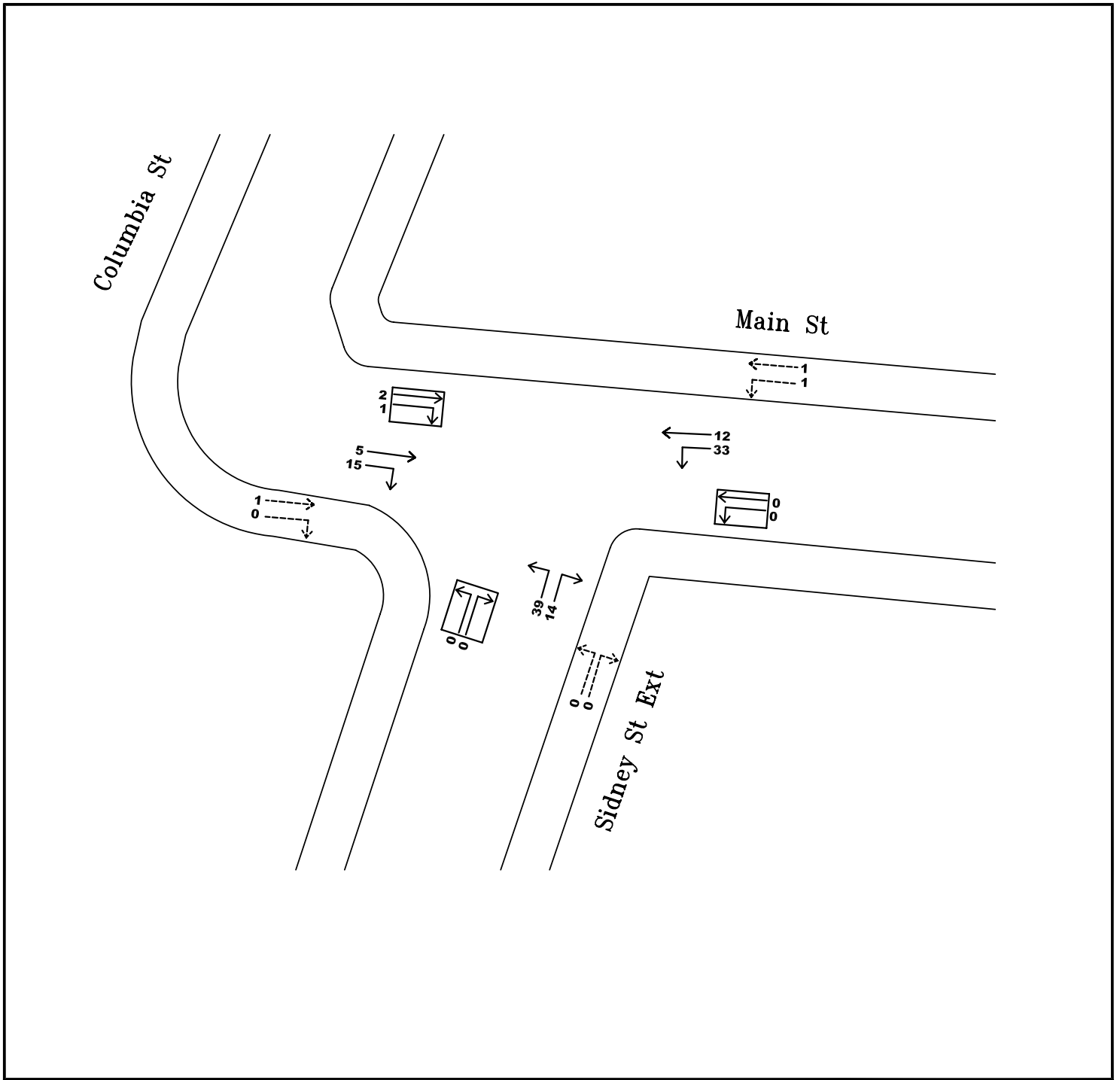
Bicycle on Sidewalk

Bicycle on Roadway

Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
 http://www.gpnet.com

**Figure 7**



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Main St., Sidney St. and Columbia St.**

**Count Date: April 29th, 2009**

**Peak Hour: 5:00-6:00pm (124 Bicycles)**

**Weather: Clear**



**KEY**

00 Bicycle Count

Bicycle on Sidewalk

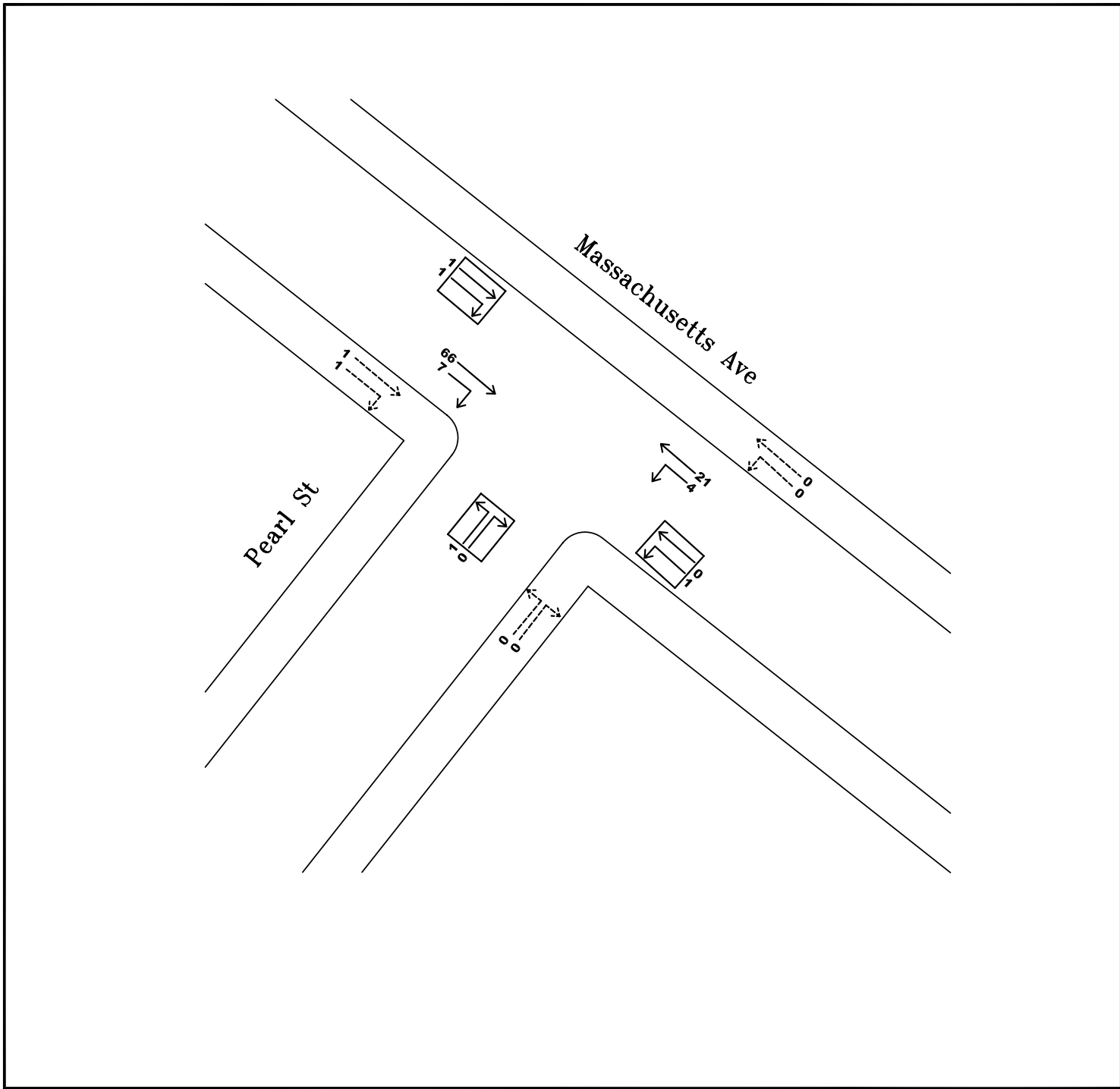
Bicycle on Roadway

Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 8**





**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Massachusetts Ave. and Pearl St.**

**Count Date: April 29th, 2009**

**Peak Hour: 8:00-9:00am (104 Bicycles)**

**Weather: Clear**



**KEY**

00 Bicycle Count

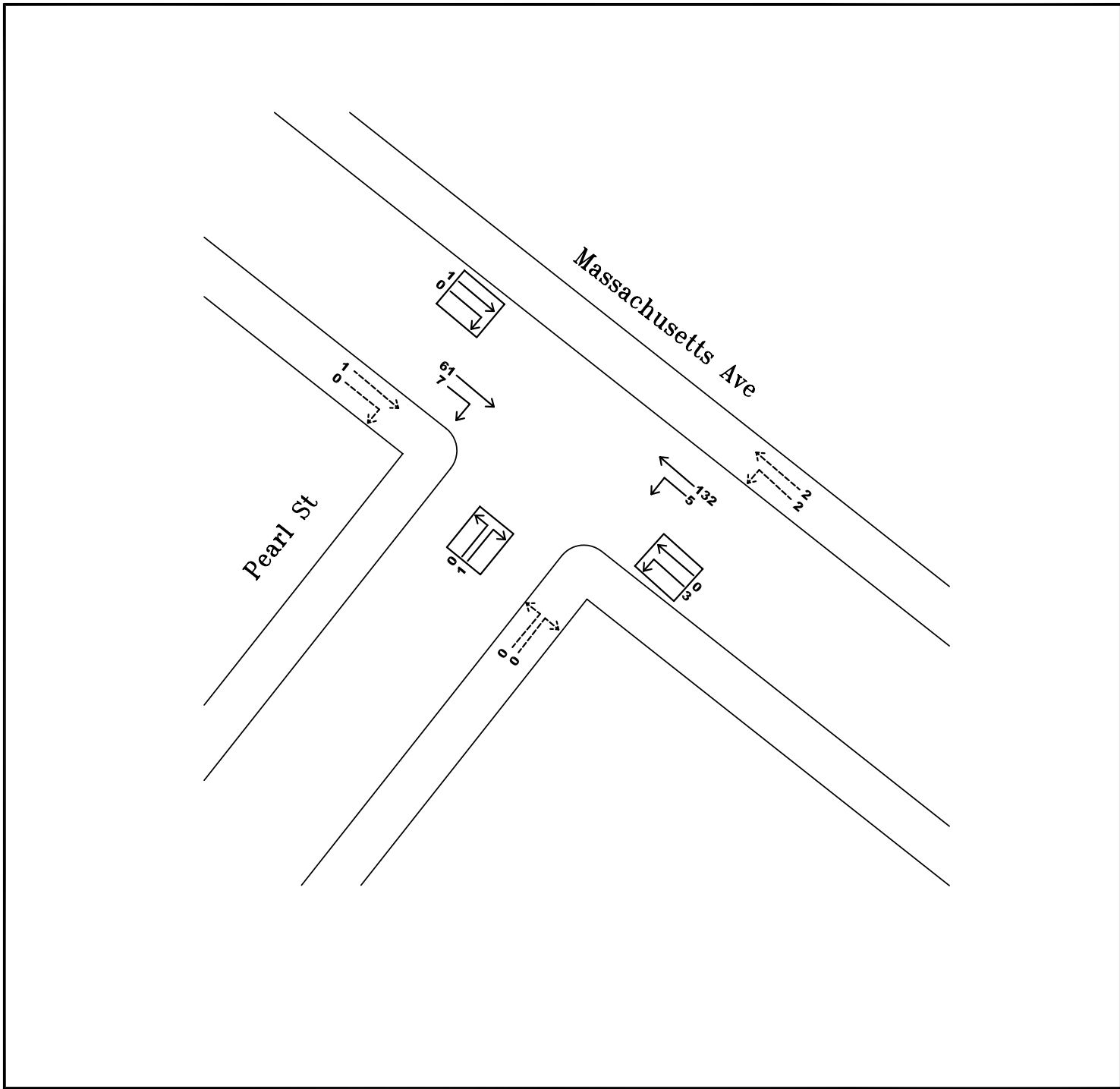
Bicycle on Roadway

Bicycle on Sidewalk

Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 9**



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Massachusetts Ave. and Pearl St.**

**Count Date: April 29th, 2009**

**Peak Hour: 5:00-6:00am (215 Bicycles)**

**Weather: Clear**



**KEY**

00 Bicycle Count

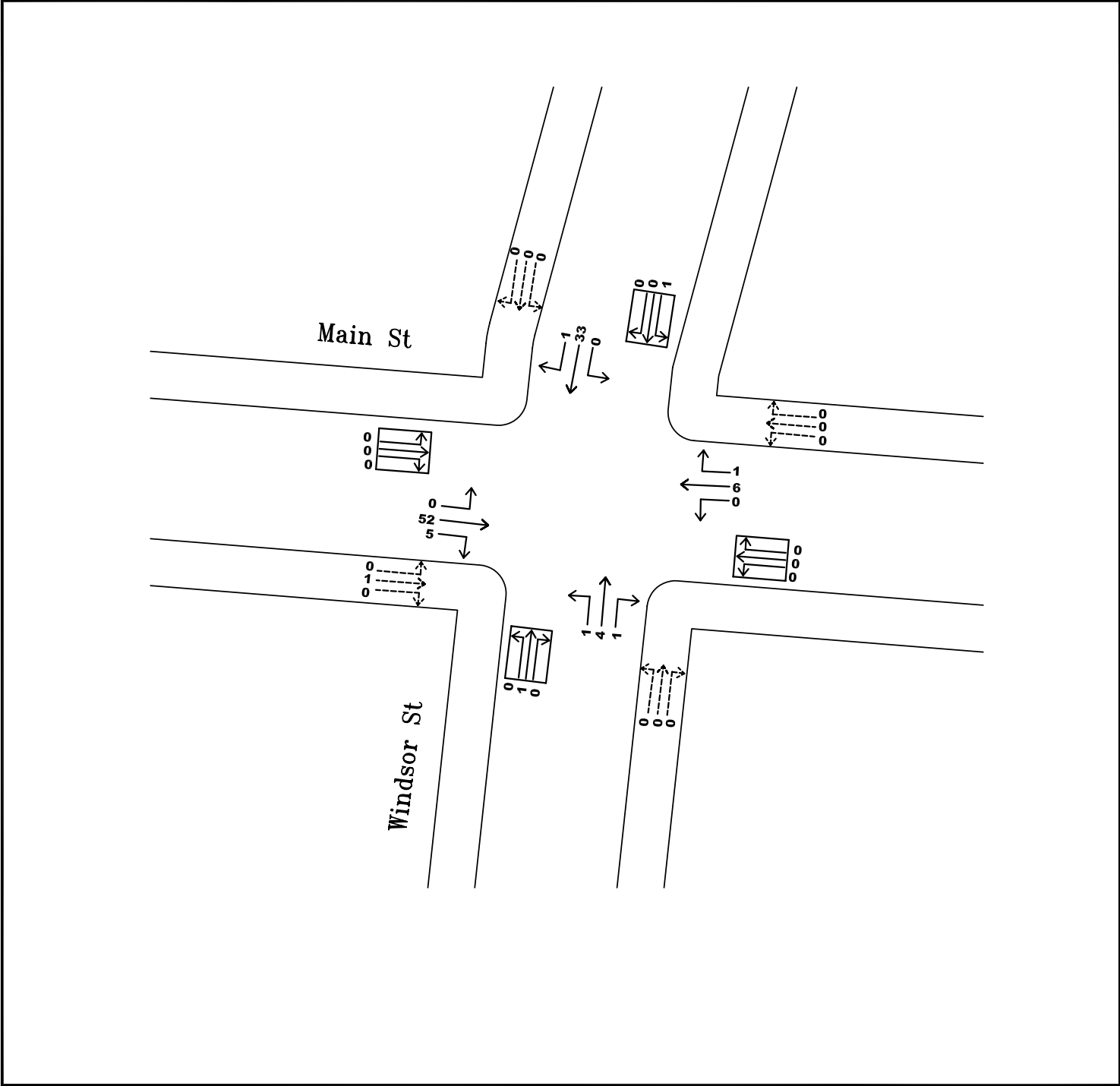
Bicycle on Sidewalk

Bicycle on Roadway

Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 10**



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Main St. and Windsor St.**  
**Count Date: April 29th, 2009**  
**Peak Hour: 8:00-9:00am (107 Bicycles)**  
**Weather: Clear**



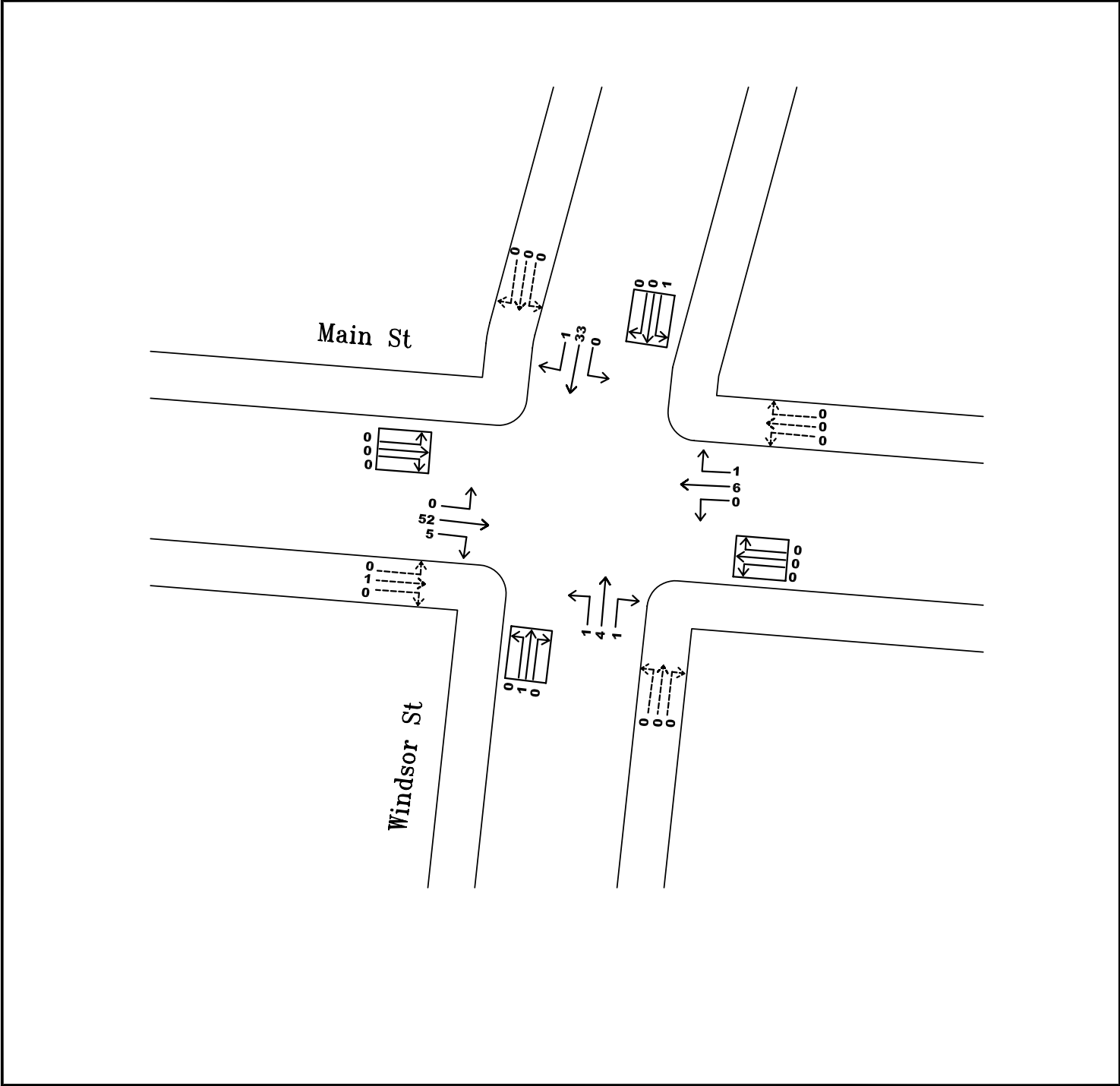
**KEY**

- 00 Bicycle Count
- ↖ Bicycle on Roadway

- ↖ Bicycle on Sidewalk
- ↖ Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 11**



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Main St. and Windsor St.**  
**Count Date: April 29th, 2009**  
**Peak Hour: 8:00-9:00am (107 Bicycles)**  
**Weather: Clear**

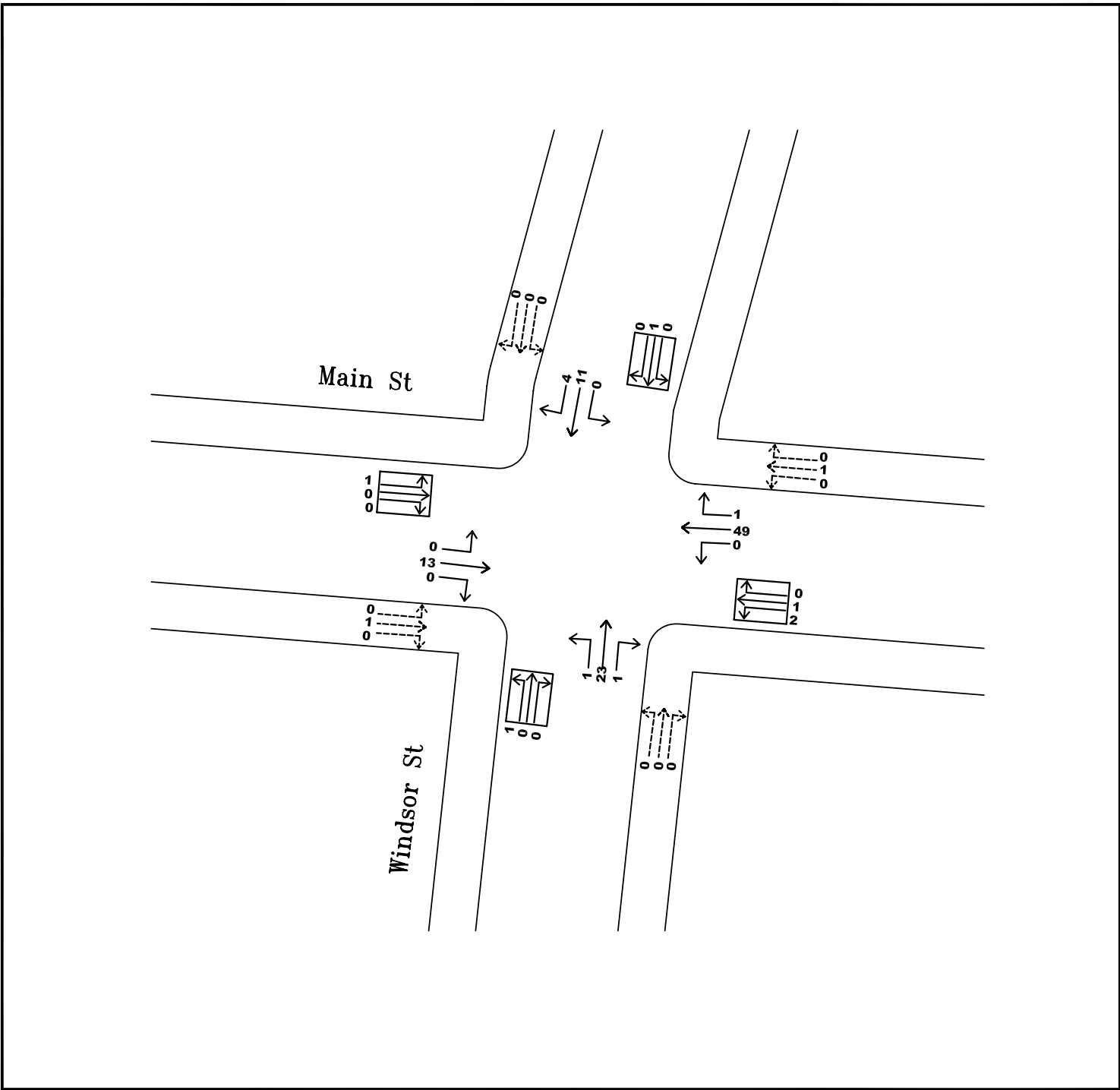


**KEY**

- 00 Bicycle Count
- ↗ Bicycle on Sidewalk
- ↖ Bicycle on Roadway
- ↗ Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 11**



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Main St. and Windsor St.**  
**Count Date: April 29th, 2009**  
**Peak Hour: 5:00-6:00pm (111 Bicycles)**  
**Weather: Clear**



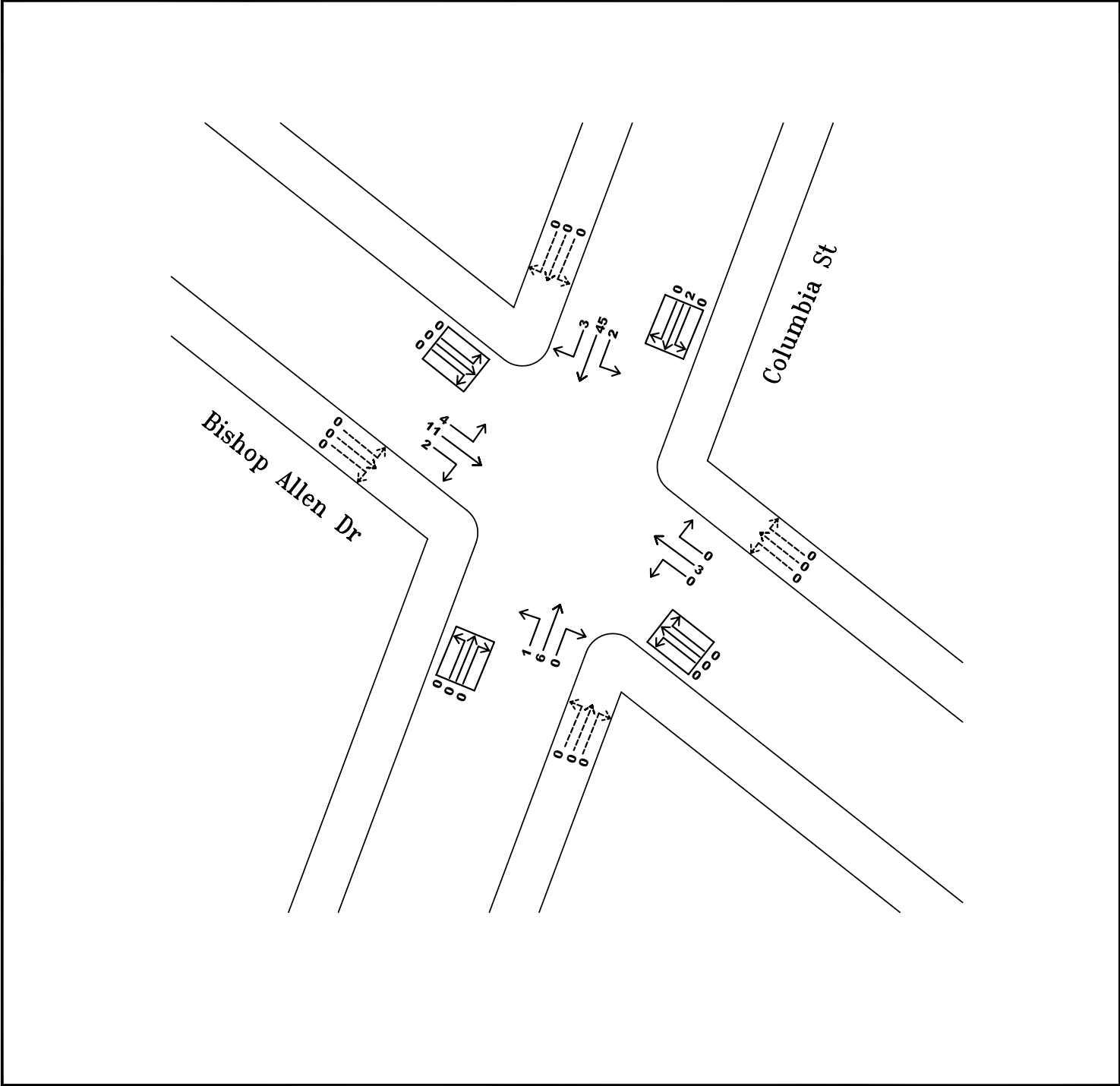
**KEY**

- 00 Bicycle Count
- Bicycle on Roadway

- Bicycle on Sidewalk
- Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 12**



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Columbia St. and Bishop Allen Dr**

**Count Date: April 29th, 2009**

**Peak Hour: 8:00-9:00am (79 Bicycles)**

**Weather: Clear**



**KEY**

00 Bicycle Count

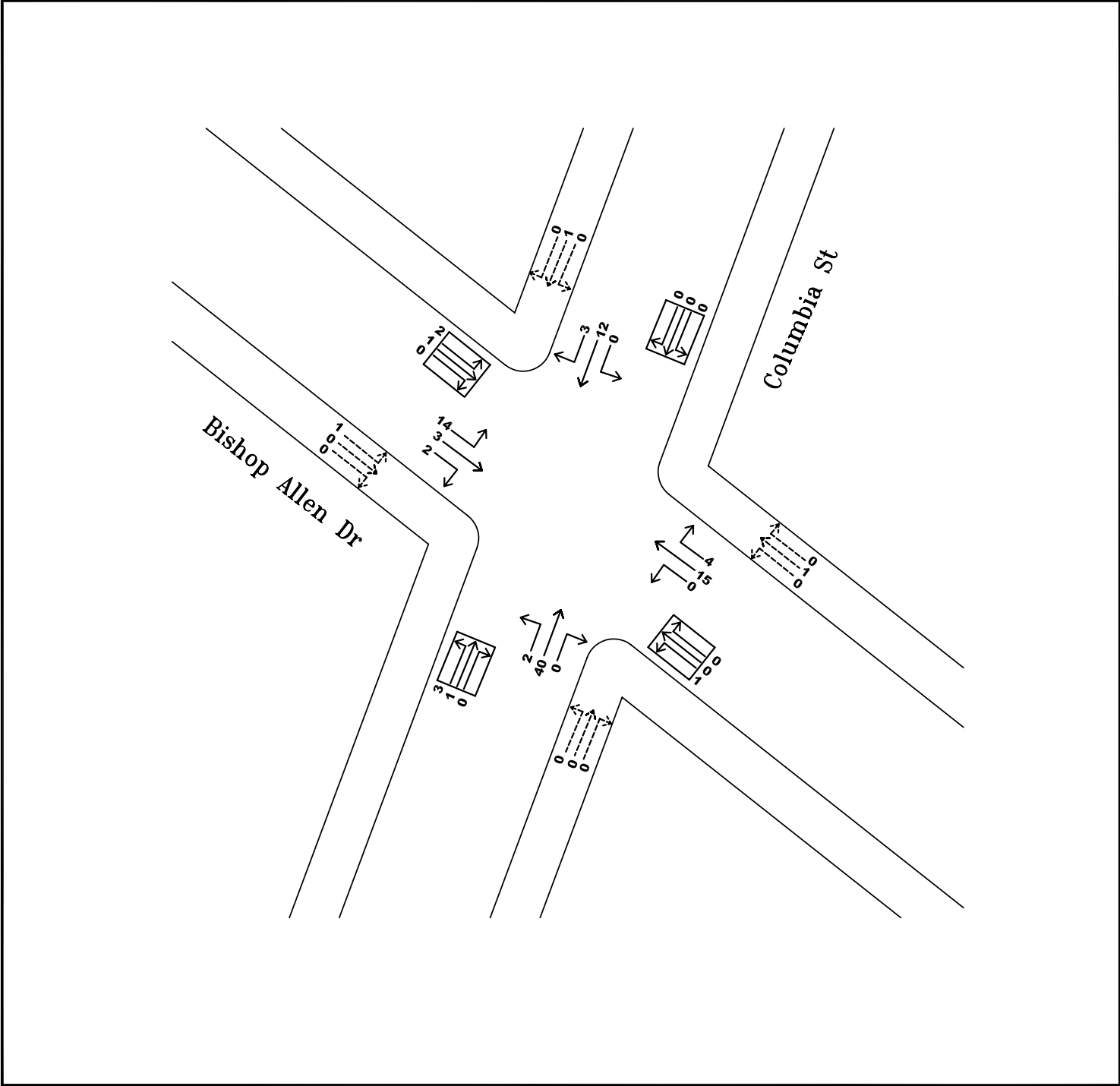
Bicycle on Sidewalk

Bicycle on Roadway

Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 13**



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Columbia St. and Bishop Allen Dr**

**Count Date: April 29th, 2009**

**Peak Hour: 5:00-6:00pm (106 Bicycles)**

**Weather: Clear**



**KEY**

00 Bicycle Count

Bicycle on Sidewalk

Bicycle on Roadway

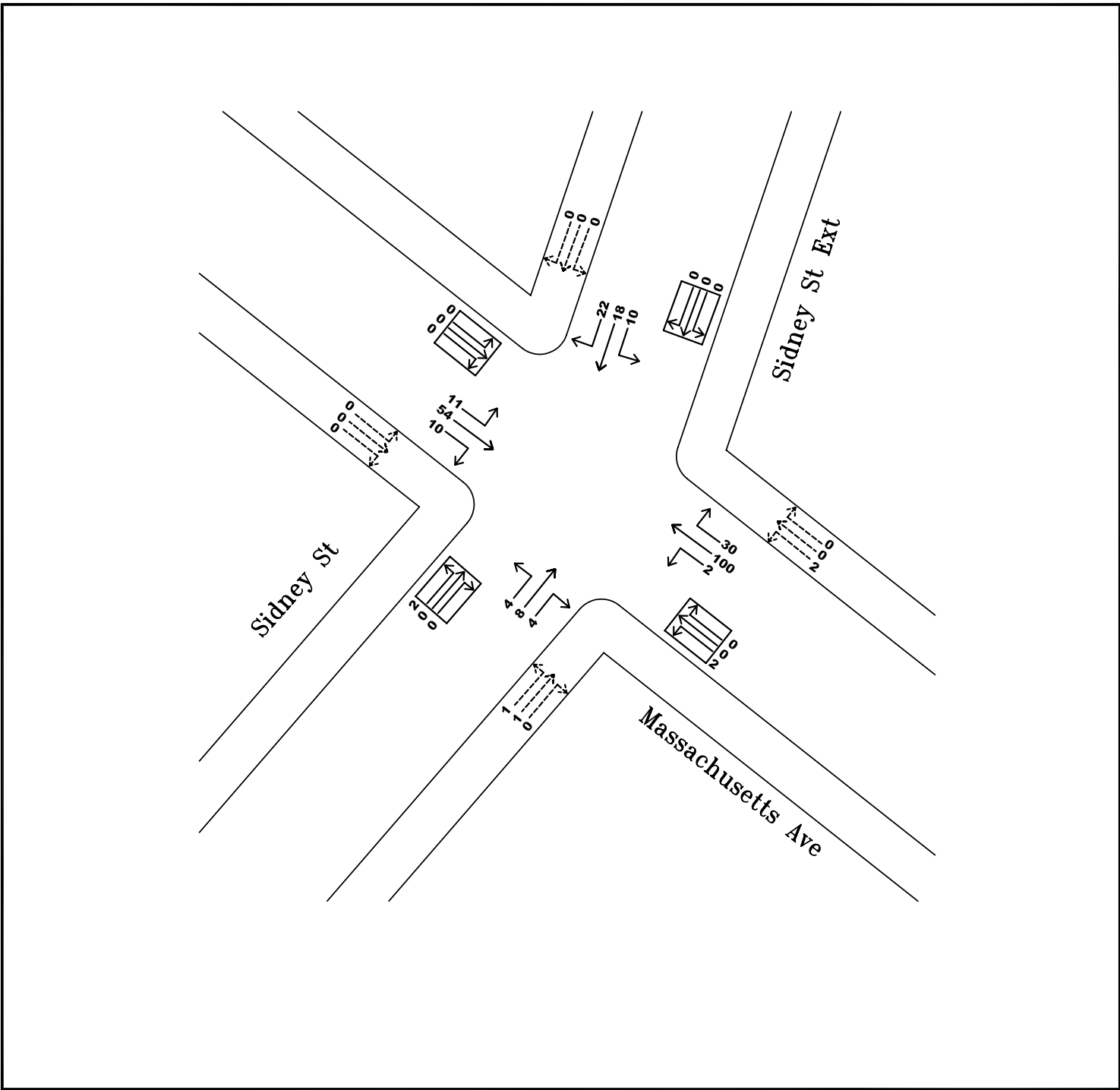
Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 14**







**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Massachusetts Ave. and Sidney St.**

**Count Date: April 29th, 2009**


**Peak Hour: 5:00-6:00pm (281 Bicycles)**


**Weather: Clear**



**KEY**

00 Bicycle Count

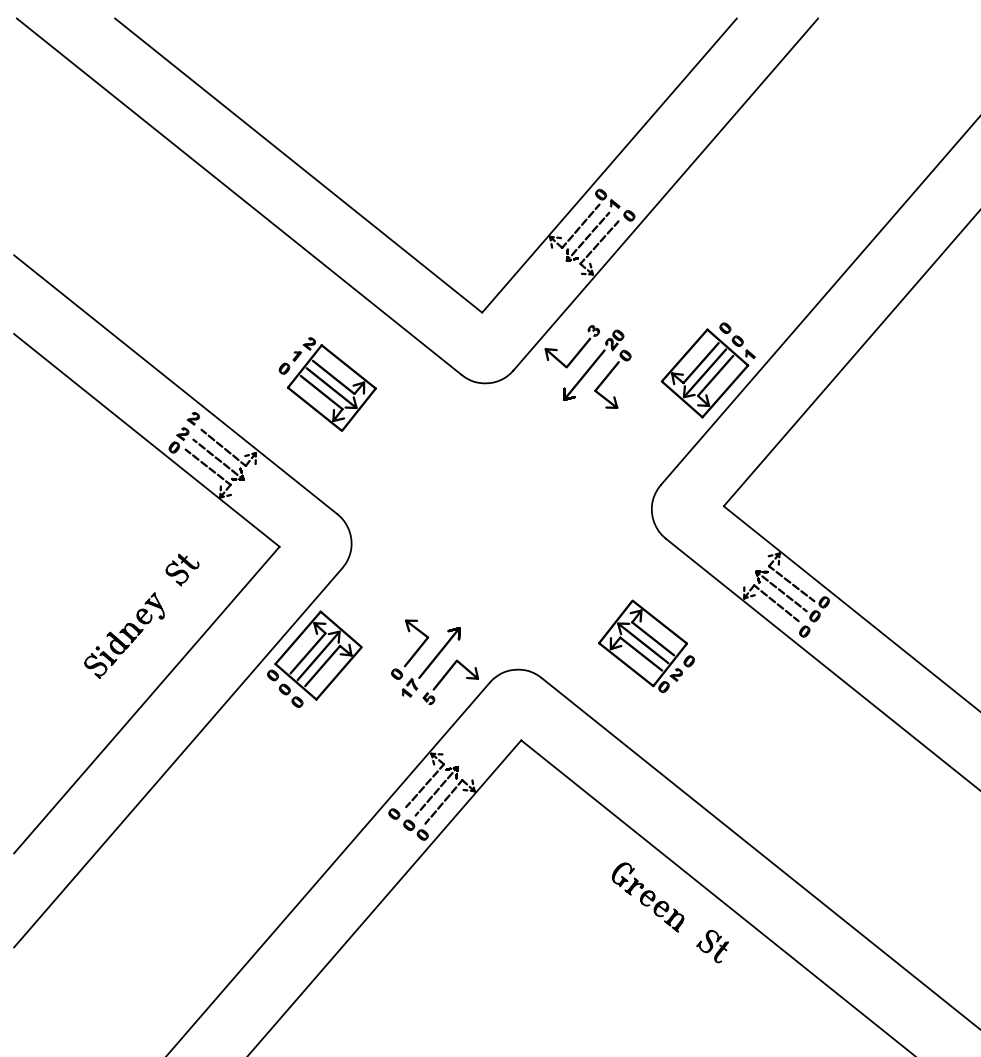
 Bicycle on Sidewalk

 Bicycle on Roadway

 Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 16**



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Green St. and Sidney St.**  
**Count Date: April 29th, 2009**  
**Peak Hour: 8:00-9:00am (56 Bicycles)**  
**Weather: Clear**

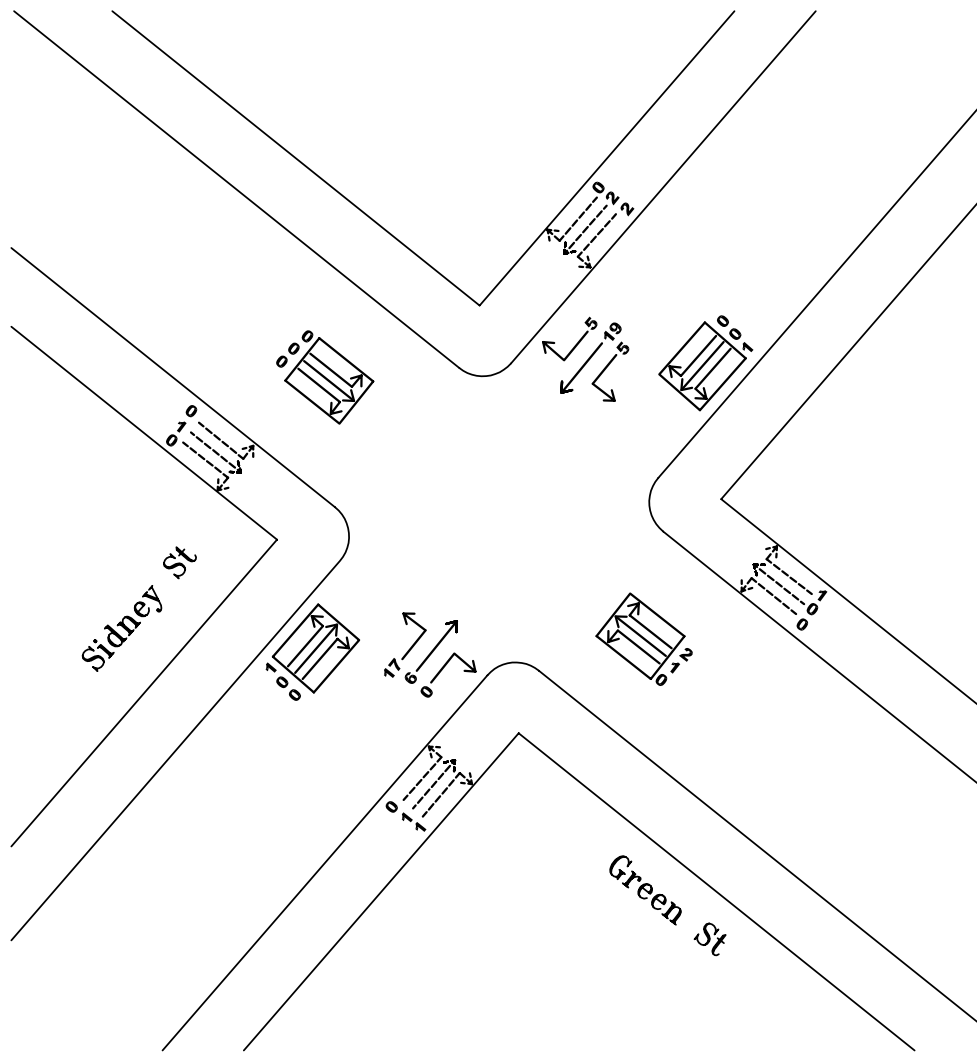


**KEY**

- 00 Bicycle Count
- ↗ Bicycle on Sidewalk
- ↖ Bicycle on Roadway
- ↗ Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 17**



**CITY OF CAMBRIDGE BICYCLE COUNT PROGRAM**

**Intersection of Green St. and Sidney St.**  
**Count Date: April 29th, 2009**  
**Peak Hour: 5:00-6:00pm (65 Bicycles)**  
**Weather: Clear**



**KEY**

00 Bicycle Count  
 Bicycle on Roadway

Bicycle on Sidewalk  
 Bicycle Traveling Against Traffic

**GPI** Greenman-Pedersen, Inc.  
 Engineers, Architects, Planners, Construction Engineers & Inspectors  
 105 Central Street, Suite 4100, Stoneham, MA 02180  
 Tel: (781) 279-5500 Fax: (781) 279-5501  
<http://www.gpinet.com>

**Figure 18**

## LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

year may have had a minor effect on the volume of bicycle traffic, either positively or negatively. The weather on each day was moderate in temperature and it was not precipitating. The improvements to the Lafayette Square area have provided additional amenities for bicycles. These modifications make the Lafayette Square area more appealing to cyclists, but given that regular counts by the City of Cambridge show that the number of cyclists in Cambridge has doubled over the last five years, it is not clear how much the new bicycle facilities at Lafayette Square account for the increase in cyclists at this location.

Although pre-construction bicycle ridership is not available for all the study area intersections, the 2009 bicycle counts are summarized in Table 4.

**Table 4**  
**Bicycle Ridership <sup>1</sup>**

<b>Location</b>	<b>2009 Bicycle Counts <sup>2</sup></b>	
	<b>AM</b>	<b>PM</b>
Main Street at Columbia Street and Sidney Street Ext.	109	124
Massachusetts Avenue at Pearl Street	104	215
Main Street at Windsor Street	107	111
Columbia Street at Bishop Allen Drive	79	106
Massachusetts Avenue at Sidney Street and Sidney Street Ext.	220	281
Sidney Street at Green Street	56	65

<sup>1</sup> In bicycles per hour entering the intersection.

<sup>2</sup> April 2009 TMCs.

### **Pedestrian Volumes and Patterns**

Pedestrian counts were conducted in April 2009 within the study area at all six study area locations. Limited pre-construction pedestrian data were available from the City of Cambridge that were collected in December 1998 as part of the MIT Dormitory project located on Pacific Street. To evaluate the changes in pedestrian activity through Lafayette Square as a result of the recent improvements and attributed to increased pedestrian activity in the area, the total number of pedestrians at available crossings was examined during the weekday peak periods observed. Table 5 provides a comparison between similar pedestrian crossings observed in 1998 and 2009

## LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

at various locations throughout Lafayette Square during the weekday AM and weekday PM peak hours. Figures 19 through 22 depict the 2009 pedestrian movements based on the constructed crosswalk locations, while available pre-construction pedestrian volumes and movements are presented in the Appendix.

**Table 5**  
**Pedestrian Comparison (1998-2009) <sup>1</sup>**

Location	1998 Pedestrian Counts <sup>2</sup>		2009 Pedestrian Counts <sup>3</sup>		% Change	
	AM	PM	AM	PM	AM	PM
Crossing Main Street at Columbia Street Ext. and Sidney Street Ext.	24	51	63	99	163%	94%
Crossing Massachusetts Avenue at Columbia Street Ext. and Sidney Street	69	87	168	223	143%	156%
Crossing Sidney Street south of Massachusetts Avenue	101	169	214	248	112%	47%
Crossing Columbia Street Ext. and Sidney Street Ext. between Main Street and Massachusetts Avenue	102	292	115	303	13%	4%
Crossings at Sidney Street and Green Street Intersection	204	269	403	445	98%	65%

<sup>1</sup> In pedestrians per hour.

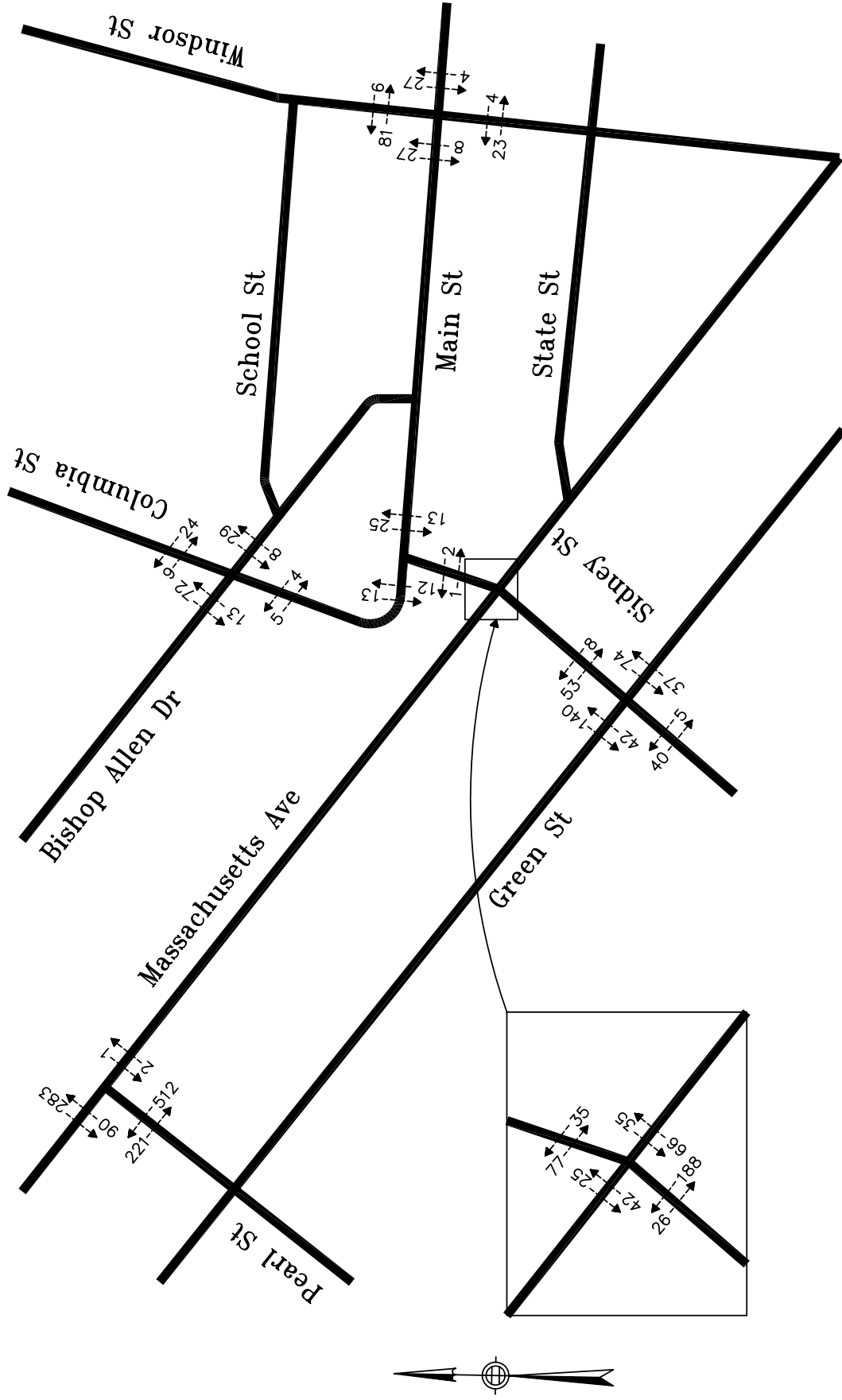
<sup>2</sup> December 1998 pedestrian counts provided by the City of Cambridge as part of the MIT Dormitory project on Pacific Street.

<sup>3</sup> April 2009 TMCs.

Based on a comparison of pre- and post-construction conditions at Lafayette Square, it appears that pedestrian activity through the area has increased at all the crossings during the weekday AM and weekday PM peak hours, and in most cases more than doubled during the weekday AM peak hour. The improvements to the Lafayette Square area have provided additional amenities for pedestrians and therefore made the Lafayette Square area more appealing to pedestrians. Since the observations in 1998 were conducted in December and the observations in 2009 were conducted in April, the time of the year may have had an effect on the volume of pedestrians. In addition, the date of the December pedestrian counts was not available and therefore inclement weather for that day could not be verified. The total pedestrian activity observed in 2009 at all study area intersections are summarized in Table 6.

LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

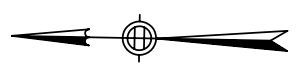
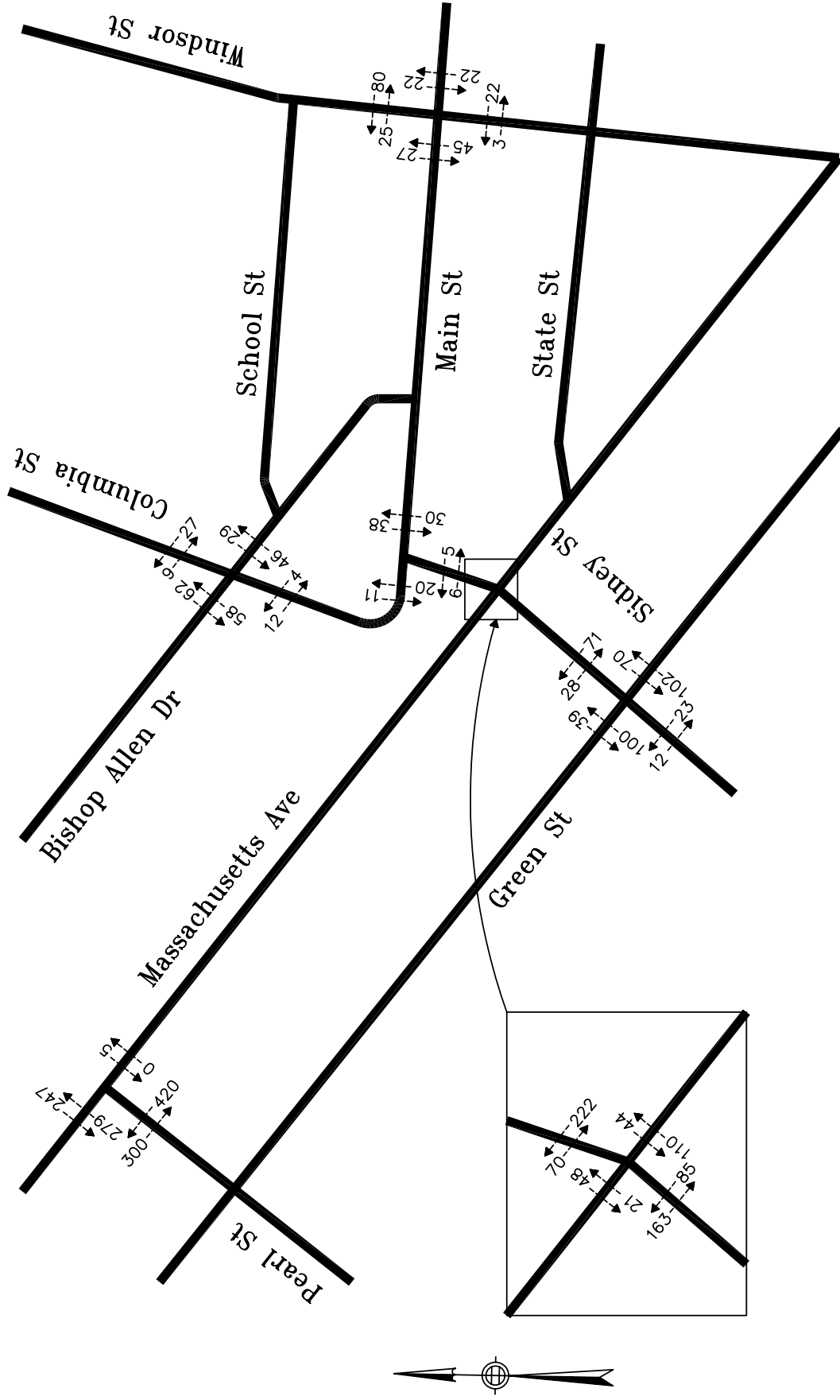


Not To Scale

Figure 19  
Lafayette Square Post-Construction  
April 2009 AM Pedestrian Volumes  
By Direction

LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts



Not To Scale



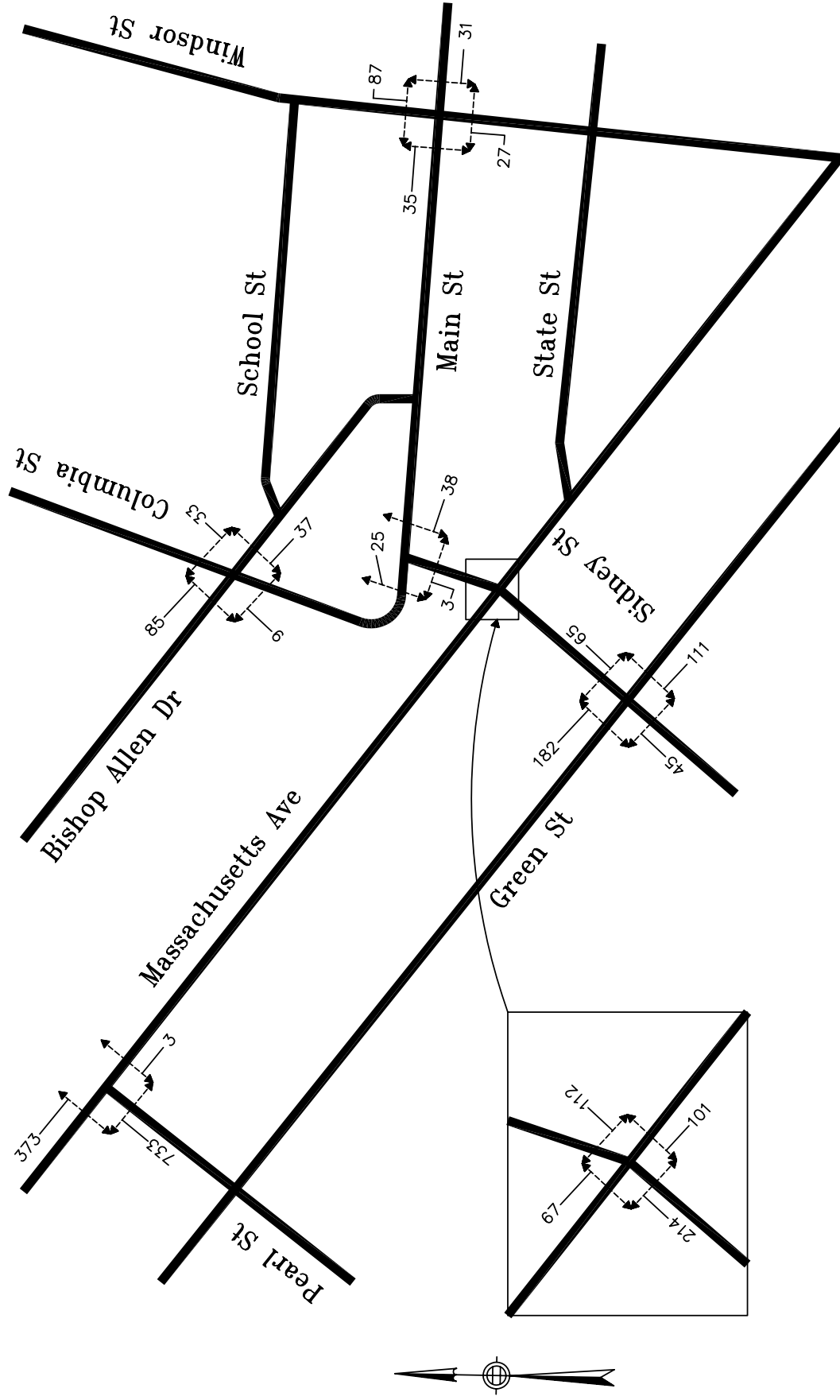
Greenman-Pedersen, Inc.

Engineers, Architects, Planners, Construction Engineers & Inspectors

Figure 20  
Lafayette Square Post-Construction  
April 2009 PM Pedestrian Volumes  
By Direction

LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts



Not To Scale



Greenman-Pedersen, Inc.

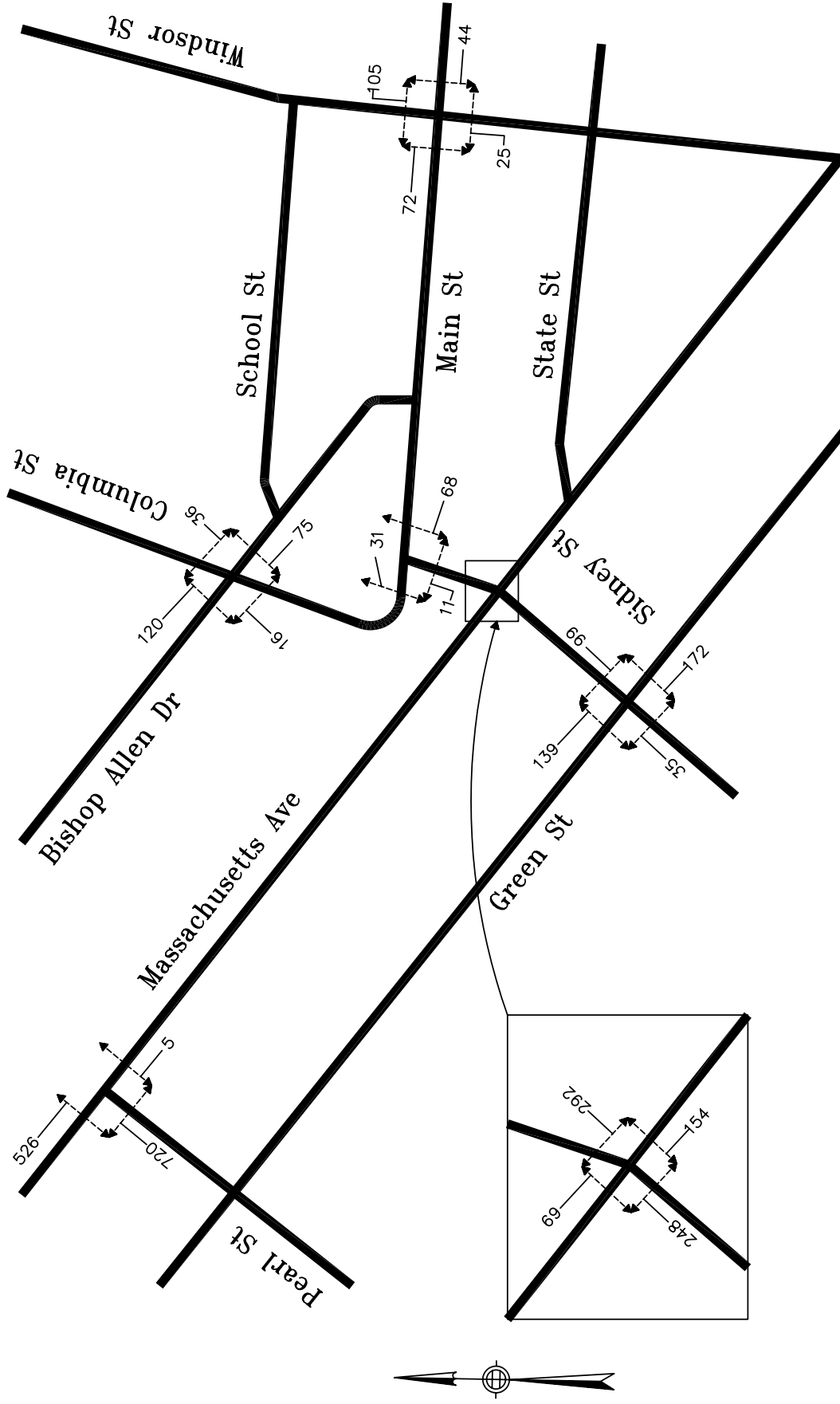
Engineers, Architects, Planners, Construction Engineers & Inspectors

Figure 21  
Lafayette Square Post-Construction  
April 2009 AM Pedestrian Volumes  
Total



LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts



Not To Scale

Figure 22  
Lafayette Square Post-Construction  
April 2009 PM Pedestrian Volumes  
Total

**Table 6**  
**Total Pedestrian Activity <sup>1</sup>**

<b>Location</b>	<b>2009 Pedestrian Counts <sup>2</sup></b>	
	<b>AM</b>	<b>PM</b>
Main Street at Columbia Street and Sidney Street Ext.	66	110
Massachusetts Avenue at Pearl Street	1,109	1,251
Main Street at Windsor Street	180	246
Columbia Street at Bishop Allen Drive	164	247
Massachusetts Avenue at Sidney Street and Sidney Street Ext.	494	763
Sidney Street at Green Street	403	445

<sup>1</sup> In pedestrians per hour.<sup>2</sup> April 2009 TMCs.

As shown in Table 6, the highest pedestrian volumes under 2009 conditions occur at the intersection of Massachusetts Avenue and Pearl Street during both the weekday AM and weekday PM peak hours. This level of pedestrian activity could be due to its close proximity to the Central Square MBTA Station. The next highest pedestrian volume was observed to occur at Lafayette Square at the crossing of Sidney Street Extension and Massachusetts Avenue.

### **Intersection Capacity Analysis**

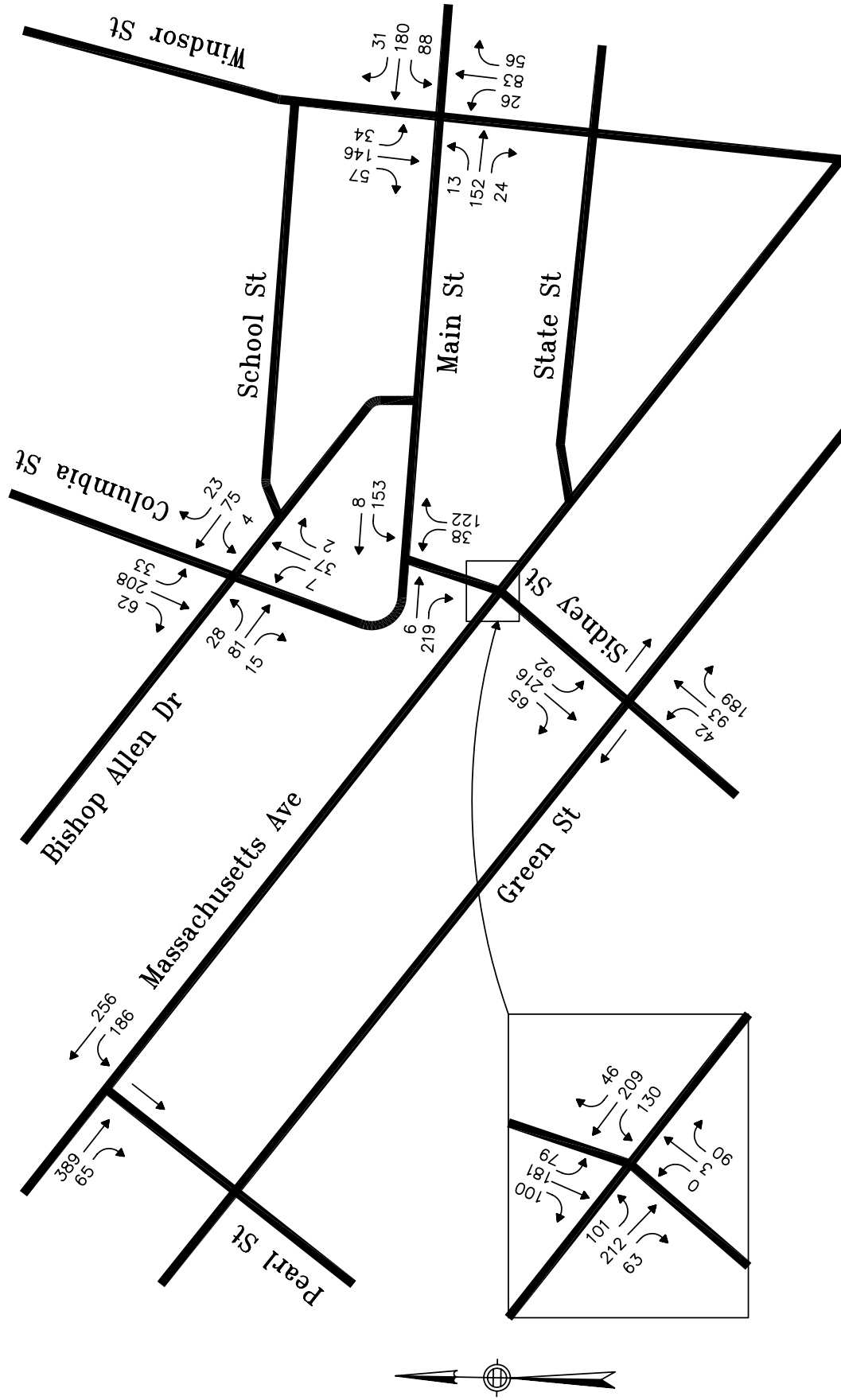
Two of the critical concerns throughout Lafayette Square were increased traffic congestion along Massachusetts Avenue and conflicts between motor vehicles, pedestrians, and cyclists. The reconfiguration of Lafayette Square reduces the number of intersections and creates two signalized intersections with new traffic signal equipment at the Massachusetts Avenue intersection with Sidney Street and the Main Street intersection with Columbia Street and Sidney Street Extension. Additional concurrent pedestrian phasing is provided where pedestrian crossing can occur without significant conflicts with vehicles. In addition, the two traffic signals are running under one traffic signal controller to allow for better timing coordination between the two closely spaced intersections.

In order to provide an accurate post-construction evaluation of vehicle traffic operations, the capacity or Level of Service (LOS) at each of the intersections was computed. LOS calculations

were completed based on peak-hour traffic volumes collected at the intersections in April 2009. Figures 23 and 24 provide a summary of the vehicle counts and movements for the weekday AM and weekday PM peak hours, respectively. The pre-construction peak-hour TMCs are presented in the Appendix.

LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

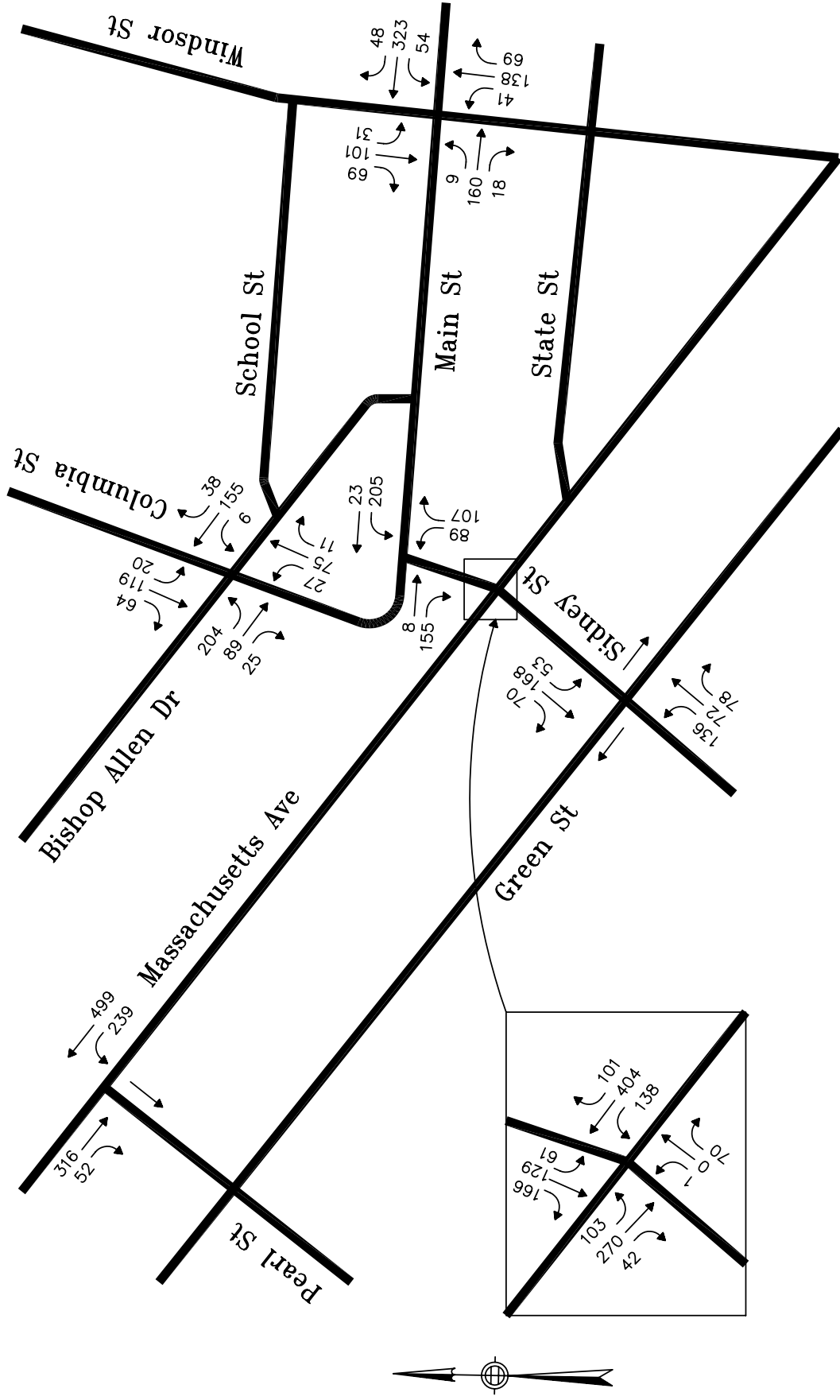


Not To Scale

Figure 23  
 Lafayette Square Post-Construction  
 April 2009 AM TMC Volumes

LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts



Not To Scale

Figure 24  
 Lafayette Square Post-Construction  
 April 2009 PM TMC Volumes

## LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

In order to provide an accurate representation of the operations of the current traffic signals, the signal timing plans were obtained from the City's Traffic Engineer in July 2009. Tables 7 through 12 provide the post-construction LOS operations for each of the intersections within the study area.

**Table 7**  
**Capacity Analysis Summary –**  
**Massachusetts Avenue at Sidney Street and Sidney Street Extension**

Intersection/Peak Hour/Lane Group	2009 (Post-Construction)				
	V/C <sup>a</sup>	g/C <sup>b</sup>	Del. <sup>c</sup>	LOS <sup>d</sup>	Queue <sup>e</sup>
<b>Massachusetts Avenue at Sidney Street and Sidney Street Extension</b>					
<i>Weekday AM:</i>					
Massachusetts Ave. EB Left	0.36	0.22	34.1	C	51/100
Massachusetts Ave. EB Thru/Right	0.47	0.43	20.2	C	105/177
Massachusetts Ave. WB Left	0.69	0.14	56.0	E	77/162
Massachusetts Ave. WB Thru/Right	0.60	0.35	29.5	C	121/205
Sidney St. NB Right	0.15	0.14	0.4	A	0/0
Sidney Street Ext. SB Left/Thru/Right	0.64	0.28	31.3	D	82/141
Sidney Street Ext. SB Right	0.32	0.22	10.8	B	6/45
<b>OVERALL INTERSECTION</b>	--	--	<b>28.2</b>	<b>C</b>	--
<i>Weekday PM:</i>					
Massachusetts Ave. EB Left	0.48	0.16	41.7	D	60/114
Massachusetts Ave. EB Thru/Right	0.47	0.48	17.6	B	122/196
Massachusetts Ave. WB Left	0.56	0.17	43.0	D	80/143
Massachusetts Ave. WB Thru/Right	0.77	0.49	26.8	C	238/385
Sidney St. NB Right	0.12	0.17	0.4	A	0/0
Sidney Street Ext. SB Left/Thru/Right	0.63	0.19	47.2	F	120/158
Sidney Street Ext. SB Right	0.47	0.16	9.9	B	0/27
<b>OVERALL INTERSECTION</b>	--	--	<b>33.6</b>	<b>C</b>	--

<sup>a</sup> Volume-to-capacity ratio.

<sup>b</sup> Actuated effective green time to cycle length ratio.

<sup>c</sup> Average control delay in seconds per vehicle.

<sup>d</sup> Level of service.

<sup>e</sup> Maximum queue length in feet per lane during an average/95<sup>th</sup> percentile cycle (assuming 25 feet per vehicle).

**Table 8  
Capacity Analysis Summary –  
Main Street at Columbia Street and Sidney Street Extension**

Intersection/Peak Hour/Lane Group	2009 (Post-Construction)				
	V/C <sup>a</sup>	g/C <sup>b</sup>	Del. <sup>c</sup>	LOS <sup>d</sup>	Queue <sup>e</sup>
<b>Main Street at Columbia Street and Sidney Street Extension</b>					
<i>Weekday AM:</i>					
Columbia St. EB Thru/Right	0.34	0.28	28.7	C	61/110
Columbia St. EB Right	0.34	0.28	28.7	C	61/109
Main St. WB Left/Thru	0.69	0.22	47.7	E	99/177
Sidney Street Ext. NB Left	0.08	0.35	13.4	B	18/38
Sidney Street Ext. NB Right	0.18	0.62	1.8	A	5/8
<b>OVERALL INTERSECTION</b>	--	--	<b>30.3</b>	<b>C</b>	--
<i>Weekday PM:</i>					
Columbia St. EB Thru/Right	0.25	0.28	27.0	C	43/83
Columbia St. EB Right	0.25	0.28	27.1	C	43/82
Main St. WB Left/Thru	0.91	0.19	73.6	F	140/282
Sidney Street Ext. NB Left	0.18	0.37	14.0	B	39/66
Sidney Street Ext. NB Right	0.16	0.62	3.7	A	7/19
<b>OVERALL INTERSECTION</b>	--	--	<b>42.5</b>	<b>D</b>	--

<sup>a</sup> Volume-to-capacity ratio.

<sup>b</sup> Actuated effective green time to cycle length ratio.

<sup>c</sup> Average control delay in seconds per vehicle.

<sup>d</sup> Level of service.

<sup>e</sup> Maximum queue length in feet per lane during an average/95<sup>th</sup> percentile cycle (assuming 25 feet per vehicle).

**Table 9**  
**Capacity Analysis Summary – Massachusetts Avenue at Pearl Street**

Intersection/Peak Hour/Lane Group	2009 (Post-Construction)			
	V/C <sup>a</sup>	Del. <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>
<b>Massachusetts Avenue at Pearl Street</b>				
<i>Weekday AM:</i>				
Massachusetts Ave. EB Thru/Right	0.30	0.0	A	0
Massachusetts Ave. WB Left	0.22	9.6	A	21
Massachusetts Ave. WB Thru	0.18	0.0	A	0
<i>Weekday PM:</i>				
Massachusetts Ave. EB Thru/Right	0.24	0.0	A	0
Massachusetts Ave. WB Left	0.21	9.0	A	20
Massachusetts Ave. WB Thru	0.30	0.0	A	0

<sup>a</sup> Volume-to-capacity ratio.

<sup>b</sup> Average control delay in seconds per vehicle.

<sup>c</sup> Level of service.

<sup>d</sup> Maximum queue length in feet (assuming 25 feet per vehicle).

**Table 10**  
**Capacity Analysis Summary – Sidney Street at Green Street**

Intersection/Peak Hour/Lane Group	2009 (Post-Construction)			
	V/C <sup>a</sup>	Del. <sup>b</sup>	LOS <sup>c</sup>	Queue <sup>d</sup>
<b>Sidney Street at Green Street</b>				
<i>Weekday AM:</i>				
Sidney St. NB Approach	0.05	1.5	A	4
Sidney St. SB Approach	0.09	2.8	A	8
<i>Weekday PM:</i>				
Sidney St. NB Approach	0.13	4.5	A	11
Sidney St. SB Approach	0.04	1.7	A	3

<sup>a</sup> Volume-to-capacity ratio.

<sup>b</sup> Average control delay in seconds per vehicle.

<sup>c</sup> Level of service.

<sup>d</sup> Maximum queue length in feet (assuming 25 feet per vehicle).



**Table 11  
Capacity Analysis Summary – Main Street at Windsor Street**

Intersection/Peak Hour/Lane Group	2009 (Post-Construction)				
	V/C <sup>a</sup>	g/C <sup>b</sup>	Del. <sup>c</sup>	LOS <sup>d</sup>	Queue <sup>e</sup>
<b>Main Street at Windsor Street</b>					
<i>Weekday AM:</i>					
Main St. EB Approach	0.36	0.46	21.3	C	97/150
Main St. WB Approach	1.25	0.46	154.6	F	572/572
Windsor St. NB Approach	0.30	0.46	20.0	C	78/130
Windsor St. SB Approach	0.40	0.46	21.9	C	115/183
<b>OVERALL INTERSECTION</b>	--	--	<b>87.4</b>	<b>F</b>	--
<i>Weekday PM:</i>					
Main St. EB Approach	0.31	0.46	20.2	C	88/143
Main St. WB Approach	0.77	0.46	34.3	C	283/394
Windsor St. NB Approach	0.46	0.46	23.1	C	135/198
Windsor St. SB Approach	0.36	0.46	21.0	C	98/159
<b>OVERALL INTERSECTION</b>	--	--	<b>26.8</b>	<b>C</b>	--

<sup>a</sup> Volume-to-capacity ratio.

<sup>b</sup> Actuated effective green time to cycle length ratio.

<sup>c</sup> Average control delay in seconds per vehicle.

<sup>d</sup> Level of service.

<sup>e</sup> Maximum queue length in feet per lane during an average/95<sup>th</sup> percentile cycle (assuming 25 feet per vehicle).

**Table 12  
Capacity Analysis Summary – Columbia Street at Bishop Allen Drive**

Intersection/Peak Hour/Lane Group	2009 (Post-Construction)			
	V/C <sup>a</sup>	Del. <sup>c</sup>	LOS <sup>d</sup>	Queue <sup>e</sup>
<b>Columbia Street at Bishop Allen Drive</b>				
<i>Weekday AM:</i>				
Bishop Allen Dr. EB Approach	0.24	9.7	A	24
Bishop Allen Dr. WB Approach	0.20	9.3	A	19
Columbia St. NB Approach	0.12	8.8	A	10
Columbia St. SB Approach	0.51	11.9	B	73
<i>Weekday PM:</i>				
Bishop Allen Dr. EB Approach	0.57	14.8	B	91
Bishop Allen Dr. WB Approach	0.35	11.1	B	39
Columbia St. NB Approach	0.25	10.6	B	24
Columbia St. SB Approach	0.44	12.3	B	56

<sup>a</sup> Volume-to-capacity ratio.

<sup>b</sup> Average control delay in seconds per vehicle.

<sup>c</sup> Level of service.

<sup>d</sup> Maximum queue length in feet (assuming 25 feet per vehicle).

As illustrated in Tables 7 through 12, the new geometry and upgraded traffic signals for Lafayette Square have achieved the goal of providing LOS D or better at the majority of the intersections in the area with the exception of the Main Street at Windsor Street intersection, where the overall operations are at LOS F during the weekday AM peak period.

It was observed in the field that the pavement markings for the Massachusetts Avenue westbound approach at the intersection with Sidney Street and Sidney Street Extension are not striped per plan. Currently, the westbound inside lane is striped as an exclusive left-turn lane instead of a shared left-turn/through lane, causing a left-turn trap since there are no transitional pavement markings downstream. Based on field observations, this condition created some driver confusion and could result in less than desirable operations at the intersection. It is recommended that either downstream pavement markings be incorporated transitioning drivers to one lane, or the lane be re-striped as a shared left-turn/through lane per the improvement plan.

## LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

### Field Observations

As part of the evaluation GPI conducted a site visit to observe overall operations and conformance with the project goals and objectives. The following items were noted during the field visit.

- The pavement marking plans provided to GPI indicate a bicycle STOP BOX was to be striped in front of the STOP line on Main Street to allow cyclists to turn left onto Sidney Street Extension prior to any of the queued vehicles. This STOP BOX has not been striped in the field.



- Drainage in areas of the curb extensions is not working effectively. At the time of the site visit, it had recently rained. Large puddles were observed in many areas throughout the project.



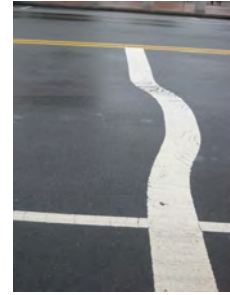
- There are no curb cuts in front of the Salvation Army Building, however, vehicles were observed to be parking on the sidewalk. This creates a conflict with pedestrians as it is not clearly identified as a parking area and vehicles would not be expected.



## LAFAYETTE SQUARE – POST-CONSTRUCTION EVALUATION STUDY

Cambridge, Massachusetts

- The STOP line along the southbound approach to the Fire Station has shifted. This could be the result of the thermoplastic marking shifting or the pavement structure shifting. This should be further examined and repaired.



- The northbound approach to Sydney Street is currently striped as a dedicated left turn lane and a single through lane. However, there are no pavement markings or signs to channelize northbound motorists into the appropriate lanes. This traps through vehicles in the dedicated left turn lane and was observed frequently during site visits.

### Lane Drop Observations on Massachusetts Avenue at Vassar Street

As part of this study, GPI also evaluated the lane drop along the Massachusetts Avenue southbound corridor between Vassar Street and the mid-block pedestrian crossing. Based on traffic counts along Massachusetts Avenue, the heaviest southbound traffic levels occur during the weekday PM peak hour. Therefore, on June 30, 2009 from 3:45 to 5:15 PM, GPI observed the operations of southbound traffic in this area and noted that the lane drop/merge area operated fairly well. The following was noted:

- During the 90 minute period observed, 23 vehicles were observed to encroach on the adjacent bicycle lane.
- Of these 23 vehicles, most were minor lane violations and 9 vehicles were observed to use the lane to bypass queued vehicles.
- Most of the encroachments, particularly those actually passing on the right, occurred during the RED interval at the pedestrian crossing signal when the queues would significantly back up.
- Several vehicles were observed to encroach on the bicycle lane (i.e. not follow the marked taper) even when no vehicles were to the left. This may be partially due to the location of the W4-2R (Lane Drop-Graphic) sign located too far to the south beyond the merge point.
- It is recommended that a W9-1R (Right Lane Ends) sign be installed approximately 150 feet north of the existing W4-R sign to provide additional notification to drivers.

## **CONCLUSIONS AND RECOMMENDATIONS**

This study has been prepared to evaluate how the recently completed reconstruction of Lafayette Square addressed the original goals of the project and has impacted pedestrians, bicyclists, and motor vehicle operators in the study area. This study included an analysis of pedestrian and bicycle movements and trends, as well as an evaluation of the operations of the newly reconstructed traffic signals and other nearby intersections in the area. The following is a summary of the original project goals:

- Make the Lafayette Square intersections easy for all users to navigate.
- Provide safe pedestrian crossings.
- Improve accessibility and safety for cyclists.
- Make Lafayette Square more attractive and create a new community plaza.
- Create a design that acknowledges Lafayette Square's historic street patterns.
- Minimize impacts on parking and loading.

Based on field observations and review of data collected, the goals of the project have been achieved. The overall project provides enhanced facilities for pedestrians by providing fewer and shorter pedestrian crossings. This makes the intersections easier to navigate and safer for pedestrians than the pre-construction condition. In addition, the creation of the pedestrian plaza has increased the focus of the Lafayette Square area as a pedestrian and bicycle friendly area. Bicycle lanes have been created through Lafayette Square, facilitating connections from Massachusetts Avenue to Main Street. The increased presence of bicycles during the critical peak hours is an indication that the enhanced facilities have been successful. Additional observations and recommendations are noted below:

- Overall traffic volumes throughout the area have generally decreased. The most significant reduction is noted along Massachusetts Avenue between State Street and Village Street (23 percent).
- The reconfiguration of Lafayette Square has not significantly affected the volume of traffic entering and exiting onto neighborhood streets.
- Pedestrian crossings have been enhanced resulting in shorter crossings and pedestrian countdown signals have been included to provide additional guidance to pedestrians.
- Bicycle volumes throughout the area have increased between 2004 and 2009. The doubling of the number of bicycles observed during the weekday peak hours between 2004 and 2009 indicate a general trend towards an increased bicycle ridership through the Lafayette Square area. This conclusion has been confirmed by the recent completion of

the citywide bicycle count program which concluded that citywide bicycle usage has more than doubled since 2002.

- To address the trapping of through vehicles in the Massachusetts Avenue westbound exclusive left-turn lane at its intersection with Sidney Street and Sidney Street Extension, it is recommended that either downstream pavement markings be incorporated transitioning drivers to one lane, or the lane be re-striped as a shared left-turn/through lane per the improvement plan.

***APPENDIX***

---

- 2004 Traffic-Volume Count Data
- 2004 Bicycle Count Data
- 1998 Pedestrian Count Data
- 2009 Traffic-Volume Count Data
  - ATR Data – Vehicles
  - TMC Data – Vehicles
  - Bicycle Counts
  - Pedestrian Counts
- Capacity Analysis Worksheets