

# ***Devens Traffic Monitoring Program 2012 Biennial Traffic Report Devens, Massachusetts***

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# EXECUTIVE SUMMARY

## Introduction

This 2012 Traffic Study Report is the ninth in a series of Traffic Monitoring Reports conducted for Devens and the surrounding communities. The purpose of this study is to observe and quantify current traffic patterns in and around Devens that may have changed given the redevelopment of the former military base. This study focuses on comparing current traffic volumes with those projected in the 1994 Environmental Impact Report (EIR) and those observed in previous Reuse Plan Traffic Monitoring Reports.

The study area was identified as part of the EIR and comports with the previous studies, and includes the communities of Shirley, Ayer, Harvard, Lancaster, Lunenburg, Groton, Littleton, and Boxborough.

## Data Collection

Traffic data were collected during Spring 2012 in the study area in order to develop an understanding of traffic operations at critical roadways and intersections within the study area. The following data were collected for this study:

- Intersection turning movement and vehicle classification counts at 14 locations outside of Devens during the 7-9 AM and 4-6 PM peak periods. The peak hour traffic volumes occurring during one hour (peak hour) were identified for each intersection for both the morning and evening peak periods. The peak hour traffic volumes were used to perform intersection level-of-service (LOS) capacity analyses.
- Vehicle volume and classification counts were performed for 48 consecutive hours along 14 roadways within Devens and in the surrounding communities. The counts have been used to determine Average Weekday Traffic Volumes on study roadways.
- Vehicle volume and classification counts were performed for seven consecutive days along six roadways in communities surrounding Devens. The counts have been used to determine Average Weekday and Weekend Traffic Volumes on study roadways.
- Devens development data were collected to make trip generation estimates for the planned community. The trip estimates were compared with actual traffic count data to assess the level of Devens' trip making on surrounding roadways compared to typical development levels.

## Findings

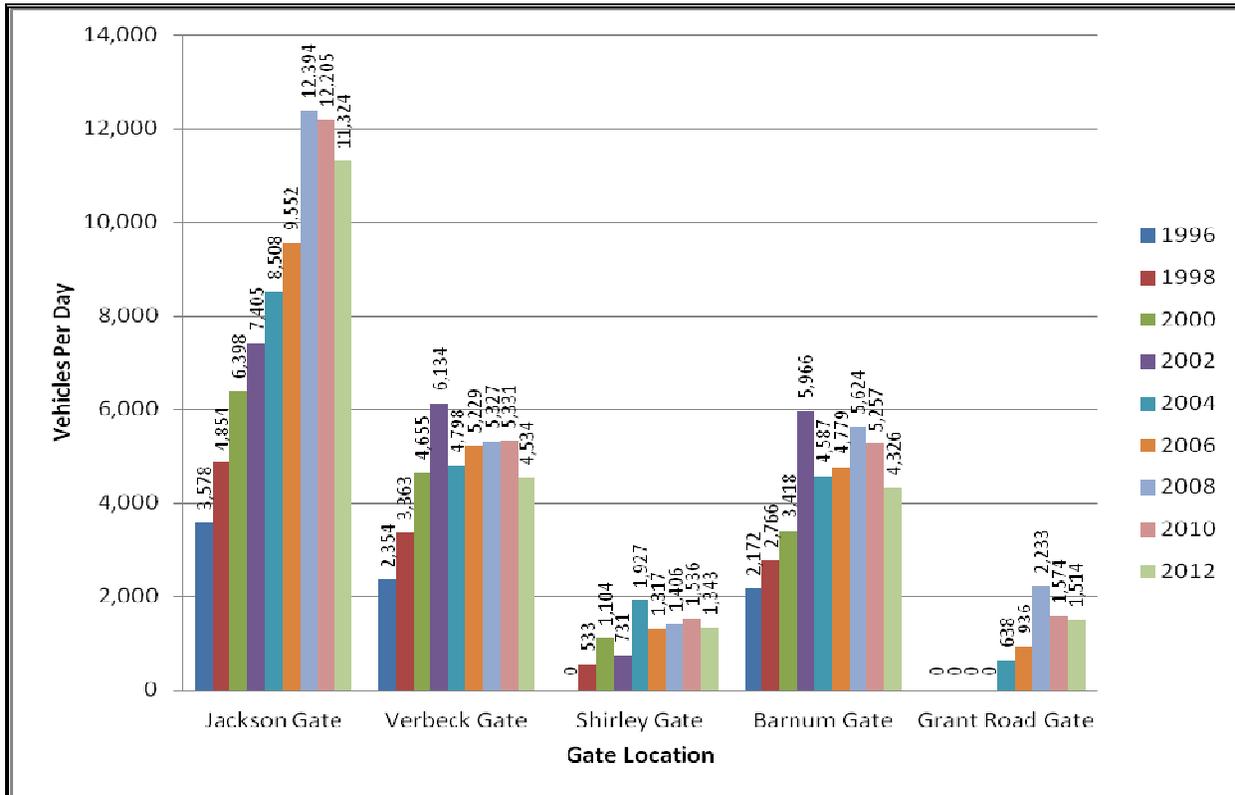
To evaluate the 2012 conditions, the traffic volume data and capacity analysis results were compared to previous reports, including the 2010 and 1996 (baseline) report. The findings include:

- The occupied development in Devens has increased from 3,662,758 square feet in 2010 to 4,139,959 square feet in 2012. Unlike in years past, when increases in occupied development were due to new construction, this year's increase is mainly due to occupation of properties previously unoccupied in 2010.
- Average weekday traffic volumes on the surrounding numbered routes (Routes 2, 2A/110, and 110/111) have increased by 14% since 1996 but are currently decreasing from their peak in 2004

at an average rate of 2.4% per year, indicating that Devens-generated traffic is not significantly affecting volumes on Route 2. Planning studies commonly assume a background growth rate of about 1% per year.

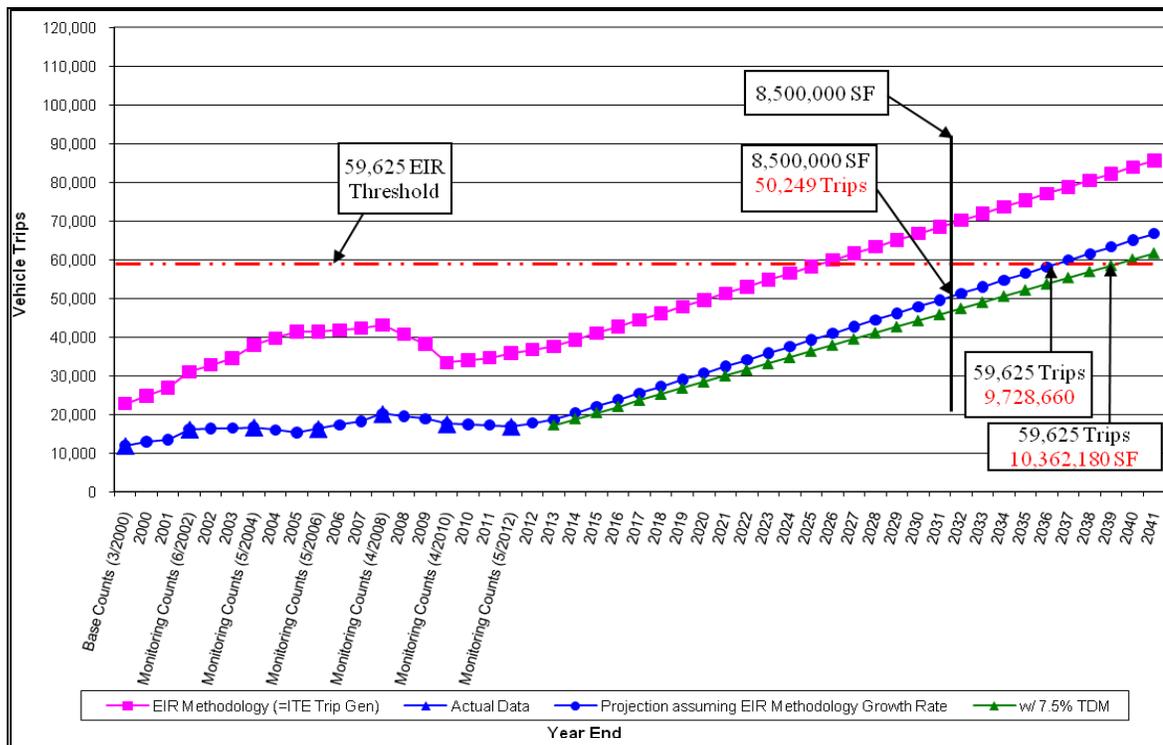
- Average weekday traffic volumes (internal and external) are up a total of 0.5% since 1996 but are currently declining from their 2004 peak at an average rate of 1.4% per year. Over the last two years, the decline has been even steeper: 4% per year.
- Cumulative average weekday traffic volumes on local roadways (outside of Devens) are down 6% since 1996. Volumes peaked in 2004 but have decreased by approximately 2% per year since then. The decline has increased to 3 percent per year from 2010 to 2012. There are some isolated roadways and intersections that have shown an increase in traffic volumes since 2010 (see table 2-3), but, overall, this pattern indicates that Devens-generated traffic is not significantly affecting traffic volumes on local roadways.
- Study intersection traffic volumes (outside of Devens) are down 0.6% in the AM peak and down 8.2% in the PM peak since 1996. During that period, peak traffic volumes have been flat with only minor year-to-year fluctuations. Since the 2010 study, volumes have decreased by 1.7% during the AM peak hour and 3.9% during the PM peak hour.
- Traffic volumes through the five Devens' gates experienced decreased average weekday traffic volumes between 2010 and 2012 (Figure ES-1). Devens' gate average weekday traffic volumes have decreased by about eleven percent over the past two years. Volumes through all Devens' gates have increased by 184% since 1996.

**Figure ES-1: Average Weekday Daily Traffic – Devens Gates**



- The average total weekday daily truck traffic volumes through all Devens gates have increased by 27 percent since 2010, but remain much lower than volumes observed in 2004/2006/2008. Barnum and Jackson gates continue to serve the highest volumes of heavy vehicles.
- Daily vehicle trips generated by Devens development were estimated using Institute of Transportation Engineers (ITE) trip generation rates. The current 4,139,959 square feet of development in 2012 is estimated to generate about 35,900 daily trips. When compared to the actual trips generated counted through Devens gates (15,668), this indicates that Devens development is generating off-site traffic at a rate of 44 percent of that to a comparable development's tripmaking activity.
- Based on discussions with the MassDevelopment Real Estate Office, much of the remaining development in Devens will consist of smaller research and development land uses. It is assumed that development at Devens will proceed, on average, at 225,000 square feet per year, mainly consisting of research and development type facilities. Based on measured traffic volume data, the current development, and projected development patterns noted above, the EIR trip threshold of 59,625 trips per day would not be reached until 2036 (Figure ES-2). Implementation of traffic demand management techniques (TDM) projects this threshold to be met in 2039.

**Figure ES-2: Devens Build-Out Summary by Year - Trips**



- Intersection LOS analyses were performed at 14 study intersections for the AM and PM peak hours using methodologies explained in the 2000 *Highway Capacity Manual*. The results indicate that, between 1996 and 2012, two intersection experienced an improved LOS, six intersections experienced no LOS change, three study intersections deteriorated by only one level, and three intersections have deteriorated by more than one level. It should be noted that a portion of this LOS degradation occurred between 2008 and 2012 when the number of trips generated by Devens was decreasing.

# 1. INTRODUCTION

## 1.1. Project Purpose and Goals

The 1995 Devens Final Environmental Impact Report (EIR) was issued by the Department of the Army for the disposal and reuse of Fort Devens as a mixed use planned community, currently known as Devens. MassDevelopment (formerly Massachusetts Government Land Bank) is the exclusive public agency responsible for the maintenance, control, and redevelopment of the community and has committed to a traffic monitoring program to study the vehicular growth resulting from development within Devens.

This 2012 Biennial Traffic Report is the ninth in a series of Traffic Monitoring Reports conducted for Devens and the surrounding communities. The purpose of this study is to report and comment on current traffic patterns in and around Devens, resulting from the redevelopment of the former military base. This study focuses on comparing current traffic volumes with those projected in the 1994 EIR and those observed in previous Reuse Plan Traffic Monitoring Reports. In addition, this study forecasts traffic volumes based on known future development and identifies when build-out thresholds are expected to be surpassed.

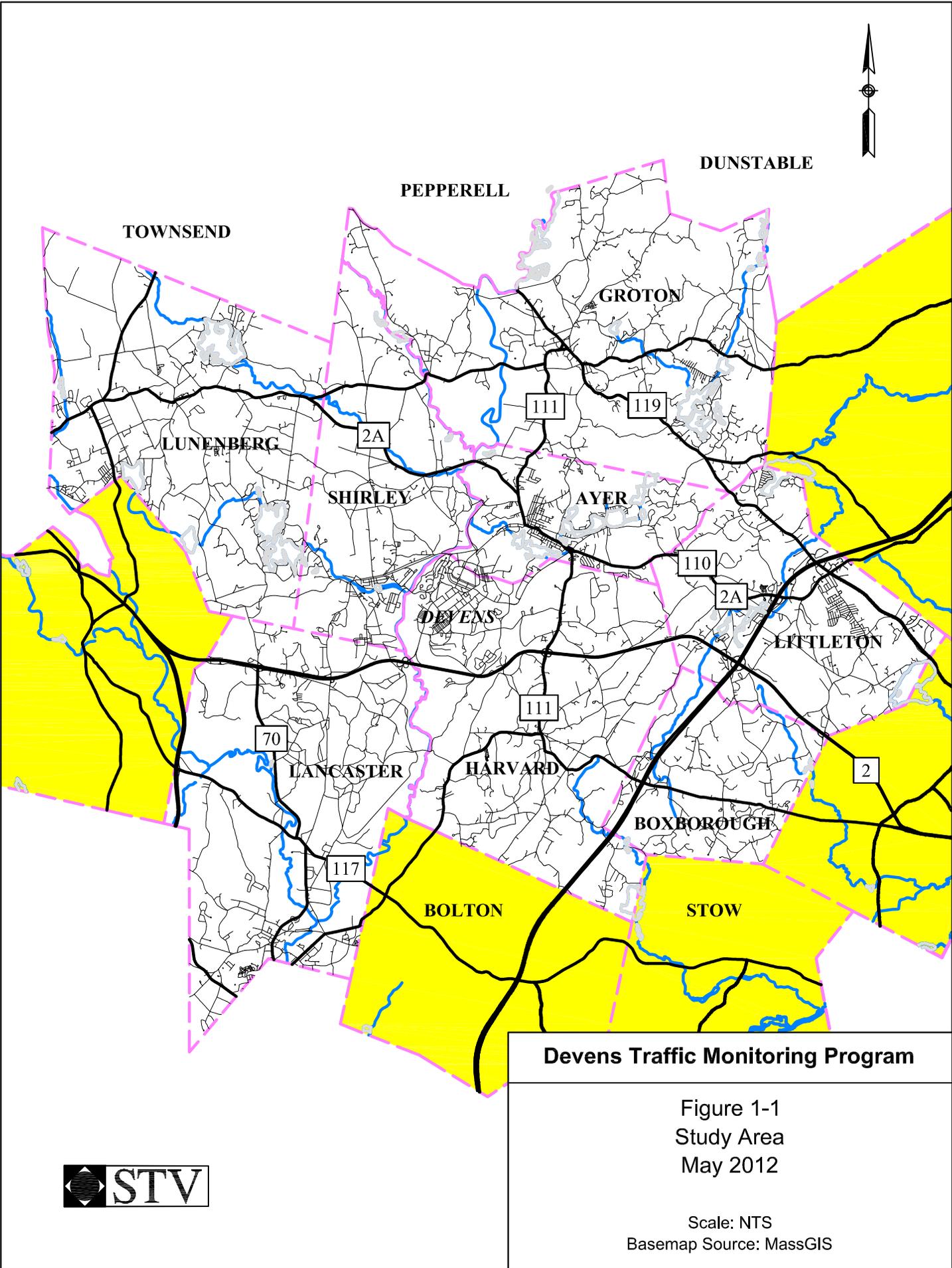
## 1.2. Study Area

The study area is based on those established in the two previous Devens 5-Year Traffic Reports (Figure 1-1). Devens is located completely within the host towns of Ayer, Shirley, Lancaster, and Harvard, Massachusetts. The bordering towns of Boxborough, Groton, Littleton, and Lunenburg were included in the study area as potentially affected communities.

## 1.3. Scope of Work

The following tasks were completed in this study:

- Conduct comprehensive traffic volumes counts;
- Conduct a Build-Out Analysis for Devens;
- Update Devens-Area Traffic Model;
- Conduct Level-of-Service (LOS) Analyses for Existing 2012 Conditions.





## 2. TRAFFIC DATA COLLECTION

### 2.1. Overview

Current traffic data were collected in the study area in order to develop an understanding of existing traffic conditions at critical roadways and intersections in the study area. The following traffic data were collected for this study:

- Intersection turning movement counts at intersection located outside of Devens
- Roadway volume and vehicle classification counts on roadways external to Devens

Intersection turning movement counts and average daily traffic counts were completed at locations external (Figure 2-1) to Devens, as required by the Memorandum of Understanding with the Massachusetts Highway Department.

### 2.2. Intersection Turning Movement Counts

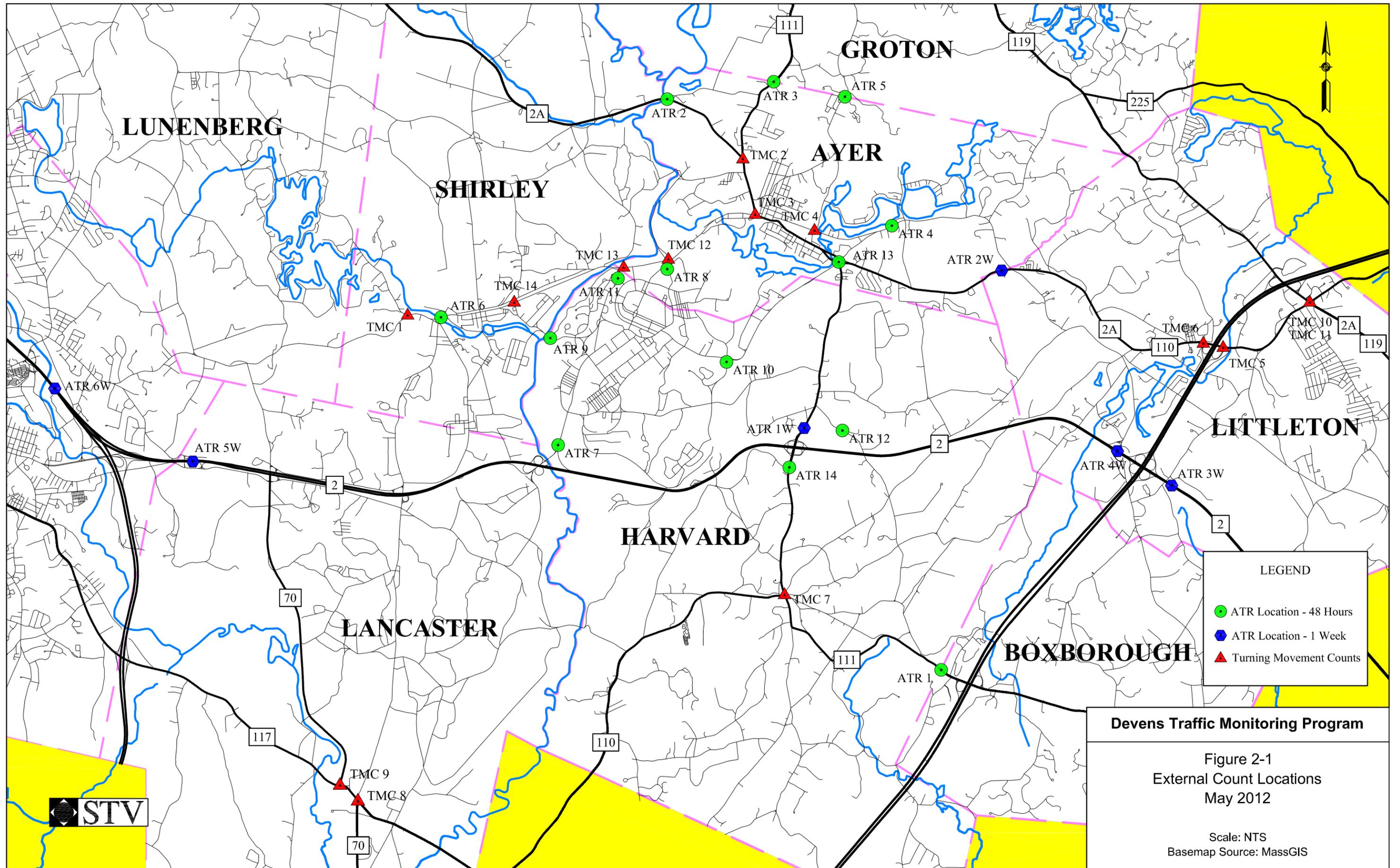
Existing intersection traffic volumes were collected during weekday 7-9 AM and 4-6 PM peak periods at locations consistent with the previous traffic monitoring studies. The intersection numbering system used in this study has been maintained from previous studies for consistency.

Intersection turning movement counts and vehicle classification at locations in the towns surrounding Devens were completed on May 2<sup>nd</sup> and 3<sup>rd</sup>, 2012 at the following locations:

<b>ID</b>	<b>Intersection</b>	<b>Town</b>	<b>Date</b>
1	Front Street/Lancaster Street/Leominster Road/Center Road	Shirley	5/2/2012
2	Park Street/Fitchburg Road/Groton School Road	Ayer	5/2/2012
3	Park Street/Main Street/West Main Street	Ayer	5/2/2012
4	Groton-Harvard Road/Central Avenue	Ayer	5/2/2012
5	Route 2A-110/I-495 Exit 30 Northbound (NB) Ramps	Littleton	5/3/2012
6	Route 2A-110/I-495 Exit 30 Southbound (SB) Ramps	Littleton	5/3/2012
7	Route 110-111 (Ayer Road)/Route 110 (Still River Road)/Route 111	Harvard	5/3/2012
8	Route 70/117 (Seven Bridge Road)	Lancaster	5/3/2012
9	Route 70/117 (Lunenburg Road)	Lancaster	5/3/2012
10	Route 110 (King Street)/Route 119/Route 2A (Great Road)	Littleton Common	5/3/2012
11	Route 2A-110 (King Street)/Goldsmith Street	Littleton Common	5/3/2012
12	Verbeck Gate/MacPherson Road	Ayer	5/2/2012
13	Grant Road/West Main Street	Ayer	5/2/2012
14	Hospital Road/Front Street	Shirley	5/2/2012

A summary of all AM and PM peak hour intersection volumes with comparisons are shown in Figures 2-2 and 2-3 and listed in Tables 2-1 and 2-2, respectively.





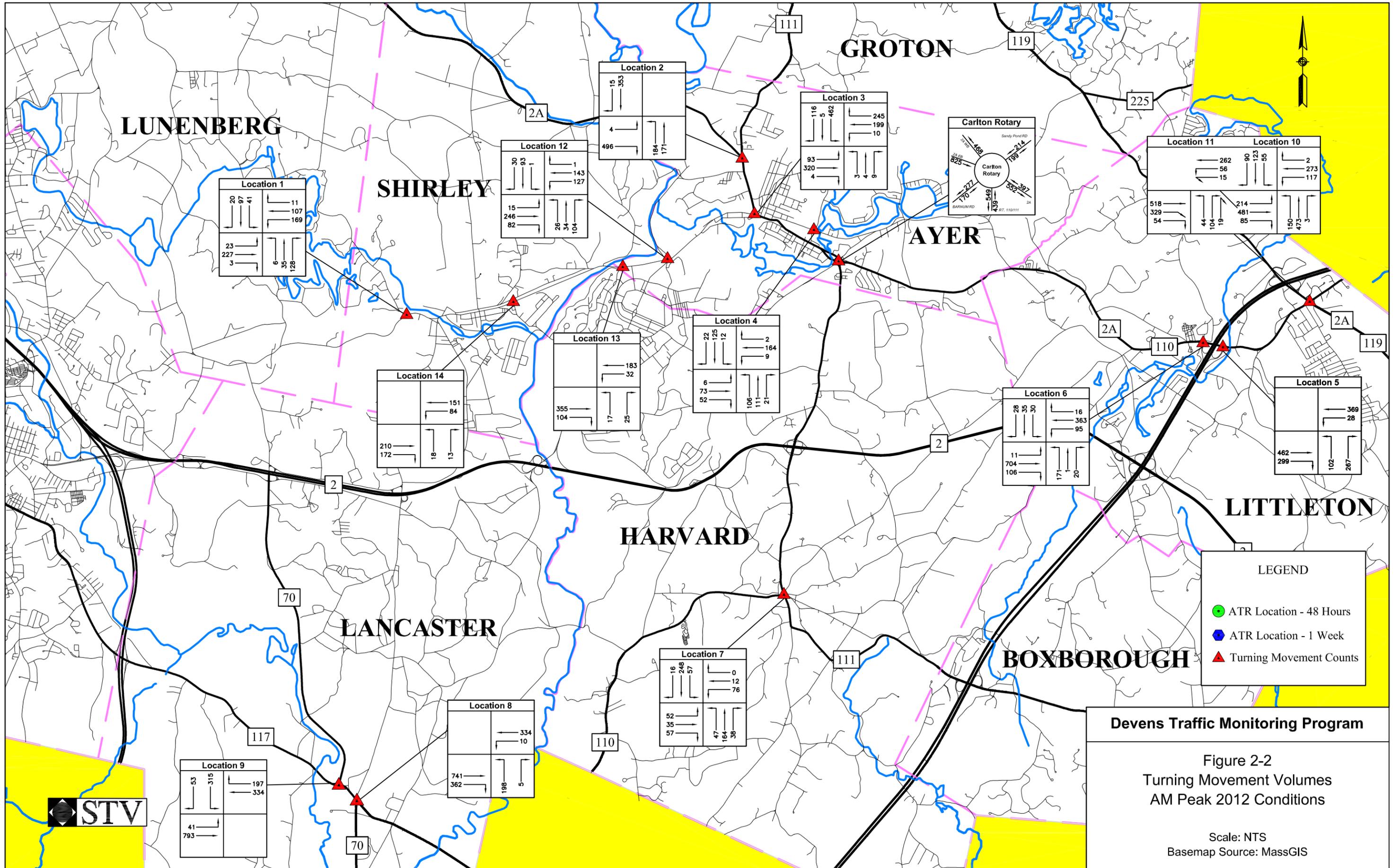


**Table 2-1 Total Intersection Volumes (vph) – AM Peak Hour**

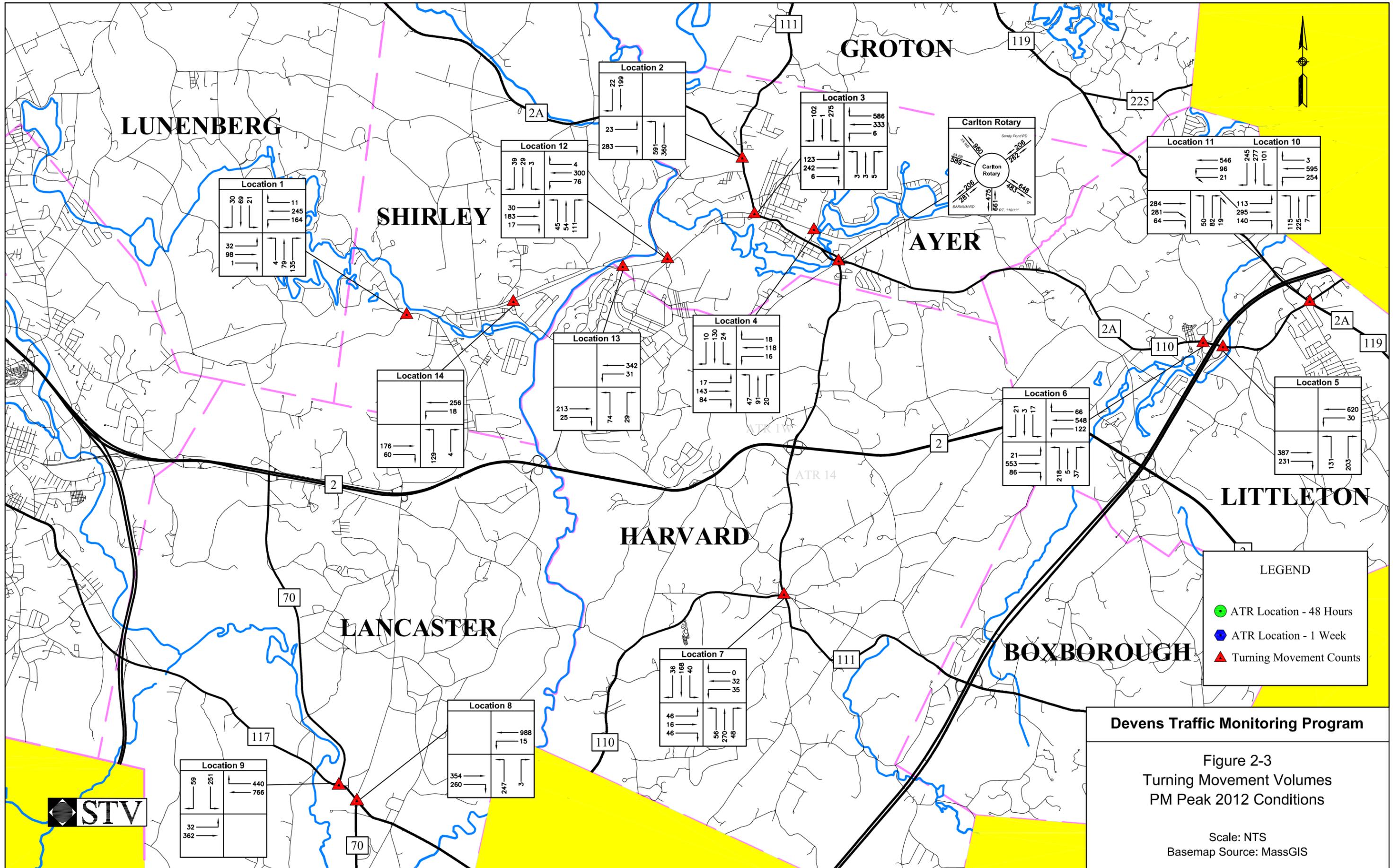
<b>Devens Traffic Monitoring Program</b>									
<b>Total Intersection Volume Summary</b>									
<b>AM Peak Hour</b>									
Intersection	1996 AM Baseline Pk. Hr. (vph)	1998 AM Pk. Hr. (vph)	2000 AM Pk. Hr. (vph)	2002 AM Pk. Hr. (vph)	2004 AM Pk. Hr. (vph)	2006 AM Pk. Hr. (vph)	2008 AM Pk. Hr. (vph)	2010 AM Pk. Hr. (vph)	<b>2012 AM Pk. Hr. (vph)</b>
1. Front St./Lancaster St./Leominster Rd./Center Rd., Shirley	802	861	803	738	761	815	838	841	<b>867</b>
2. Park St./Fitchburg Rd./Groton School Rd., Ayer	1210	1241	1157	1239	1146	1196	1238	1220	<b>1223</b>
3. Park St./Main St./West Main St., Ayer	1492	1556	1361	1442	1372	1578	1504	1448	<b>1470</b>
4. Groton-Harvard Rd./Central Ave., Ayer	864	941	880	990	869	782	801	737	<b>703</b>
5. Route 2A-110 (King St.)/I-495 Exit 30 NB Ramps, Littleton	1555	1703	1833	1941	1482	1462	1472	1559	<b>1527</b>
6. Route 2A-110 (King St.)/I-495 Exit 30 SB Ramps, Littleton	1539	1714	1830	1782	1583	1657	1578	1631	<b>1580</b>
7. Route 110-111 (Ayer Rd.)/Route 110/Route 111, Harvard	818	952	833	823	875	891	949	844	<b>802</b>
8. Route 70/Route 117 (Seven Bridge Rd.), Lancaster	1452	1582	1616	1597	1564	1621	1760	1620	<b>1666</b>
9. Route 70/Route 117 (Lunenburg Rd.), Lancaster	1471	1581	1652	1649	1608	1664	1818	1681	<b>1733</b>
10. Route 110 (King St.)/Route 119/Route 2A, Littleton Common	2085	2196	2225	2382	2180	1873	1921	1825	<b>2066</b>
11. Route 2A-110 (King St.)/Goldsmith St., Littleton Common	1469	1667	1674	1638	1449	1213	1319	1138	<b>1401</b>
12. Verbeck Gate/MacPherson Rd., Ayer	774	710	888	1014	916	1094	1062	883	<b>902</b>
13. Grant Rd./West Main St., Ayer	n/a	n/a	n/a	n/a	637	625	777	649	<b>716</b>
14. Hospital Rd./Front St., Shirley	n/a	n/a	n/a	n/a	668	553	671	624	<b>648</b>

**Table 2-2 Total Intersection Volumes (vph) – PM Peak Hour**

Devens Traffic Monitoring Program Total Intersection Volume Summary PM Peak Hour									
Intersection	1996 PM Baseline Pk. Hr. (vph)	1998 PM Pk. Hr. (vph)	2000 PM Pk. Hr. (vph)	2002 PM Pk. Hr. (vph)	2004 PM Pk. Hr. (vph)	2006 PM Pk. Hr. (vph)	2008 PM Pk. Hr. (vph)	2010 PM Pk. Hr. (vph)	<b>2012 PM Pk. Hr. (vph)</b>
1. Front St./Lancaster St./Leominster Rd./Center Rd., Shirley	953	779	847	782	850	776	889	815	<b>899</b>
2. Park St./Fitchburg Rd./Groton School Rd., Ayer	1353	1523	1447	1487	1482	1450	1414	1381	<b>1478</b>
3. Park St./Main St./West Main St., Ayer	1721	1547	1698	1646	1699	1804	1754	1689	<b>1685</b>
4. Groton-Harvard Rd./Central Ave., Ayer	841	956	904	960	854	796	765	693	<b>718</b>
5. Route 2A-110 (King St.)/I-495 Exit 30 NB Ramps, Littleton	1675	1711	1656	1927	1737	1893	1647	1514	<b>1548</b>
6. Route 2A-110 (King St.)/I-495 Exit 30 SB Ramps, Littleton	1844	1705	1814	1981	1853	1959	1733	1655	<b>1697</b>
7. Route 110-111 (Ayer Rd.)/Route 110/Route 111, Harvard	869	1135	668	642	710	609	822	592	<b>793</b>
8. Route 70/Route 117 (Seven Bridge Rd.), Lancaster	1614	1685	1657	1570	1636	1677	1793	1730	<b>1877</b>
9. Route 70/Route 117 (Lunenburg Rd.), Lancaster	1578	1800	1679	1600	1650	1720	1825	1787	<b>1910</b>
10. Route 110 (King St.)/Route 119/Route 2A, Littleton Common	2809	2880	2574	2871	2717	2450	2499	2304	<b>2370</b>
11. Route 2A-110 (King St.)/Goldsmith St., Littleton Common	1758	1724	1588	1840	1683	1521	1600	1440	<b>1443</b>
12. Verbeck Gate/MacPherson Rd., Ayer	726	669	926	959	936	1093	1010	924	<b>884</b>
13. Grant Rd./West Main St., Ayer	n/a	n/a	n/a	n/a	662	617	890	713	<b>714</b>
14. Hospital Rd./Front St., Shirley	n/a	n/a	n/a	n/a	604	591	676	610	<b>643</b>









## 2.3.Average Daily Traffic Counts

Automatic traffic recorder (ATR) machines were used to collect 48-hour and seven-day traffic volume and vehicle classification counts on study roadways consistent with the previous studies. ATR machines were configured to collect heavy vehicle volumes, including the 13 different Federal Highway Administration (FHWA) vehicle classifications. The FHWA vehicles that were classified as trucks include buses; 2 Axle 6 Tire; 3 Axle Single; 4 Axle Single; <5 Axle Double; 5 Axle Double; >6 Axle Double; <6 Axle Multi; 6 Axle Multi; and >6 Axle Multi vehicles.

### 2.3.1. 48-Hour ATR Counts

These counts were included as part of the traffic monitoring program compare the daily and hourly directional traffic on critical study area roadways. These counts were conducted at 14 locations between 5/8/2012-5/10/2012; however some locations were recounted at later date due to malfunctions with the automatic traffic recorder. Counts were taken at the following locations:

<b>ID</b>	<b>Location</b>	<b>Date</b>
1	Route 111 at Boxborough/Harvard Town Line	5/9/2012-5/10/2012
2	Route 2A at Ayer/Shirley Town Line	5/9/2012-5/10/2012
3	Route 111 at Ayer/Groton Town Line	5/15/2012-5/16/2012
4	Sandy Pond Road east of Central Avenue, Ayer	5/9/2012-5/10/2012
5	Groton-Harvard Road at Ayer/Groton Town Line	5/9/2012-5/10/2012
6	Front Street west of Ayer Street, Shirley	5/8/2012-5/9/2012
7	Jackson Gate	5/8/2012-5/9/2012 5/15/2012-5/16/2012
8	Verbeck Gate	5/8/2012-5/9/2012
9	Shirley Gate (between Frost Street and Elliot Road)	5/8/2012-5/9/2012
10	Barnum Gate (east of railroad bridge)	5/8/2012-5/9/2012
11	Grant Road Gate	5/8/2012-5/9/2012
12	Poor Farm Road east of Route 110/111, Harvard	5/9/2012-5/10/2012
13	Carlton Rotary (all approaches and exits)	5/8/2012-5/9/2012 5/15/2012-5/16/2012 5/23/2012-5/24/2012
14	Route 110/111 south of Route 2, Harvard	5/9/2012-5/10/2012

A summary of the average weekday daily traffic volumes (AWDT) and peak hour traffic volumes on the study roadways is provided in the following table (Tables 2-3 through 2-5).

As shown in Table 2-3, all of the Devens' gates (Jackson Road, Verbeck, Shirley, Barnum, and Grant Road) experienced decreased average weekday traffic volumes between 2010 and 2012. Devens' gate average weekday traffic volumes have decreased between ten and 20 percent over the past two years. Traffic volumes on other roadways external to Devens have generally followed the same trend as Devens' gates, either stabilizing or decreasing five to 15 percent between 2010 and 2012

**Table 2-3: Average Weekday Daily Traffic (AWDT) – 48-Hour Counts**

Location Number	Location	AWDT 1996	AWDT 1998	AWDT 2000	AWDT 2002	AWDT 2004	AWDT 2006	AWDT 2008	AWDT 2010	AWDT 2012
	<b>48-Hour ATR Counts</b>									
1	Route 111 at Boxborough /Harvard Town Line	4,480	n/a	4,859	5,508	6,847	5,298	4,899	4,968	<b>6,118</b>
2	Route 2A at Ayer/Shirley Town Line	9,316	8,643	7,667	8,537	8,465	7,845	7,109	9,397	<b>7,346</b>
3	Route 111 at Ayer/Groton Town Line	6,482	5,497	5,120	5,764	5,609	6,102	5,553	6,684	<b>5,482</b>
4	Sandy Pond Road east of Central Avenue, Ayer	5,529	n/a	5,907	5,939	5,921	5,855	5,869	5,760	<b>6,120</b>
5	Groton-Harvard Road at Ayer/Groton Town Line	4,922	n/a	4,705	5,602	6,064	5,376	4,788	4,838	<b>4,233</b>
6	Front Street west of Ayer Street, Shirley	5,651	5,790	5,509	5,872	5,677	5,716	6,398	5,291	<b>5,020</b>
7	Jackson Gate	3,578	4,854	6,398	7,405	8,508	9,552	12,394	12,205	<b>11,324</b>
	From Route 2 WB Off Ramp to Jackson Road NB							2,024	2,062	<b>1,869</b>
	From Route 2 EB Off Ramp to Jackson Road NB							4,296	4,505	<b>3,821</b>
	From Jackson Road SB to Route 2 WB On Ramp							4,285	4,299	<b>3,812</b>
	From Jackson Road SB to Route 2 EB On Ramp							1,784	2,110	<b>1,822</b>
8	Verbeck Gate	2,354	3,363	4,655	6,134	4,798	5,229	5,327	5,331	<b>4,534</b>
9	Shirley Gate	n/a	533	1,104	731	1,927	1,317	1,406	1,536	<b>1,343</b>
10	Barnum Gate	2,172	2,766	3,418	5,966	4,587	4,779	5,624	5,257	<b>4,326</b>
11	Grant Road Gate	n/a	n/a	n/a	n/a	638	936	2,233	1,574	<b>1,514</b>
12	Poor Farm Road east of Route 110/111, Harvard	1,351	1,442	1,255	1,709	1,659	1,520	1,421	1,453	<b>1,375</b>
13	Carlton Rotary									
	Route 2A/110 east of rotary	14,472	15,229	14,131	17,677	16,258	16,722	15,338	13,744	<b>12,434</b>
	Sandy Pond Road north of rotary	4,701	6,505	3,798	4,301	5,030	5,178	5,022	5,236	<b>5,183</b>
	Route 2A/111 west of rotary (WB)	10,355	10,650	9,629	10,352	10,806	10,080	9,583	9,102	<b>8,795</b>
	Route 2A/111 west of rotary (EB)	9,951	10,394	9,483	9,796	10,101	9,370	9,152	8,670	<b>8,624</b>
	Barnum Road south of rotary	3,186	2,694	3,418	5,966	5,326	5,920	7,749	6,314	<b>5,230</b>
	Route 110/111 south of rotary	13,837	14,533	13,475	15,677	16,127	10,715	14,417	12,864	<b>12,156</b>
14	Route 110/111 south of Route 2, Harvard	7,440	8,140	7,279	8,302	8,591	8,186	7,735	7,886	<b>7,752</b>

While individual study roadways have experienced either an increase or decrease in volume, collectively, the study roadways have experienced an average daily traffic growth rate of about minus four percent per year since 2010. When compared to the typical MassDOT and MRCP annual growth of 1.77 percent (based on traffic trends from 1979 to 1997), the current traffic growth in the Devens area indicates regional traffic growth has slowed to a no or even negative growth rate.

Table 2-4 lists a comparison of the external roadway AM peak hour volumes. Jackson, Grant Road, and Shirley gates have experienced decreased AM peak hour volumes, while Barnum Road and Verbeck Gate have experienced increased AM peak hour volumes. Most notably, AM peak hour volumes at Jackson Gate have reduced eleven percent, while Barnum Gate volumes have increased ten percent. Traffic volumes on other roadways external to Devens have generally stabilized or decreased since 2010. The most dramatic fluctuation in AM peak hour volume between 2010 and 2012 occurred at Route 111 at the Boxborough/Harvard Town Line (+30 percent).

Table 2-5 lists a comparison of the external roadway PM peak hour volumes. There are no significant changes in PM peak hour traffic volumes at Devens gates (all volumes within +/- six percent of 2010 volumes). Traffic volumes on other roadways external to Devens have generally stabilized or decreased since 2010. The most dramatic fluctuations in PM peak hour traffic volumes between 2010 and 2012 occurred at Route 111 at the Boxborough/Harvard Town Line (+18 percent), Route 2A at the Ayer/Shirley Town Line (-25 percent), and Route 111 at Ayer/Groton Town Line (-13 percent).

**Table 2-4: AM Peak Hour Traffic – 48-Hour Counts**

Location Number	Location	AM Peak Hour 1996	AM Peak Hour 1998	AM Peak Hour 2000	AM Peak Hour 2002	AM Peak Hour 2004	AM Peak Hour 2006	AM Peak Hour 2008	AM Peak Hour 2010	AM Peak Hour 2012
	<b>48-Hour ATR Counts</b>									
1	Route 111 at Boxborough /Harvard Town Line	448	n/a	540	552	715	516	550	526	<b>686</b>
2	Route 2A at Ayer/Shirley Town Line	852	740	723	743	816	728	697	788	<b>680</b>
3	Route 111 at Ayer/Groton Town Line	596	540	426	469	580	496	500	544	<b>463</b>
4	Sandy Pond Road east of Central Avenue, Ayer	445	n/a	502	498	471	481	519	482	<b>507</b>
5	Groton-Harvard Road at Ayer/Groton Town Line	473	n/a	546	549	500	552	482	440	<b>393</b>
6	Front Street west of Ayer Street, Shirley	412	403	429	495	441	456	541	416	<b>505</b>
7	Jackson Gate	324	462	812	770	836	951	1,236	1,469	<b>1,302</b>
	From Route 2 WB Off Ramp to Jackson Road NB							236	382	<b>310</b>
	From Route 2 EB Off Ramp to Jackson Road NB							689	693	<b>632</b>
	From Jackson Road SB to Route 2 WB On Ramp							203	204	<b>188</b>
	From Jackson Road SB to Route 2 EB On Ramp							120	190	<b>172</b>
8	Verbeck Gate	217	264	470	492	441	454	417	457	<b>474</b>
9	Shirley Gate	n/a	48	70	53	232	132	245	194	<b>172</b>
10	Barnum Gate	159	193	260	384	418	366	529	400	<b>441</b>
11	Grant Road Gate	n/a	n/a	n/a	n/a	67	97	249	190	<b>173</b>
12	Poor Farm Road east of Route 110/111, Harvard	129	162	132	180	168	154	146	147	<b>131</b>
13	Carlton Rotary									
	Route 2A/110 east of rotary	1,023	978	1,071	1,215	1,158	1,097	1,052	1,005	<b>954</b>
	Sandy Pond Road north of rotary	307	441	325	403	433	433	423	426	<b>415</b>
	Route 2A/111 west of rotary (WB)	537	459	519	488	622	546	513	495	<b>468</b>
	Route 2A/111 west of rotary (EB)	1,056	1,054	1,034	1,040	940	890	852	802	<b>834</b>
	Barnum Road south of rotary	220	181	260	384	401	403	575	518	<b>449</b>
	Route 110/111 south of rotary	1,075	1,148	1,121	1,202	1,346	796	1,254	1,000	<b>993</b>
14	Route 110/111 south of Route 2, Harvard	658	678	672	695	783	738	738	733	<b>706</b>

**Table 2-5: PM Peak Hour Traffic – 48-Hour Counts**

Location Number	Location	PM Peak Hour 1996	PM Peak Hour 1998	PM Peak Hour 2000	PM Peak Hour 2002	PM Peak Hour 2004	PM Peak Hour 2006	PM Peak Hour 2008	PM Peak Hour 2010	PM Peak Hour 2012
	<b>48-Hour ATR Counts</b>									
1	Route 111 at Boxborough /Harvard Town Line	538	n/a	530	549	714	603	534	496	<b>585</b>
2	Route 2A at Ayer/Shirley Town Line	905	787	704	805	789	762	698	986	<b>739</b>
3	Route 111 at Ayer/Groton Town Line	554	541	406	483	554	529	490	578	<b>502</b>
4	Sandy Pond Road east of Central Avenue, Ayer	538	n/a	575	550	551	563	588	530	<b>590</b>
5	Groton-Harvard Road at Ayer/Groton Town Line	438	n/a	453	493	536	483	448	431	<b>393</b>
6	Front Street west of Ayer Street, Shirley	492	458	471	482	506	495	550	445	<b>465</b>
7	Jackson Gate	369	434	579	631	853	926	1,188	1,188	<b>1,150</b>
	From Route 2 WB Off Ramp to Jackson Road NB							220	147	<b>134</b>
	From Route 2 EB Off Ramp to Jackson Road NB							184	268	<b>224</b>
	From Jackson Road SB to Route 2 WB On Ramp							668	519	<b>552</b>
	From Jackson Road SB to Route 2 EB On Ramp							206	254	<b>240</b>
8	Verbeck Gate	206	252	380	506	421	488	512	462	<b>432</b>
9	Shirley Gate	n/a	53	122	36	179	138	150	160	<b>162</b>
10	Barnum Gate	172	224	367	430	454	462	470	430	<b>423</b>
11	Grant Road Gate	n/a	n/a	n/a	n/a	72	92	264	153	<b>162</b>
12	Poor Farm Road east of Route 110/111, Harvard	147	152	124	164	152	140	148	133	<b>146</b>
13	Carlton Rotary									
	Route 2A/110 east of rotary	1,248	1,257	1,133	1,326	1,324	1,414	1,281	1,093	<b>976</b>
	Sandy Pond Road north of rotary	456	558	320	363	449	494	440	484	<b>450</b>
	Route 2A/111 west of rotary (WB)	1,232	1,182	1,043	1,137	1,142	1,086	1,072	922	<b>960</b>
	Route 2A/111 west of rotary (EB)	611	555	581	507	636	604	572	574	<b>538</b>
	Barnum Road south of rotary	261	170	367	430	532	598	709	536	<b>463</b>
	Route 110/111 south of rotary	1,222	1,269	1,098	1,210	1,338	944	1,260	1,081	<b>1,079</b>
14	Route 110/111 south of Route 2, Harvard	760	766	600	640	736	764	735	696	<b>745</b>

### 2.3.2. 7-Day ATR Counts

Week long counts were conducted at the following locations between April 29<sup>th</sup> and May 25<sup>th</sup> 2012; however some locations were recounted at later date due to malfunctions with the automatic traffic recorder.

<b>ID</b>	<b>Location</b>	<b>Date</b>
1	Route 110-111 north of Route 2, Harvard	4/29/2012-5/6/2012
2	Route 2A-110 at Littleton/Ayer Town Line	4/29/2012-5/6/2012
3	Route 2 east of I-495, Littleton	4/29/2012-5/6/2012 (WB) 5/18/2012-5/25/2012 (EB)
4	Route 2 west of I-495, Littleton	5/18/2012-5/25/2012
5	Route 2 west of Route 70, Lancaster	4/29/2012-5/6/2012 (EB) 5/18/2012-5/25/2012 (WB)
6	Route 2 west of I-190, Leominster	5/18/2012-5/25/2012

The 2012 average daily traffic (ADT) volumes decreased at all six locations compared to the 2010 volumes (Table 2-6). Location 1 (Route 110-111 north of Route 2, Harvard) experienced the largest decrease since 2010 in average daily traffic (-14 percent) and average weekday traffic (-13 percent). Also noteworthy is Location 5 (Route 2 west of Route 70, Lancaster), where the average daily traffic and average weekday traffic both declined ten percent since 2010.

The 2012 AM and PM peak hour volumes declined at all locations except Location 3 (Route 2 east of I-495, Littleton). Location 1 (Route 110-111 north of Route 2, Harvard), Location 4 (Route 2 west of I-495, Littleton), and Location 5 (Route 2 west of Route 70, Lancaster) all experienced peak hour traffic volume reductions greater than ten percent. Peak hour volumes at all other locations are comparable to 2010 peak hour volumes.

The 2012 Saturday traffic volumes are generally comparable to 2010 volumes with only minor fluctuations up or down by less than ten percent. The only exceptions to this general trend are Location 1 (Route 110-111 north of Route 2, Harvard) and Location 3 (Route 2 east of I-495, Littleton), which have seen traffic reductions in excess of ten percent.

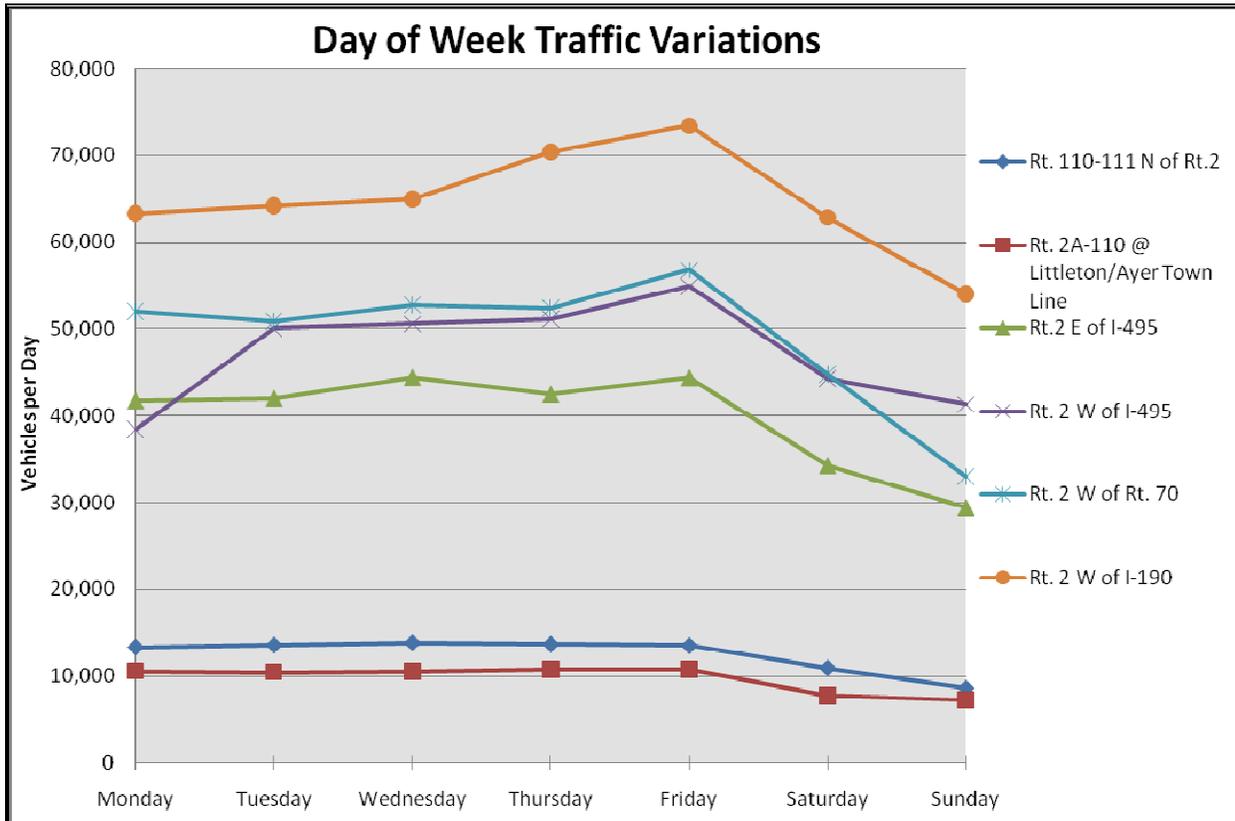
The 2012 Sunday traffic volumes have generally increased five to ten percent since 2010 volumes. The only exceptions that show decreased volumes (over ten percent) are Location 1 (Route 110-111 north of Route 2, Harvard) and Location 5 (Route 2 west of Route 70, Lancaster).

**Table 2-6: Automatic Traffic Recorder (ATR) Summary – 7-Day Counts**

Location	ADT 1996	ADT 1998	ADT 2000	ADT 2002	ADT 2004	ADT 2006	ADT 2008	ADT 2010	ADT 2012	AWDT 1996	AWDT 1998	AWDT 2000	AWDT 2002	AWDT 2004	AWDT 2006	AWDT 2008	AWDT 2010	AWDT 2012
Route 110-111 north of Route 2, Harvard	11,912	11,524	13,258	13,471	13,378	12,758	12574 <sup>E</sup>	14,511	<b>12,502</b>	13,185	12,813	14,748	14,986	14,961	13,907	14203 <sup>F</sup>	15,606	<b>13,598</b>
Route 2A-110 at Littleton/Ayer Town Line <sup>A</sup>	8,567	10,681	12,039	12,126	11,721	11,376	10,987	10,233	<b>9,728</b>	9,598	11,958	12,039	13,470	13,084	13,101	12,548	11,362	<b>10,624</b>
Route 2 east of I-495, Littleton	36,141	38,979	43,851	42,076	52,876	41,970	41,136	40,131	<b>39,822</b>	40,233	43,328	50,195	46,033	59,095	45,982	45,992	42,787	<b>43,020</b>
Route 2 west of I-495, Littleton <sup>B</sup>	40,510	44,620	42,485	51,083	60,066	52,484	48,340	49,552	<b>47,237</b>	44,720	49,076	46,707	58,944	67,145	57,240	54,148	53,297	<b>49,022</b>
Route 2 west of Route 70, Lancaster	41,441	41,981	NA	NA	51,628	53,198	51,902	54,266	<b>48,960</b>	43,940	45,581	43,870	NA	57,989	57,464	57,367	58,973	<b>52,983</b>
Route 2 west of I-190, Leominster <sup>C</sup>	51,857	55,982	58,650	64,339	70,414	69,094	67,698	66,889	<b>64,758</b>	55,588	60,966	64,482	71,263	75,706	73,935	73,237	71,220	<b>67,282</b>
Location	AM Peak Hour 1996	AM Peak Hour 1998	AM Peak Hour 2000	AM Peak Hour 2002	AM Peak Hour 2004	AM Peak Hour 2006	AM Peak Hour 2008	AM Peak Hour 2010	AM Peak Hour 2012	PM Peak Hour 1996	PM Peak Hour 1998	PM Peak Hour 2000	PM Peak Hour 2002	PM Peak Hour 2004	PM Peak Hour 2006	PM Peak Hour 2008	PM Peak Hour 2010	PM Peak Hour 2012
Route 110-111 north of Route 2, Harvard	1,083	969	1,201	1,252	1,156	1,150	1,227	1,303	<b>1,141</b>	1,169	1,092	1,237	1,222	1,230	1,185	1268 <sup>F</sup>	1,285	<b>1,157</b>
Route 2A-110 at Littleton/Ayer Town Line <sup>A</sup>	799	890	1,030	1,054	1,004	958	947	902	<b>866</b>	725	911	940	1,003	1,111	1,060	1,017	1,019	<b>932</b>
Route 2 east of I-495, Littleton	3,886	3,896	4,374	4,064	5,430	4,217	4,230	3,774	<b>3,916</b>	3,872	3,964	5,133	3,962	4,860	4,025	4,055	3,688	<b>3,726</b>
Route 2 west of I-495, Littleton <sup>B</sup>	4,096	4,666	4,486	4,931	6,120	5,008	5,127	4,580	<b>4,082</b>	4,008	4,080	4,052	5,028	5,787	4,914	4,762	4,583	<b>4,120</b>
Route 2 west of Route 70, Lancaster	4,143	4,610	<sup>D</sup>	<sup>D</sup>	6,040	4,830	5,029	4,712	<b>4,134</b>	3,858	3,868	<sup>D</sup>	NA	4,443	4,966	4,693	4,788	<b>4,457</b>
Route 2 west of I-190, Leominster <sup>C</sup>	4,701	5,417	5,556	5,567	6,150	5,998	6,050	5,213	<b>5,017</b>	4,625	5,082	5,313	5,766	6,135	6,058	5,935	5,758	<b>5,327</b>
Location	Saturday Peak Hour 1996	Saturday Peak Hour 1998	Saturday Peak Hour 2000	Saturday Peak Hour 2002	Saturday Peak Hour 2004	Saturday Peak Hour 2006	Saturday Peak Hour 2008	Saturday Peak Hour 2010	Saturday Peak Hour 2012	Saturday Peak Hour 1996	Saturday Peak Hour 1998	Saturday Peak Hour 2000	Saturday Peak Hour 2002	Saturday Peak Hour 2004	Saturday Peak Hour 2006	Saturday Peak Hour 2008	Saturday Peak Hour 2010	Saturday Peak Hour 2012
Route 110-111 north of Route 2, Harvard	10,175	9,209	10,641	11,167	10,916	11,307	10,234	13,367	<b>10,933</b>	880	764	875	933	958	1,000	896	1,133	<b>933</b>
Route 2A-110 at Littleton/Ayer Town Line <sup>A</sup>	6,597	8,270	NA	10,033	9,659	9,003	8,235	7,799	<b>7,769</b>	553	653	NA	814	776	704	681	606	<b>581</b>
Route 2 east of I-495, Littleton	27,235	30,428	28,399	34,232	44,822	34,039	31,001	39,368	<b>34,263</b>	2,047	2,240	2,227	2,454	3,294	2,595	2,396	2,918	<b>2,333</b>
Route 2 west of I-495, Littleton <sup>B</sup>	30,194	37,623	33,015	38,747	40,606	42,099	38,749	41,038	<b>44,249</b>	2,383	2,972	2,341	2,954	3,011	3,134	2,992	3,103	<b>3,311</b>
Route 2 west of Route 70, Lancaster	35,527	35,321	<sup>D</sup>	<sup>D</sup>	30,552	45,817	39,025	46,279	<b>44,817</b>	2,553	2,732	<sup>D</sup>	<sup>D</sup>	2,237	3,341	2,855	3,311	<b>3,242</b>
Route 2 west of I-190, Leominster <sup>C</sup>	43,925	<sup>D</sup>	46,368	53,238	62,260	62,440	58,145	60,836	<b>62,857</b>	3,174	<sup>D</sup>	3,592	4,198	4,695	4,680	4,490	4,399	<b>4,446</b>
Location	Sunday Peak Hour 1996	Sunday Peak Hour 1998	Sunday Peak Hour 2000	Sunday Peak Hour 2002	Sunday Peak Hour 2004	Sunday Peak Hour 2006	Sunday Peak Hour 2008	Sunday Peak Hour 2010	Sunday Peak Hour 2012	Sunday Peak Hour 1996	Sunday Peak Hour 1998	Sunday Peak Hour 2000	Sunday Peak Hour 2002	Sunday Peak Hour 2004	Sunday Peak Hour 2006	Sunday Peak Hour 2008	Sunday Peak Hour 2010	Sunday Peak Hour 2012
Route 110-111 north of Route 2, Harvard	7,282	7,403	8,442	11,167	7,926	8,464	8,398	10,185	<b>8,594</b>	628	587	828	933	815	800	769	909	<b>857</b>
Route 2A-110 at Littleton/Ayer Town Line <sup>A</sup>	5,380	6,722	NA	10,033	6,969	6,906	5,918	7,026	<b>7,210</b>	491	532	NA	814	625	652	532	625	<b>678</b>
Route 2 east of I-495, Littleton	24,582	25,805	27,591	34,232	29,835	29,845	26,984	27,603	<b>29,391</b>	1,989	2,149	2,436	2,454	2,583	2,758	2,320	2,411	<b>2,500</b>
Route 2 west of I-495, Littleton <sup>B</sup>	29,775	29,340	30,834	38,747	44,132	38,089	34,701	39,340	<b>41,301</b>	2,499	2,307	2,616	2,954	3,708	3,363	3,139	3,340	<b>3,212</b>
Route 2 west of Route 70, Lancaster	32,387	30,644	<sup>D</sup>	<sup>D</sup>	40,889	39,248	37,459	38,713	<b>32,984</b>	2,642	2,735	<sup>D</sup>	<sup>D</sup>	3,429	3,289	3,058	3,266	<b>2,633</b>
Route 2 west of I-190, Leominster <sup>C</sup>	41,133	40,936	30,834	53,238	52,103	51,540	49,557	51,272	<b>54,037</b>	3,310	3,391	3,592	4,198	4,227	4,454	4,428	4,445	<b>4,151</b>

Day-of-week variations in traffic volumes on these roadways are shown in Figure 2-4. These roadways tend to follow an expected pattern of increasing traffic from Monday to Friday, with decreased Saturday and Sunday volumes. Beyond such typical traffic patterns is the spiking of traffic volumes on Fridays, which possibly indicates people are making extra 'out-of-town' trips associated with weekend vacations.

**Figure 2-4: Day of Week Traffic Variations – 7-Day Counts**



### 2.3.3. Vehicle Classification Counts

Vehicle classification counts were conducted to monitor heavy vehicle volumes at Devens' gates for a minimum 48-hour period and were programmed to identify the 13 different Federal Highway Administration (FHWA) vehicle classifications. For simplicity of reporting, these results have been summarized into four categories: motorcycles, passenger vehicles, single-unit trucks and buses, and tractor-trailer trucks.

Figures 2-5 through 2-10 show the average hourly distribution of two-way heavy vehicles passing through each gate. Data was collected in one-hour increments over a 48-hour period starting on May 8<sup>th</sup>, 2012. Truck traffic at most gates experiences spikes in truck volumes in the 6-8 AM and 2-4 PM periods, which coincides with delivery and construction schedules.

Figure 2-11 summarizes the results of the vehicle classification counts for all gates. Heavy vehicles make up approximately 11% of all vehicles counted.

Figure 2-5: Truck Traffic Distribution, Jackson Gate

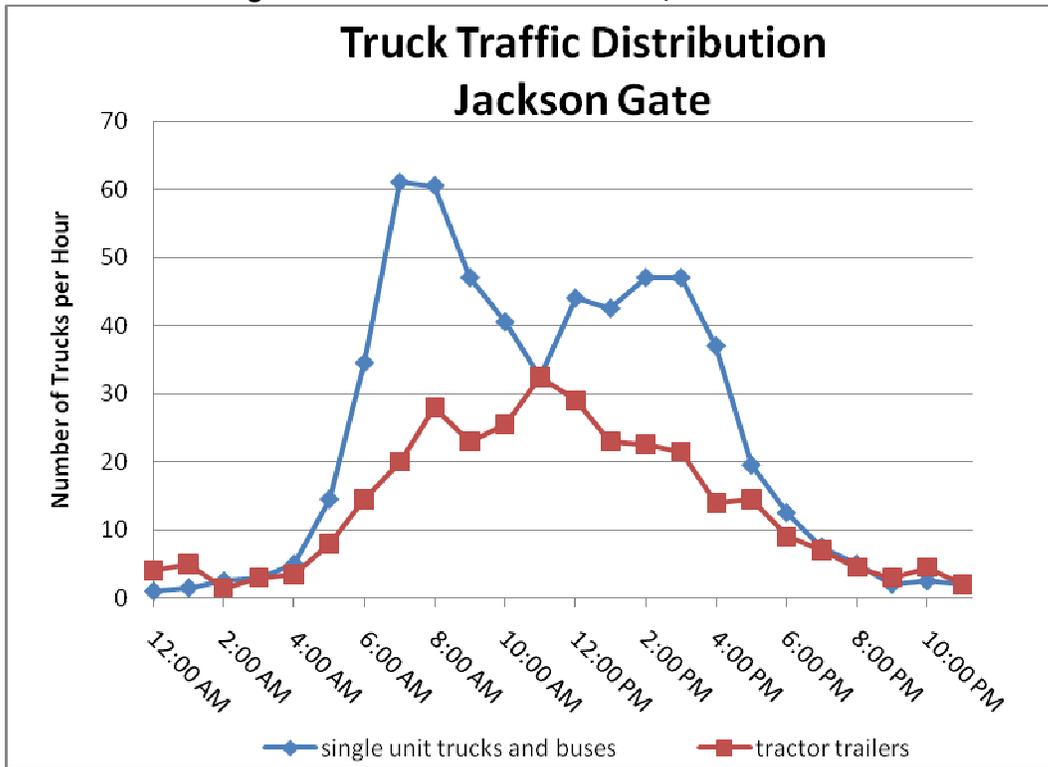


Figure 2-6: Truck Traffic Distribution, Verbeck Gate

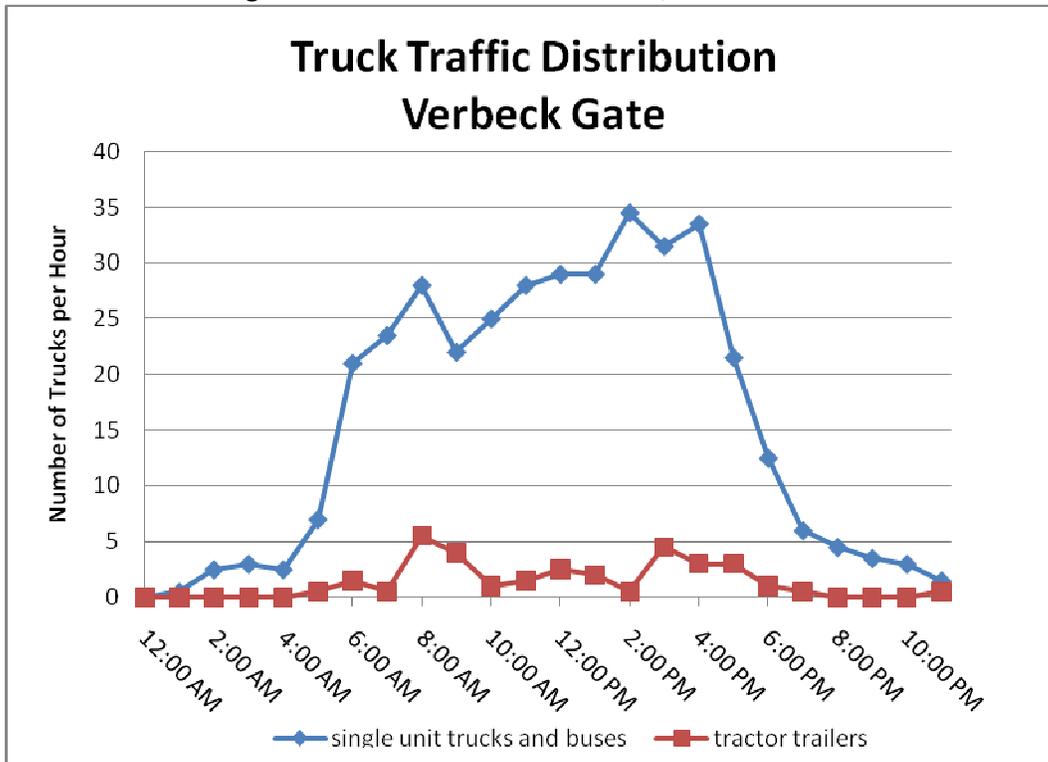


Figure 2-7: Truck Traffic Distribution, Barnum Gate

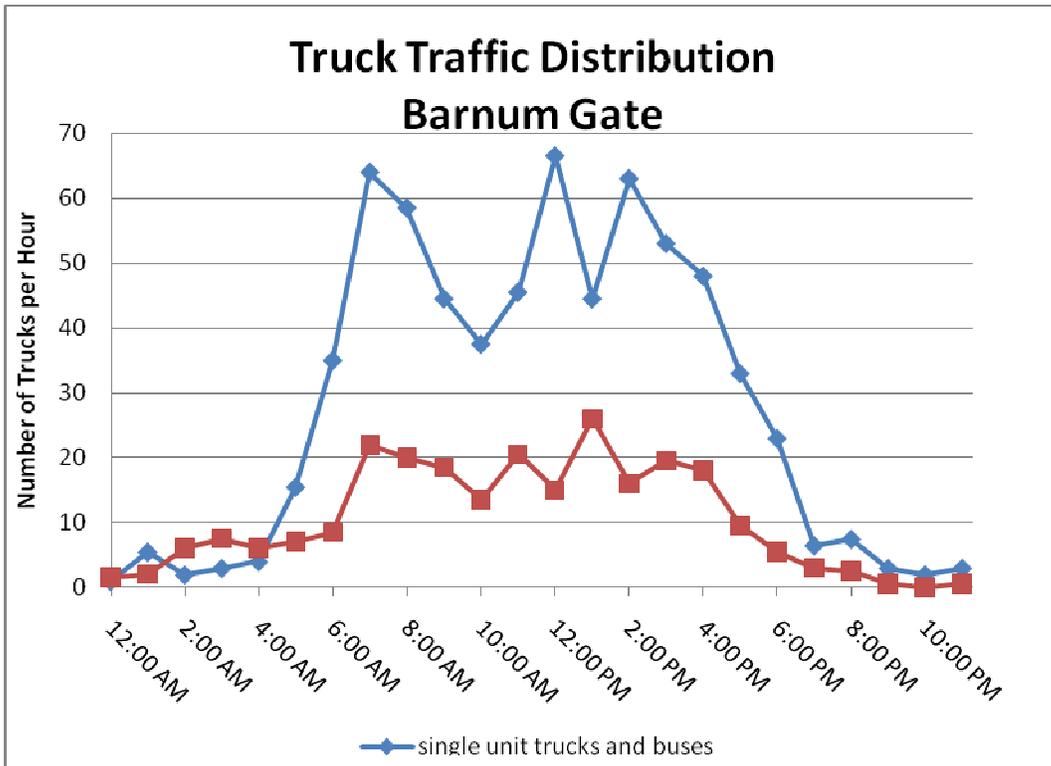


Figure 2-8: Truck Traffic Distribution, Grant Road Gate

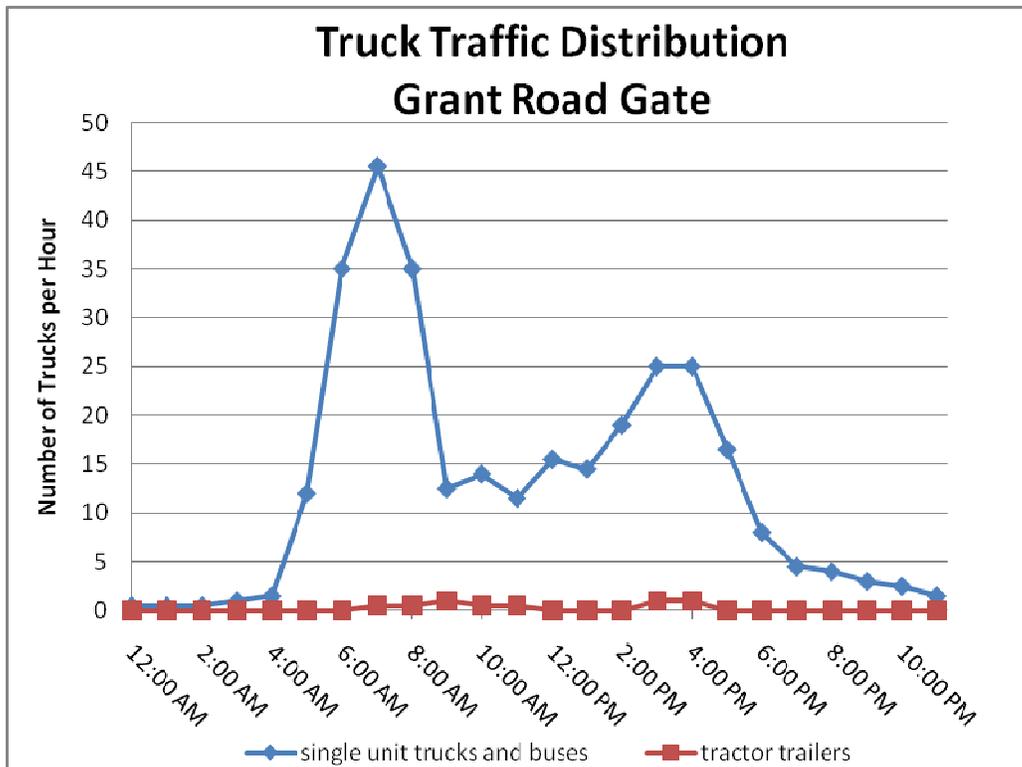


Figure 2-9: Truck Traffic Distribution, Shirley Gate

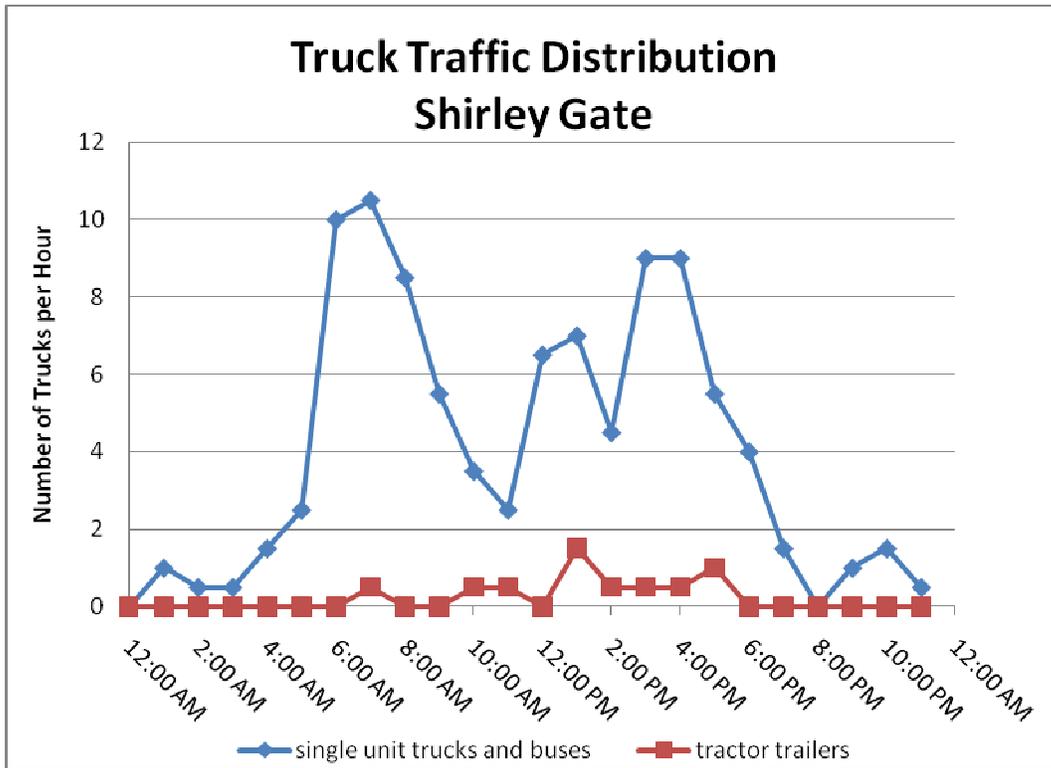
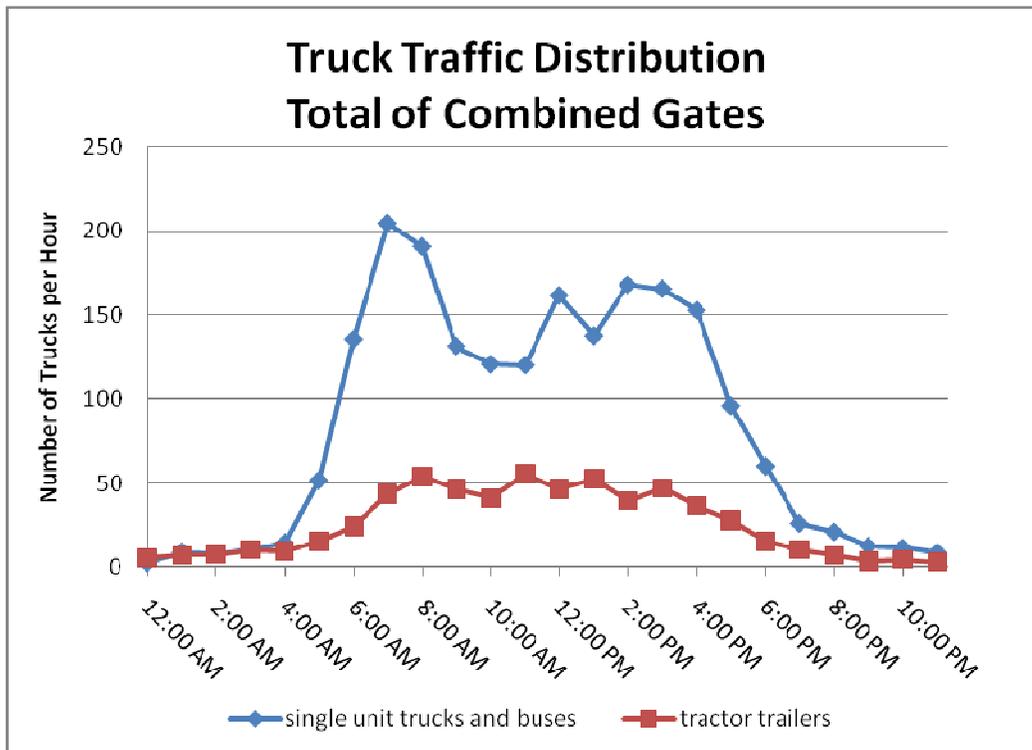
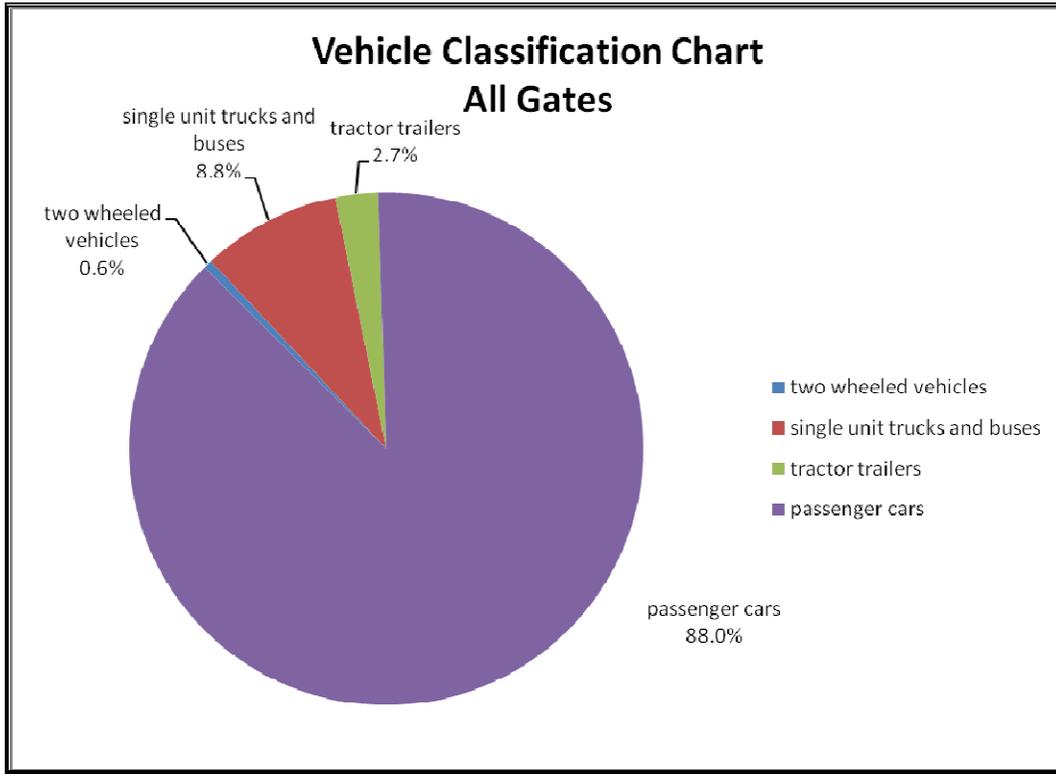


Figure 2-10: Truck Traffic Distribution, Total of Combined Gates



**Figure 2-11: Vehicle Classification Summary, All Gates**



The average weekday daily truck traffic volumes through all Devens gates has increased 27 percent since 2010 but is still lower than the peak period from 2004 to 2008 (Table 2-7). All gates experienced an increase in daily truck traffic except for Verbeck Gate. The most significant increase in truck traffic – over a four fold rise – observed at Grant Road Gate (+432 percent). Some of this increase in truck traffic at Grant Road may be a result of US Fish and Wildlife construction activity in the vicinity of Hospital Road.

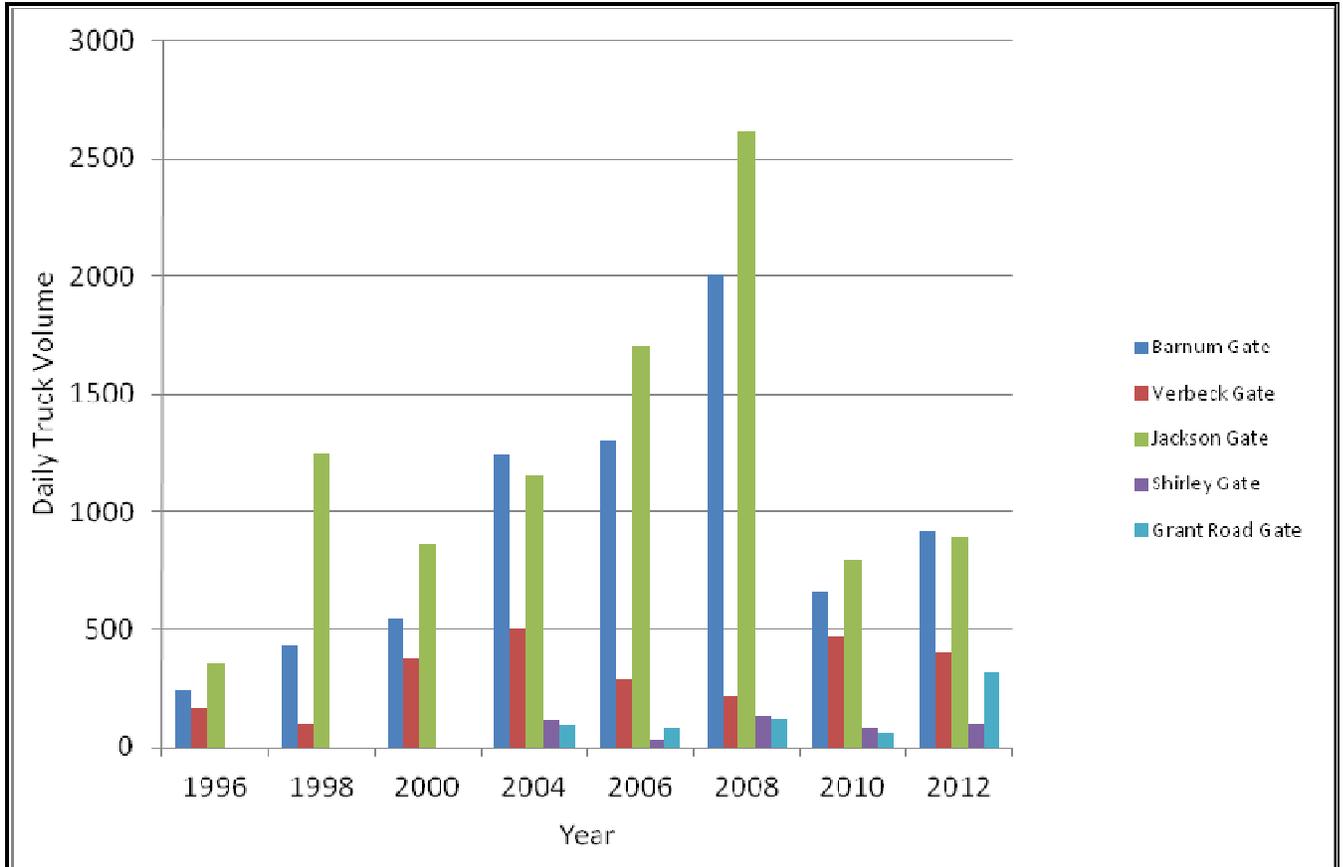
**Table 2-7: Average Weekday Daily Truck Traffic - Devens Gates**

Average Weekday Daily Truck Traffic at Devens Gates								
	1996	1998	2000	2004	2006	2008	2010	2012
Barnum Gate	244	427	546	1245	1304	2003	661	918
Verbeck Gate	165	102	380	505	286	220	475	405
Jackson Gate	358	1253	862	1156	1705	2614	801	895
Shirley Gate	n/a	n/a	n/a	117	30	136	79	102
Grant Road Gate	n/a	n/a	n/a	95	78	125	59	314
<b>Total</b>	<b>767</b>	<b>1782</b>	<b>1788</b>	<b>3118</b>	<b>3403</b>	<b>5098</b>	<b>2075</b>	<b>2634</b>

Jackson and Barnum gates continue to serve the highest volumes of heavy vehicles, likely a result of improvements targeted to better accommodate truck traffic and establish Jackson and Barnum Roads as primary truck routes into Devens (Figure 2-12). Jackson and Barnum gates continue to be

the preferred entry for trucks into Devens as these two gates combine for 69 percent of the daily truck traffic.

**Figure 2-12: Average Weekday Daily Truck Traffic at Devens' Gates**



## 2.4. Carlton Rotary

Traffic counts were performed at the Carlton Rotary for a 48-hour period. The daily and peak hour unadjusted volumes recorded for each leg of the rotary must be adjusted to report equivalent volumes entering and exiting the rotary due to the physical configuration of the rotary approaches and the logistical requirements of ATR placement. The balanced weekday volumes decreased seven percent from 2010 to 2012 and, except for a bump in 2008, generally have decreased from their 2004 peak (Table 2-8). AM peak hour volumes have also decreased seven percent from 2010 to 2012 (Table 2-9) and PM peak hour volumes have decreased three percent from 2010 to 2012 (Table 2-10)

**Table 2-8: Carlton Rotary – Weekday Volumes – Entering/Exiting (balanced)**

	<b>1996 Entering (vpd)</b>	<b>1998 Entering (vpd)</b>	<b>2000 Entering (vpd)</b>	<b>2002 Entering (vpd)</b>	<b>2004 Entering (vpd)</b>	<b>2006 Entering (vpd)</b>	<b>2008 Entering (vpd)</b>	<b>2010 Entering (vpd)</b>	<b>2012 Entering (vpd)</b>
Route 2A-110, East of Rotary	7,200	7,500	6,994	8,844	8,512	8,248	8,070	7,068	6,487
Route 110-111, South of Rotary	7,400	7,200	6,775	7,920	8,571	6,194	7,775	6,960	6,479
Barnum Road	1,650	1,200	1,704	3,048	2,740	3,105	3,955	3,337	2,743
Route 2A-111 EB, West of Rotary	10,350	10,200	9,489	9,751	10,645	9,300	9,428	9,234	9,065
Route 2A-111 WB, West of Rotary	n/a								
Sandy Pond Road	2,650	3,900	2,003	2,337	2,190	2,082	2,203	2,242	2,088
<b>Total</b>	<b>29,250</b>	<b>30,000</b>	<b>26,965</b>	<b>31,900</b>	<b>32,659</b>	<b>28,930</b>	<b>31,431</b>	<b>28,841</b>	<b>26,862</b>
	<b>1996 Exiting (vpd)</b>	<b>1998 Exiting (vpd)</b>	<b>2000 Exiting (vpd)</b>	<b>2002 Exiting (vpd)</b>	<b>2004 Exiting (vpd)</b>	<b>2006 Exiting (vph)</b>	<b>2008 Exiting (vph)</b>	<b>2010 Exiting (vpd)</b>	<b>2012 Exiting (vpd)</b>
Route 2A-110, East of Rotary	7,600	7,500	7,140	8,842	8,181	8,235	7,812	7,103	6,258
Route 110-111, South of Rotary	6,750	7,200	6,693	7,764	7,994	4,605	6,865	6,325	5,993
Barnum Road	1,550	1,500	1,713	2,921	2,726	2,693	4,100	3,179	2,623
Route 2A-111 EB, West of Rotary	n/a								
Route 2A-111 WB, West of Rotary	10,350	11,100	9,625	10,409	10,806	10,318	9,737	9,104	8,795
Sandy Pond Road	3,000	2,700	1,794	1,964	2,952	3,079	2,917	3,130	3,194
<b>Total</b>	<b>29,250</b>	<b>30,000</b>	<b>26,965</b>	<b>31,900</b>	<b>32,659</b>	<b>28,930</b>	<b>31,431</b>	<b>28,841</b>	<b>26,863</b>
	<b>1996 Total (vpd)</b>	<b>1998 Total (vpd)</b>	<b>2000 Total (vpd)</b>	<b>2002 Total (vpd)</b>	<b>2004 Total (vpd)</b>	<b>2006 Total (vpd)</b>	<b>2008 Total (vpd)</b>	<b>2010 Total (vpd)</b>	<b>2012 Total (vpd)</b>
Route 2A-110, East of Rotary	14,800	15,000	14,134	17,686	16,693	16,483	15,882	14,171	12,745
Route 110-111, South of Rotary	14,150	14,400	13,468	15,684	16,565	10,799	14,640	13,285	12,472
Barnum Road	3,200	2,700	3,417	5,969	5,466	5,798	8,055	6,516	5,366
Route 2A-111 EB, West of Rotary	10,350	10,200	9,489	9,751	10,645	10,101	9,428	9,234	9,065
Route 2A-111 WB, West of Rotary	10,350	11,100	9,625	10,409	10,806	10,806	9,737	9,104	8,795
Sandy Pond Road	5,650	6,600	3,797	4,301	5,142	5,161	5,120	5,372	5,282
<b>Total</b>	<b>58,500</b>	<b>60,000</b>	<b>53,930</b>	<b>63,800</b>	<b>65,318</b>	<b>57,860</b>	<b>62,862</b>	<b>57,682</b>	<b>53,725</b>

**Table 2-9: Carlton Rotary – AM Peak Hour Volumes – Entering/Exiting (balanced)**

	<b>1996 AM Peak Entering (vph)</b>	<b>1998 AM Peak Entering (vph)</b>	<b>2000 AM Peak Entering (vph)</b>	<b>2002 AM Peak Entering (vph)</b>	<b>2004 AM Peak Entering (vph)</b>	<b>2006 AM Peak Entering (vph)</b>	<b>2008 AM Peak Entering (vph)</b>	<b>2010 AM Peak Entering (vph)</b>	<b>2012 AM Peak Entering (vph)</b>
Route 2A-110, East of Rotary	332	328	658	469	520	436	454	421	<b>397</b>
Route 110-111, South of Rotary	441	455	586	440	558	357	549	477	<b>439</b>
Barnum Road	86	85	252	170	205	197	304	200	<b>170</b>
Route 2A-111 EB, West of Rotary	1,143	1,122	518	999	997	842	862	873	<b>825</b>
Route 2A-111 WB, West of Rotary	n/a	<b>n/a</b>							
Sandy Pond Road	150	141	186	288	243	229	258	231	<b>214</b>
<b>Total</b>	<b>2,152</b>	<b>2,131</b>	<b>2,200</b>	<b>2,366</b>	<b>2,522</b>	<b>2,061</b>	<b>2,427</b>	<b>2,202</b>	<b>2,045</b>
	<b>1996 AM Peak Exiting (vph)</b>	<b>1998 AM Peak Exiting (vph)</b>	<b>2000 AM Peak Exiting (vph)</b>	<b>2002 AM Peak Exiting (vph)</b>	<b>2004 AM Peak Exiting (vph)</b>	<b>2006 AM Peak Exiting (vph)</b>	<b>2008 AM Peak Exiting (vph)</b>	<b>2010 AM Peak Exiting (vph)</b>	<b>2012 AM Peak Exiting (vph)</b>
Route 2A-110, East of Rotary	716	639	413	758	668	643	611	603	<b>552</b>
Route 110-111, South of Rotary	651	661	515	775	820	426	720	546	<b>549</b>
Barnum Road	141	107	118	216	208	210	354	328	<b>277</b>
Route 2A-111 EB, West of Rotary	n/a	<b>n/a</b>							
Route 2A-111 WB, West of Rotary	476	426	1,019	509	622	568	538	519	<b>468</b>
Sandy Pond Road	168	298	135	108	204	214	204	206	<b>199</b>
<b>Total</b>	<b>2,152</b>	<b>2,131</b>	<b>2,200</b>	<b>2,366</b>	<b>2,522</b>	<b>2,061</b>	<b>2,427</b>	<b>2,202</b>	<b>2,045</b>
	<b>1996 AM Peak Total (vph)</b>	<b>1998 AM Peak Total (vph)</b>	<b>2000 AM Peak Total (vph)</b>	<b>2002 AM Peak Total (vph)</b>	<b>2004 AM Peak Total (vph)</b>	<b>2006 AM Peak Total (vph)</b>	<b>2008 AM Peak Total (vph)</b>	<b>2010 AM Peak Total (vph)</b>	<b>2012 AM Peak Total (vph)</b>
Route 2A-110, East of Rotary	1,048	967	1,071	1,227	1,188	1,079	1,065	1,024	<b>949</b>
Route 110-111, South of Rotary	1,092	1,116	1,101	1,215	1,378	783	1,269	1,023	<b>988</b>
Barnum Road	227	192	370	386	413	407	658	528	<b>447</b>
Route 2A-111 EB, West of Rotary	1,143	1,122	518	999	997	940	862	873	<b>825</b>
Route 2A-111 WB, West of Rotary	476	426	1,019	509	622	622	538	519	<b>468</b>
Sandy Pond Road	318	439	321	396	676	443	462	437	<b>413</b>
<b>Total</b>	<b>4,304</b>	<b>4,262</b>	<b>4,400</b>	<b>4,732</b>	<b>5,044</b>	<b>4,122</b>	<b>4,854</b>	<b>4,404</b>	<b>4,090</b>

**Table 2-10: Carlton Rotary – PM Peak Hour Volumes – Entering/Exiting (balanced)**

	1996 PM Peak Entering (vph)	1998 PM Peak Entering (vph)	2000 PM Peak Entering (vph)	2002 PM Peak Entering (vph)	2004 PM Peak Entering (vph)	2006 PM Peak Entering (vph)	2008 PM Peak Entering (vph)	2010 PM Peak Entering (vph)	2012 PM Peak Entering (vph)
Route 2A-110, East of Rotary	820	817	359	762	778	828	797	649	<b>648</b>
Route 110-111, South of Rotary	809	789	438	776	874	632	822	638	<b>661</b>
Barnum Road	110	110	45	282	312	326	391	312	<b>281</b>
Route 2A-111 EB, West of Rotary	579	601	1,063	502	713	659	634	634	<b>589</b>
Route 2A-111 WB, West of Rotary	n/a	<b>n/a</b>							
Sandy Pond Road	169	177	228	175	188	204	218	225	<b>206</b>
<b>Total</b>	<b>2,487</b>	<b>2,494</b>	<b>2,133</b>	<b>2,497</b>	<b>2,865</b>	<b>2,649</b>	<b>2,862</b>	<b>2,458</b>	<b>2,385</b>
	1996 PM Peak Exiting (vph)	1998 PM Peak Exiting (vph)	2000 PM Peak Exiting (vph)	2002 PM Peak Exiting (vph)	2004 PM Peak Exiting (vph)	2006 PM Peak Exiting (vph)	2008 PM Peak Exiting (vph)	2010 PM Peak Exiting (vph)	2012 PM Peak Exiting (vph)
Route 2A-110, East of Rotary	458	449	703	563	630	609	572	497	<b>483</b>
Route 110-111, South of Rotary	443	499	678	452	558	346	486	496	<b>475</b>
Barnum Road	61	75	210	146	254	302	414	250	<b>206</b>
Route 2A-111 EB, West of Rotary	n/a	<b>n/a</b>							
Route 2A-111 WB, West of Rotary	1,232	1,222	443	1,148	1,142	1,099	1,085	937	<b>960</b>
Sandy Pond Road	293	249	99	188	281	293	305	278	<b>262</b>
<b>Total</b>	<b>2,487</b>	<b>2,494</b>	<b>2,133</b>	<b>2,497</b>	<b>2,865</b>	<b>2,649</b>	<b>2,862</b>	<b>2,458</b>	<b>2,386</b>
	1996 PM Peak Total (vph)	1998 PM Peak Total (vph)	2000 PM Peak Total (vph)	2002 PM Peak Total (vph)	2004 PM Peak Total (vph)	2006 PM Peak Total (vph)	2008 PM Peak Total (vph)	2010 PM Peak Total (vph)	2012 PM Peak Total (vph)
Route 2A-110, East of Rotary	1,278	1,266	1,062	1,325	1,408	1,437	1,369	1,146	<b>1,131</b>
Route 110-111, South of Rotary	1,252	1,288	1,116	1,228	1,432	978	1,307	1,134	<b>1,136</b>
Barnum Road	171	185	255	428	566	628	805	562	<b>487</b>
Route 2A-111 EB, West of Rotary	579	601	1,063	502	713	659	634	634	<b>589</b>
Route 2A-111 WB, West of Rotary	1,232	1,222	443	1,148	1,142	1,099	1,085	937	<b>960</b>
Sandy Pond Road	462	426	327	363	469	497	523	503	<b>468</b>
<b>Total</b>	<b>4,974</b>	<b>4,988</b>	<b>4,266</b>	<b>4,994</b>	<b>5,730</b>	<b>5,298</b>	<b>5,724</b>	<b>4,916</b>	<b>4,771</b>

### 3. Capacity Analysis

Intersection turning movement counts were collected at fourteen locations in the towns surrounding Devens. Turning movement counts were completed during the 7-9 AM and 4-6 PM peak traffic hours. The following sections detail the traffic volume and intersection capacity analysis results at each location.

#### 3.1. Intersection Turning Movement Counts and Traffic Operations

Traffic volumes and intersection attributes were updated to reflect operation and geometric changes since the 2010 study. These updates may include traffic volumes, intersection geometry, number of lanes and widths, traffic control, and presence of on-street parking.

The intersection capacity analysis results were determined using analysis methodologies of the 2000 *Highway Capacity Manual* (HCM). As in previous reports, the 2012 traffic volumes and intersection capacity analysis results are compared with those observed in previous years. Descriptions for each LOS are provided below.

##### Level of Service Definitions

Description	Intersection Stopped Delay per Vehicle (sec)	
	Signalized Intersection	Unsignalized Intersection
<b>LOS A</b> describes primarily free flow operations at average travel speeds, usually about 90 percent of the free-flow speed for the arterial. Stopped delays at signalized and unsignalized intersections are minimal.	<10	<10
<b>LOS B</b> describes reasonably unimpeded operations at average travel speeds, usually about 70 percent of the free-flow speed for the arterial. More vehicles stop at intersections than with LOS A, causing higher but manageable delays.	10-20	10-15
<b>LOS C</b> describes stable operations, however the ability to maneuver and change lanes in mid block locations may be restricted. Travel speeds are 50 percent of the arterial free-flow speed. Delays at intersections will increase from LOS B.	20-35	15-25
<b>LOS D</b> describes a slight breakdown in operation of arterials and intersections. Longer queues will occur and high delays will be evident for some approaches.	35-55	25-35
<b>LOS E</b> characterized by significant delays, low travel speeds, and poor progression. This level of service is considered to be unacceptable by some agencies.	55-80	35-50
<b>LOS F</b> characterizes extremely low travel speeds, intersection congestion, excessive delays, and extensive queues. This LOS describes a condition that is usually concurrent with oversaturation of a roadway or intersection, and can often be mitigated by signal optimization or increasing intersection capacity by adding lanes.	>80	>50

Source: 2000 *Highway Capacity Manual*, Transportation Research Board

A description of traffic volumes, operational data, and intersection attribute modifications is provided in the following sections for each intersection location. A summary of all existing intersection volumes and intersection capacity analysis results are listed in Tables 3-13.

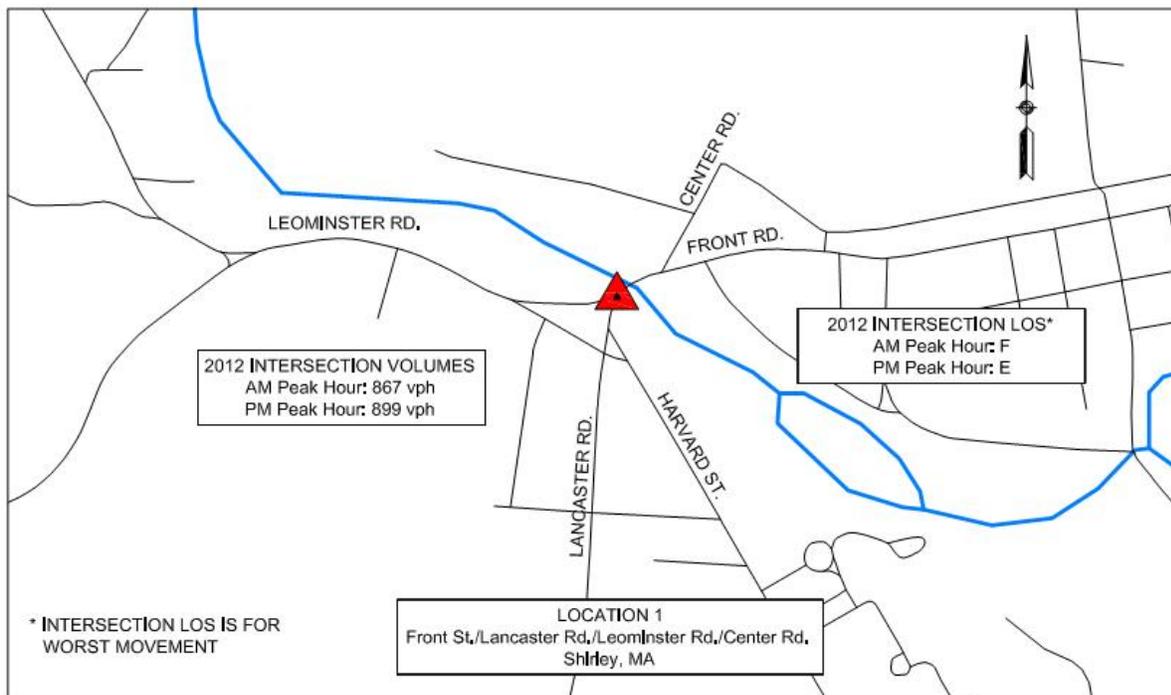
### 3.1.1. Location 1 – Front Street/Lancaster Street/Leominster Road/Center Road

Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. Peak hour traffic volumes have increased by approximately three percent during the AM peak hour and ten percent during the PM peak hour compared to 2010 volumes. This location operates at LOS F and E during the respective AM and PM peak hours. Afternoon conditions, particularly the northbound movement, have worsened compared to 2010 conditions because conflicting movement volumes have intensified.

**Table 3-1: Location 1 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
AM	802	861	803	738	761	815	838	841	867
PM	953	779	847	782	850	776	889	815	899

**Figure 3-1: Location 1 Existing Conditions Summary**



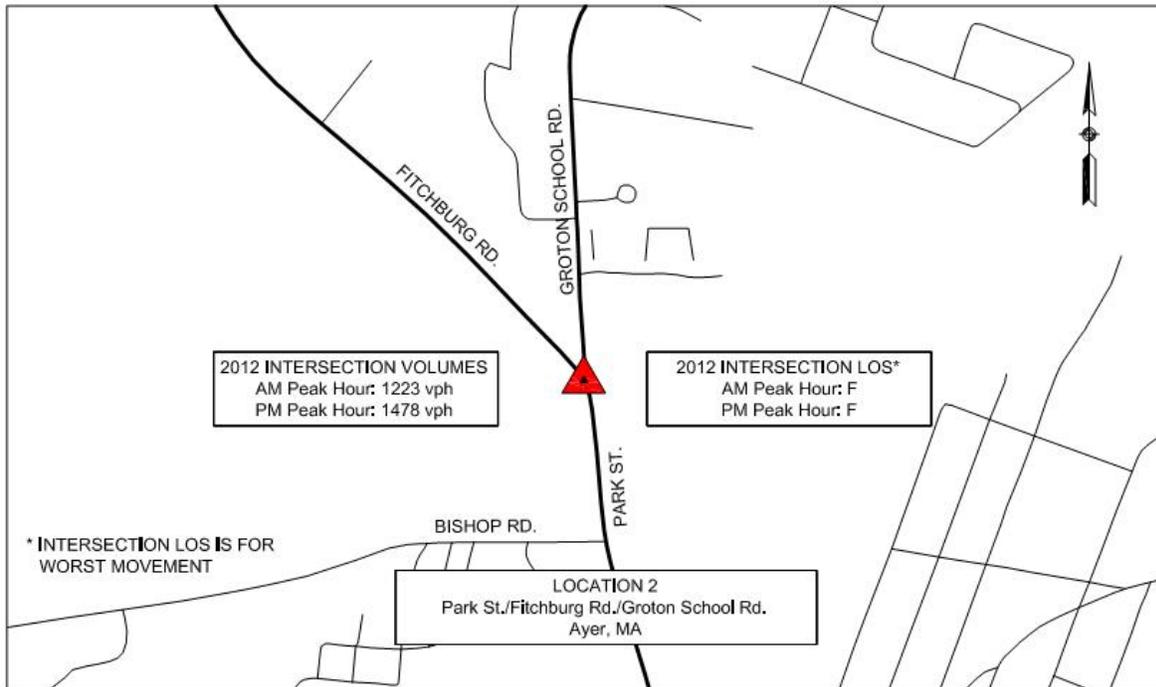
### 3.1.2. Location 2 – Park Street/Fitchburg Road/Groton School Road

This location was identified in the Final EIR as exhibiting existing deficiencies and requiring new traffic signalization due to the failure conditions identified for vehicles attempting to enter Park Street from Groton School Road. This need was based on 1990 peak hour traffic volumes. While traffic volumes have not significantly increased since 1990 at this location, the intersection continues to operate at LOS F because a new signal has never been installed.

**Table 3-2: Location 2 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
AM	1,210	1,241	1,157	1,239	1,146	1,196	1,238	1,220	1,223
PM	1,353	1,523	1,447	1,487	1,482	1,450	1,414	1,381	1,478

**Figure 3-2: Location 2 Existing Conditions Summary**



### 3.1.3. Location 3 – Park Street/Main Street/West Main Street

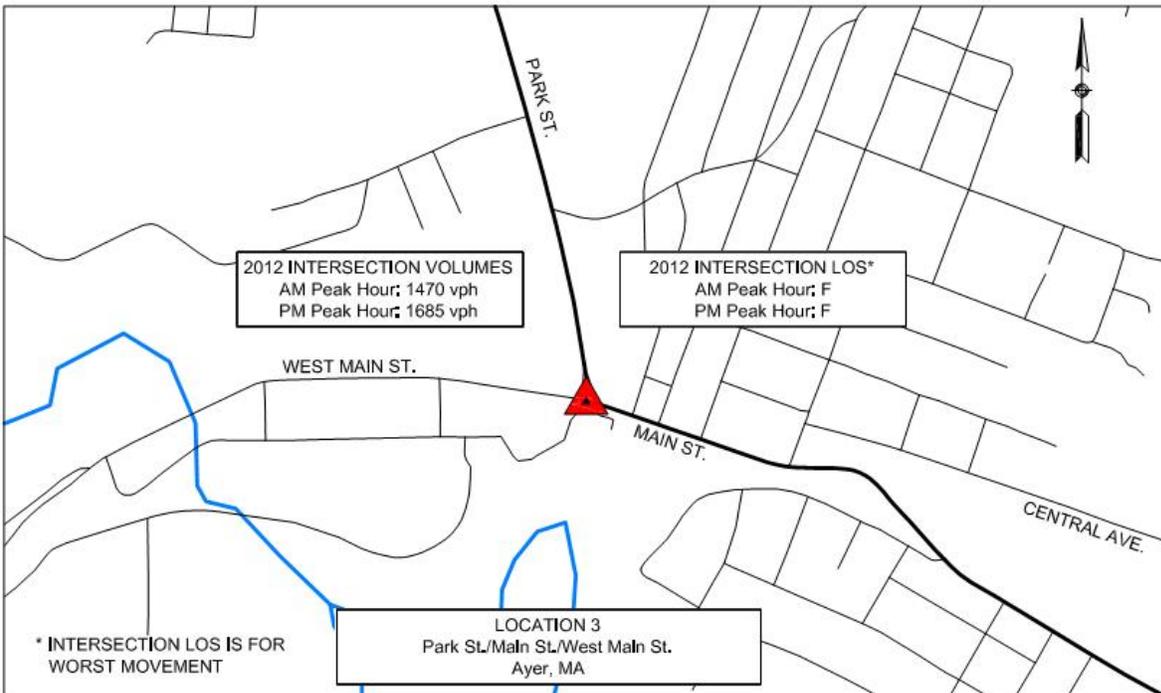
Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. Peak hour traffic volumes have remained relatively constant at this location since 2012, and traffic at this location continues to operate at LOS F during the AM and PM peak hours.

This location was also identified in the Final EIR as exhibiting existing deficiencies and requiring traffic signalization based on 1990 peak hour traffic volumes. While traffic volumes have not significantly increased since 1990 at this location, the intersection continues to operate at LOS F because a new signal has not yet been installed.

**Table 3-3: Location 3 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
AM	1,492	1,556	1,367	1,442	1,372	1,578	1,504	1,448	1,470
PM	1,721	1,547	1,698	1,646	1,699	1,804	1,754	1,689	1,685

**Figure 3-3: Location 3 Existing Conditions Summary**



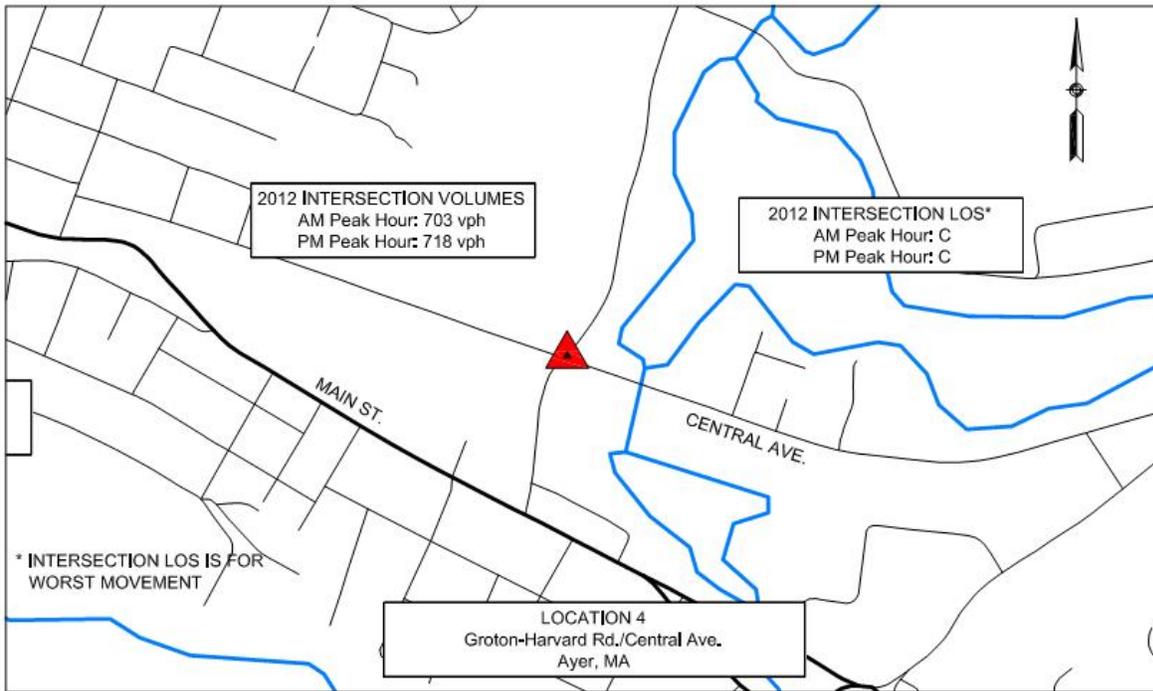
### 3.1.4. Location 4 – Groton-Harvard Road/Central Avenue

Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. Peak hour traffic volumes have decreased by approximately five percent during the AM peak hour and increased by four percent during the PM peak hour compared to 2010 volumes. This location operates at LOS C during the AM and PM peak hour. Both morning and afternoon conditions have improved compared to 2010 conditions because several critical volumes decreased.

**Table 3-4: Location 4 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
AM	864	941	880	990	869	782	801	737	703
PM	841	956	904	960	854	796	765	693	718

**Figure 3-4: Location 4 Existing Conditions Summary**



**3.1.5. Location 5 – Route 2A-110/I-495 Exit 30 Northbound Ramps, Littleton  
Location 6 – Route 2A-110/I-495 Exit 30 Southbound Ramps, Littleton**

While the lane configuration at these intersections remains unchanged since 2010, it is noted that the existing Route 2A-110 bridge over I-495 is currently under construction. The bridge work has been staged to shift traffic to the southern half of the bridge while maintaining one travel lane in each direction.

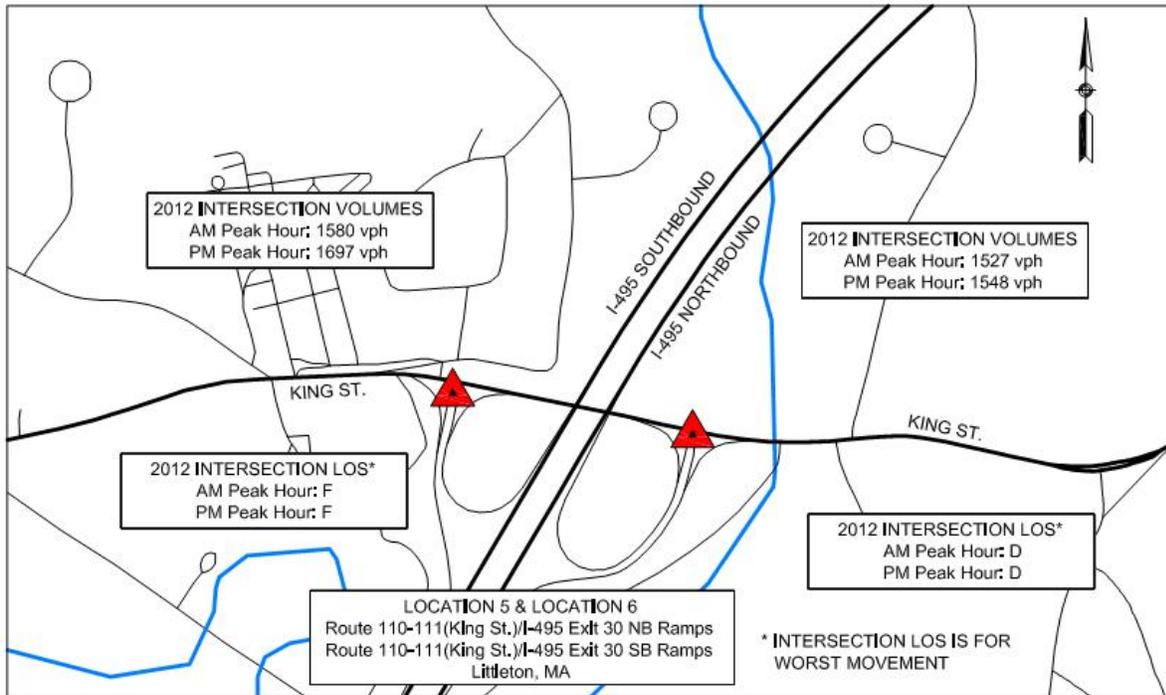
Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. Peak hour traffic volumes for these two locations have decreased during the AM peak hour and increased during the PM peak hour compared to 2010 volumes. While Location 5 has seen improved traffic operations compared to 2010 (LOS D during both the AM and PM peak hours), Location 6 continues to operate at LOS F.

The Final EIR identified a mid to long term need for traffic signalization at the southbound ramp intersection with Route 2A-110(Location 6) and a potential need for a new traffic signal at the northbound ramp intersection (Location 5). While Location 6 traffic volumes have returned to near 1996 levels, the intersection continues to operate at LOS F because signalization improvements have not been implemented.

**Table 3-5: Location 5 and Location 6 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
<i>Location 5: Route 2A-110/NB Ramps</i>									
AM	1,555	1,703	1,833	1,941	1,482	1,462	1,472	1,559	1,527
PM	1,675	1,711	1,656	1,927	1,737	1,893	1,647	1,514	1,548
<i>Location 6: Route 2A-110/SB Ramps</i>									
AM	1,539	1,714	1,830	1,782	1,583	1,657	1,578	1,631	1,580
PM	1,844	1,705	1,814	1,981	1,853	1,959	1,733	1,655	1,697

Figure 3-5: Location 5 and 6 Existing Conditions Summary



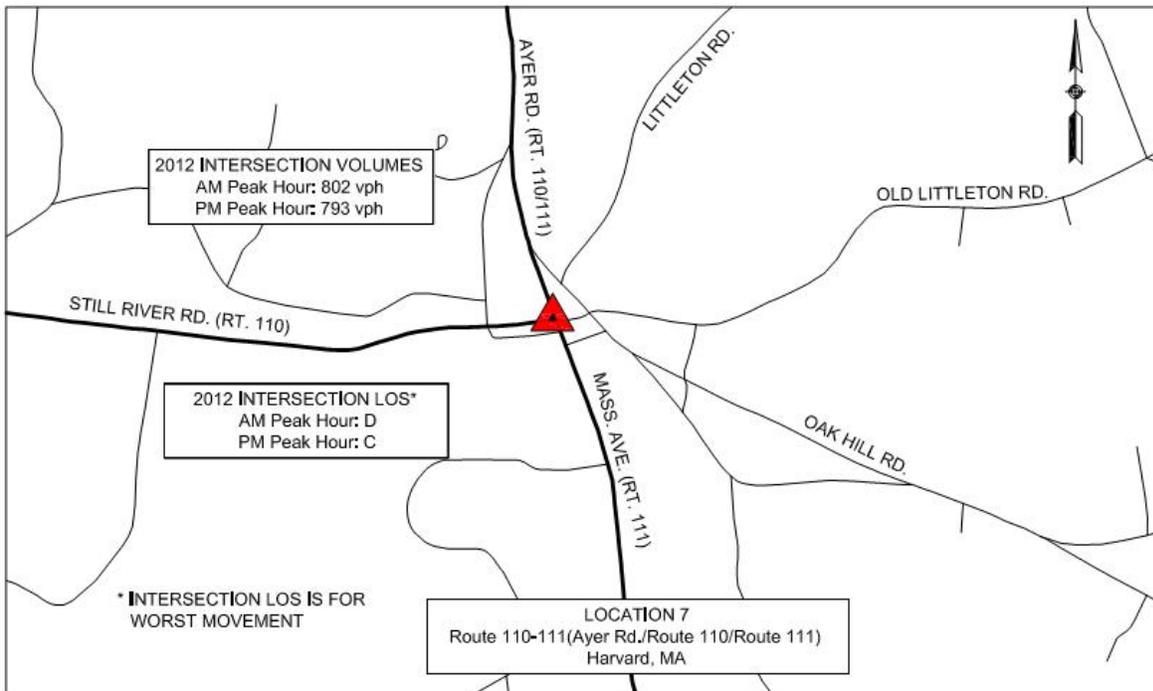
### 3.1.6. Location 7 – Route 110-111 (Ayer Road)/Route 110 (Still River Road)/ Route 111, Harvard

Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. Peak hour traffic volumes have decreased by approximately five percent during the AM peak hour and increased by approximately 34 percent during the PM peak hour compared to 2010 volumes. Despite these significant changes in traffic volumes, the 2012 average delays and corresponding LOS remain relatively unchanged compared to 2010.

**Table 3-6: Location 7 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
AM	818	952	833	823	875	891	949	844	802
PM	869	1,135	668	642	710	609	822	592	793

**Figure 3-6: Location 7 Existing Conditions Summary**



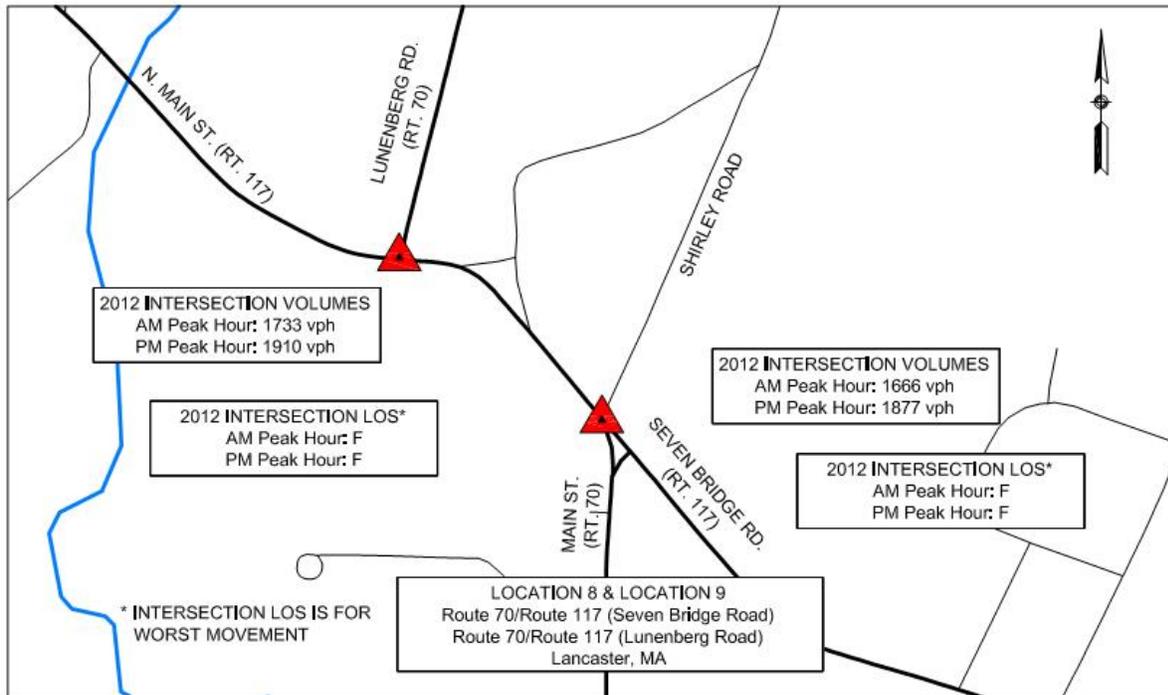
**3.1.7. Location 8 – Route 70/Route 117 (Seven Bridge Road), Lancaster  
Location 9 – Route 70/Route 117 (Lunenburg Road), Lancaster**

Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. Location 8 peak hour traffic volumes have increased by approximately three percent during the AM peak hour and eight percent during the PM peak hour compared to 2010 volumes. Location 9 peak hour traffic volumes have increased by approximately three percent during the AM peak hour and seven percent during the PM peak hour compared to 2010 volumes. Both the northbound Main Street (Route 70) approach and the southbound Lunenburg Road (Route 70) approaches operate at LOS F during the AM and PM peak hours. Traffic conditions at these two locations are essentially unchanged at this location since 1996.

**Table 3-7: Location 8 and Location 9 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
<i>Location 8: Route 70/Route 117 (Seven Bridge Road)</i>									
AM	1,452	1,582	1,616	1,597	1,564	1,621	1,760	1,620	1,666
PM	1,614	1,685	1,657	1,570	1,636	1,677	1,793	1,730	1,877
<i>Location 9: Route 70/Route 117 (Lunenburg Road)</i>									
AM	1,471	1,581	1,652	1,649	1,608	1,664	1,818	1,681	1,733
PM	1,578	1,800	1,679	1,600	1,650	1,720	1,825	1,787	1,910

**Figure 3-7: Location 8 and 9 Existing Conditions Summary**



**3.1.8. Location 10 – Route 110 (King Street)/Route 119/Route 2A (Great Road), Littleton Common**  
**Location 11 – Route 2A-110 (King Street)/Goldsmith Street, Littleton Common**

Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. AM peak hour traffic volumes at Locations 10 and 11 have increased significantly compared to 2010 volumes (13 and 23 percent, respectively). PM peak hour traffic volumes are relatively unchanged compared to 2010 volumes (less than three percent difference). It is assumed that the majority of the increased traffic volumes can be attributed to the June 2010 occupation of the IBM facility at 550-560 King Street.

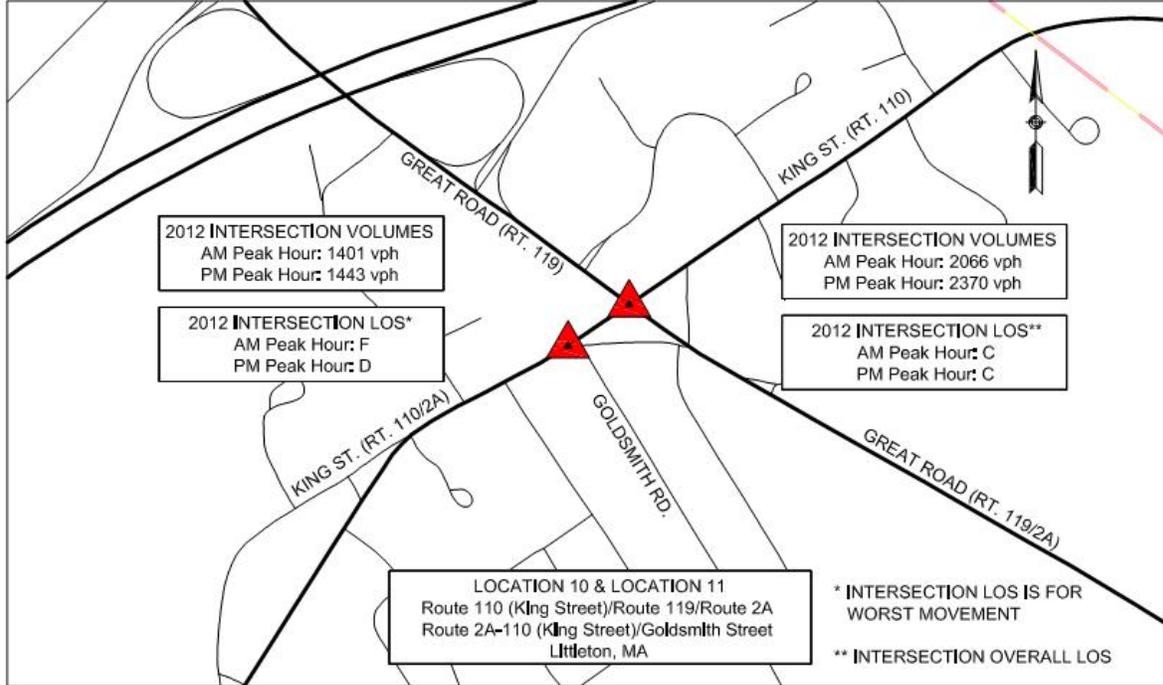
AM peak hour operation for the northbound approach at Location 10 worsened from 2010 to 2012 because of increased northbound traffic volumes. Despite a slight increase in volume from 2010 to 2012, the overall LOS improved in the PM peak hour, including reduced delays for the southbound approach due to decreased southbound and critical movement volumes.

AM peak hour operation at Location 11 declined from LOS C to F for the northbound (Goldsmith Street) movement because the northbound right turn volume increased from 20 vph in 2010 to 123 vph in 2012. Increased northbound volumes also contributed to a decline in the northbound LOS (LOS C to LOS D) for the PM peak hour.

**Table 3-8: Location 10 and Location 11 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
<i>Location 10: Route 110/Route 119/Route 2A (Great Road)</i>									
AM	2,085	2,196	2,225	2,382	2,180	1,873	1,921	1,825	2,066
PM	2,809	2,880	2,574	2,871	2,717	2,450	2,499	2,304	2,370
<i>Location 11: Route 2A-110/Goldsmith Street</i>									
AM	1,469	1,667	1,734	1,638	1,449	1,213	1,319	1,138	1,401
PM	1,758	1,724	1,588	1,840	1,683	1,521	1,600	1,440	1,443

**Figure 3-8: Location 10 and 11 Existing Conditions Summary**



### 3.1.9. Location 12 – Verbeck Gate/MacPherson Road/West Main Street, Ayer

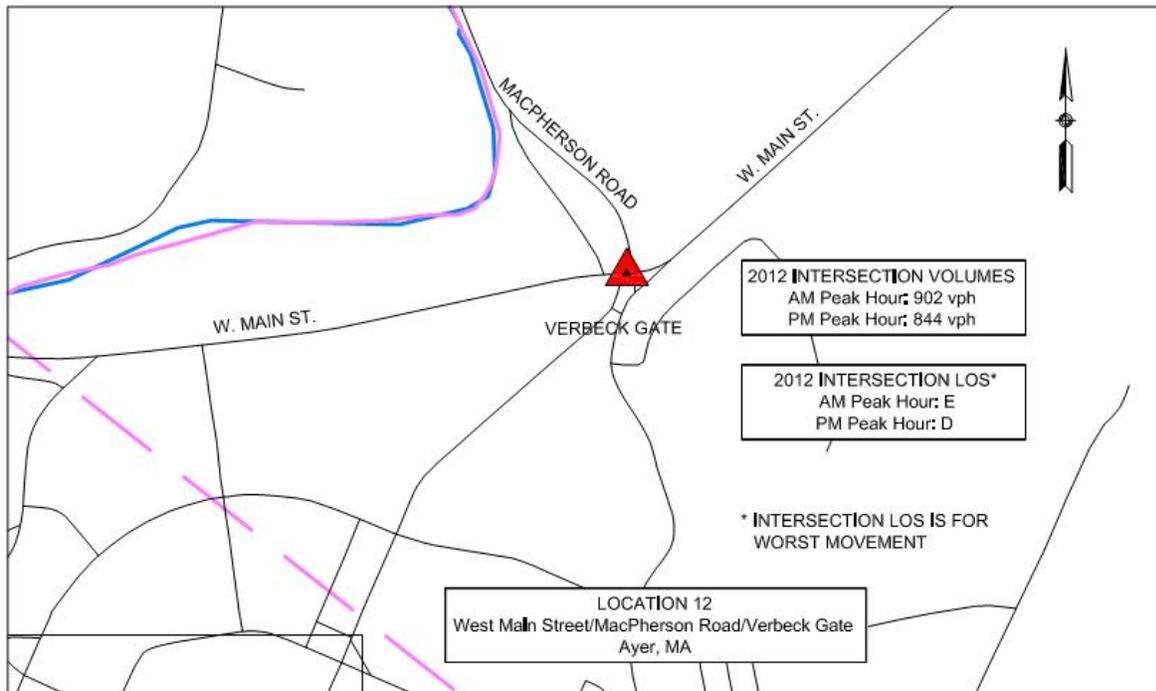
Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. Peak hour traffic volumes have increased two percent during the AM peak hour and have decreased four percent during the PM peak hour compared to 2010 volumes. Both AM and PM peak traffic volumes remain below the highest peak hour traffic volumes observed between 2002 and 2008. This location operates at LOS E during the AM peak hour and LOS D during the PM peak hour. AM peak hour operations have worsened from 2010 to 2012 due to increased critical traffic volumes, and PM peak hour operations have improved from 2010 to 2012 because northbound volumes decreased.

It is noted that while inspecting the intersection geometry at this location in mid-June, the southbound MacPherson Road approach had been gated and closed to traffic. However, this southbound approach was open and vehicle volumes were counted during the traffic data collection in early May.

**Table 3-9: Location 12 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
AM	774	710	888	1,014	916	1,094	1,062	883	902
PM	726	669	926	959	936	1,093	1,010	924	884

**Figure 3-9: Location 12 Existing Conditions Summary**



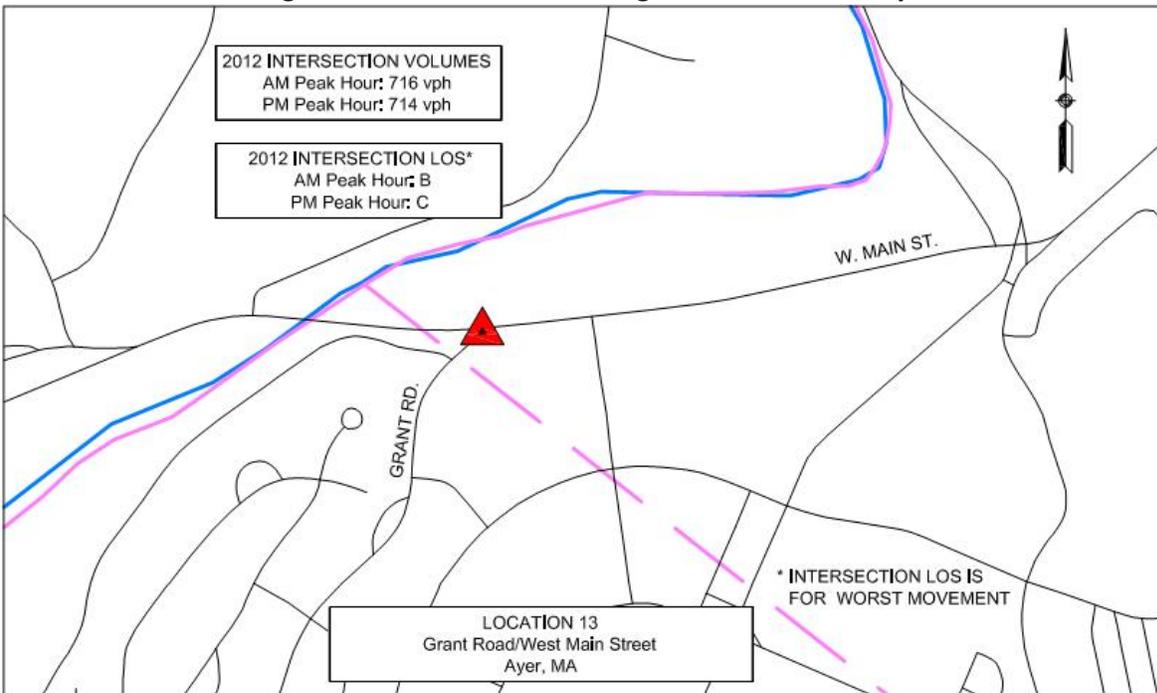
### 3.1.10. Location 13 – Grant Road/West Main Street, Ayer

Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. Peak hour traffic volumes have increased ten percent during the AM peak hour compared to 2010 volumes, and PM peak hour volumes are unchanged compared to 2010 volumes. This location operates at LOS B during the AM peak hour and LOS C during the PM peak hour. 2012 AM and PM peak hour traffic operations are nearly identical to those in 2010.

**Table 3-10: Location 13 Traffic Volume Comparison (vph)**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
AM	N/A				637	625	777	649	716
PM	N/A				662	617	890	713	714

**Figure 3-10: Location 13 Existing Conditions Summary**



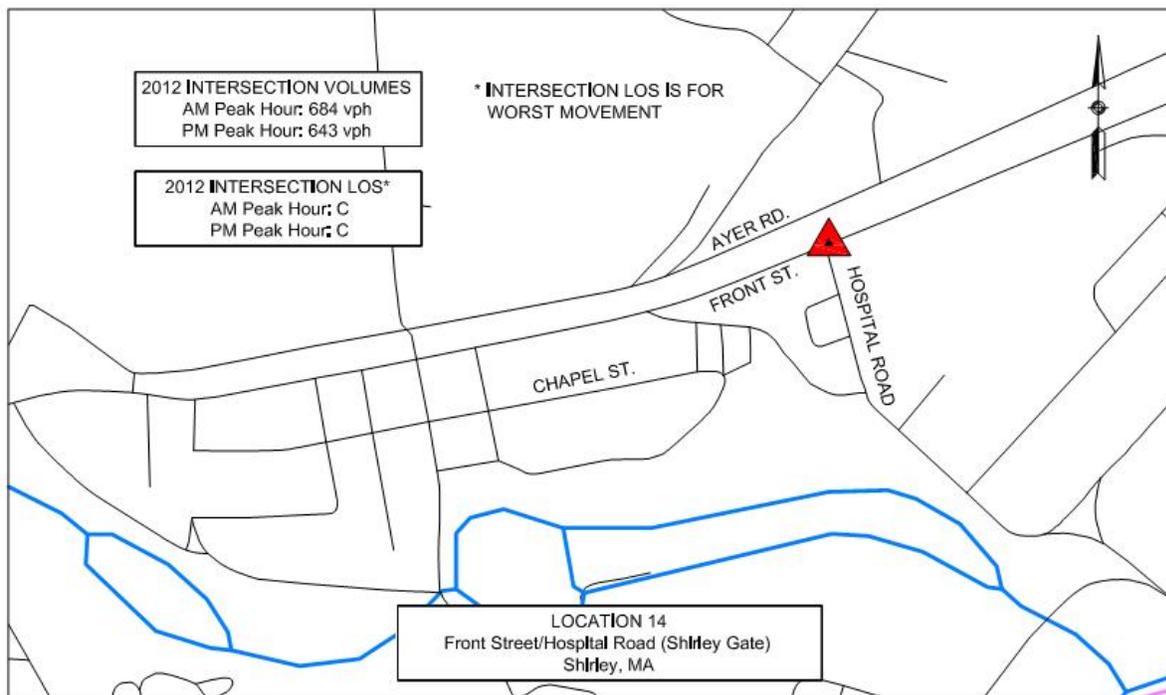
### 3.1.11. Location 14 – Hospital Road/Front Street, Shirley

Traffic volumes and intersection LOS for the AM and PM peak hours are summarized in the figure below. Peak hour traffic volumes have increased four percent during the AM peak and five percent during the PM peak hour compared to 2010 volumes. This location operates at LOS C during the AM peak hour and LOS C during the PM peak hour. 2012 AM and PM peak hour traffic operations are nearly identical to those in 2010.

**Table 3-11: Location 14 Traffic Volume Comparison**

Analysis Peak Hour	1996 Composite	1998	2000	2002	2004	2006	2008	2010	2012
AM	N/A				668	553	671	624	648
PM	N/A				604	591	676	610	643

**Figure 3-11: Location 14 Existing Conditions Summary**



### 3.2. Intersection Capacity Summary

The intersection capacity analysis results were determined using the Methodology of the 2000 *Highway Capacity Manual* (HCM). As done in previous reports, the 2012 traffic volumes and intersection capacity analysis results are compared with those observed in previous years (Tables 3-13 and 3-14).

**Table 3-12: Intersection Capacity Analysis Level of Service Summary – 1996-2012 AM Peak Hour**

	1996		1998		2000		2002		2004		2006		2008		2010		2012	
	LOS	Delay																
<b>Location 1 - Front/Lancaster/Leominster/Center</b>																		
All movements from Lancaster Northbound	B	6	B	8	D	26	C	15	B	12	B	13	B	14	C	19	E	36
All movements from Center Southbound	B	10	C	20	E	48	D	29	C	19	C	23	C	24	F	52	F	>120
Left turn from Leominster Eastbound	A	2	A	2	A	8	A	7	A	7	A	7	A	7	A	8	A	8
Left turn from Front Street Westbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	A	8	A	9
<b>Location 2 - Park/Fitchburg/Groton School</b>																		
Left/Right from Groton School Southbound (stop control)	F	>120	F	>120	F	102	E	44	C	20	C	20	F	79	F	>120	F	>120
Left turn from Fitchburg Road Eastbound	A	3	A	3	A	8	A	8	A	9	A	9	A	8	A	8	A	8
<b>Location 3 - Park/Main/West Main</b>																		
All movements from Park (Mill) Street Northbound	B	9	B	8	n/a	n/a	C	16	B	14	C	15	C	18	C	20	C	19
All movements from Park Street Southbound	F	>120																
Left turn from West Main Street Eastbound	A	4	A	5	A	9	A	9	A	9	A	9	A	9	A	9	A	9
Left turn from Main Street Westbound	A	3	A	3	n/a	n/a	A	8	A	8	A	8	A	8	A	8	A	8
<b>Location 4 - Groton-Harvard/Central</b>																		
All movements from Groton-Harvard Northbound	B	8	C	12	C	18	C	18	B	14	B	13	C	21	F	55	C	23
All movements from Groton-Harvard Southbound	C	12	F	>120	F	80	F	118	D	26	C	20	B	13	C	18	C	16
Left turn from Central Eastbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	A	8	A	8
Left turn from Central Westbound	A	3	A	3	A	8	A	8	A	8	A	8	A	7	A	8	A	8
<b>Location 5 - Route 2A-110/I-495 Northbound Ramps</b>																		
Left turn from Ramps Northbound	C	16	C	19	E	106	E	36	C	23	C	22	C	20	E	35	E	37
Right turn from Ramps Northbound	C	15	C	17	F	n/a	F	106	C	23	B	13	C	15	C	20	C	22
Left turn from Route 2A-110 Westbound	B	5	B	6	B	11	B	10	A	9	A	9	A	9	A	10	A	10
<b>Location 6 - Route 2A-110/I-495 Southbound Ramps</b>																		
Left turn from Ramps Northbound	F	>120																
Right turn from Ramps Northbound	B	6	B	8	C	21	C	18	B	13	B	14	B	14	C	15	C	15
All movements from Murray St(HartwellAve) Southbound	E	35	F	>120	F	>120	F	>120	F	88	F	76	F	60	F	>120	F	107
Left turn from Route 2A-110 Eastbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	A	8	A	8
Left turn from Route 2A-110 Westbound	B	6	B	10	B	12	B	12	A	10	B	10	B	10	B	11	B	11
<b>Location 7 - Route 110-111(Ayer Road)/Still River</b>																		
All movements from Still River Road Eastbound	C	11	C	19	E	47	D	28	C	22	C	20	D	30	B	13	B	13
All movements from Still River Road Westbound	C	12	E	30	F	>120	D	31	D	27	D	27	C	23	B	12	B	12
Left turn from Ayer Road Northbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	C	17	C	16
Left turn from Ayer Road Southbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	C	22	D	27

**Table 3-12: Intersection Capacity Analysis Level of Service Summary – 1996-2012 AM Peak Hour (Continued)**

	1996		1998		2000		2002		2004		2006		2008		2010		2012	
	LOS	Delay																
<b>Unsignalized Intersections</b>																		
<b>Location 8 - Route 70/Route 117 (Seven Bridge Rd)</b>																		
All movements from Main St (Rt. 70/Rt.117) Eastbound	F	88	A	3	A	< 8	n/a	n/a	n/a	n/a	n/a	n/a	A	8	A	3	A	8
All movements from Seven Bridge Road Westbound	B	10	B	8	B	11	B	11	B	11	B	11	B	12	B	11	B	13
All movements from Route 70 Northbound	B	7	F	>120	F	>120	F	>120	F	76	F	>120	F	>120	F	>120	F	>120
All movements from Shirley Road Southbound	n/a	n/a	C	17	E	43	n/a	n/a	n/a	n/a	D	26	D	30	n/a	n/a	F	56
<b>Location 9 - Route 70 (Lunenburg Road)/Route 117</b>																		
All movements from Lunenburg Road Southbound	F	>120																
Left turn from Route 117 Eastbound	A	4	A	4	A	9	A	9	A	8	A	8	A	9	A	9	A	9
<b>Location 11 - Route 2A-110/Goldsmith</b>																		
All movements from Goldsmith Northbound	F	>120	F	489	F	117	F	69	D	30	C	20	C	22	C	20	F	60
Left turn from Route 2A-110 Westbound	B	9	B	10	B	12	B	12	B	10	A	10	A	10	A	9	B	11
<b>Location 12 - Verbeck Gate/MacPherson/West Main</b>																		
All movements from MacPherson Northbound	B	7	B	6	C	20	F	>120	C	19	E	36	D	27	D	31	E	48
All movements from MacPherson Southbound	B	6	B	9	A	< 5	F	62	C	20	D	35	D	33	E	40	E	39
All movements from West Main Eastbound			A	2	A	< 5	A	8	A	8	A	8	A	8	A	8	A	8
All movements from West Main Westbound	A	4	A	4	A	9	A	9	A	9	A	9	A	9	A	9	A	9
<b>Location 13 - Grant/West Main</b>																		
All movements from Grant Road Northbound									B	12	B	12	B	14	B	13	B	15
Left turn from Front Street (West Main St) Westbound									A	8	A	8	A	9	A	8	A	9
<b>Location 14 - Hospital/Front</b>																		
All movements from Hospital Road Northbound									B	13	B	12	B	13	C	16	C	16
Left turn from Front Street Westbound									A	8	A	8	A	8	A	9	A	9
<b>Signalized Intersections</b>																		
<b>Location 10 – Rte 110 (King St)/Rte 119 (Great Rd) * (overall)</b>																		
Left turn from King St Northbound (or Eastbound)	F	66	F	>120	F	>120	F	>120	F	>120	B	17	B	16	D	43	E	77
Through/Right from King St Northbound (or Eastbound)	C	17	D	37			F	>120	F	>120	B	16	B	16	D	43	E	77
Left turn from King St Southbound (or Westbound)	D	38	F	>120			E	77	D	48	B	14	B	14	C	33	C	32
Through/Right from King St Southbound (or Westbound)	B	13	C	19			C	24	E	62	B	15	B	15	C	33	C	32
Left turn from Great Road Westbound (or Northbound)	B	6	B	7			A	6	B	10	A	6	A	6	B	14	B	18
Through/Right from Great Road Westbound (or Northbound)	B	7	B	8			C	20	C	29	C	28	C	28	B	17	B	20
Left turn from Great Road Eastbound (or Southbound)	A	4	A	4			A	10	B	12	A	8	A	7	A	10	B	12
Through/Right from Great Road Eastbound (or Southbound)	B	14	C	17			B	12	F	>120	E	75	F	>120	B	19	C	24

Note: (\*) Location 10 was a signalized intersection as of 2006.

**Table 3-13: Intersection Capacity Analysis Level of Service Summary – 1996-2012 PM Peak Hour**

	1996		1998		2000		2002		2004		2006		2008		2010		2012	
	LOS	Delay																
<b>Location 1 - Front/Lancaster/Leominster/Center</b>																		
All movements from Lancaster Northbound	B	9	B	7	C	23	C	17	C	18	C	16	C	18	C	24	C	23
All movements from Center Southbound	C	12	B	10	C	24	C	22	D	25	C	23	D	27	E	38	E	45
Left turn from Leominster Eastbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	A	8	A	8
Left turn from Front Street Westbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	A	8	A	8
<b>Location 2 - Park/Fitchburg/Groton School</b>																		
Left/Right from Groton School Southbound (stop control)	F	>120	F	54	F	101	F	>120	F	>120								
Left turn from Fitchburg Road Eastbound	B	6	B	8	B	11	B	10	B	11	A	10	B	10	B	10	B	11
<b>Location 3 - Park/Main/West Main</b>																		
All movements from Park (Mill) Street Northbound	C	10	D	21			D	26	D	31	D	33	E	38	D	26	E	46
All movements from Park Street Southbound	F	>120																
Left turn from West Main Street Eastbound	B	8	C	11	B	10	B	11	B	12	B	13	B	13	B	11	B	12
Left turn from Main Street Westbound	A	3	A	3			A	8	A	8	A	8	A	8	A	8	A	8
<b>Location 4 - Groton-Harvard/Central</b>																		
All movements from Groton-Harvard Northbound	C	10	D	24	D	34	F	64	D	33	C	23	C	22	D	26	C	23
All movements from Groton-Harvard Southbound	B	10	D	25	D	34	F	67	C	21	C	24	C	21	C	18	C	21
Left turn from Central Eastbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	A	8	A	8
Left turn from Central Westbound	A	2	A	3	A	8	A	8	A	8	A	8	A	8	A	8	A	8
<b>Location 5 - Route 2A-110/I-495 Northbound Ramps</b>																		
Left turn from Ramps Northbound	F	73	F	>120	F	94	F	>120	F	162	F	>120	F	77	F	59	F	56
Right turn from Ramps Northbound	B	6	B	7	C	16	C	16	C	18	C	20	C	21	B	14	B	13
Left turn from Route 2A-110 Westbound	A	4	A	4	A	9	A	9	A	9	A	9	A	9	A	9	A	9
<b>Location 6 - Route 2A-110/I-495 Southbound Ramps</b>																		
Left turn from Ramps Northbound	F	>120																
Right turn from Ramps Northbound	B	5	B	6	B	14	B	14	B	14	B	13	B	14	B	12	B	13
All movements from Murray St(HartwellAve) Southbound	F	49	E	41	F	78	F	85	F	93	F	>120	F	88	F	82	F	63
Left turn from Route 2A-110 Eastbound	A	5	A	5	A	9	A	10	A	10	A	10	A	9	A	9	A	9
Left turn from Route 2A-110 Westbound	B	5	B	6	A	9	B	10	B	10	A	10	B	10	A	10	A	10
<b>Location 7 - Route 110-111(Ayer Road)/Still River</b>																		
All movements from Still River Road Eastbound	C	11	C	11	C	18	C	15	C	21	C	16	D	32	A	10	B	11
All movements from Still River Road Westbound	B	9	B	10	C	23	C	18	C	24	C	19	E	35	A	9	B	10
Left turn from Ayer Road Northbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	B	11	C	18
Left turn from Ayer Road Southbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	A	10	B	13

**Table 3-13: Intersection Capacity Analysis Level of Service Summary – 1996-2012 PM Peak Hour (Continued)**

	1996		1998		2000		2002		2004		2006		2008		2010		2012	
	LOS	Delay																
<b>Unsignalized Intersections</b>																		
<b>Location 8 - Route 70/Route 117 (Seven Bridge Rd)</b>																		
All movements from Main St (Rt. 70/Rt.117) Eastbound	F	>120	B	6	A	10	n/a	n/a	n/a	n/a	A	10	B	10	A	3	A	3
All movements from Seven Bridge Road Westbound	C	14	A	4	A	9	C	22	A	9	A	9	A	9	A	9	A	9
All movements from Route 70 Northbound	A	4	F	>120														
All movements from Shirley Road Southbound	B	5	D	22	E	36	n/a	n/a	n/a	n/a	E	37	E	41	n/a	n/a	F	51
<b>Location 9 - Route 70 (Lunenburg Road)/Route 117</b>																		
All movements from Lunenburg Road Southbound	F	>120																
Left turn from Route 117 Eastbound	B	7	B	9	B	11	B	11	B	11	B	11	B	12	B	12	B	13
<b>Location 11 - Route 2A-110/Goldsmith</b>																		
All movements from Goldsmith Northbound	F	>120	F	>120	F	58	F	>120	F	156	F	88	F	>120	C	22	D	33
Left turn from Route 2A-110 Westbound	B	7	B	7	A	9	B	11	B	10	A	10	B	10	A	9	A	10
<b>Location 12 - Verbeck Gate/MacPherson/West Main</b>																		
All movements from MacPherson Northbound	B	7	B	8	E	44	F	54	F	56	F	>120	F	>120	D	35	D	30
All movements from MacPherson Southbound	B	7	C	12	C	16	C	16	C	20	D	33	C	23	C	18	C	19
All movements from West Main Eastbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	A	8	A	8
All movements from West Main Westbound	A	3	A	3	A	8	A	8	A	8	A	8	A	8	A	8	A	8
<b>Location 13 - Grant/West Main</b>																		
All movements from Grant Road Northbound									B	13	B	12	C	20	C	16	C	18
Left turn from Front Street (West Main St) Westbound									A	8	A	8	A	8	A	8	A	8
<b>Location 14 - Hospital/Front</b>																		
All movements from Hospital Road Northbound									B	13	B	13	B	12	C	16	C	17
Left turn from Front Street Westbound									A	8	A	8	A	8	A	8	A	8
<b>Signalized Intersections</b>																		
<b>Location 10 – Rte 110 (King St)/Rte 119 (Great Rd) * (overall)</b>																		
Left turn from King St Northbound (or Eastbound)	F	>120	F	>120	F	>120	F	95	F	136	F	>120	F	107	C	28	C	32
Through/Right from King St Northbound (or Eastbound)	B	7	B	9			B	15	B	16	B	16	C	19	C	28	C	32
Left turn from King St Southbound (or Westbound)	B	11	C	17			F	86	B	19	B	15	C	19	E	70	D	55
Through/Right from King St Southbound (or Westbound)	B	15	C	17			C	27	D	48	C	33	C	25	E	70	D	55
Left turn from Great Road Westbound (or Northbound)	E	60	E	59			F	15	A	10	A	9	A	9	B	19	B	17
Through/Right from Great Road Westbound (or Northbound)	D	39	D	37			F	15	F	>120	F	>120	F	>120	C	21	C	27
Left turn from Great Road Eastbound (or Southbound)	E	55	F	>120			C	24	A	8	A	7	A	8	C	22	C	22
Through/Right from Great Road Eastbound (or Southbound)	E	13	D	32			F	>120	E	59	D	39	E	45	D	38	D	36

Note: (\*) Location 10 was a signalized intersection as of 2006.

Based on the results presented above, existing development at Devens has impacted the study area intersections on varying levels. When comparing existing 2012 LOS to the 1996 baseline conditions, the study area intersections can be classified as improved, unaffected, minimally affected, or affected.

“Improved intersections” are those intersections where the 2012 LOS improved by one or more level since 1996, including:

- Location 10 - Route 110 (King Street)/Route 119/Route 2A (Great Road)
- Location 11 - Route 2A-110 (King Street)/Goldsmith Street

“Unaffected intersections” are those intersections where the 2012 LOS remain unchanged from 1996, including:

- Location 2 - Park Street/Fitchburg Road/Groton School Road
- Location 3 - Park Street/Main Street/West Main Street
- Location 4 - Groton-Harvard Road/Central Avenue
- Location 6 - Route 2A-110/I-495 Exit 30 SB Ramps
- Location 8 - Route 70/117 (Seven Bridge Road)
- Location 9 - Route 70/117 (Lunenburg Road)

“Minimally affected intersections” are those intersections where the 2012 LOS have only degraded by one level since 1996. This additional delay may be contributed to several factors, including background regional traffic growth. The minimally affected intersections include:

- Location 7 - Route 110-111 (Ayer Road)/Route 110 (Still River Road)/Route 111
- Location 13 - Grant Road/West Main Street
- Location 14 - Hospital Road/Front Street

“Affected intersections” include those intersections where the 2012 LOS have degraded by more than one level since 1996. Side street traffic at these intersections typically operate at LOS F during peak hours, which is not uncommon for unsignalized intersections if there are few discernable gaps in heavy major-street flow. This additional delay may be contributed to several factors, including background regional traffic growth and shifting regional traffic patterns. The affected intersections include:

- Location 1 - Front Street/Lancaster Street/Leominster Road/Center Road
- Location 5 - Route 2A-110/I-495 Exit 30 NB Ramps
- Location 12 - Verbeck Gate/ MacPherson Road/West Main Street

It is noted that a portion of the LOS degradation occurred since 2008; however, this is likely not attributed to development at Devens since average weekday daily traffic through Devens gates has *decreased* by approximately eleven percent, despite the increase in occupied development area at Devens. It is more likely that LOS degradation service since 2008 is due to isolated increase in traffic volumes associated with development in surrounding areas. For example, all three affected intersections lie on an arterial roadway between Shirley, MA and IBM’s new Mass Lab campus in Littleton, an office complex with approximately 2,200 employees which opened in 2010.

## 4. Build-Out Analysis and Trip Generation/Distribution

### 4.1. Overview

There has been substantial industrial, commercial, and office facility development at Devens over the past several years. A build-out analysis was updated for the 2010 Five-Year Traffic Report. The information presented in the 2010 Report has been updated for this 2012 Traffic Monitoring Report. Devens Base Reuse Plan limits the total development area (i.e., buildings) to 8.5 million square feet. The number of daily vehicle trips listed in the EIR is 59,625 at the maximum build-out capacity.

For the purpose of this study, two build-out scenarios were considered in evaluating the projected development and associated traffic volumes within Devens:

- Scenario 1 represents a development condition whereby the 59,625 daily vehicle trips allowed by the EIR are reached.
- Scenario 2 represents a development condition whereby total development reach 8.5 million square feet as allowed in the Devens Base Reuse Plan.

### 4.2. Existing Build-Out

Coordination with the MassDevelopment Real Estate Office was required to inventory existing and planned development (build-out) data at Devens. The following information was provided for existing development, potential expansion, and planned development:

- Company Name
- Number of Employees
- Land Use Type
- Existing/Planned Building Footprint (sf)
- Expansion Footprint (sf)

Since 2010, the total occupied build-out has increased by 477,200 square feet. In April 2012, about 4.14 million square feet of total build-out was occupied, while 886,660 square feet of new construction was unoccupied and 2.20 million square feet of build-out was planned for potential expansions (Table 4-1). The total area of occupied, unoccupied, and planned build-out (7.32 million square feet) is 1.18 million square feet less than the 8.5 million square feet permitted under Devens By-Laws. This is equivalent to 4,830 daily trips based on current tripmaking rates at Devens.

**Table 4-1: Devens Build-Out Summary**

<b>Category</b>	<b>Area (Bldg. SF)</b>
Existing Reused	657,520
New Construction (occupied)	3,482,439
<i>subtotal (occupied development)</i>	4,139,959
New Construction (unoccupied)	886,660
Potential Expansions	2,220,062
Current Prospects	75,000
<i>subtotal (future development)</i>	2,295,062
Total Actual and Planned Buildout	7,321,681
<b>Total Buildout Permitted Under Devens By-Laws</b>	<b>8,500,000</b>
Potential Uncommitted Buildout	1,178,319

### 4.3.Existing Trip Generation

ITE trip generation rates were used to calculate the theoretical total weekday vehicle trips, AM peak hour entering and exiting trips, and PM peak hour entering and exiting trips for each development in Devens. The number of vehicle trips assigned to each development is typically based on the square footage of the development category; however, for some developments vehicle trips were assigned based on other factors such as number of employees, students, or hotel rooms. No traffic counts were performed at development driveways as part of this 2012 Biennial Traffic Monitoring Report.

Using ITE rates, it is estimated that the current Devens development would generate 35,884 daily vehicle trips in 2012 (Table 4-2). The 2012 total average daily traffic counts actually observed at Devens gates is 23,041 vehicle trips. As surveyed in the 2010 Five Year Traffic Report, 32 percent of the total traffic volume is cut-through traffic. The 2012 daily vehicles counted at the Devens gates adjusted for cut-through is 15,668 vehicle trips. This indicates that Devens development is generating off-site traffic at a rate of 44 percent of what a comparable development would be expected generate according to the ITE methodology. This is consistent with previous 5-Year Traffic Monitoring Studies.

**Table 4-2: Trip Generation Summary**

	<b>Year 2010</b>	<b>Year 2012</b>	<b>Difference</b>
Occupied Development	3,662,758 SF	4,139,959 SF	+477,201 SF
Total Daily Traffic Counts at Devens Gates	25,903 vehicle trips	23,041 vehicle trips	-2,052 vehicle trips
Daily Gate Counts Adjusted for Cut-Thru Traffic	17,614 vehicle trips	15,668 vehicle trips	-1,946 vehicle trips
Daily Vehicle Trips per 1,000 SF Development	4.81 trips/KSF	3.78 tips/KSF	-1.03 trips/KSF
ITE Estimated Daily Devens Trips	33,396 vehicle trips	35,884 vehicle trips	+2,488 vehicle trips
ITE Estimated Daily Vehicle Trips per 1,000 SF Development	9.12 trips/KSF	8.67 trips/KSF	-0.45 trips/KSF

#### **4.4. Build-Out Projections**

The traffic conditions for two development scenarios are analyzed as part of this study. To predict these two scenarios, development conditions and associated traffic volumes were projected out to the 8.5 million square feet of total development threshold and 59,625 daily vehicle trips threshold as defined in the Devens Base Reuse Plan (Figures 4-1 and 4-2).

The Year 2012 total average weekday daily traffic (AWDT) at the five Devens' gates is 23,041 vehicle trips. Using the 32% cut-through rate determined in the 2010 Five Year Traffic Report, the 2012 AWDT generated by Devens development adjusted for cut-through is 15,668 vehicle trips, which has been retained as the baseline condition for projecting future daily vehicle trips.

Development projections are based on measured traffic volume data and the real estate data provided by the MassDevelopment Real Estate Office. Where insufficient information exists, the following assumptions were made:

1. Annual development is expected to occur at a rate of 225,000 square feet per year, with a corresponding annual trip increase of 1,717 vehicle trips per day.
2. Unplanned development is expected to be similar in type to existing and planned development, consisting mainly of research and development, manufacturing, general office, and general light industrial land uses.

Figure 4-1: Devens Build-Out Summary by Year - Trips

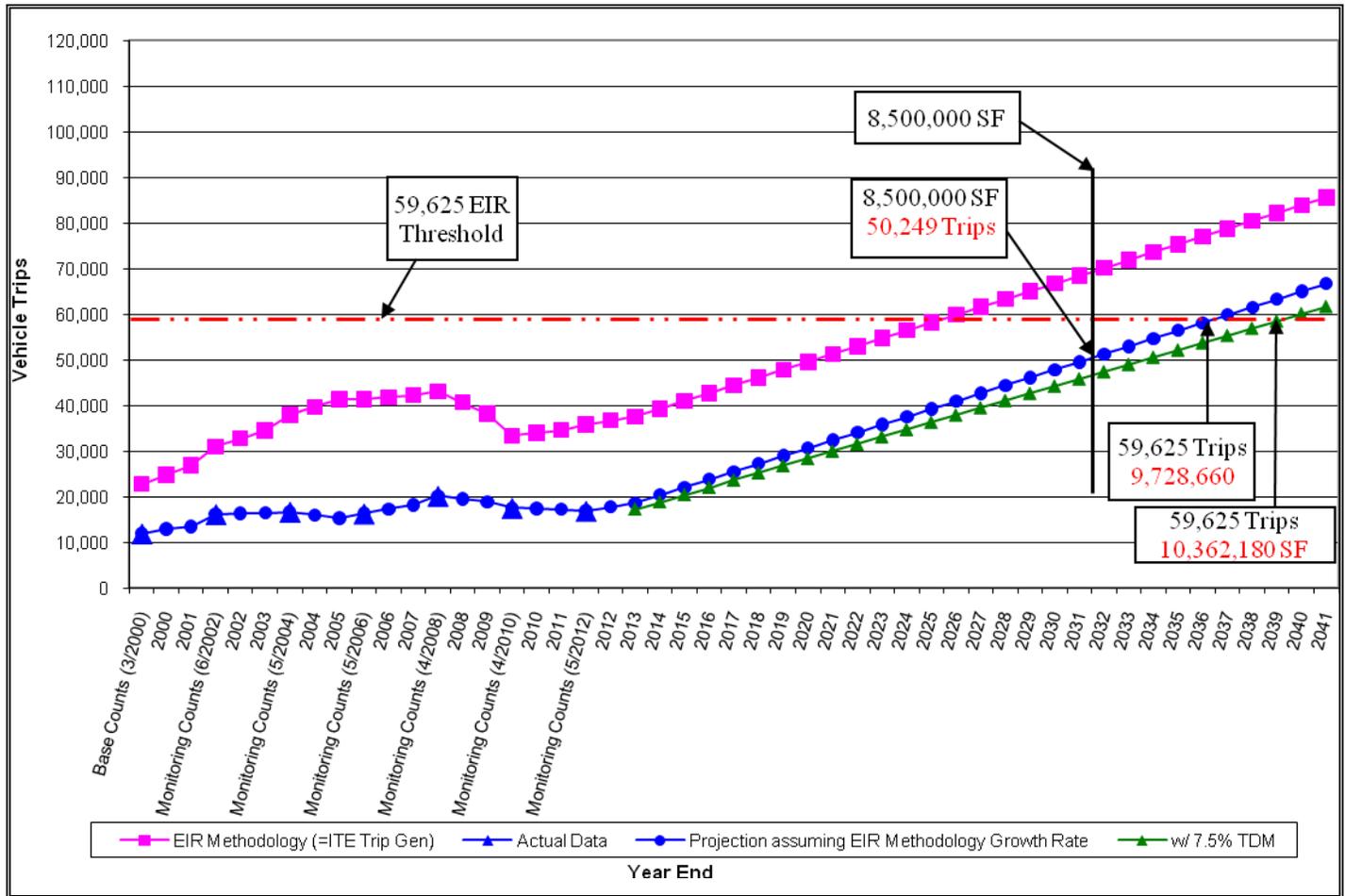
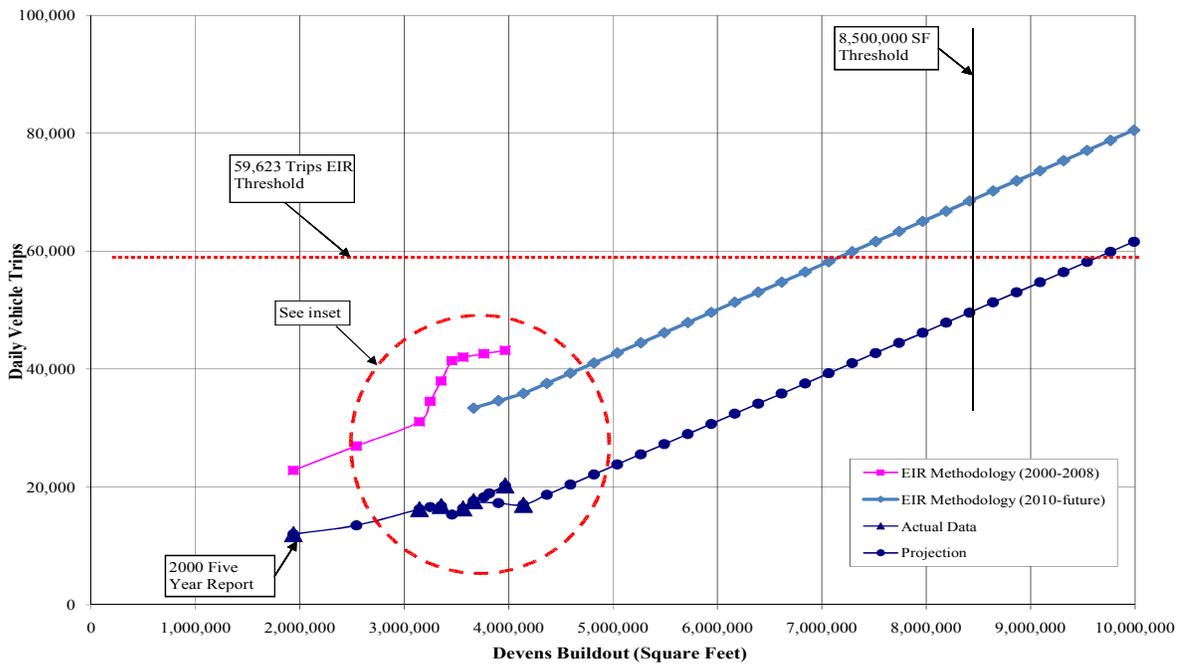


Figure 4-1 above is similar to the graph shown in previous traffic monitoring reports. The trend labeled EIR Methodology represents the historic trip generation based on ITE Trip Generation rates with an assumed straight-line project for future years. The trend labeled Actual Data shows the historic vehicle trips counted from 2000-2012 then assumes a straight-line projection for future years. The EIR threshold of 59,625 daily vehicle trips (Scenario 1) is projected to be reached in 2036 with 9,728,660 square feet of development. The Scenario 2 build-out limit of 8.5 million square feet is projected to be reached in 2031, with a corresponding 50,249 daily vehicle trips.

The lowest trend shows a projection of actual data assuming Transportation Demand Management (TDM) daily trip reduction of 7.5 percent. As discussed above, TDM strategies are have not proven to be as prevalent as anticipated; however with the completion of the MBTA Fitchburg Commuter Rail Line improvements in 2013 additional Devens business will have the ability to more easily commute to Devens from points east. Thus, this projection with TDM reduction does not begin until 2013 and is projected to reach the 59,625-trip threshold in 2039.

**Figure 4-2: Devens Build-Out Summary by Square Feet - Trips**



**Figure 4-2 Inset:**

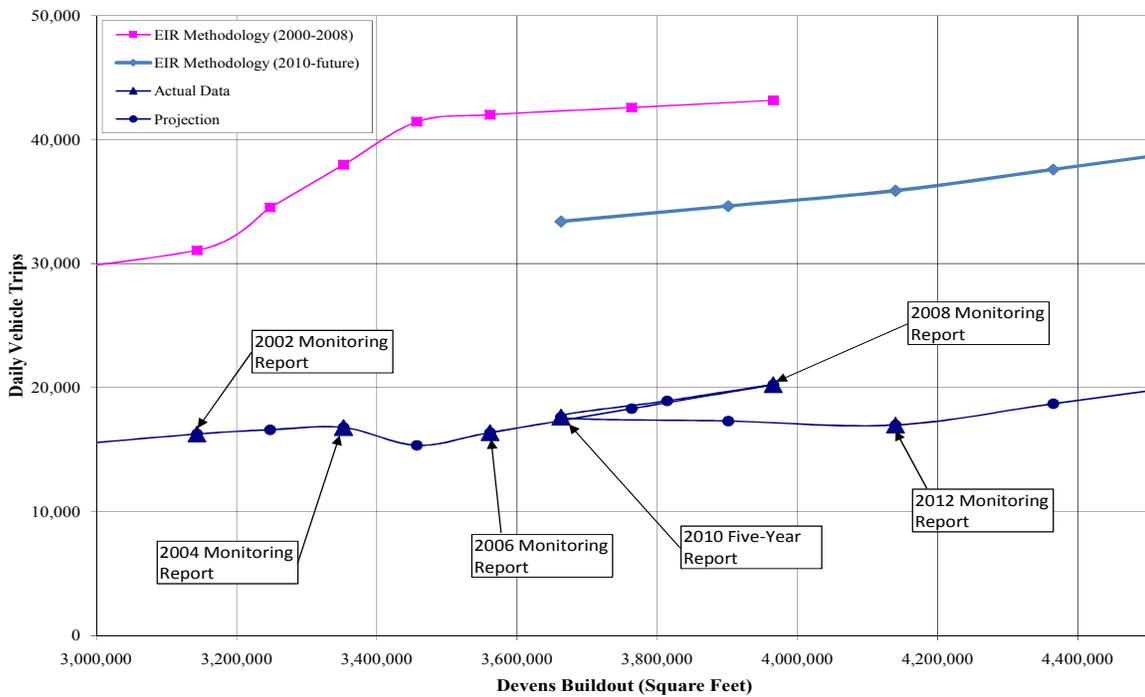


Figure 4-2 above represents a relationship between build-out area and daily vehicle trips. The line labeled EIR Methodology (2000-2008) represents the historic trip generation based on ITE Trip Generation rates as calculated from 2000-2008. The line labeled EIR methodology (2010-future) represents the trip generation based on ITE Trip Generation rates as calculated in 2010 and 2012 and projected forward at a constant yearly rate. The overlap in these two lines that can be seen between 3,600,000 and 4,000,000 square feet is due to a decrease in occupied development between 2008 and 2010.

The difference between the 2000-2008 and 2010-2012 methodologies is that different ITE Trip Generation Rates are used for each. EIR methodology (2000-2008) used more generic land uses to develop trip generation rates, whereas the 2010-2012 EIR methodology uses more specific land uses for each development, which accounts for the lower trip rates for equivalent build-out areas. Using the more specific land uses results in projections that are closer to the actual measured traffic volumes.

## 5. Conclusions

This comprehensive study indicates that regional traffic volumes are generally stabilizing and/or decreasing; however, there are isolated roadways with increased traffic volumes. Total daily traffic volumes at Devens gates have decreased by eleven percent since 2010. Average total weekday daily truck traffic volumes through all of Devens gates have increased by 27 percent since 2010, yet those volumes remain much lower than volumes observed in 2004, 2006, and 2008.

Devens' Base Reuse Plan sets a limit of 8.5 million square feet of total development in Devens and the EIR limits the daily vehicle trips to 59,625. In April 2012, approximately 4.14 million square feet of total build-out was currently occupied, while 886,660 square feet of new construction remained unoccupied (2.30 million square feet of build-out is planned for potential expansions). The total square footage of occupied, unoccupied, and planned build-out (7.32 million square feet) is 1.18 million square feet less than the 8.5 million square feet permitted under Devens By-Laws. The EIR threshold of 59,625 daily vehicle trips is projected to be met in 2036 with a corresponding 9,728,660 square feet of occupied development. The build-out limit of 8.5 million square feet is projected to be met in 2031, with a corresponding 50,249 daily vehicle trips being generated.

Through the review and approval of the Final EIR in 1995, MassDevelopment is required to mitigate traffic impacts resulting from future Devens development. Mitigation measures for the following locations included in the Final EIR to address projected congestion at external intersections, including:

- Location 2 - Park Street/Fitchburg Road/Groton School Road in Ayer
- Location 3 Park Street/Main Street/West Main Street in Ayer
- Location 5 - Route 2A-110/I-495 Exit 30 NB Ramps in Littleton
- Location 6 - Route 2A-110/I-495 Exit 30 SB Ramps in Littleton
- Carlton Rotary in Ayer

The LOS analyses of these five locations shows that, when compared to 1996 baseline conditions, LOS are either no worse or only slightly worse in 2012. It is reasonable to conclude that it is unlikely that development at Devens is responsible for increased delay at study area intersections since 2010, given the reduction in average weekday daily traffic through Devens gates from 2010 to 2012 (despite an increase in occupied development).

Daily traffic through Devens' gates *has* increased since 1996; however, peak hour traffic volumes through the five intersections named in the Final EIR has generally remained steady or decreased. Impacts to the level of service are mostly due to changing travel patterns resulting in increases to the critical volumes (e.g. more left turns), not to an overall increase in traffic. Changing regional traffic patterns can be attributed to a variety of factors unrelated to the development of Devens.