65 Glenn Street | Lawrence, MA 01843
tel 978.794.1792 | fax 978.794.1793
www.tecmass.com

MEMORANDUM

TO: City of Woburn Board of Appeals
Woburn City Hall
10 Common Street
Woburn, MA 01801

DATE: January 27, 2012

FROM: Rebecca L. Brown, PE, Senior Engineer
Kevin R. Dandrade, PE, PTOE, Principal

PROJECT NO.: T0413.01

RE: Woburn Heights Residential Development
1042 Main Street, Woburn, MA
Traffic Impact Assessment

INTRODUCTION

TEC has been retained by Woburn 38 Development LLC (Proponent) to prepare a traffic impact assessment for the proposed modification to the previously approved Woburn Heights Residential Development at 1042 Main Street in Woburn, Massachusetts. The site is located on the westerly side of Main Street (Route 38) approximately 200 feet north of Wheeling Street. The project was previously approved for a 40B Comprehensive Permit from the City of Woburn's Board of Appeals to include the construction of 168 residential apartment units in a single building. The Proponent is requesting a modification to the existing Comprehensive Permit to construct a total of 168 residential apartment units within four separate buildings. A new access driveway is proposed along the site's frontage in an area that has acceptable sight distance. Main Street is currently owned and operated by the Massachusetts Department of Transportation (MassDOT), who retains exclusive authority over the permits to access State Highway.

On October 4, 2011, the Board of Appeals denied a request to extend the Comprehensive Permit for the proposed Woburn Heights residential housing project on the basis that there are health, safety, environmental, and traffic concerns that have arisen since the original permitting of the project and that these outweigh the regional need for affordable housing. The concerns related to traffic safety and operations, as included in the Board of Appeals Decision, include:

- Traffic volumes have increased on Main Street (Route 38) in the vicinity of the site since the original application in 2000.
- A number of other projects have been constructed or are proposed in the area that have resulted in increases in traffic volumes including:
  - *Trade Center 128* – a 575,000 SF office park, which houses the Middlesex Superior Court and 200 tenants and was constructed in 2007-2008.
  - *859 Main Street* – a 33-unit Alzheimer's Care Facility and 98 two-bedroom condominiums, which was approved on December 20, 2011.
  - *Dunkin Donuts* – conversion of an existing Dunkin Donuts at 880 Main Street to provide a drive-through window, which was recently approved.
- Bottlenecks during peak traffic hours between the signals at Main Street / Alfred Street / Elm Street and Main Street / School Street

- Heavy truck traffic on Mountain Street due to use as a cut-through route to avoid Main Street.

On January 19, 2012, the Board of Appeals revised their decision to allow an extension of the Comprehensive Permit. The intent of this traffic impact assessment is to assess the traffic impacts associated with the proposed modification and respond to concerns raised by the Board of Appeals in their original decision.

TRAFFIC VOLUMES

Traffic Volume Growth

As part of the permitting of the Trade Center 128 project, Edwards and Kelcey prepared a Traffic Impact Study[1] to evaluate the impacts of the proposed project. As part of this study, turning movement counts (TMCs) were collected during the weekday morning (7:00 to 9:00 AM) and weekday evening (4:00 to 6:00 PM) peak periods at the intersections of Route 38 with Alfred Street and School Street in 2006. Additional traffic counts were collected at these locations during the same time periods in 2011 as part of the Traffic Impact Study[2] prepared for 880 Main Street by Conley Associates. Both of these projects have been approved, and the traffic volumes have been accepted by the City of Woburn. Table 1 below provides a comparison of these counts to show the amount of traffic-volume growth that has occurred on Route 38 since the original permitting of the Woburn Heights project in 2006.

Table 1. Traffic Volume Summary

	Traffic Volume[a]		Net Increase	
Intersection/Time Period	2006 Study[b]	2011 Study[c]	Vehicles	Percentage Increase
Route 38 at Alfred Street				
Weekday Morning	2,501	2,672	171	6.8%
Weekday Evening	2,970	3,072	102	3.4%
Route 38 at School Street				
Weekday Morning	1,709	1,875	166	9.7%
Weekday Evening	1,892	1,951	59	3.1%

[a]Expressed in vehicles per hour (vph).
[b]From Traffic Study Update for Trade Center Executive Park prepared by Edwards and Kelcey in November 2006.
[c]From Traffic Impact Study for 880 Main Street prepared by Conley Associates in June 2011.

As shown in Table 1, traffic volumes along Route 38 have grown by approximately 6.8 to 9.7 percent during the weekday morning peak period and have grown by approximately 3.1 to 3.4 percent during the weekday evening peak hour since 2006. These increases represent an approximately 0.6 to 1.8 percent increase per year over the last five years.

The original Supplemental Traffic Analysis[3] prepared by Highway & Traffic Signal Design (HTSD) as part of the permitting for the Woburn Heights project assumed a 1.5 percent per year compounded annual growth rate and added additional traffic to be generated by the Trade Center 128 project, which has resulted in the majority of traffic growth along Route 38 in this area. The combination of the annual background growth rate and traffic to be generated by the Trade Center 128 project were estimated to result in a total growth of 12.5 percent during the weekday

[1] Traffic Study Update – Trade Center Executive Park, Woburn, Massachusetts. Edwards & Kelcey; November 1, 2006.
[2] Traffic Impact Study – 880 Main Street Redevelopment, Woburn, Massachusetts. Conley Associates; June, 2011.
[3] Supplemental Traffic Study – Woburn Heights, Main Street, Woburn, Massachusetts. Highway & Traffic Signal Design (HTSD); June 4, 2002.

morning peak period and of 12.0 percent during the weekday evening peak period, which is significantly higher than the actual traffic growth trend that has been experienced on Route 38 in the area. Therefore, the existing traffic volumes along Route 38 are actually less than the volumes originally projected in the traffic study prepared by HTSD for permitting of the Woburn Heights. In June 2003, the Housing Appeals Committee (HAC) issued a decision on the Woburn Heights project noting that no traffic operations or safety issues will result from the construction of the proposed Woburn Heights project. As the traffic volumes projected in the study that led to this decision were higher than the actual traffic volumes along Route 38, it is reasonable to assume that no traffic operations or safety issues would result from the construction of the project at this time either.

Other Development

Members of the public and two members of City Council noted that traffic volumes on Route 38 have grown as a result of other development that has occurred along the corridor since the original permitting of the proposed residential housing project. City Council members identified the Trade Center 128 project as a large new traffic generator and identified the conversion of a Dunkin Donuts at 880 Main Street to provide a drive-through window and a proposed Alzheimer's Care Facility and residential condominium development at 859 Main Street as potential future development along Route 38.

Trade Center 128

The Trade Center 128 project had been proposed at the time that the original Traffic Impact and Access Study was completed for the proposed Woburn Heights project by HTSD in 2002. As such, traffic volumes estimated to be generated by the Trade Center 128 project were included in the projected 2005 traffic-volume networks and capacity analysis for the proposed Woburn Heights project. With inclusion of the Trade Center 128 project, the capacity and queue analysis included in HTSD's 2002 traffic study indicated that all movements at the intersection of Route 38 with Kearsarge Avenue were expected to operate at acceptable levels of service with queues not exceeding one vehicle under 2005 Build conditions. Although traffic exiting Mountain Street onto Route 38 was expected to operate at LOS E during the weekday morning and evening peak hours, the volume-to-capacity (v/c) ratio was expected to be well below 1.00, indicating there would be adequate capacity to accommodate the anticipated traffic volumes. In addition, queues were not expected to exceed two vehicles. This is similar to most side streets and commercial driveways along the Route 38 corridor.

The previously projected volume of new traffic on Route 38 from the Trade Center 128 project (passing School Street and Mountain Street to the north) is significantly greater than the projected level of traffic from the Woburn Heights project. Therefore, any potential safety or capacity issues should have been identified by the City during the review process and theoretically limited that Proponent's ability to secure permits. The site-generated traffic-volume networks for the Trade Center 128 and Woburn Heights projects are included in Attachment A.

An updated Traffic Study was prepared in November 2006 by Edwards and Kelcey for the Trade Center 128 project. This study should have included traffic to be generated by the proposed Woburn Heights project within the traffic volume projections and analysis as the housing project had already been approved at the time the study was completed. The Planning Department should have required this applicant to evaluate the Woburn Heights project within the background growth. However, the Trade Center 128 study did not include any such traffic projection.

880 Main Street

A Traffic Impact Study (TIS) was prepared in June 2011 by Conley Associates for redevelopment of 880 Main Street to include a reduction in retail space and an expansion of the existing Dunkin Donuts to provide a drive-through window. This study should have included traffic to be generated by the proposed residential housing project within the traffic volume projections and analysis as the housing project had already been approved at the time the 880 Main Street study was completed. The Planning Department should have required this applicant to evaluate the Woburn Heights project within the background growth. However, the 880 Main Street study did not include any such traffic projection.

The TIS completed for the 880 Main Street redevelopment project indicates that the project is expected to generate approximately 16 new trips (8 entering and 8 exiting) during the weekday morning peak hour and 12 new trips (6 entering and 6 exiting) during the weekday evening peak hour. These increases represent one additional vehicle every 7 to 10 minutes, and will result in a less than one percent increase in traffic volumes on Route 38.

859 Main Street

A Traffic & Parking Impact Assessment[4] (TPIA) was prepared in November 2010 by C3 Consulting Group for development of an Alzheimer's Care Facility at 859 Main Street. This study also included analysis of a 48-unit residential condominium project at the same address. The project is now proposed to include a total of 98 residential units. This study should have included traffic to be generated by the proposed Woburn Heights project within the traffic-volume projections and analysis as the housing project had already been approved at the time the 859 Main Street study was completed. However, the 859 Main Street study did not include any traffic to be generated by the Woburn Heights project.

The TPIA for the 859 Main Street project indicates that the project is expected to generate approximately 61 trips (15 entering and 46 exiting) during the weekday morning peak hour and 72 trips (37 entering and 35 exiting) during the weekday evening peak hour. These increases represent an approximately 1.1 percent increase in traffic volumes on Route 38 based on Automatic Traffic Recorder (ATR) counts on Route 38 near Alfred Street included in the Traffic Impact Study for the 880 Main Street redevelopment project.

1071 Main Street

Although not identified by the Board of Appeals or City Council as part of the denial of the extension of the Comprehensive Permit for Woburn Heights, a 57-unit residential development was recently proposed to be located at 1071 Main Street and is currently in the approvals process. The traffic study completed for this project should include traffic to be generated by the proposed Woburn Heights project within the traffic-volume projections and analysis as the housing project has already been approved. Any traffic-volume increase on Route 38 resulting from the 1071 Main Street project should be evaluated as the basis for approval or denial of the 1071 Main Street project, and should not impact the approval of the Woburn Heights project as the traffic-volume increase associated with Woburn Heights has already been approved by the Housing Appeals Committee.

[4] Traffic & Parking Impact Assessment – Proposed Alzheimer's Care Facility, Main Street, Woburn, Massachusetts. C3 Consulting Group; November, 2010.

Traffic Volume Projections

As previously noted, the existing traffic volumes on Main Street (Route 38) are lower than projected within the Traffic Impact Study prepared by HTSD as part of the original permitting of the Woburn Heights project. The City Council argued that traffic operations and safety issues may result from the addition of the Woburn Heights project, especially when compounded with additional traffic generated by the proposed 880 Main Street and 859 Main Street projects. TEC has projected Build conditions traffic volumes through the Main Street / Mountain Street intersection assuming construction of the Woburn Heights, 880 Main Street, and 859 Main Street projects and compared these to Build traffic volumes included in the traffic study prepared by HTSD for the original permitting of the Woburn Heights project. This information is summarized in Table 2 below.

Table 2. Traffic Volume Projections

Intersection/Time Period	2011 Existing	Woburn Heights[a]	880 Main Street[b]	859 Main Street[b]	Build[c]	Build Projected[a]	Difference
Main St at Mountain St							
Weekday Morning	1,612	56	8	19	**1,695**	1,697	**-2**
Weekday Evening	1,583	71	4	23	**1,681**	1,731	**-49**

[a]From the Supplemental Traffic Analysis prepared by HTSD in June 2002 for Woburn Heights.
[b]From the Traffic Impact Study prepared by Conley Associates in June 2011 for 880 Main Street.
[c]Sum of 2011 Existing, Woburn Heights, 880 Main Street, and 859 Main Street traffic.

As shown in Table 2, the projected Build traffic volumes included in the traffic study prepared by HTSD for the original permitting of the Woburn Heights project are higher than actual anticipated Build traffic volumes following construction of all three projects. The HTSD study indicated that no traffic operations or safety issues would result from the projected Build traffic volumes and the HAC agreed with this conclusion. As the currently projected Build volumes are lower than previously analyzed volumes, no traffic operations or safety issues will result from the proposed Woburn Heights project.

Truck Traffic

A member of the City Council, Alderman Raymond, indicated that Mountain Street currently experiences heavy truck traffic as it is used as a cut-through route to avoid delays on Main Street during peak commuter periods. The proposed residential housing project is expected to have a negligible increase in truck traffic once construction is complete. The few trucks visiting the site will be the occasional delivery vehicles or moving trucks. Therefore, the project will not noticeably increase truck traffic or worsen the operating conditions on Mountain Street. The Trade Center 128 project is likely to generate significantly higher truck traffic than the Woburn Heights project due to the nature of its use and was not required to evaluate operations on Mountain Street or provide any mitigation at this location.

Alderman Raymond has proposed banning heavy trucks from using the residential Mountain Street. Traffic patterns for traffic generated by the residential development will not be impacted by this heavy vehicle restriction.

CRASH HISTORY ANALYSIS

Crash data for the study intersections was compiled and analyzed for the most recent consecutive three year period (2008-2010) on file from the City of Woburn Police Department and supplemented with data from MassDOT for the most recent years on file (2008-2009). The data is summarized in the table below. A detailed list of the crash data can be found in Attachment B for the intersections identified within the study area for the Woburn Heights project.

In addition to examining the number of collisions at the study area intersections, a crash rate was calculated to compare occurrence of collisions to the volume of traffic passing through the intersection. The crash rate per million entering vehicles (MEV) was calculated using the evening peak hour volumes from the TMCs and a calculated K-factor of 0.072 obtained from a ratio of the weekday evening peak hour traffic volumes to the daily traffic volumes. The crash rate was compared to the statewide and district-wide averages to determine the significance of the collision occurrence.

The statewide average for unsignalized intersections is 0.61 and the District 4 average for unsignalized intersections is 0.59. The statewide average for signalized intersections is 0.81 and the District 4 average for signalized intersections is 0.78. All four study area intersections experienced a crash rate less than that of the statewide and District 4 averages. The detailed crash data and crash rate worksheets are provided in Attachment B.

All of the study area intersections experienced three or fewer collisions per year and crash rates of less than 0.20 crashes per MEV, which is far lower than the state-wide and district-wide averages, indicating that no noticeable collision trends exist. It should be noted that the majority of the collisions (11 of 14) occurred at off-peak periods when traffic volumes were lower on Route 38, which indicates that traffic volumes are not a contributing factor to collisions at the study area intersections.

Table 3. Crash Data Summary

		Study Area Intersection			
		Main Street / Kearsarge Avenue	Main Street / Mountain Street	Main Street / School Street / Elm Street	Between 1030-1180 Main Street
Year:	2008	0	0	2	0
	2009	0	2	6	2
	2010	0	0	0	0
	2011*	0	0	0	2
	TOTAL	**0**	**2**	**8**	**4**
Average Annual:		*0.00*	*0.50*	*2.00*	*1.00*
MEV[a] Rate:		***0.00***	***0.05***	***0.21***	***0.11***
Above State/District Average?		*No*	*No*	*No*	*No*
Crash Type:	Angle	0	2	1	1
	Rear-End	0	0	4	1
	Single Vehicle	0	0	0	1
	Sideswipe	0	0	3	1
	Head-On	0	0	0	0
	Ped / Bike	0	0	0	0
	Not Reported	0	0	0	0
	TOTAL	**0**	**2**	**8**	**4**
Pavement Conditions:	Dry	0	0	5	3
	Wet	0	2	3	0
	Snow/Ice	0	0	0	1
	Other	0	0	0	0
	Not Reported	0	0	0	0
	TOTAL	**0**	**2**	**8**	**4**
Severity:	PDO	0	1	7	3
	Non-Fatal Inj.	0	1	1	1
	Fatal	0	0	0	0
	Not Reported	0	0	0	0
	TOTAL	**0**	**2**	**8**	**4**
Time of Day:	M-F 7am-9am	0	0	1	1
	M-F 4pm-6pm	0	0	1	0
	All Other	0	2	7	3
	TOTAL	**0**	**2**	**12**	**4**

[a] crashes per million entering vehicles
*2011 Data through October 31, 2011

SIGHT DISTANCE MEASUREMENTS

TEC, Inc. visited the site on Thursday, October 20, 2011 to measure the available sight distances at the proposed site driveway. The available sight distances were compared to minimum requirements established by the American Association of State Highway and Transportation Officials (AASHTO).

Sight distance represents the length of roadway that is visible to a driver traveling within the roadway. Two types of sight distance are typically evaluated for driveways and intersections: stopping sight distance (SSD) and intersection sight distance (ISD). SSD is the minimum distance required for a driver traveling along a roadway to perceive an object in the roadway and stop safely in advance of the object when traveling on a wet pavement surface. SSD is measured from an eye height of 3.5 feet to an object height of 2 feet above the ground, which is equivalent to a driver viewing the taillight of a vehicle ahead. SSD is measured along the centerline of the travel lane approaching the driveway or intersection.

ISD represents the length of the roadway visible to a driver waiting to exit a driveway or minor street. Minimum ISD requirements are based on the distance required for a driver to exit a minor street onto a major street without requiring an approaching vehicle to reduce its speed from the design speed to less than 70 percent of the design speed. ISD is measured from an eye height of 3.5 feet to an object height of 3.5 feet, and is measured from a distance 15 feet off the edge of the travel-way of the major roadway to represent a driver waiting to exit a driveway or minor roadway.

SSD is typically considered the critical sight distance, as it represents the minimum distance required for safe stopping, while ISD represents an acceptable speed reduction for approaching vehicles. The ISD, however, must be at least equal to the minimum required SSD in order to prevent a driver from entering the roadway when an approaching vehicle is too close to safely stop. This is standard practice for the design of low-volume driveways. The guidance provided by AASHTO states:

> *"If the available sight distance for an entering or crossing vehicle is at least equal to the appropriate stopping sight distance for the major road, then drivers have sufficient sight distance to anticipate and avoid collisions. However, in some cases, this may require a major-road vehicle to stop or slow to accommodate the maneuver by a minor-road vehicle. To enhance traffic operations, intersection sight distances that exceed stopping sight distances are desirable along the major road."*

The available SSD and ISD at the proposed site driveway were measured and compared to AASHTO's minimum requirements based on a posted speed of 30 miles per hour (mph) along Main Street (Route 38). The table below summarizes the resulting sight distances.

Table 3. Sight Distance Measurements

Approach/Direction	Minimum Required	Measured	
		Stopping Sight Distance	Intersection Sight Distance
Wildwood Avenue at Site Driveway:			
North of Site Driveway	200 ft	+650 ft	+650 ft
South of Site Driveway	200 ft	+650 ft	+650 ft

As shown in Table 3, the available sight distances at the proposed site driveway will substantially exceed the minimum requirements for safe operations.

TRAFFIC OPERATIONS ANALYSIS

Main Street / Kearsarge Avenue

The Supplemental Traffic Analysis prepared for the Woburn Heights project indicates that all movements at the intersection of Main Street / Kearsarge Avenue are anticipated to operate at acceptable levels of service (LOS D or better) during the weekday morning and weekday evening peak periods with construction of the proposed Woburn Heights project. It should be noted that the traffic volume projections included in the Supplemental Traffic Analysis were conservative (worse than expected) based on traffic growth trends that were shown to have occurred on Route 38 from 2006 to 2011 as shown in Table 1.

Main Street / Mountain Street

The Supplemental Traffic Analysis prepared for the Woburn Heights project indicates that traffic exiting Mountain Street onto Route 38 is expected to experience delay during the weekday morning and weekday evening peak hours. However, the volume-to-capacity (v/c) ratio will be well below 1.00, indicating there will be adequate capacity to accommodate future traffic volumes. In addition, queues exiting Mountain Street are not expected to exceed two vehicles. It should be noted that the traffic volume projections included in the Supplemental Traffic Analysis were conservative (worse than expected) based on traffic growth trends that were shown to have occurred on Route 38 from 2006 to 2011 as shown in Table 1.

Main Street / School Street

The traffic studies completed for the Trade Center 128, 859 Main Street, and 880 Main Street redevelopment projects in March 2010, November 2010, and June 2011, respectively, indicate that all movements at the intersection of Main Street / School Street currently operate at acceptable levels of service (LOS D or better) during the weekday morning peak period and will continue to operate at these levels of service under 2016 Build conditions. Although traffic exiting School Street experiences a low LOS E during the weekday evening peak period, the volume-to-capacity (v/c) ratio is well below 1.00, indicating adequate capacity exists to accommodate the traffic volumes and the intersection currently operates at overall LOS C.

CONCLUSIONS AND RECOMMENDATIONS

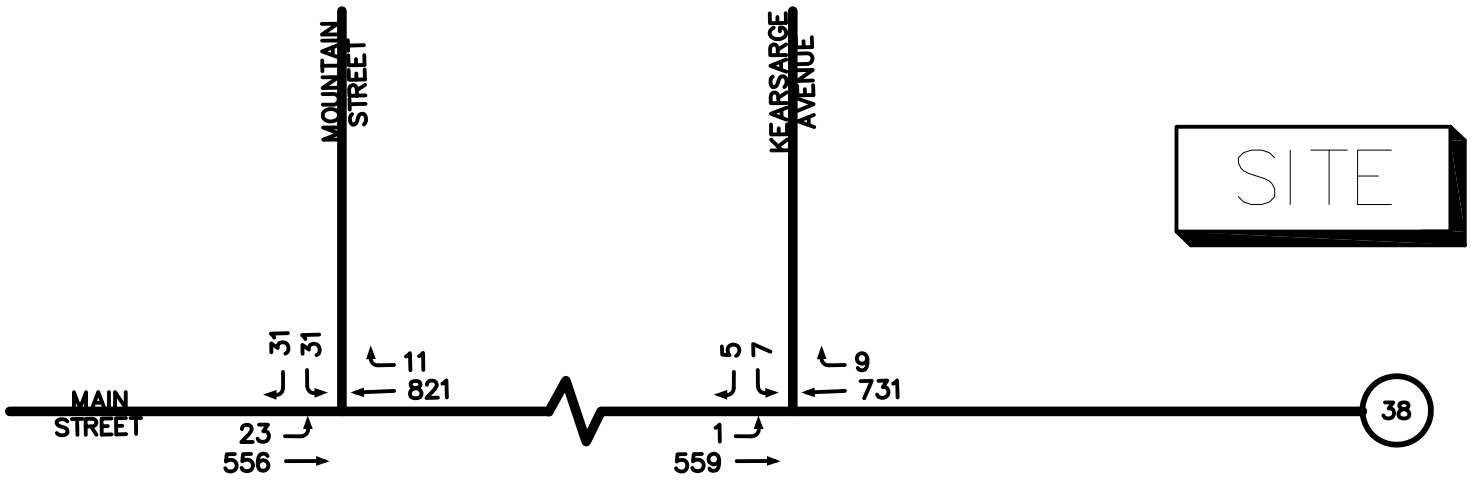
TEC has examined the potential traffic impacts of the proposed Woburn Heights project on the study area intersections and roadways. The following is a summary of the results and conclusions of this effort.

- As shown in the June 2011 Traffic Impact Study prepared by Conley Associates for the 880 Main Street project, traffic growth along Main Street (Route 38) is less than the growth projections included in the original traffic study for the Woburn Heights project in 2002; this confirms that it was conservatively prepared.
- In addition, Build traffic volumes with the inclusion of traffic to be generated by the Woburn Heights, 880 Main Street and 859 Main Street projects are anticipated to be lower than the Build traffic volumes included in the original HTSD study completed for permitting of the Woburn Heights project. The HTSD study concluded that no traffic operations or safety issues would result from these volumes and the HAC agreed with this conclusion in their June 2003 decision.
- The collision history indicates that all study area intersections experience a crash rate far less than that of the statewide and District 4 averages for unsignalized and signalized intersections. The history also indicated that there were no significant safety trends that exist at any of the study area intersections. The majority of the collisions (11 of 14) during off-peak periods when traffic volumes were low on Route 38, which indicates that traffic volumes are not a contributing factor to collisions at the study area intersections.
- Sight distances at the proposed driveway location exceed AASHTO recommendations for safe operations. All signage and vegetation along the site frontage will be kept low to the ground or sufficiently set back so as not to impede sight lines.
- All movements at the intersection of Main Street / Kearsarge Avenue are anticipated to operate at acceptable levels of service (LOS D or better) during the weekday morning and weekday evening peak hours with construction of the Woburn Heights project.
- Traffic exiting Mountain Street onto Main Street is expected to experience delay during the weekday morning and weekday evening peak hours. However, the volume-to-capacity (v/c) ratio will be well below 1.00, indicating adequate capacity will exist to accommodate the anticipated traffic volumes. In addition, queues on Mountain Street are not expected to exceed two vehicles. This intersection was not analyzed for the Trade Center 128 project, which had higher projected traffic volumes passing through this intersection.
- All movements at the intersection of Main Street / School Street are expected to operate at acceptable levels of service (LOS D or better) during the weekday morning peak period. Although traffic exiting School Street will experiences a low LOS E during the weekday evening peak period, the v/c ratio is well below 1.00, indicating adequate capacity will exist to accommodate the traffic volumes. Other recent project applicants were not required to mitigate impacts to this intersection even though their uses would result in a higher increase in traffic at this intersection.
- Access to Main Street (Route 38), including the safety and efficiency of operations, lies under the exclusive jurisdiction of MassDOT. The project proponent will apply separately to MassDOT for a permit to access State Highway.

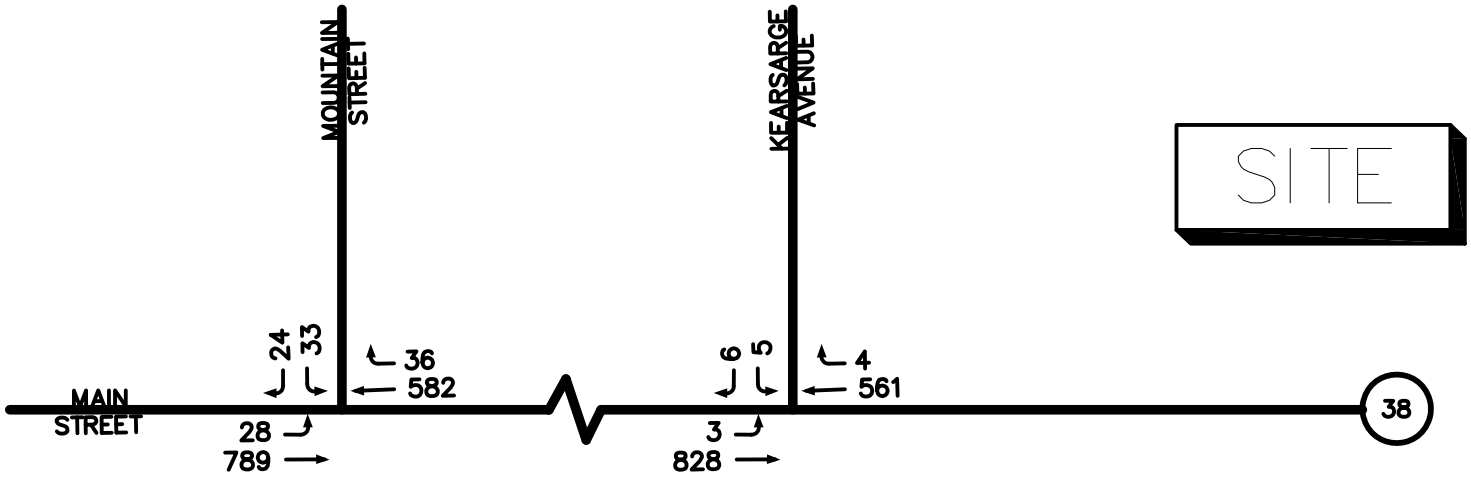
In conclusion, existing and projected traffic volumes on Route 38 are lower than traffic volume projections included in the previously prepared Supplemental Traffic Analysis. There is no significant collision history or sight distance limitation suggesting a traffic safety issue may result from construction of the Woburn Heights project. Therefore, the traffic generated by the project can be reasonably accommodated along the existing street system in Woburn.

Attachment A

Traffic Volume Networks



WEEKDAY AM



NOT TO SCALE

WEEKDAY PM

HTSD
Highway & Traffic Signal Design
a division of GREENMAN-PEDERSEN, INC.

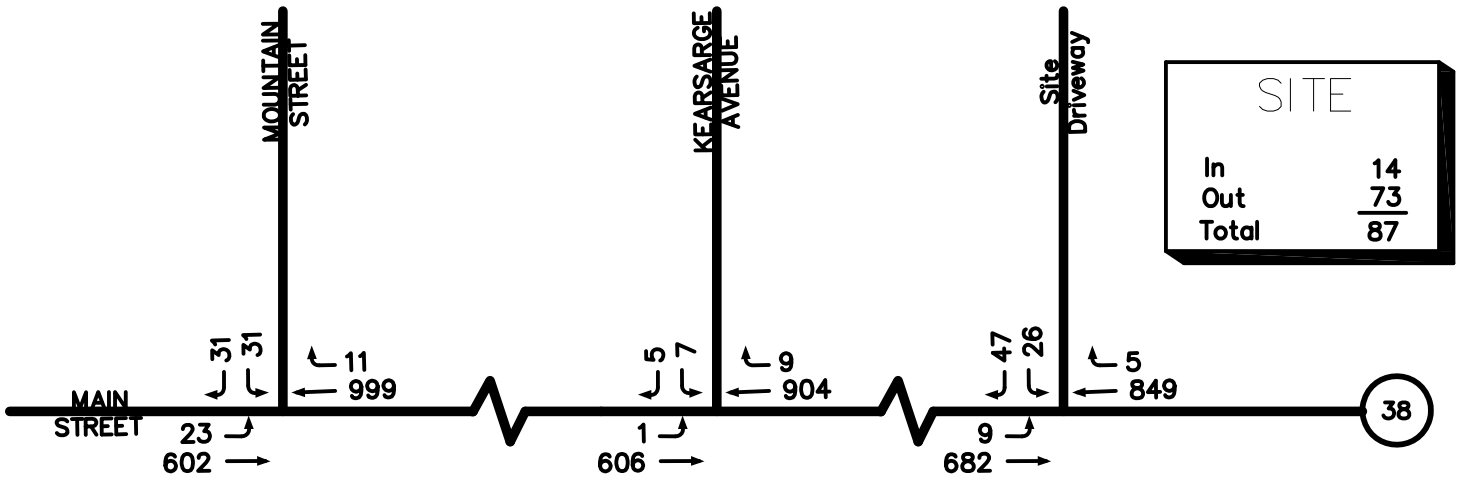
Figure 1

2002 Existing
Peak Hour Traffic Volumes

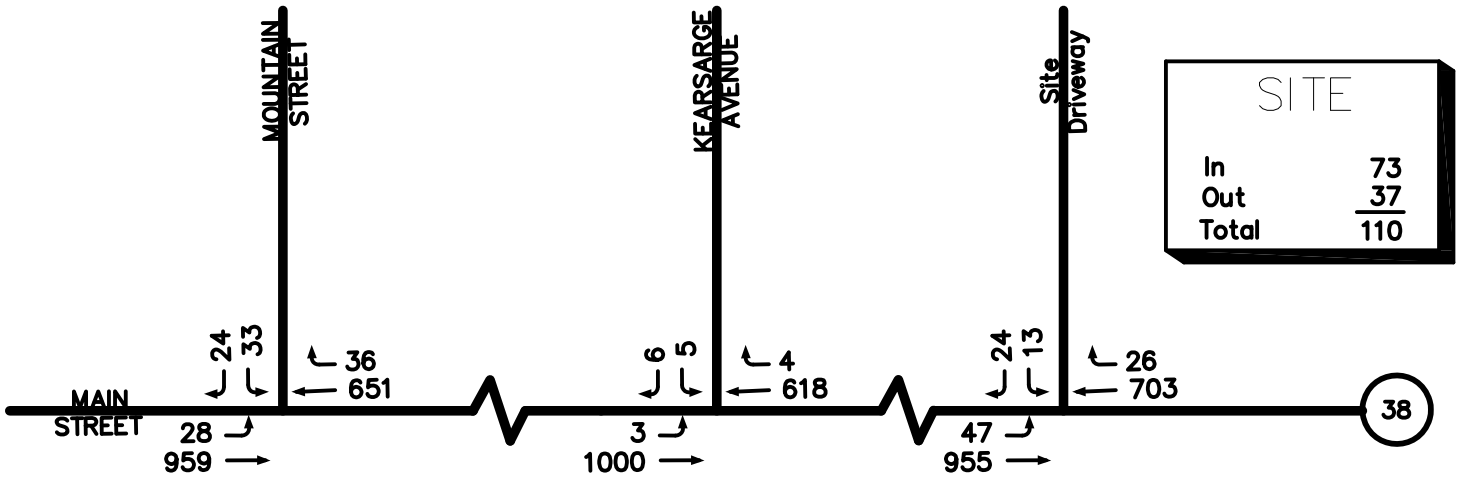
HTSD
Highway & Traffic Signal Design
a division of GREENMAN-PEDERSEN, INC.

Figure 4

Site Generated
Peak Hour Traffic Volumes



WEEKDAY AM



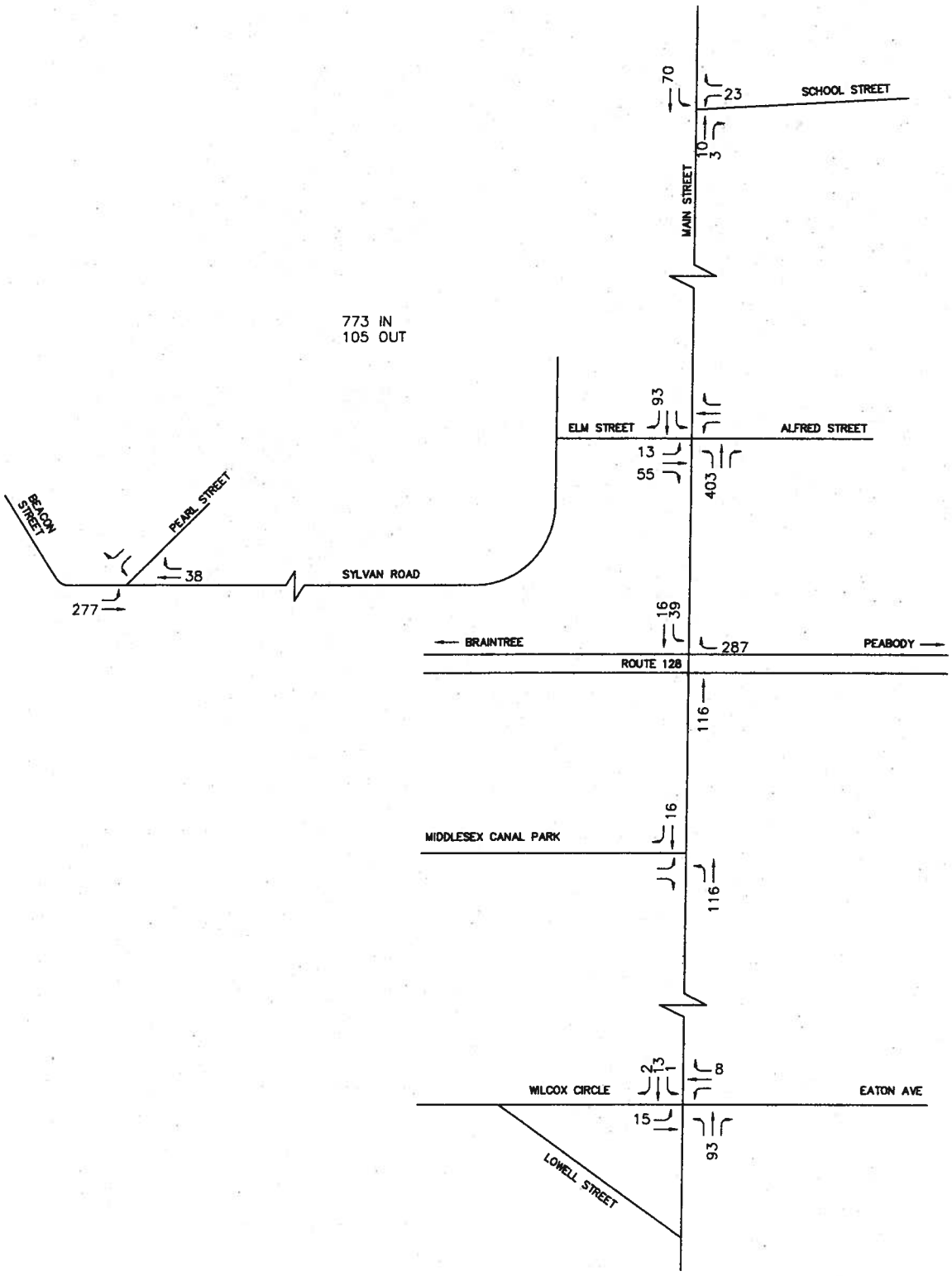
NOT TO SCALE

WEEKDAY PM

HTSD
Highway & Traffic Signal Design
a division of GREENMAN-PEDERSEN, INC.

Figure 5

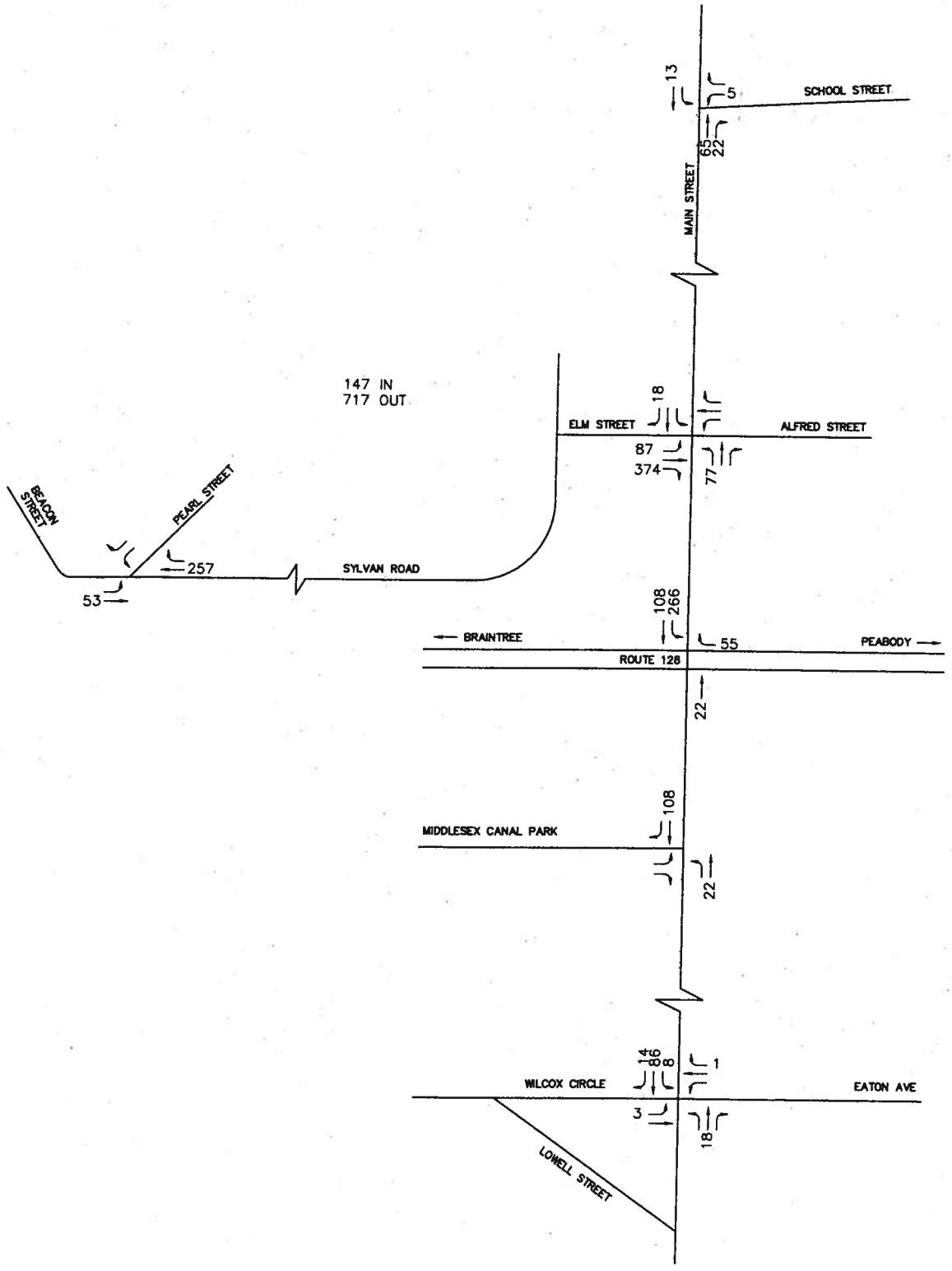
2005 Build
Peak Hour Traffic Volumes



NOT TO SCALE

Edwards AND Kelcey
343 Congress Street
Boston, MA 02210
(617) 242-9222

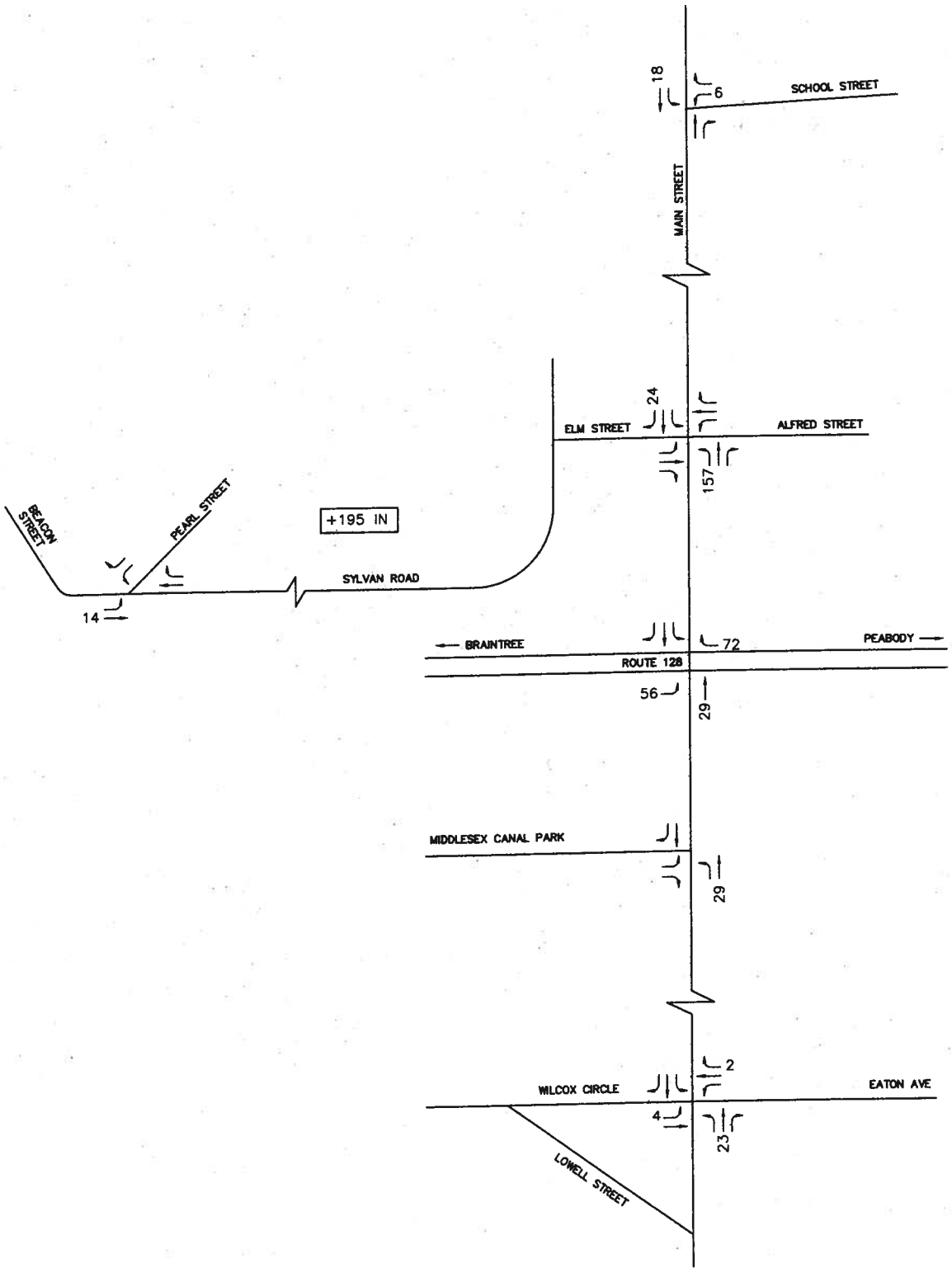
FIGURE 12
PROPOSED CUMMINGS SITE
TRIPS GENERATED (OFFICE ONLY)
AM PEAK HOUR



NOT TO SCALE

Edwards AND Kelcey
343 Congress Street
Boston, MA 02210
(617) 242-9222

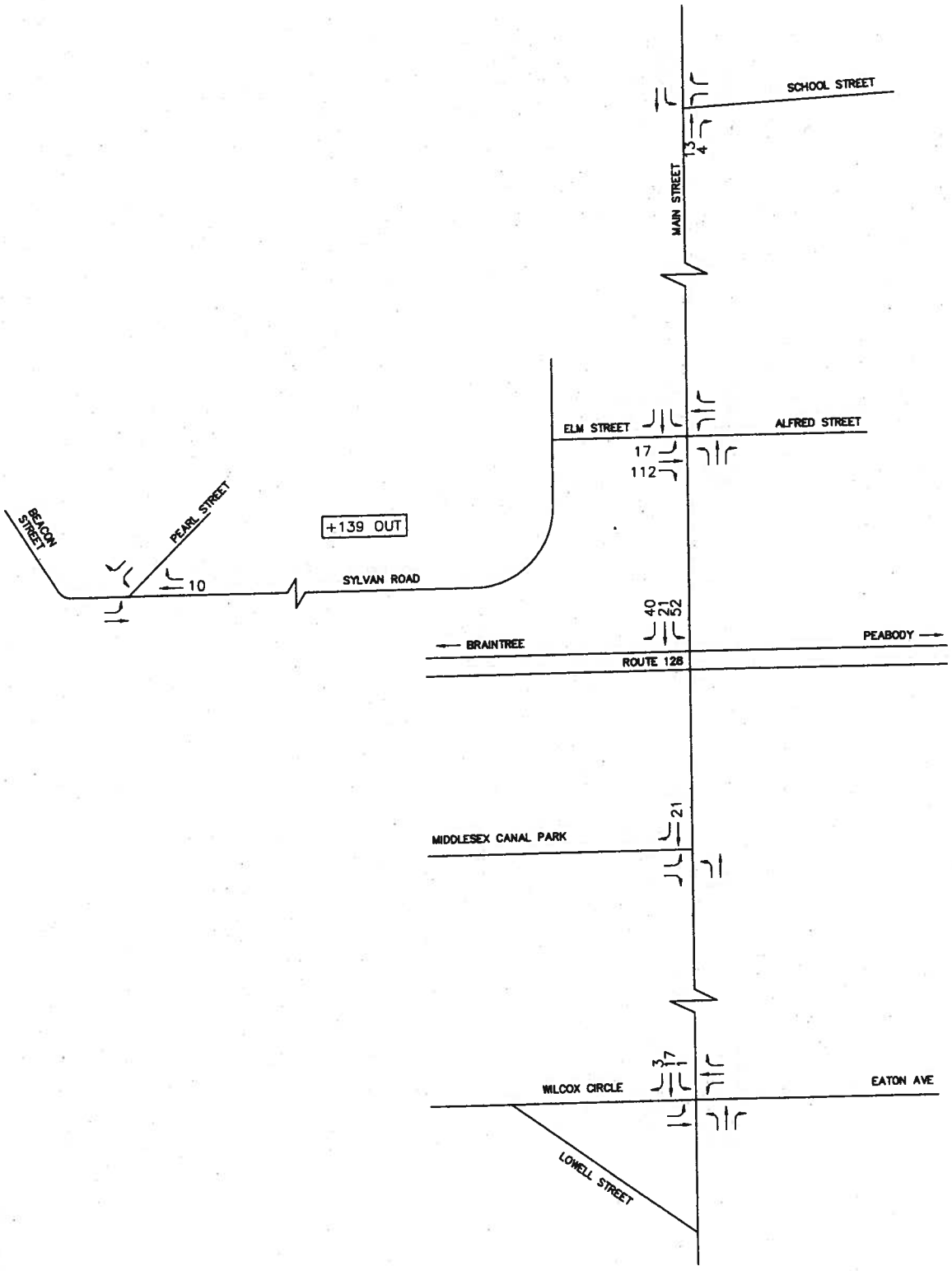
FIGURE 13
PROPOSED CUMMINGS SITE
TRIPS GENERATED (OFFICE ONLY)
PM PEAK HOUR



NOT TO SCALE

Edwards AND Kelcey
343 Congress Street
Boston, MA 02210
(617) 242-9222

FIGURE 17
ADDITIONAL TRIPS
MIXED USE
AM PEAK HOUR



NOT TO SCALE

Edwards AND Kelcey
343 Congress Street
Boston, MA 02210
(617) 242-9222

FIGURE 18
ADDITIONAL TRIPS
MIXED USE
PM PEAK HOUR

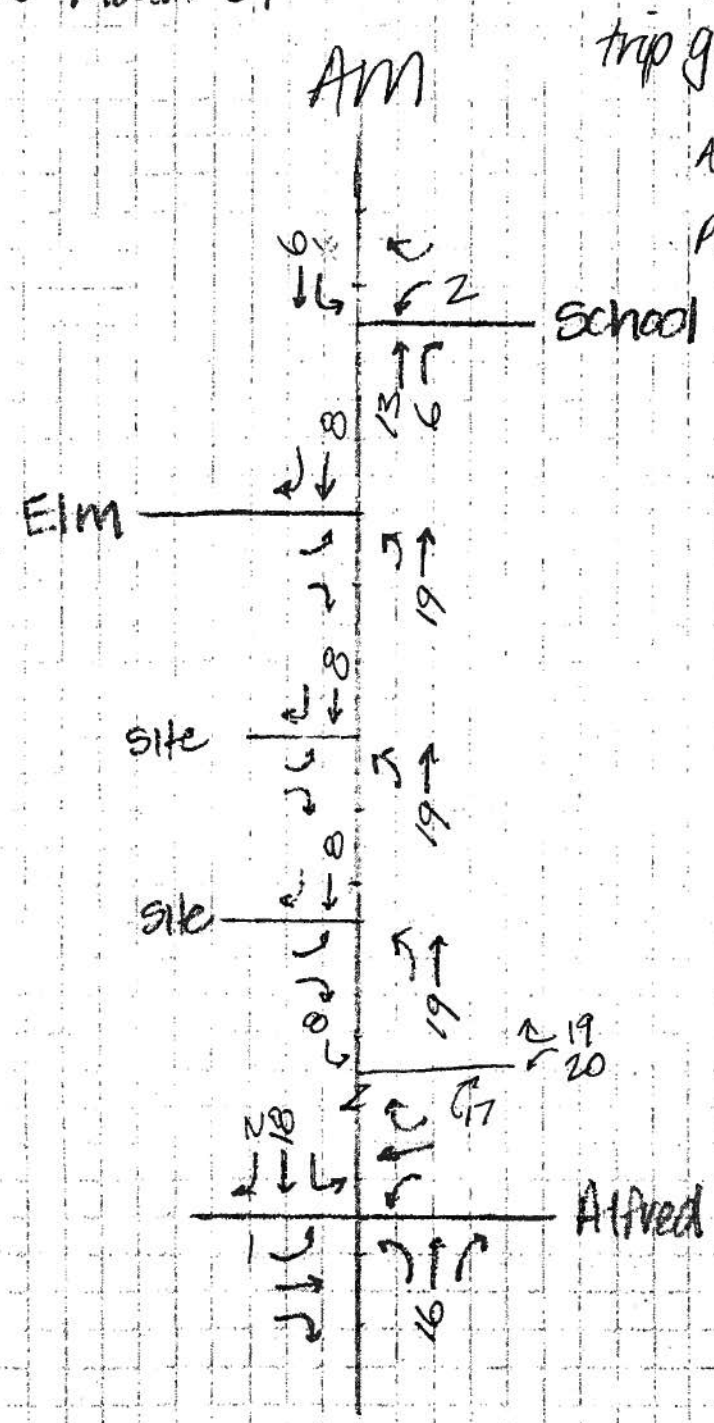
880 Main St

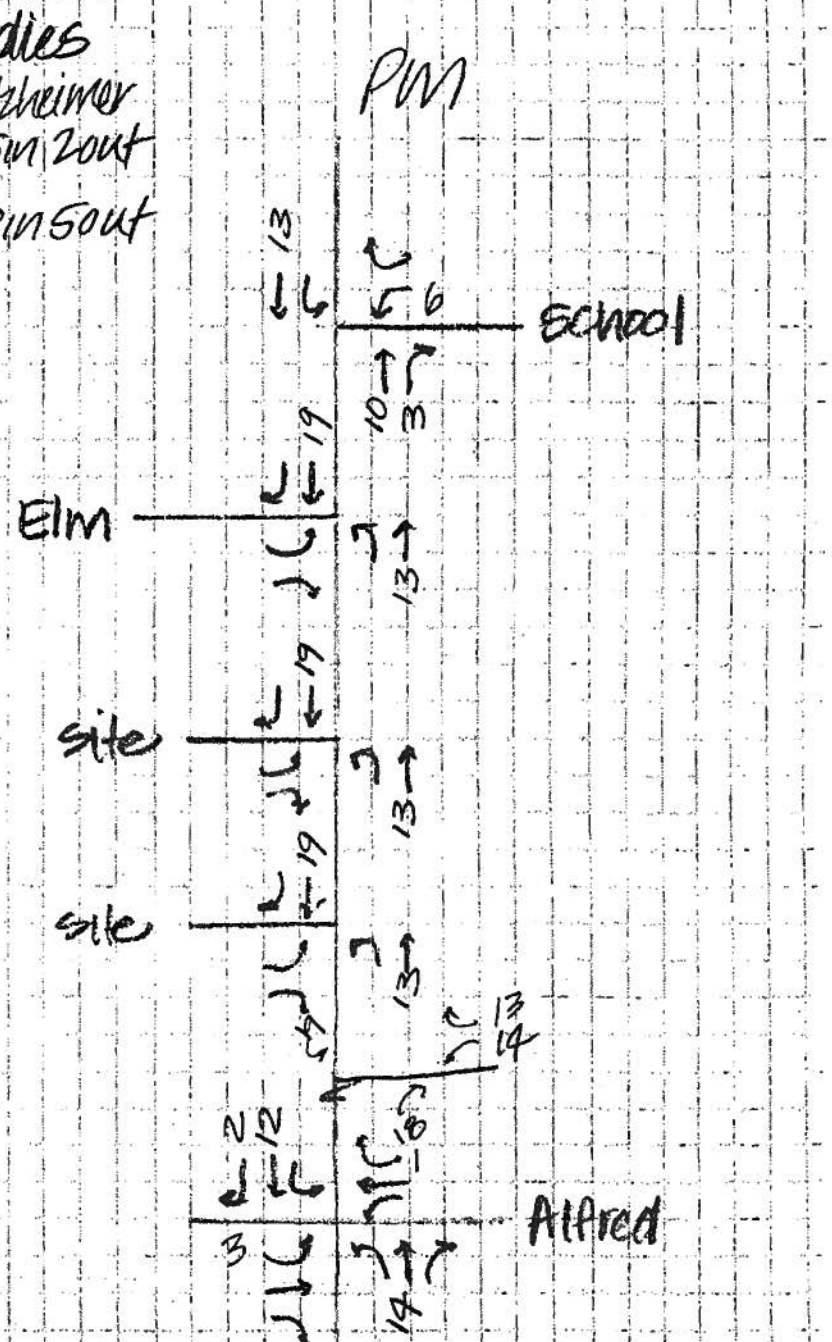
Other Developments

trip gen from studies

	cardo	alzheimer
AM	20 in 31 out	5 in 2 out
PM	19 in 22 out	8 in 5 out

June '201





880 Main St

AM peak trip generation
Dunkin Donuts

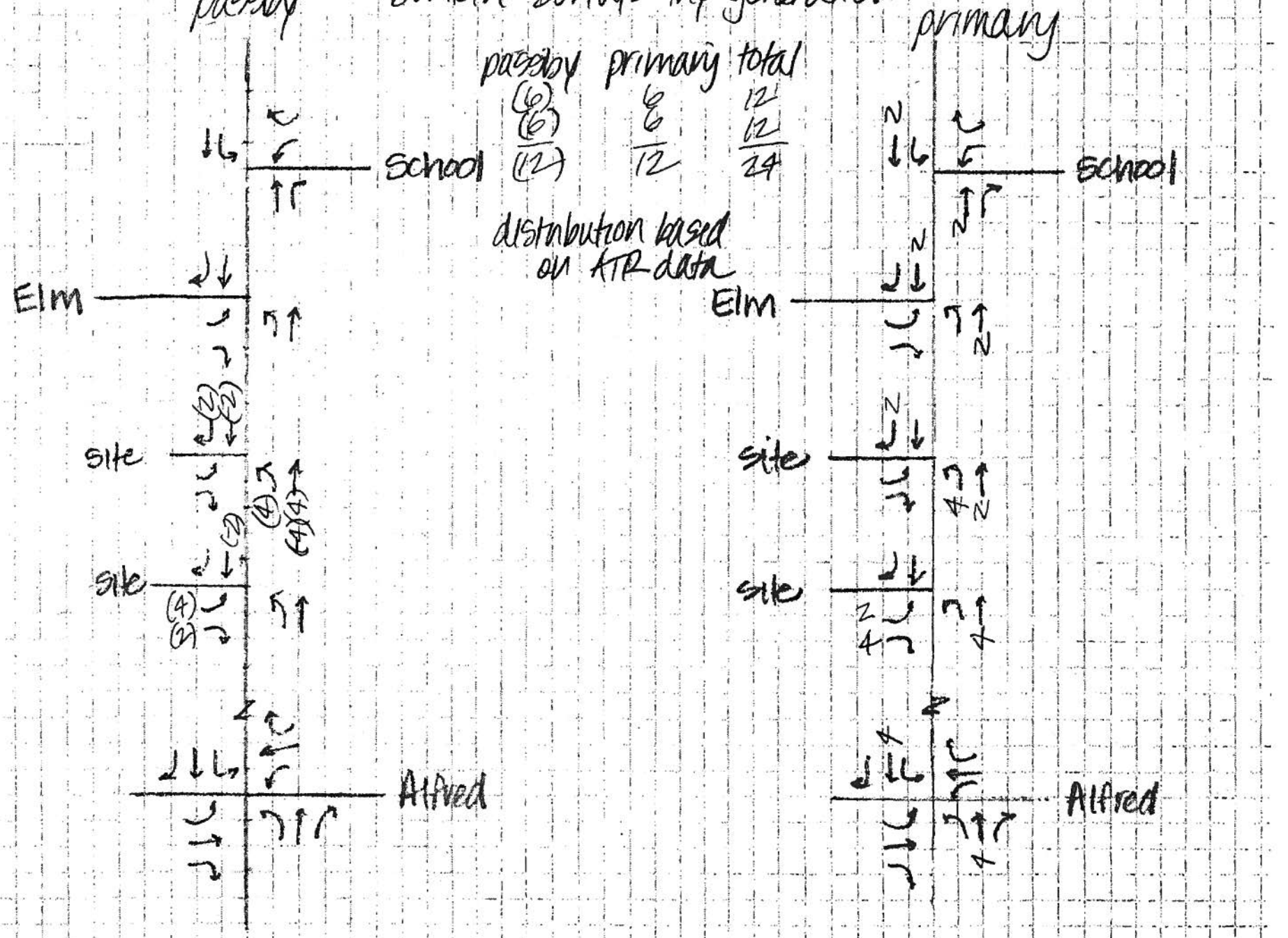
	passby	primary	total
	(31)	8	39
	(31)	8	39
	(62)	16	78

Distribution based on existing DD trips

880 Main St

PM peak hour
Dunkin Donuts trip generation

June 2011



Attachment B

Compiled Crash Data (2008 - 2011)

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Woburn COUNT DATE : Jun-11

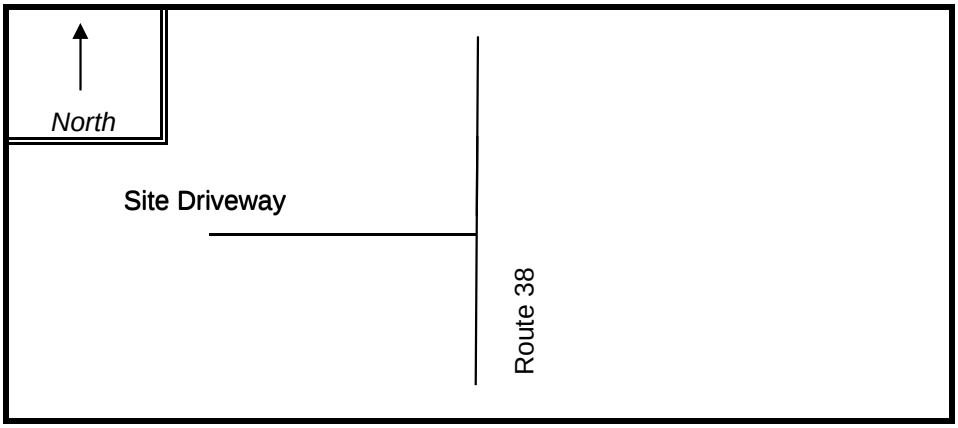
DISTRICT : 4 UNSIGNALIZED : **YES** SIGNALIZED : NO

~ INTERSECTION DATA ~

MAJOR STREET : Route 38

MINOR STREET(S) : Between 1030 and 1080 Main Street

INTERSECTION DIAGRAM (Label Approaches)



Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :						
VOLUMES (PM) :						1,889

" K " FACTOR : **0.072** APPROACH ADT : **26,236** **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF CRASHES : 4 # OF YEARS : 3.83 AVERAGE # OF CRASHES (**A**) : **1.04**

CRASH RATE CALCULATION : **0.11** RATE = $\frac{(A * 1{,}000{,}000)}{(ADT * 365)}$

Comments : K-factor of 0.072 - ratio of the weekday PM peak hour traffic volumes to the daily traffic volume

Project Title & Date:

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Woburn COUNT DATE : Jun-11

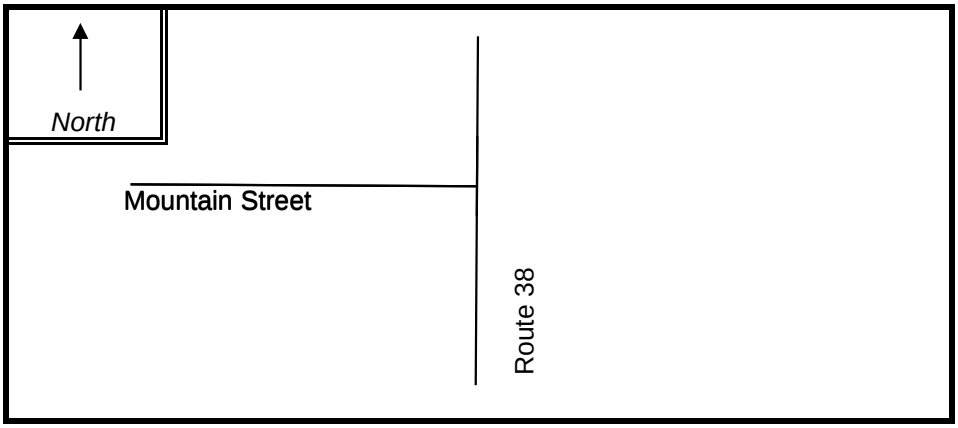
DISTRICT : 4 UNSIGNALIZED : **YES** SIGNALIZED : NO

~ INTERSECTION DATA ~

MAJOR STREET : Route 38

MINOR STREET(S) : Mountain Street

INTERSECTION DIAGRAM (Label Approaches)



Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :						
VOLUMES (PM) :						2,016

" K " FACTOR : **0.072** APPROACH ADT : **28,000** **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF CRASHES : 2 # OF YEARS : 3.83 AVERAGE # OF CRASHES (**A**) : **0.52**

CRASH RATE CALCULATION : **0.05** RATE = $\frac{(A * 1{,}000{,}000)}{(ADT * 365)}$

Comments : K-factor of 0.072 - ratio of the weekday PM peak hour traffic volumes to the daily traffic volume

Project Title & Date:

INTERSECTION CRASH RATE WORKSHEET

CITY/TOWN : Woburn COUNT DATE : Jun-11

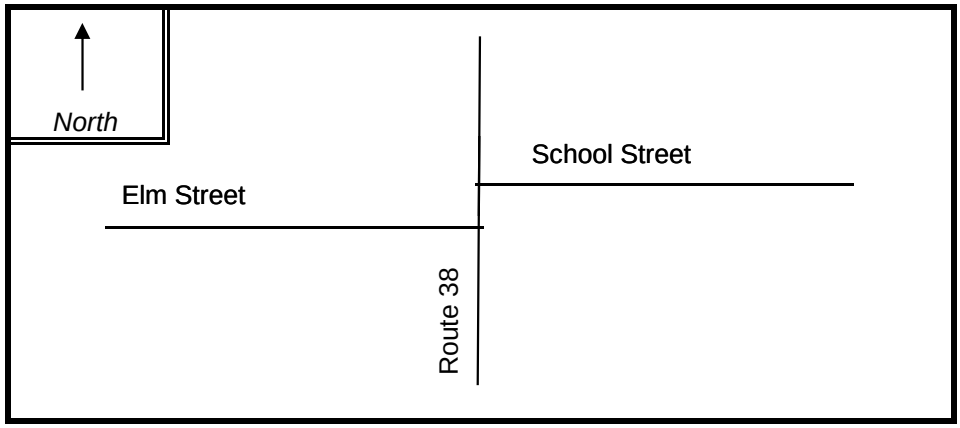
DISTRICT : 4 UNSIGNALIZED : NO SIGNALIZED : **YES**

~ INTERSECTION DATA ~

MAJOR STREET : Route 38

MINOR STREET(S) : School Street

INTERSECTION DIAGRAM (Label Approaches)



Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :						
VOLUMES (PM) :						1,951

" K " FACTOR : **0.072** APPROACH ADT : **27,097** **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF CRASHES : 8 # OF YEARS : 3.83 AVERAGE # OF CRASHES (**A**) : **2.09**

CRASH RATE CALCULATION : **0.21** RATE = $\frac{(A * 1{,}000{,}000)}{(ADT * 365)}$

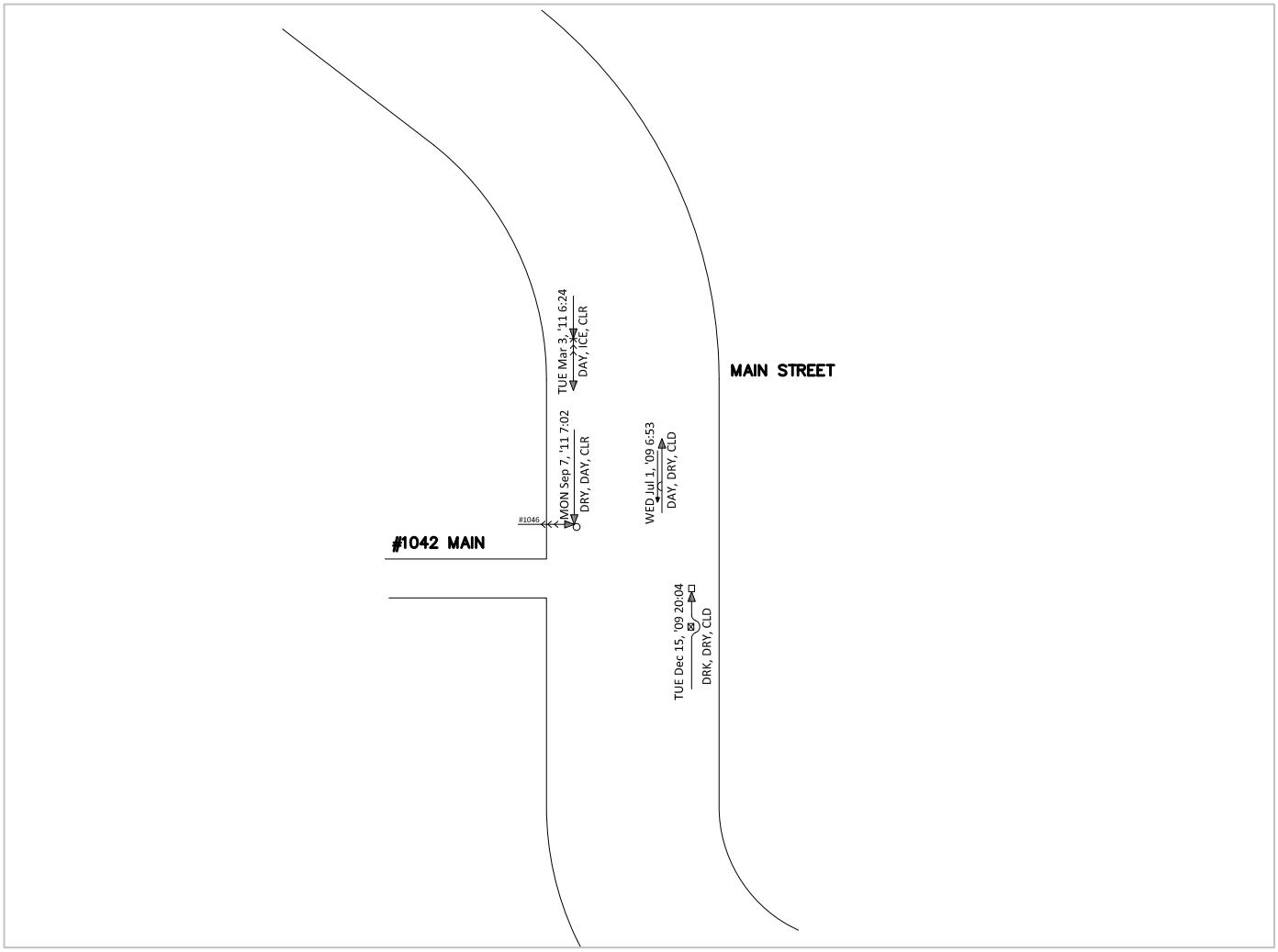
Comments : K-factor of 0.072 - ratio of the weekday PM peak hour traffic volumes to the daily traffic volume

Project Title & Date:

Woburn Heights Redevelopment - Woburn, MA

Not to Scale

LOCATION: MAIN STREET NEAR SITE DRIVEWAY
CITY/STATE: WOBURN, MA
TIME PERIOD: 2008 – 2011
PREPARED BY: TEC, INC. / SAMUEL W. GREGORIO, EIT



LEGEND

- VEHICLE PATH
- BACKING VEHICLE
- SIDESWIPE COLLISION
- PEDESTRIAN COLLISION
- REAR–END COLLISION
- HEAD–ON COLLISION
- ANGLED COLLISION
- FIXED OBJECT COLLISION
- OVERTURNED VEHICLE
- OUT–OF–CONTROL VEHICLE
- FIXED OBJECT
- MOVEABLE OBJECT
- PARKED VEHICLE
- PERSONAL INJURY
- FATALITY
- E EJECTION

SUMMARY OF CRASHES ON DIAGRAM

	REAR–END	SIDESWIPE	HEAD–ON	ANGLED	SINGLE VEH	PED/BIKE	TOTAL
PRP DMG ONLY	1	1	0	0	1	0	3
INJURY	0	0	0	1	0	0	1
FATAL	0	0	0	0	0	0	0
TOTAL	1	1	0	1	1	0	4

SITE CONDITIONS

ROAD CONDITIONS
1. DRY
2. WET
3. SNOW / ICE
4. OTHER

WEATHER CONDITIONS
1. CLEAR
2. RAIN
3. FOR
4. SNOW

LIGHT CONDITIONS
1. DAYLIGHT
2. DAWN / DUSK
3. DARKNESS
4. UNKNOWN

Figure B-1

2008-2011 Collision Diagram

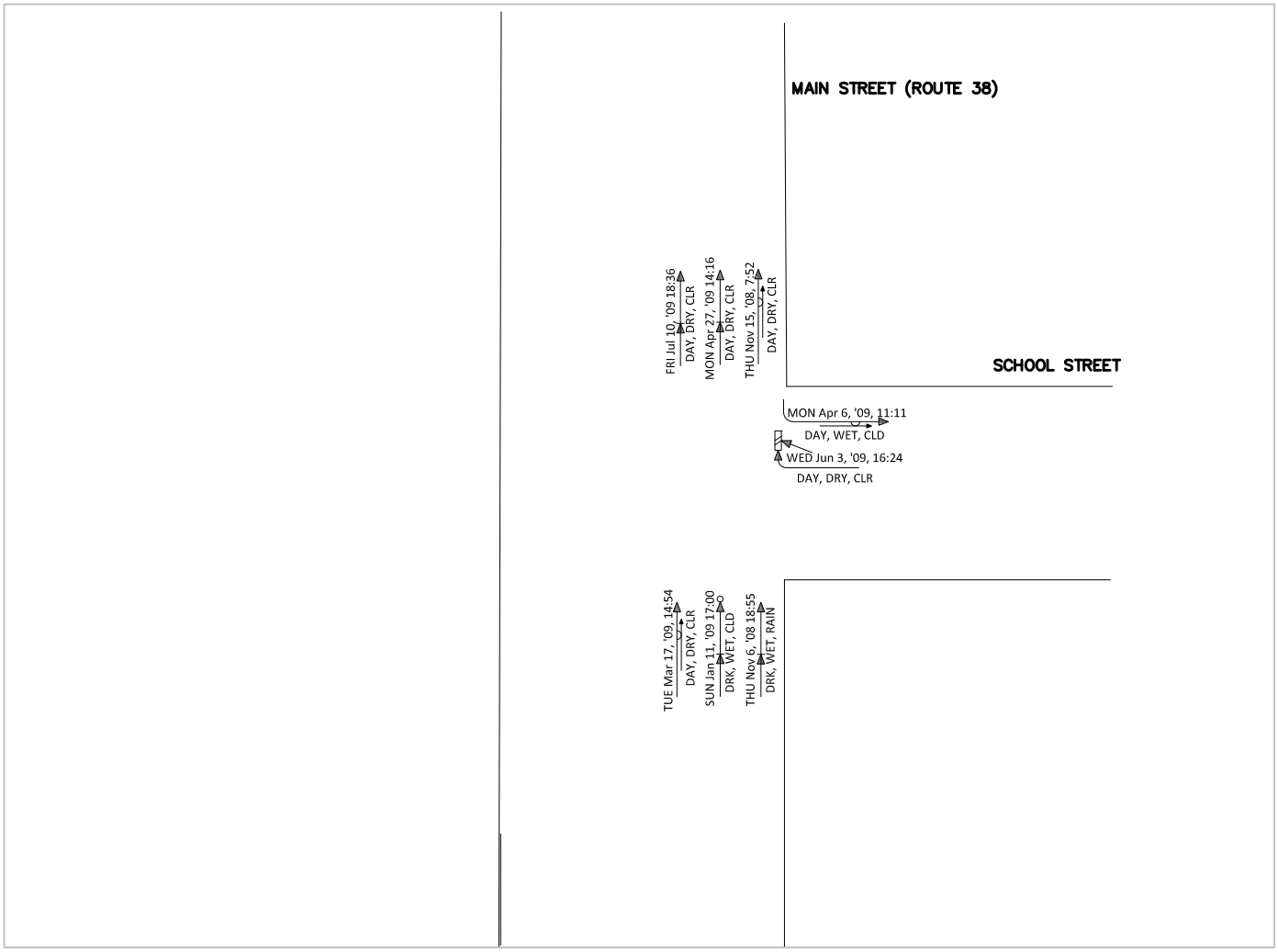
TEC, Inc.

T:\T0413\T0413.01\Tech\Crash Data\T0413.01_Collision Diagram.dwg 11/11/2011 2:58:50 PM EDT

Not to Scale

Woburn Heights Redevelopment - Woburn, MA

LOCATION: MAIN STREET (RT. 38) @ SCHOOL STREET
CITY/STATE: WOBURN, MA
TIME PERIOD: 2008 – 2011
PREPARED BY: TEC, INC. / SAMUEL W. GREGORIO, EIT



LEGEND

- VEHICLE PATH
- BACKING VEHICLE
- SIDESWIPE COLLISION
- PEDESTRIAN COLLISION
- REAR–END COLLISION
- HEAD–ON COLLISION
- ANGLED COLLISION
- FIXED OBJECT COLLISION
- OVERTURNED VEHICLE
- OUT–OF–CONTROL VEHICLE
- FIXED OBJECT
- MOVEABLE OBJECT
- PARKED VEHICLE
- PERSONAL INJURY
- FATALITY
- E EJECTION

SUMMARY OF CRASHES ON DIAGRAM

	REAR–END	SIDESWIPE	HEAD–ON	ANGLED	SINGLE VEH	PED/BIKE	TOTAL
PRP DMG ONLY	3	3	0	1	0	0	7
INJURY	1	0	0	0	0	0	1
FATAL	0	0	0	0	0	0	0
TOTAL	4	3	0	1	0	0	8

SITE CONDITIONS

ROAD CONDITIONS
1. DRY
2. WET
3. SNOW / ICE
4. OTHER

WEATHER CONDITIONS
1. CLEAR
2. RAIN
3. FOR
4. SNOW

LIGHT CONDITIONS
1. DAYLIGHT
2. DAWN / DUSK
3. DARKNESS
4. UNKNOWN

Figure B-3

2008-2011 Collision Diagram

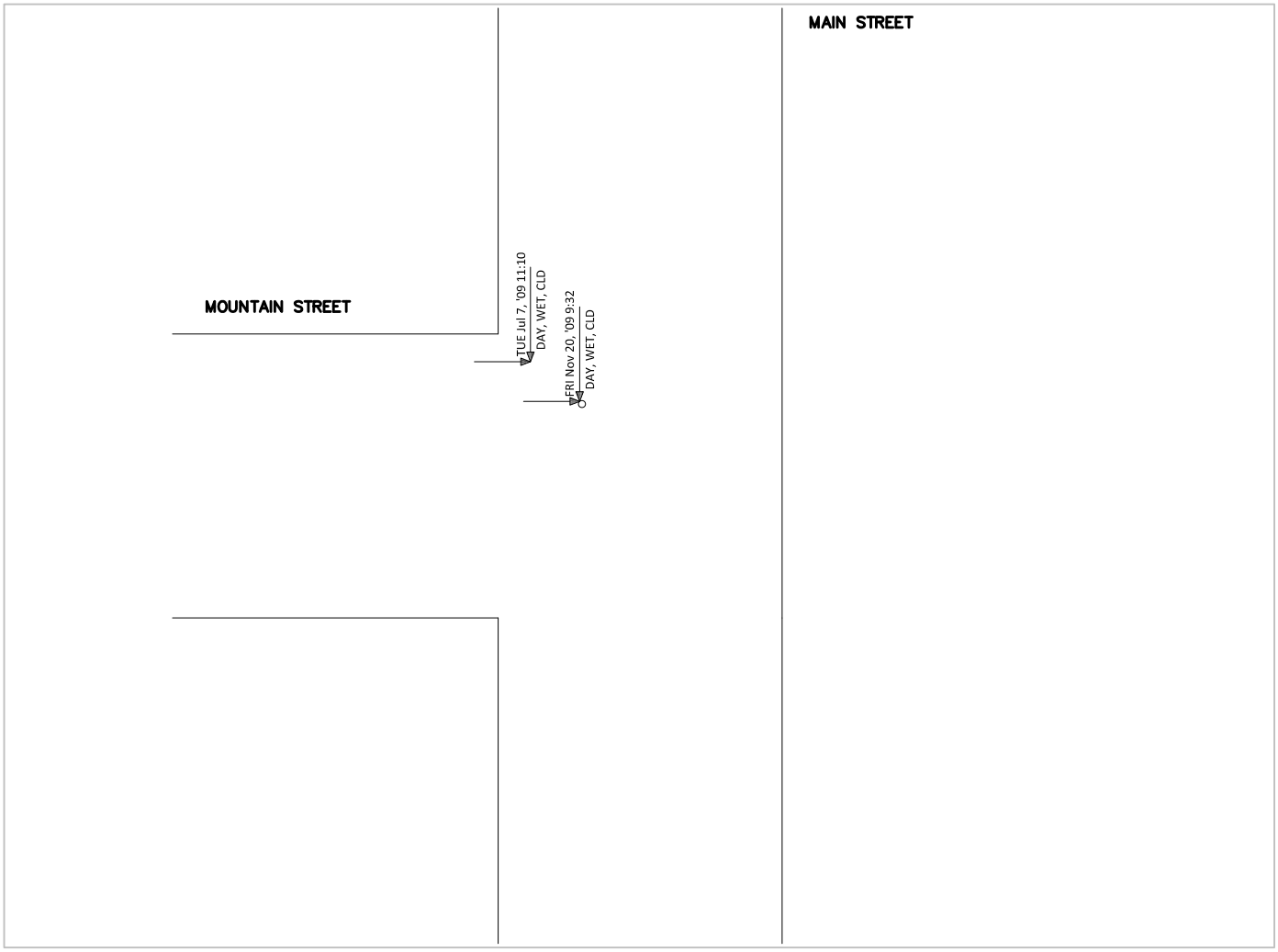
TEC, Inc.

T:\T0413\T0413.01\Tech\Crash Data\T0413.01_Collision Diagram.dwg 11/11/2011 2:58:50 PM EDT

Not to Scale

Woburn Heights Redevelopment - Woburn, MA

LOCATION: MAIN STREET (RT. 38) @ MOUNTAIN STREET
CITY/STATE: WOBURN, MA
TIME PERIOD: 2008 – 2011
PREPARED BY: TEC, INC. / SAMUEL W. GREGORIO, EIT



LEGEND

- VEHICLE PATH
- BACKING VEHICLE
- SIDESWIPE COLLISION
- PEDESTRIAN COLLISION
- REAR–END COLLISION
- HEAD–ON COLLISION
- ANGLED COLLISION
- FIXED OBJECT COLLISION
- OVERTURNED VEHICLE
- OUT–OF–CONTROL VEHICLE
- FIXED OBJECT
- MOVEABLE OBJECT
- PARKED VEHICLE
- PERSONAL INJURY
- FATALITY
- E EJECTION

SITE CONDITIONS

ROAD CONDITIONS
1. DRY
2. WET
3. SNOW / ICE
4. OTHER

WEATHER CONDITIONS
1. CLEAR
2. RAIN
3. FOR
4. SNOW

LIGHT CONDITIONS
1. DAYLIGHT
2. DAWN / DUSK
3. DARKNESS
4. UNKNOWN

SUMMARY OF CRASHES ON DIAGRAM

	REAR–END	SIDESWIPE	HEAD–ON	ANGLED	SINGLE VEH	PED/BIKE	TOTAL
PRP DMG ONLY	0	0	0	1	0	0	1
INJURY	0	0	0	1	0	0	1
FATAL	0	0	0	0	0	0	0
TOTAL	0	0	0	2	0	0	2

Figure B-2

2008-2011 Collision Diagram

TEC, Inc.

T:\T0413\T0413.01\Tech\Crash Data\T0413.01_Collision Diagram.dwg 11/11/2011 2:58:50 PM EDT

Massachusetts Department of Transportation Highway Crash Report for Woburn, 2009

Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Distance from Nearest Roadway Intersection	Non Motorist Type
06-Apr-2009	11:11 AM	Property damage only (none injured)	2	0	0	Sideswipe, opposite direction	V1: Slowing or stopped in traffic / V2:Turning left	V1:Westbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V2:Single-unit truck (2-axle, 6-tire)	Wet	Daylight	Cloudy/Rain	MAIN STREET / SCHOOL STREET		
07-Jul-2009	11:10 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2:Entering traffic lane	V1:Southbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Wet	Daylight	Cloudy/Rain	MAIN STREET Rte 38 S / MOUNTAIN STREET		
10-Jul-2009	6:36 PM	Property damage only (none injured)	2	0	0	Rear-end	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:Northbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear	MAIN STREET / SCHOOL STREET		
20-Nov-2009	9:32 AM	Non-fatal injury	2	2	0	Angle	V1: Turning left / V2:Travelling straight ahead	V1:Eastbound / V2:Southbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Wet	Daylight	Cloudy/Rain	MAIN STREET / MOUNTAIN STREET		

Massachusetts Department of Transportation Highway Crash Report for Woburn, 2008

Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Distance from Nearest Roadway Intersection	Non Motorist Type
23-May-2008	12:21 PM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:Northbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Other	Dry	Daylight	Clear		1025 MAIN STREET	
06-Nov-2008	6:55 PM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2:Not reported	V1:Northbound / V2:Not reported	V1: Collision with motor vehicle in traffic / V2: Not reported	V1: Passenger car / V2:Not reported	Wet	Dark - lighted roadway	Rain	MAIN STREET / SCHOOL STREET		
20-Nov-2008	10:37 AM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:Northbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Daylight	Cloudy		1001 MAIN STREET	