DEVENS TRAFFIC MONITORING PROGRAM

Biennial Traffic Report

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

Page

LIST OF TABLES (Continued)

Page

1.0 INTRODUCTION

1.1 Overview

In the Devens Final Environmental Impact Report (FEIR), the Massachusetts Government Land Bank (now MassDevelopment) made a commitment to conduct a traffic monitoring program for study area roadways. The purpose of the monitoring program is to establish a consistent baseline of area wide traffic volumes which can subsequently be monitored to indicate the magnitude and directional distribution of traffic growth associated with the future redevelopment of Devens. The timing of off-site mitigation identified in the FEIR is tied to certain levels of traffic, and the data obtained through the monitoring program will determine when those traffic volumes are being approached.

This document is the fifth in a series of monitoring reports. Traffic data collected for this report is compared with data obtained for the previous 2002 Monitoring Report and other studies conducted in 2000, 1998, 1996 and 1990.

2.0 EXECUTIVE SUMMARY

2.1 Data Collection and Analysis

This document is the fifth in a series of traffic monitoring reports conducted for Devens. A traffic count program was implemented in the Spring (May and June) of 2004, and the data was evaluated and summarized to compare to the results of previous reports. The traffic monitoring program consisted of the following elements:

- Intersection Turning Movement Counts were performed at 14 locations between 7:00 AM – 9:00 AM, 4:00 PM – 6:00 PM on typical weekdays excluding Monday AM and Friday PM. The following two locations were new for this report:
  - Grant Road/West Main Street, Ayer
  - Hospital Road/Front Street, Shirley
- Automatic Traffic Recorder Counts were performed at 14 locations for 48 consecutive hours on typical weekdays. The Grant Road Gate was a new location added for this report.
- Automatic Traffic Recorder Counts were performed at six locations for seven consecutive days.
- Vehicle Classification Counts were performed at six locations for 48 consecutive hours on typical weekdays. The Grant Road Gate was again a new location added for this report.
- Trip generation estimates were made based on traffic count data and industry data and were applied to current Deven's development land use.

The traffic data was compiled and summarized in various table and charts, and capacity analyses were conducted for the 14 intersection locations where turning movement counts were performed.

2.2 Findings

To evaluate the 2004 information, the traffic volume data and capacity analysis results were compared to the previous count results, including the previous year 2002 results. Traffic volume counts at Devens gates were used to compare with previous site generation and were compared with build-out projections. The traffic volume and trip generation findings are summarized below:

- The occupied development on Devens has increased from 3,143,464 square feet in 2002 to 3,720,160 square feet in 2004, an increase of 576,696 square feet.

- Between 2002 and 2004, intersection traffic turning movement volumes have decreased by approximately 8% during the AM peak hour and 3% during the PM peak hour. A total of 10 study intersections (of 12 compared) have experienced decreases in volume during the AM peak hour and six decreased in volume during the PM peak hour. *This trend indicates that while Devens development has increased between 2002 and 2004, Devens traffic is not impacting intersections in the surrounding towns.*

- In 2004, Devens development generated approximately 16,800 daily vehicle trips compared to 16,250 trips in 2002. While the number of vehicle trips is comparable, there is about 575,000 square feet more development in 2004 than in 2002. *This indicates that Devens development is generating fewer vehicle trips off-site than was measured in year 2002 and predicted in the EIR. If the current trend in trip generation continues in conjunction with development, the EIR threshold of 59,625 vehicle trips would not be reached until approximately 2013.* Figure ES-1 below shows this information.

- Daily vehicle trips generated by the current Devens development were estimated using national industry trip rates (Institute of Transportation Engineers). The current 3.7 million square feet of development is estimated to generate approximately 26,000 daily vehicle trips. This figure is more than 9,000 daily vehicle trips fewer than was recorded through the Devens gates in 2004. *Therefore, Devens development is generating significantly fewer daily vehicle trips than a comparable development.*

- While daily traffic volumes at Devens Gates has remained constant between 2002 and 2004 (despite an increase in Devens development of approximately 575,000 square feet), AM and PM peak hour volumes have increased by 17% and 23%, respectively between 2002 and 2004. This increase in peak hour gate volumes has not been reflected in increases to either intersections or local roadways in surrounding towns. *Therefore, the increase in peak hour gate volumes appears not to be attributed to Devens development growth. Instead, increases in peak hour gate volumes may have occurred as a result of higher cut-through volumes and/or growth in regional traffic volumes on Route 2 (see below).* The increase in peak hour gate traffic volumes identifies that review of possible improvements at these locations should be included in upcoming Capital Budgets.

- Traffic volumes on roadways in surrounding towns have been uniform over time between 1996 and 2004. While individual roadways have experienced either

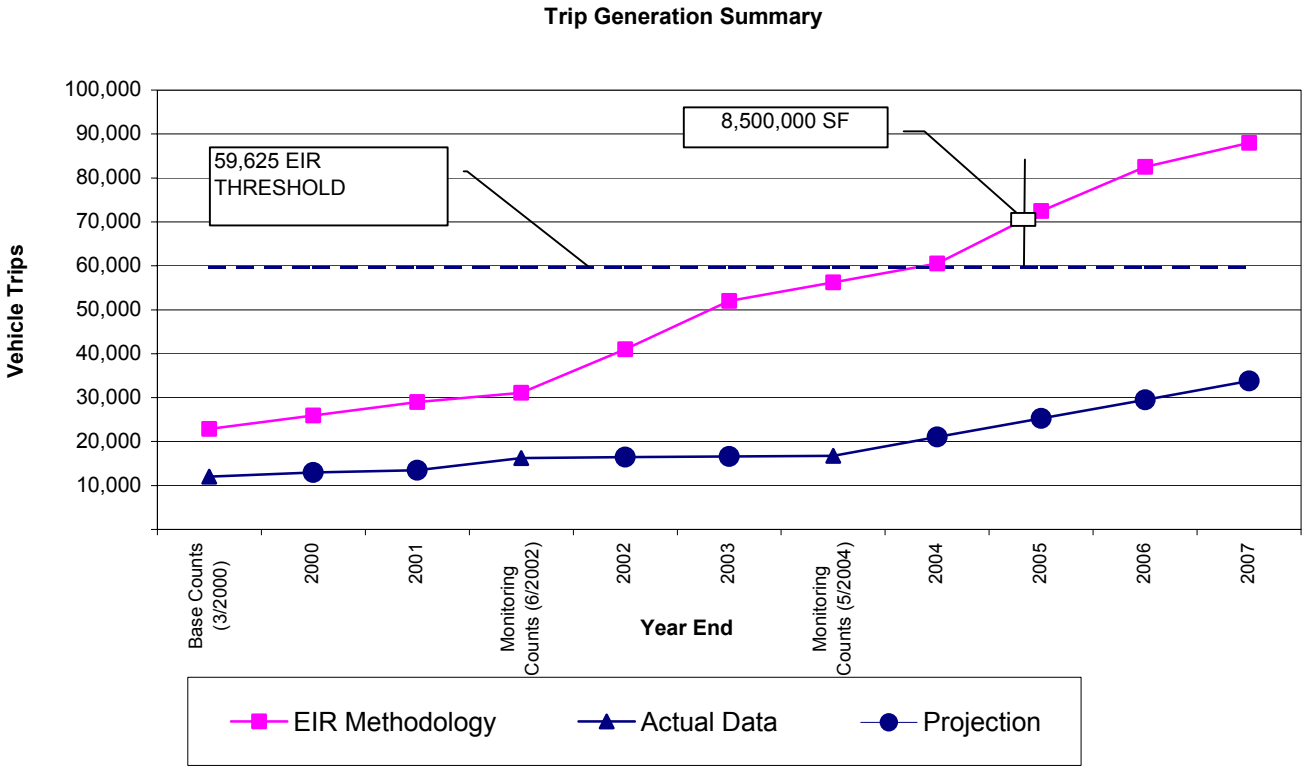
increases or decreases in volume, as a group local roadways have experienced a traffic growth rate of about 1% per year over the last eight years. *This indicates that Devens-generated traffic is not significantly affecting traffic volume on local roadways.* This is a reasonable amount to be considered as regional growth of the area.

- Traffic volumes on Route 2 have increased steadily each monitoring period since 1996. Daily traffic volumes on Route 2 have increased by approximately 15% since 2002. Between 2002 and 2004, AM peak hour traffic volumes on Route 2 have increased by approximately 22% while PM peak hour volumes have increased by about 14%. This growth in regional traffic can be attributed to the continued growth in housing starts and employment in the communities surrounding Devens such as Littleton, Harvard, Ayer, and Shirley and communities west of Devens along Route 2, Fitchburg, Leominster, etc. The affect of housing and employment trends outside of Devens will be evaluated in the next Five-Year Traffic Report.

- The percentage of trucks and buses through Devens gates has increased from 7.6% in 2002 to 18.7% in 2004. This is consistent with the 74% increase in truck traffic at Devens gates seen between 2000 and 2004. The largest increase in truck traffic has occurred at the Barnum Gate. The increase in truck traffic can be attributed to recent construction activity on-site. The Jackson and Barnum Gates experience the highest average weekday daily truck volumes with approximately 1,200 truck trips at each gate. Major contributors would be traffic using Barnum Gate while Route 2/Jackson Road construction is occurring.

- Capacity analysis results for the study intersections revealed that 5 of the 12 intersections experienced an improved Level of Service during the AM peak hour and 5 experienced no change. During the PM peak hour, one intersection experienced improved Level of Service conditions, while 10 intersections experienced no change. The analysis results are consistent with the general reduction in traffic volumes measured between 2002 and 2004.

Figure ES-1: Trip Generation Summary



3.0 BUILD OUT ANALYSIS/TRIP GENERATION

3.1 Overview

There has been substantial development at Devens in the past several years including research & development, light industrial, office, and housing. A build-out analysis was completed for the Five-Year Traffic Report and updated for the Year 2002 Traffic Monitoring Program. Based on information provided by MassDevelopment, trip generation and development analysis has been updated for the Year 2004 Traffic Monitoring Program.

Table 3-1 provides an update, as of May 21, 2004, of the existing and planned development at Devens. The table shows that 3.7 million square feet of development (and 102 units of housing) have been built out to date. This represents an increase of 576,696 square feet of development since the Year 2002 Traffic Monitoring Report. Another 1,546,509 square feet of development and 176 units of housing are planned. This results in a net balance of 3,233,331 square feet under the total buildout permitted under Devens By-Laws.

Table 3-1: Devens Building Expansion Summary – As of May 21, 2004

CATEGORY	AREA (Bldg. SF)
Existing Buildings Currently in Reuse	627,924
New Construction (occupied)	3,092,236
Total Actual Buildout to Date	3,720,160
Total Buildout Permitted Under Devens By-Laws	**8,500,000**
Remaining Buildout permitted under Bylaws	4,779,840
Permitted/Under Construction	218,000
Current Prospects	422,789
Potential Expansions	905,720
Total Potential Additional Buildout	1,546,509
Total Actual & Planned Buildout	5,266,669
Gross Uncommitted Buildout	**3,233,331**

3.2 Trip Generation

Vehicle trip generation estimates were made for existing and proposed development land uses at Devens. Estimates were based on land use type and size information provided by MassDevelopment. Trip generation estimates were based on current Year 2004 traffic count information and rates provided in the Institute of Transportation Engineer's (ITE), *Trip Generation*, 7th Edition, 2003. No counts were performed at development driveways as part of the year 2004 Traffic Monitoring Report.

Table 3-2 summarizes Year 2002 and 2004 trip generation estimates based on traffic counts at the Devens Gates and using ITE trip rates. The Year 2004 total average weekday daily traffic (AWDT) of all five Devens gates is 20,458 vehicle trips. As was the case in the Year 2002 Traffic Monitoring Program, it was assumed that 18 percent of the total traffic volume is cut-through traffic, that is not generated by Devens development. The AWDT generated by Devens adjusted for cut-through equals 16,776 vehicle trips in 2004. This is essentially the same AWDT figure estimated in the Year 2002 Traffic Monitoring Program: 16,250 vehicle trips. It is noted that in 2002, there was 576,696 fewer square feet of Devens development that generated traffic than in 2004. This indicates that Devens development in Year 2004 is generating trips at a lower rate than in Year 2002: 4.51 trips per 1,000 square feet and 5.17 trips per 1,000 square feet, respectively.

The ITE trip rates published in *Trip Generation* were applied to the currently occupied Devens development for each land use to develop daily vehicle trips. Using ITE rates, it is estimated that the current Devens development would generate approximately 26,000 daily vehicle trips. The daily vehicle traffic counted at the gates (minus cut-through traffic of 18%) is 16,776 trips attributed to Devens. This indicates that the current Devens development is generating off-site traffic at a rate of approximately two-thirds of what a comparable development would generate.

Table 3-2: Trip Generation Summary

	YEAR 2002[1]	**YEAR 2004**	**DIFFERENCE**
Occupied Development	3,143,464 SF	3,720,160 SF	+576,696 SF
Total Daily Traffic Counts at Devens Gates	20,250 vehicle trips	20,458 vehicle trips	+208 vehicle trips
Daily Gate Counts Adjusted for 18% cut-thru Traffic	16,250 vehicle trips	16,776 vehicle trips	+526 vehicle trips
Daily Vehicle Trips per 1,000 SF Development	5.17 trips/KSF	4.51 trips/KSF	-0.66 trips/KSF
ITE[2 & 3] estimated Daily Devens Trips	21,737 vehicles trips	25,962 vehicle trips	4,225 vehicle trips

(1) Year 2002 Devens Traffic Monitoring Program
(2) Institute of Transportation Engineers, Trip Generation Manual, 6th Edition, 1997
(3) Institute of Transportation Engineers, Trip Generation Manual, 7th Edition, 2002

Figure 3-1 below is similar to the graph shown in the previous year 2002 Report. The top line represents the trip generation based on the EIR methodology. The line labeled "2004 Data" shows the vehicle trips at year 2004 (16,776) then assumes a straight-line projection for future years. Based on this method, the EIR full build-out threshold of 59,625 will not be reached until 2013.

Figure 3-1: Trip Generation Summary

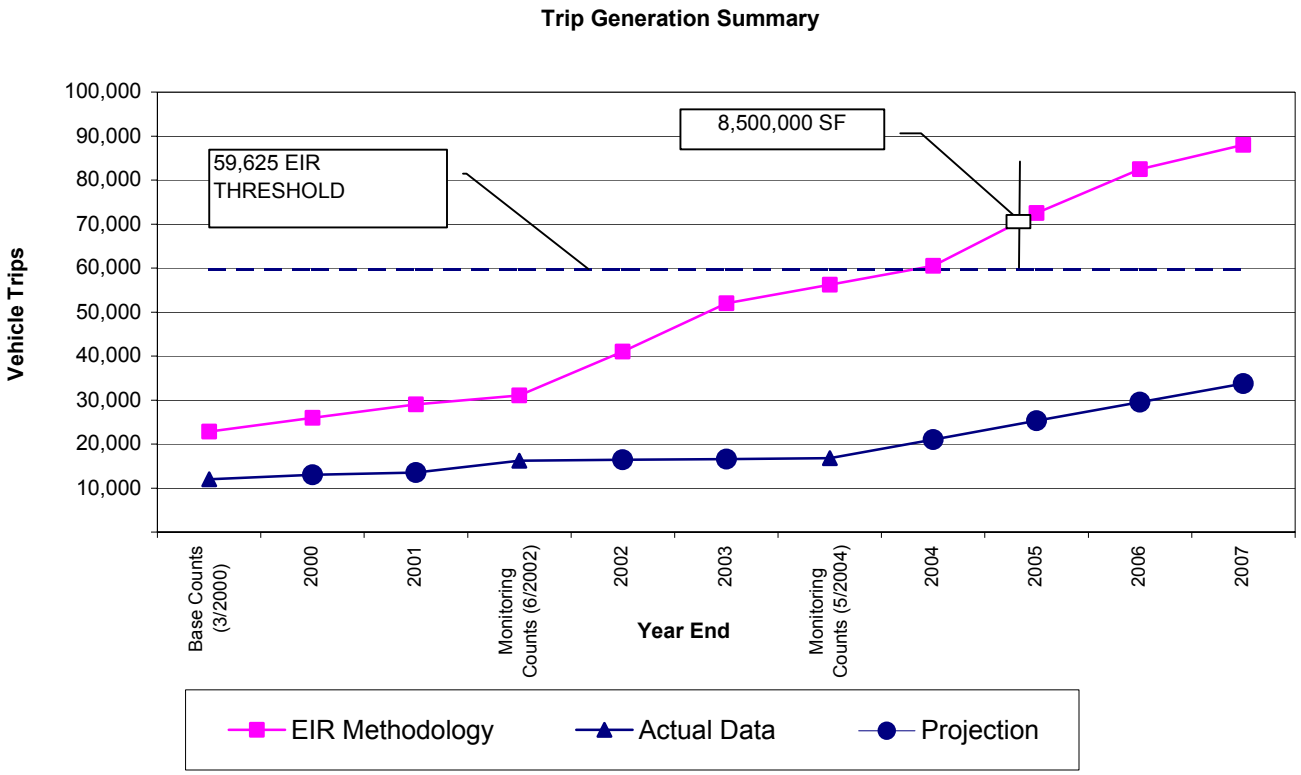
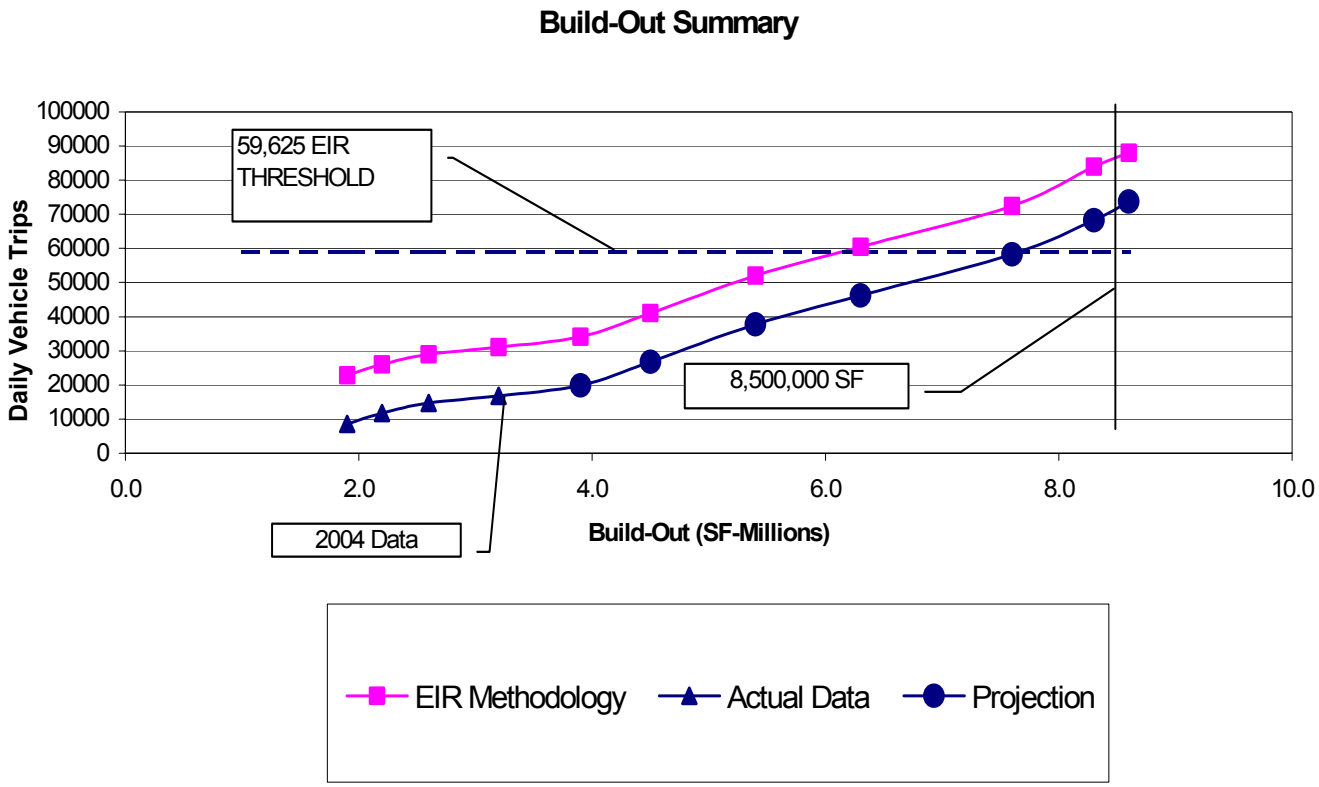


Figure 3-2 below represents the relationship between build-out square footage and vehicle trips. As previously mentioned, approximately 3.7 million square feet of building space is currently being used, which results in 16,776 vehicle trips. The top curve represents build-out based on the EIR methodology. The bottom line represents vehicle trips versus build-out up to year 2004, then assumes the same slope as the EIR. The steeper slope beyond 4 million square feet assumes that some of the current development will be replaced ("re-used") by development with higher vehicle generating characteristics. If this occurs as projected, the 59,625 daily vehicle trip EIR threshold would be reached at approximately 7.7 million square feet of development. If the current trip generation trend continues, the trip generation threshold would not be reached until well beyond 8.5 million square feet of development.

Figure 3-2: Build-Out Summary



4.0 INTERSECTION TURNING MOVEMENT COUNTS AND TRAFFIC OPERATIONS

The initial monitoring program identified twelve locations where peak hour intersection turning movement counts should be conducted. Two new intersections (#13 and #14 below) have been added for the 2004 Biennial Traffic Report. Traffic counts were completed by *Accurate Counts* on the12th and 13th of May, 2004 between 7:00 AM – 9:00 AM and 4:00 PM – 6:00 PM on weekdays, excluding Monday AM and Friday PM, at the following locations:

	Intersection	Town	Date
1.	Front Street/Lancaster Street/ Leominster Road/Center Road	Shirley	5/12/04
2.	Park Street/Fitchburg Road/Groton School Road	Ayer	5/12/04
3.	Park Street/Main Street/West Main Street	Ayer	5/12/04
4.	Groton-Harvard Road/Central Avenue	Ayer	5/12/04
5.	Route 2A-110/I-495 Exit 30 NB Ramps	Littleton	5/13/04
6.	Route 2A-110/I-495 Exit 30 SB Ramps	Littleton	5/13/04
7.	Route 110-111 (Ayer Road)/Route 110 (Still River Road)/Route 111	Harvard	5/13/04
8.	Route 70/117 (Seven Bridge Road)	Lancaster	5/13/04
9.	Route 70/117 (Lunenburg Road)	Lancaster	5/13/04
10.	Route 110 (King Street)/Route 119/Route 2A (Great Road)	Littleton Common	5/13/04
11.	Route 2A-110 (King Street)/Goldsmith Street	Littleton Common	5/13/04
12.	Verbeck Gate/MacPherson Road	Ayer	5/12/04
13.	Grant Road/West Main Street (New Location)	Ayer	5/12/04
14.	Hospital Road/Front Street (New Location)	Shirley	5/12/04

All traffic data was collected prior to school ending for the summer. It is noted that an election was held in Shirley on May 11th, but since no counts were taken on that day, there was no impact on the traffic data.

Figure 5-1, in the following section, provides a graphical depiction of all turning movement counts (TMC's) as well as all automatic traffic recorder counts (ATR's), as discussed in the following sections, conducted for this monitoring report.

A description of traffic volume and operational data at each location listed above is provided in the following pages. The operational characteristics of each intersection were determined utilizing the methodology in the 2000 Highway Capacity Manual (HCM). As was done in previous reports, descriptions of intersections analyzed

originally as part of the EIR study area include a table which compares the 2004 traffic volumes to past information including 1990, 1996, 1998 and 2002 volumes reported in the 2002 Traffic Monitoring Report and 2000 volumes contained in the Devens Five Year Traffic Report dated July 2001. As suggested in the 1996 Earth Tech Report, the 1996 traffic data serves as a baseline for comparison of operational changes (Level of Service) at intersections included within the monitoring program.

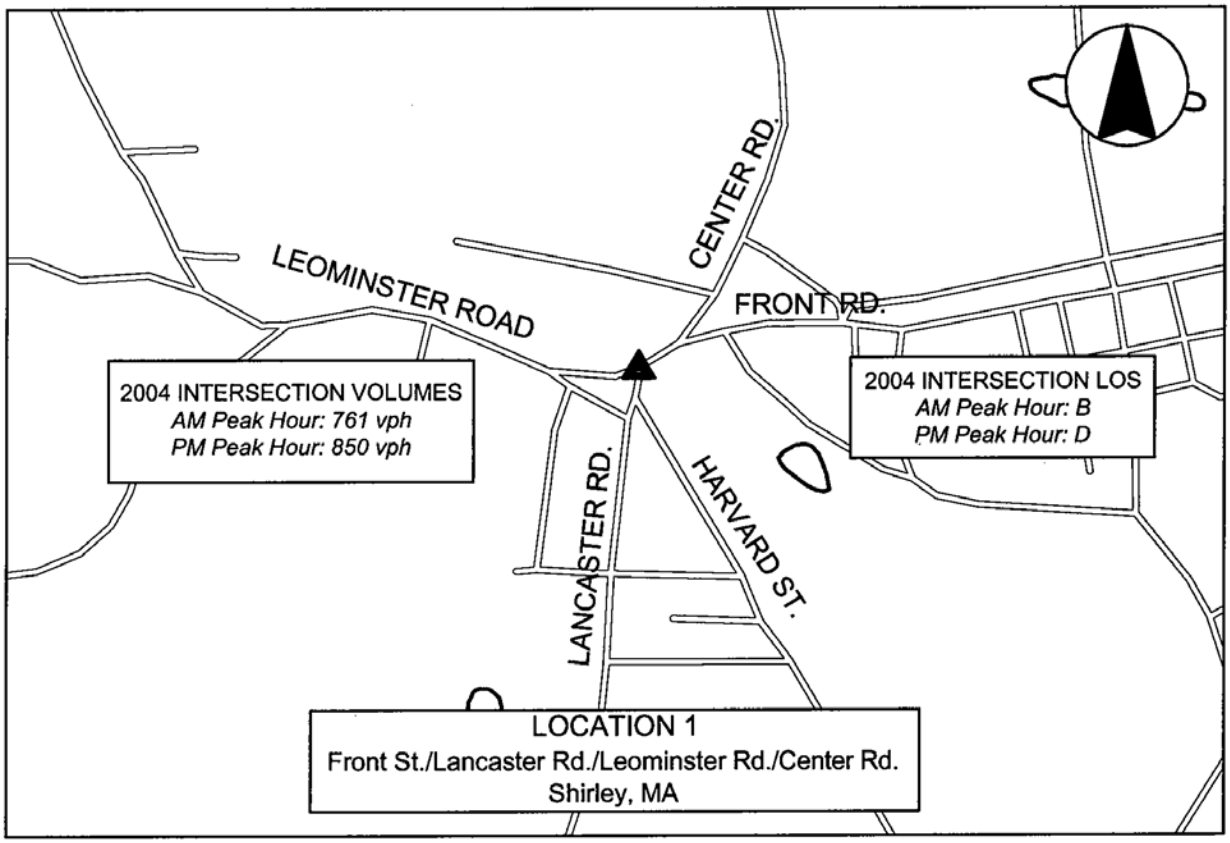
4.1 Location 1 – Front Street/Lancaster Street/Leominster Road/Center Road

This intersection was included as a monitoring location as a result of the public participation element. Figure 4-1 below depicts the intersection location and current traffic conditions. Monitoring at this location will indicate the extent to which residents of Shirley are attracted to Devens since other route options exist for out-of-town commuters. Development in the Verbeck and Shirley Gate areas of Devens will have the greatest effect on traffic volumes and operating conditions at this location.

Table 4-1: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
AM Peak Hour	n/a	802 vph	861 vph	803 vph	738 vph	761 vph
PM Peak Hour	n/a	953 vph	779 vph	847 vph	782 vph	850 vph

Figure 4-1: Existing Conditions Summary



Traffic volumes and intersection Levels of Service (LOS) for the AM and PM peak hours are summarized in the above figure. Traffic volumes have increased by about 3% in the AM peak hour 8% in the PM peak hour over 2002 conditions. This location operates at LOS B during the AM peak hour, and LOS D during the PM peak hour.

4.2 Location 2 – Park Street/Fitchburg Road/Groton School Road

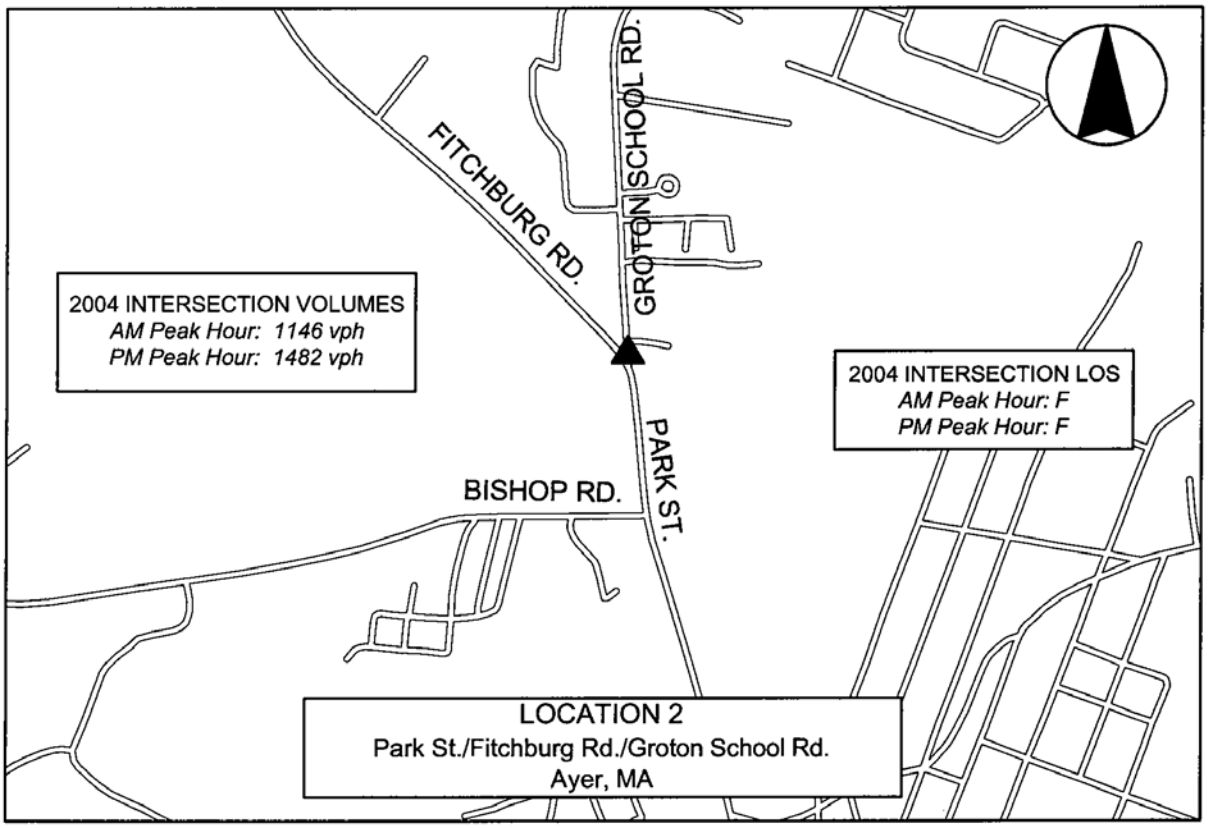
A comparison of the 1996 peak hour intersection volumes to the 1990 volumes indicates that the 1996 volumes are higher than those noted in 1990 for both AM and PM peak hours. This trend continued into 1998 but not to 2000. The 2002 volumes are approximately equal to those experienced by the intersection in 1998. The AM 2004 volume is about 90 vehicles lower than the 2002 volumes, but the PM peak hour is comparable. A full comparison of all conditions is provided in the following table.

Table 4-2: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
AM Peak Hour	1009 vph	1210 vph	1241 vph	1157 vph	1239 vph	1146 vph
PM Peak Hour	1210 vph	1353 vph	1523 vph	1447 vph	1487 vph	1482 vph

Intersection capacity analyses were conducted for both the AM and PM peak hours using the 2004 volumes. The results of these analyses indicate failing conditions during both the AM and PM peak hours for the southbound Groton School Road approach. Overall intersection operations are reported to be LOS F during both the AM peak hour and PM peak hours.

Figure 4-2: Existing Conditions Summary



The Final EIR indicated that the signalization of this intersection was an existing (immediate) need due to the failure conditions identified for vehicles attempting to enter Route 2A (Park Street) from Route 111 (Groton School Road). This need was based upon 1990 peak hour traffic volumes.

4.3 Location 3 – Park Street/Main Street/West Main Street

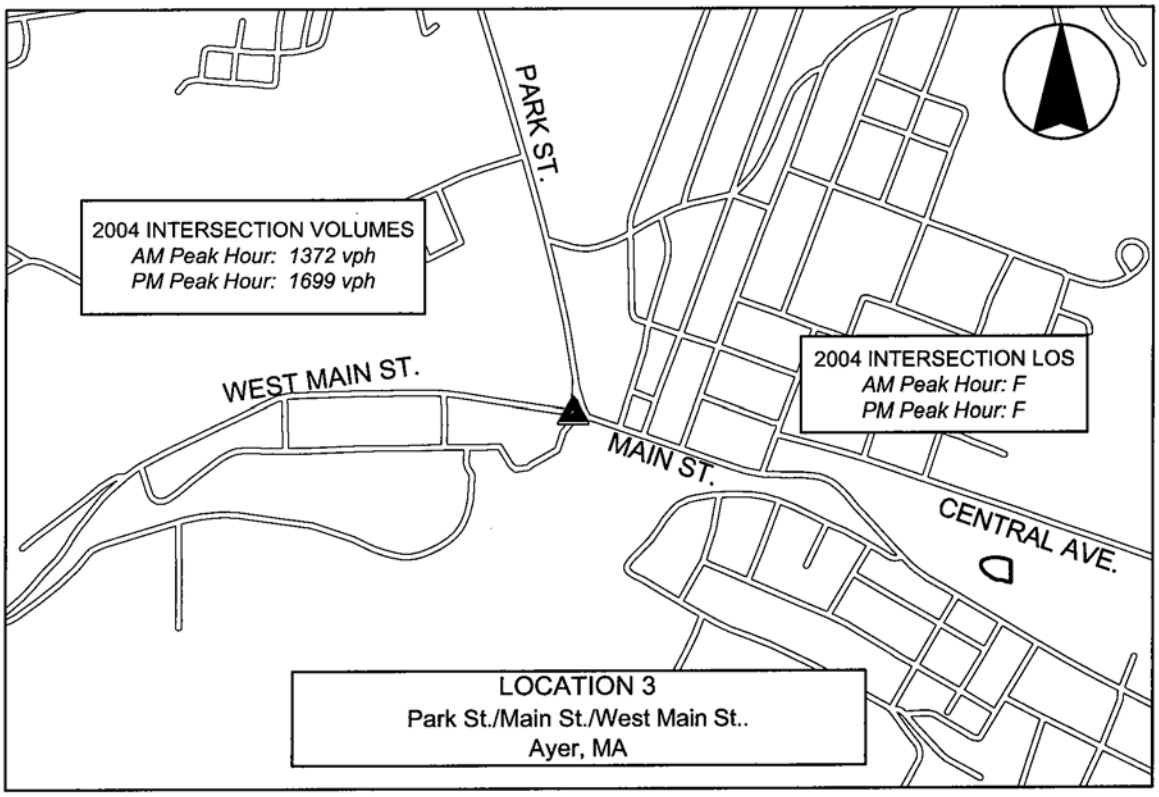
Intersection turning movement counts were performed at this location during both the AM and PM peak hours. Figure 4-3 below depicts the intersection location and current traffic conditions. Both the AM and PM peak hour volumes have remained relatively constant at this location since 2000. A comparison of traffic volumes is provided below.

Table 4-3: Traffic Volumes Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
AM Peak Hour	1431 vph	1492 vph	1556 vph	1367 vph	1442 vph	1372 vph
PM Peak Hour	1602 vph	1721 vph	1547 vph	1698 vph	1646 vph	1699 vph

This location was also identified as exhibiting existing deficiencies and requiring signalization as an immediate or short-term need based upon the 1990 peak hour traffic volumes. The 1996 intersection capacity analyses reported failure conditions for vehicles on the Park Street approach and indicated that signalization should be investigated as an immediate or short-term improvement at this location. Intersection capacity analyses using the 2004 volumes continues to show an overall LOS F both the AM and PM peak hours.

Figure 4-3: Existing Conditions Summary



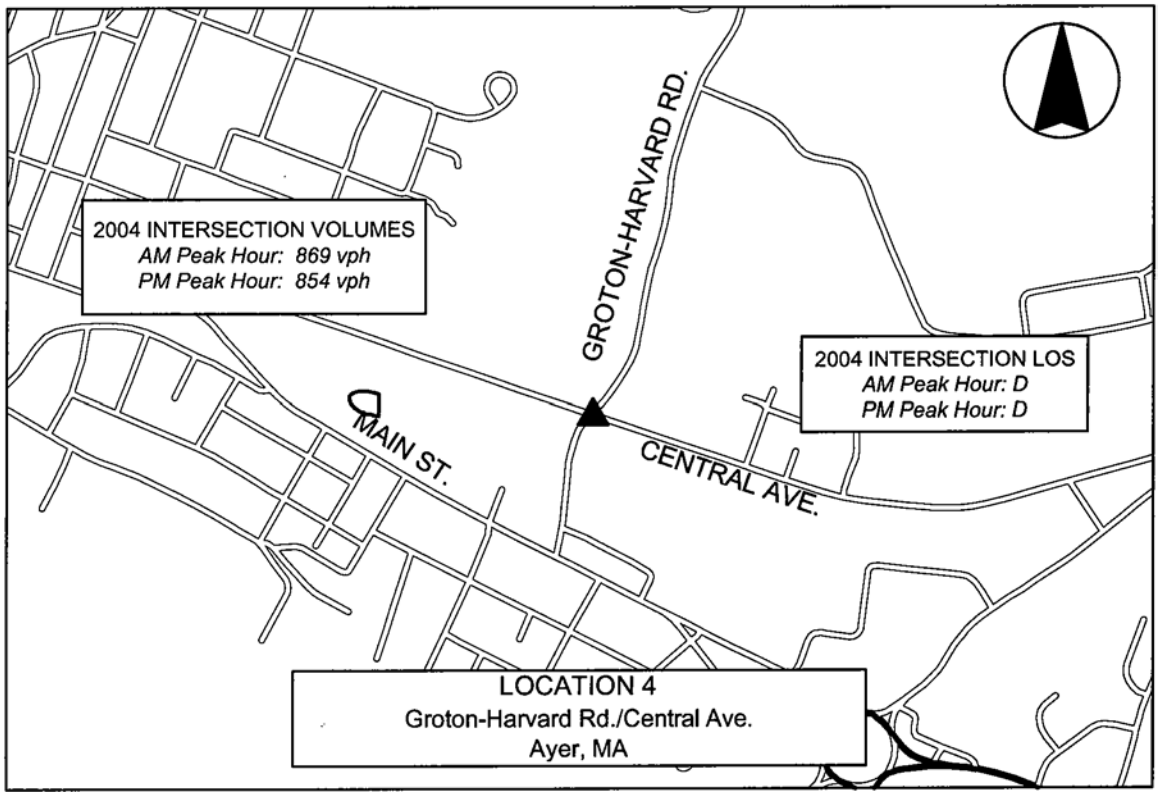
4.4 Location 4 – Groton-Harvard Road/Central Avenue

This location was not originally added as part of the EIR effort but was added as a result of the public participation element of the project. Figure 4-4 below depicts the intersection location and current traffic conditions. Traffic volumes were collected at this intersection during the AM and PM peak periods and were analyzed to determine the current operating conditions. The capacity analyses indicate that the intersection operates at LOS D during both the AM and PM peak hours, which is better than year 2002 conditions. This may be the result of lower traffic volumes experienced in year 2004, more than a 10% lower than 2002 volumes. The 2004 volumes are comparable to those experienced in 1996.

Table 4-4: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
AM Peak Hour	n/a	864 vph	941 vph	880 vph	990 vph	869 vph
PM Peak Hour	n/a	841 vph	956 vph	904 vph	960 vph	854 vph

Figure 4-4: Existing Conditions Summary



4.5 Location 5 – Route 2A-110/I-495 Exit 30 Northbound Ramps, Littleton

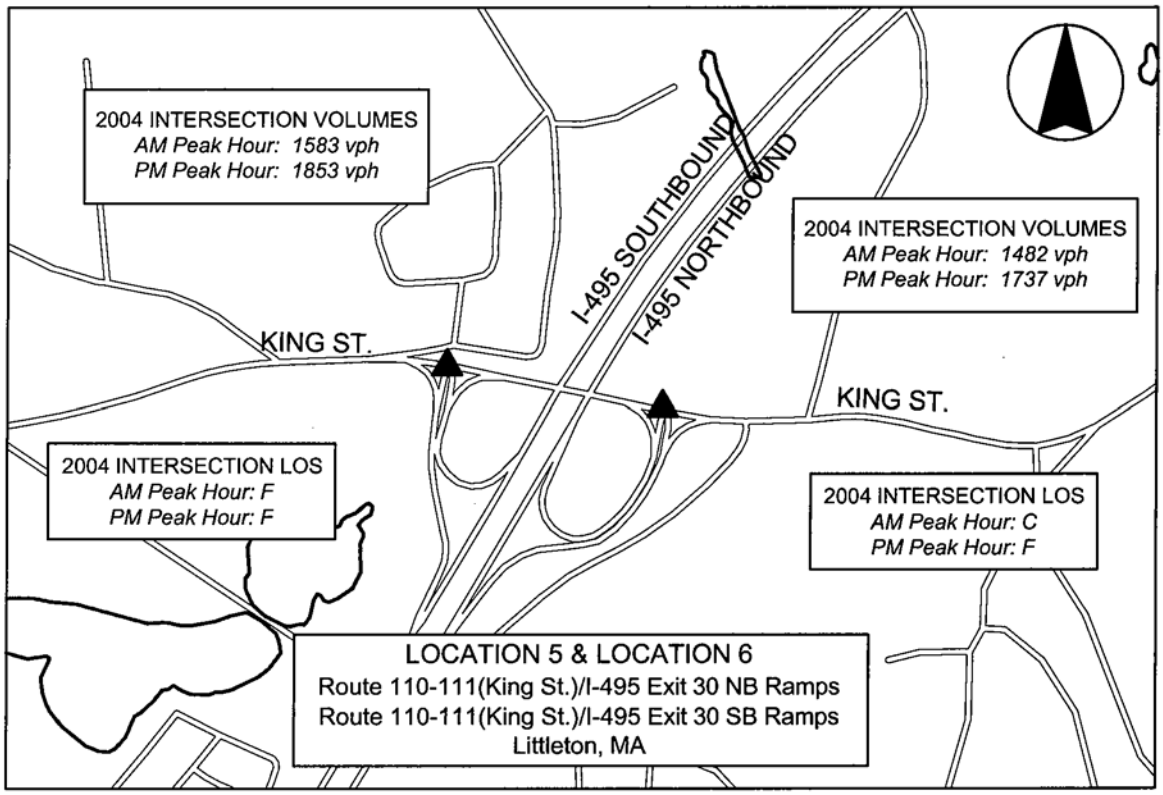
Location 6 – Route 2A-110/I-495 Exit 30 Southbound Ramps, Littleton

Traffic volumes were collected during the AM and PM peak hour at both ramp intersections with Route 2A-110 (King Street). Figure 4-5 below depicts the intersection location and current traffic conditions. A comparison of these traffic volumes to previous recorded volumes is provided below. These comparisons indicate a steady increase in the northbound ramp AM volumes and the southbound ramp PM volumes up to 2002, but both volumes decrease noticeably in 2004. The northbound PM ramp and southbound AM ramp volumes are also lower (approximately 10%) than the 2002 volumes.

Table 4-5: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
Route 2A-110/NB Ramps						
AM Peak Hour	1494 vph	1555 vph	1703 vph	1833 vph	1941 vph	1482 vph
PM Peak Hour	1317 vph	1675 vph	1711 vph	1656 vph	1927 vph	1737 vph
Route 2A-110/SB Ramps						
AM Peak Hour	1372 vph	1539 vph	1714 vph	1830 vph	1782 vph	1583 vph
PM Peak Hour	1538 vph	1844 vph	1705 vph	1814 vph	1981 vph	1853 vph

Figure 4-5: Existing Conditions Summary



Previous intersection capacity analyses performed as part of the EIR indicated a mid to long range need to signalize the southbound ramp intersection with Route 2A-110 at a minimum, with a potential need to also require signalization at the northbound ramp intersection. Intersection capacity analyses were conducted for 2004 AM and PM peak hour conditions at both ramp locations, with vehicles on the northbound ramp experiencing LOS C during the AM peak hour and LOS F during the PM peak hour, and vehicles on the southbound off-ramp approach experiencing LOS F during both the AM and PM peak hours. The northbound ramp LOS C condition in the morning is probably the result of lower traffic volumes in 2004.

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

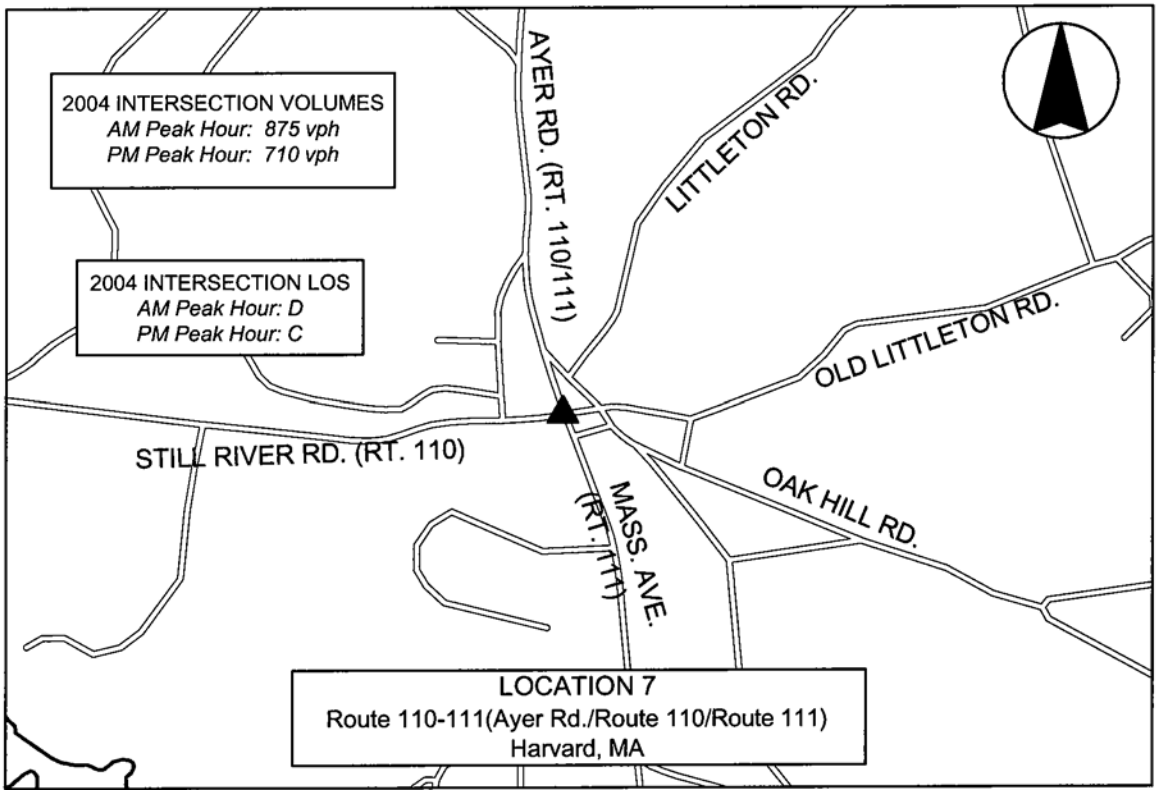
Intersection turning movement counts were conducted at the intersection of Routes 110/111 in Harvard for both AM and PM peak hour periods. Figure 4-6 below depicts the intersection location and current traffic conditions. The 2004 peak volumes are up by about 8% over 2002 volumes. A comparison of traffic volumes to previous recorded volumes is provided below.

Table 4-6: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
AM Peak Hour	551 vph	818 vph	952 vph	833 vph	823 vph	875 vph
PM Peak Hour	467 vph	869 vph	1135 vph	668 vph	642 vph	710 vph

Previous intersection capacity analyses performed as part of the EIR indicated that acceptable conditions would prevail through the 2015 condition. Intersection capacity analyses performed using the 2004 volumes indicate that the intersection will operate at LOS D during the AM peak hour and LOS C during the PM peak hour.

Figure 4-6: Existing Conditions Summary



4.7 Location 8 – Route 70/Route 117 (Seven Bridge Road), Lancaster

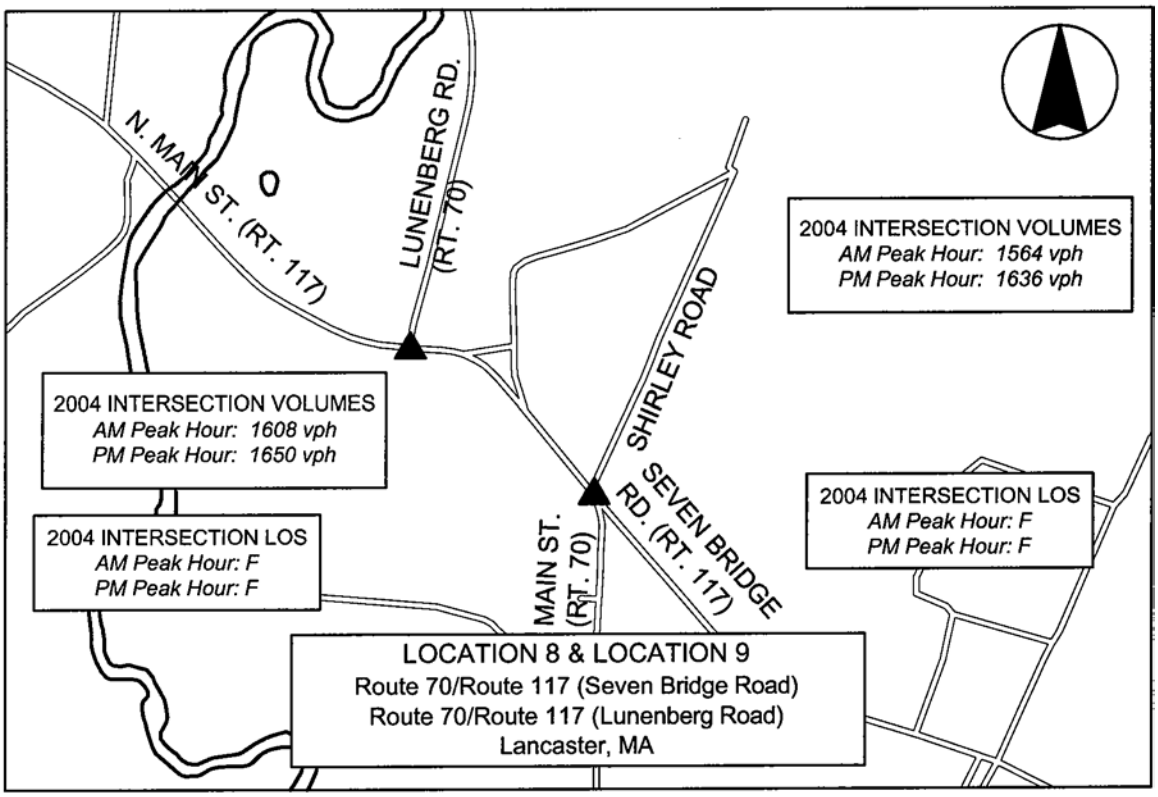
Location 9 – Route 70/Route 117 (Lunenburg Road), Lancaster

These two locations were not originally studied as part of the EIR effort but were added as a result of the public participation element of the project. Figure 4-7 below depicts the intersection location and current traffic conditions. Intersection turning movement counts and capacity analyses were conducted at these two intersections during both AM and PM peak hour periods.

Table 4-7: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
Route 70/Route 117 (Seven Bridge Road)						
AM Peak Hour	n/a	1452 vph	1582 vph	1616 vph	1597 vph	1564 vph
PM Peak Hour	n/a	1614 vph	1685 vph	1657 vph	1570 vph	1636 vph
Route 70/Route 117 (Lunenberg Road)						
AM Peak Hour	n/a	1471 vph	1581 vph	1652 vph	1649 vph	1608 vph
PM Peak Hour	n/a	1578 vph	1800 vph	1679 vph	1600 vph	1650 vph

Figure 4-7: Existing Conditions Summary



The year 2004 traffic volumes at these two intersections are comparable to year 2002 volumes. The intersection of Route 70 (Lunenburg Road)/Route 117 operates at LOS F for vehicles exiting left from Route 70 during both the AM and PM peak hours. The same conditions occur for vehicles exiting left from Route 70 at the intersection of Route 70 (Main Street/Route 117/Seven Bridge Road), during the AM and PM peak hours.

4.8 Location 10 – Route 110 (King Street)/Route 119/Route 2A (Great Road), Littleton Common

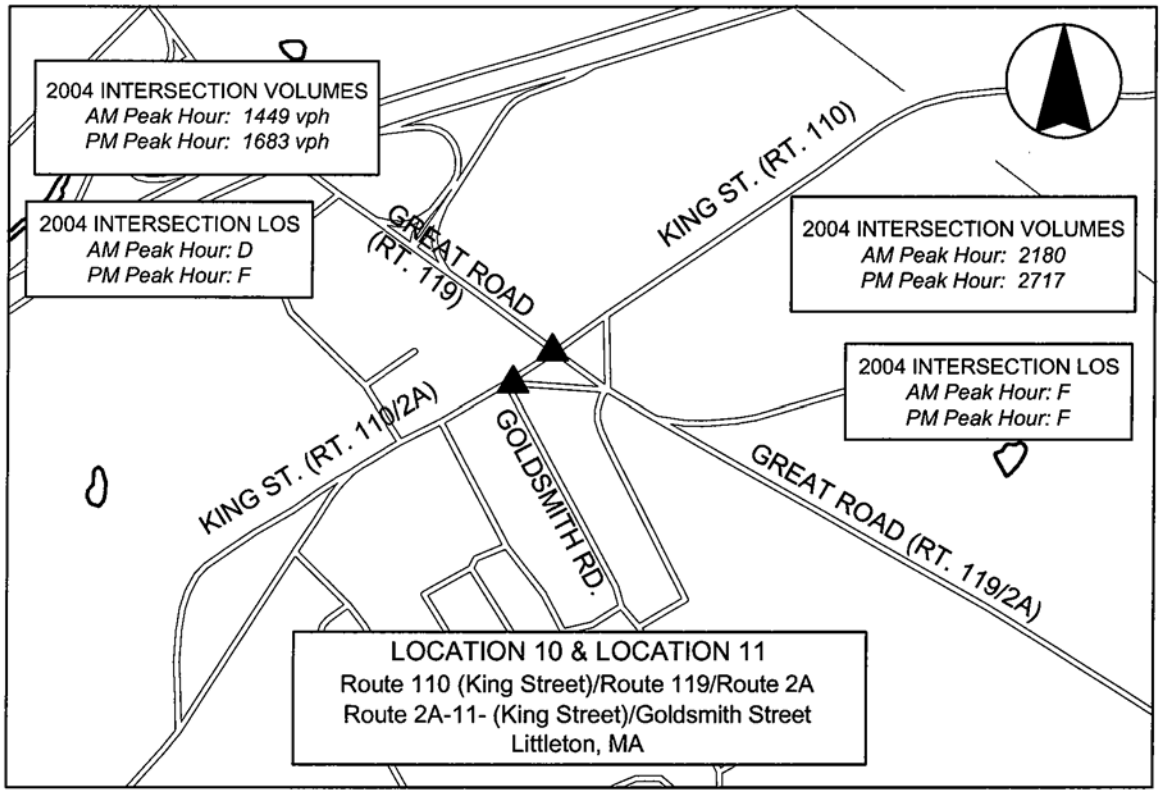
Location 11 – Route 2A-110 (King Street)/Goldsmith Street, Littleton Common

These two locations were not originally studied as part of the EIR effort but were included based on the public participation effort of the project. Figure 4-8 below depicts the intersection location and current traffic conditions. Intersection turning movement counts were conducted at these two intersections during both the AM and PM peak hour periods.

Table 4-8: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
Route 110/Route 119/Route 2A (Great Road)						
AM Peak Hour	n/a	2085 vph	2196 vph	2225 vph	2382 vph	2180 vph
PM Peak Hour	n/a	2809 vph	2880 vph	2574 vph	2871 vph	2717 vph
Route 2A-110/Goldsmith Street						
AM Peak Hour	n/a	1469 vph	1667 vph	1734 vph	1638 vph	1449 vph
PM Peak Hour	n/a	1758 vph	1724 vph	1588 vph	1840 vph	1683 vph

Figure 4-8: Existing Conditions Summary



The year 2004 volumes are between 5 and 12 percent lower at these two intersections than the 2002 volumes. Intersection capacity analyses using the 2004 volumes were conducted for the AM and PM peak hour conditions at both intersections. The signalized intersection of Route 110 (King Street)/Route 119/Route 2A exhibits existing LOS F during both the AM and PM peak hours, while the intersection of Route 2A-110 (King Street)/Goldsmith Street exhibits LOS D during the AM peak hour and LOS F during the PM peak hour for the left and right movements exiting Goldsmith Street.

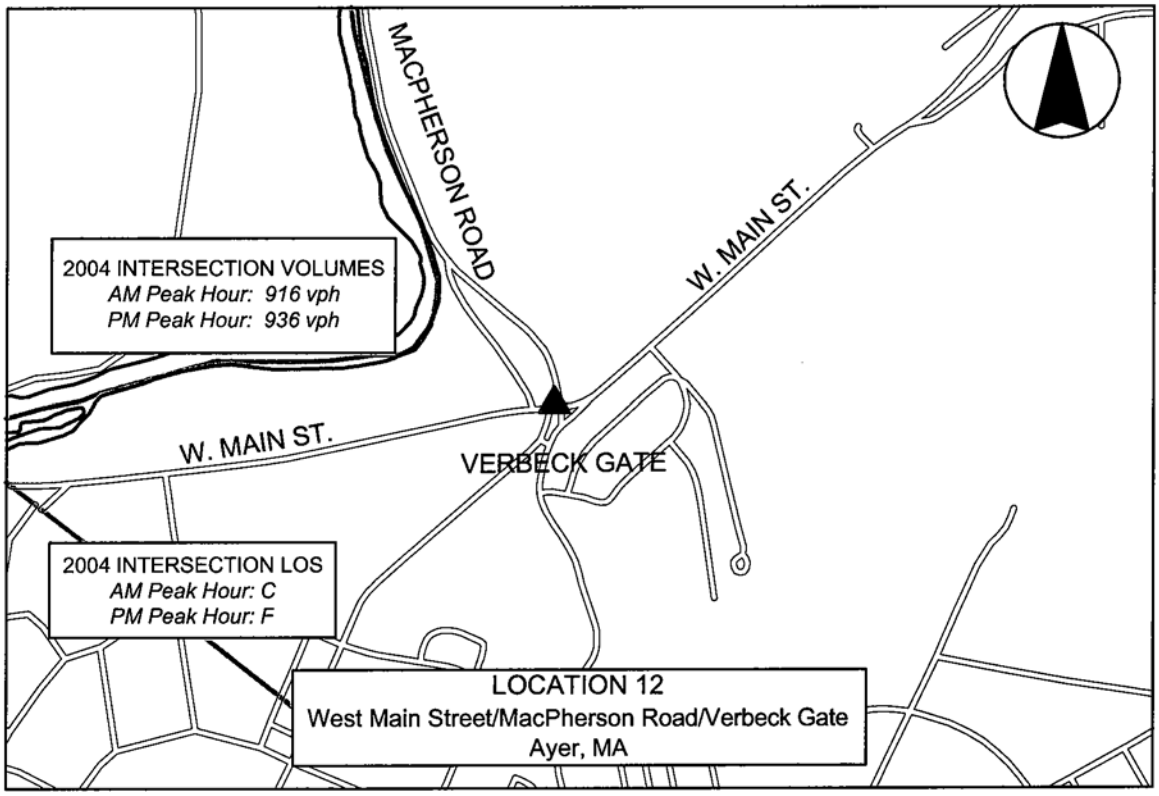
4.9 Location 12 – Verbeck Gate/MacPherson Road/West Main Street, Ayer

Intersection turning movement counts were conducted at the intersection of Verbeck Gate and MacPherson Road for both the AM and PM peak hours. Figure 4-9 below depicts the intersection location and current traffic conditions. A comparison of these traffic volumes to pervious recorded volumes is provided below.

Table 4-9: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
AM Peak Hour	936 vph	774 vph	710 vph	888 vph	1014 vph	916 vph
PM Peak Hour	1246 vph	726 vph	669 vph	926 vph	959 vph	936 vph

Figure 4-9: Existing Conditions Summary



The year 2004 AM traffic volumes are about 100 vehicles lower than the year 2002 and about 20 vehicles lower than in the PM peak hour. Previous intersection capacity analyses indicated the need for signalization as a mid-range to long-range improvement as the build-out of Devens approaches. Intersection capacity analyses conducted for 2004 peak hour conditions indicate a LOS C conditions for the AM peak period and LOS F for the PM peak hour period.

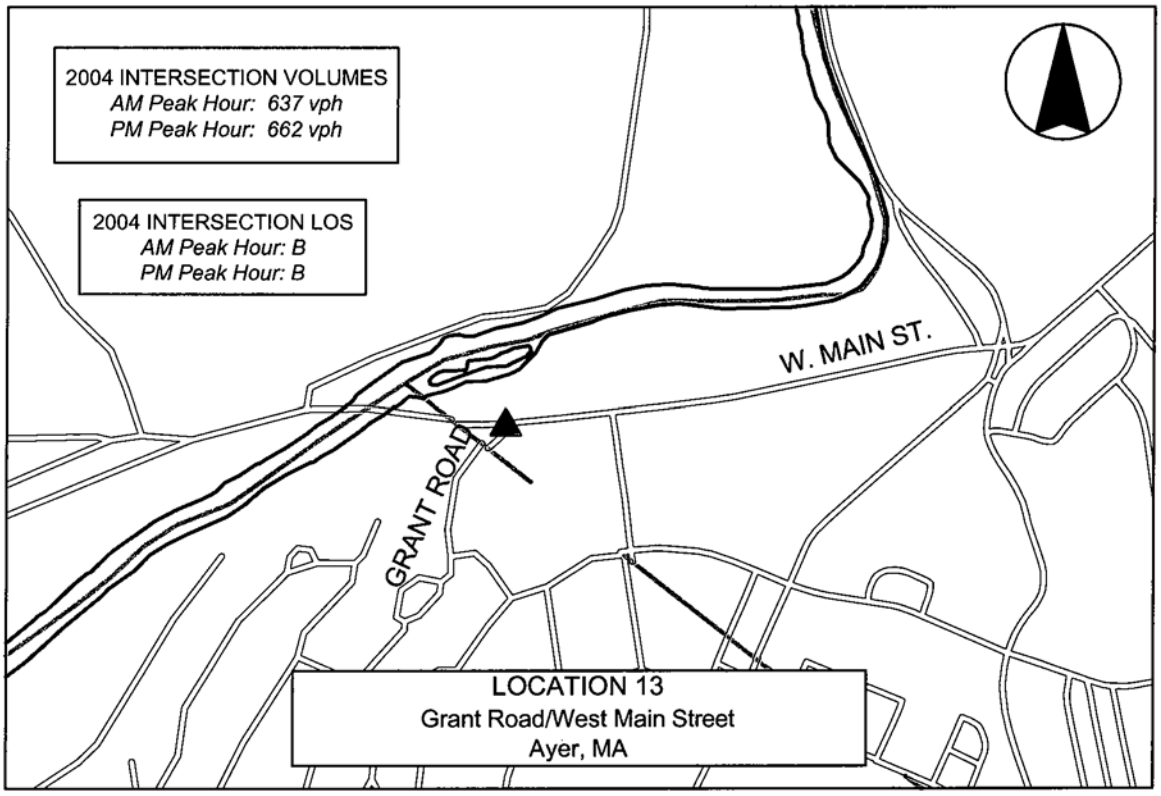
4.10 Location 13 – Grant Road /West Main Street, Ayer

This is a new location included for evaluation of the year 2004 conditions. Figure 4-10 below depicts the intersection location and current traffic conditions. Intersection turning movement counts were conducted at this intersection during both the AM and PM peak hour periods and are shown below.

Table 4-10: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
AM Peak Hour	n/a	n/a	n/a	n/a	n/a	637 vph
PM Peak Hour	n/a	n/a	n/a	n/a	n/a	662 vph

Figure 4-10: Existing Conditions Summary



Approximately 650 vehicles were counted at this intersection for both the AM and PM peak hours. Intersection capacity analyses using the 2004 volumes were conducted for the AM and PM peak hour conditions. The intersection operates at LOS B during both the AM and PM peak hours.

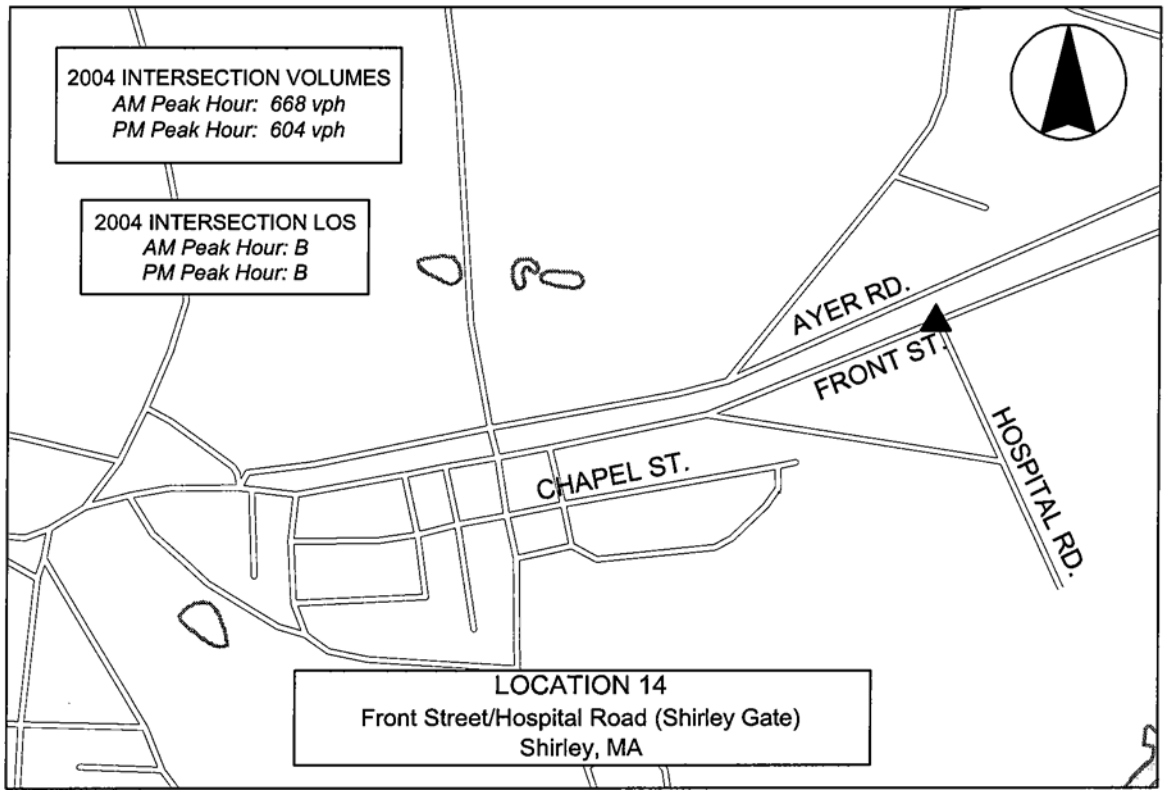
4.11 Location 14 – Hospital Road/Front Street, Shirley

This is a new location included for evaluation of the year 2004 conditions. Figure 4-11 below depicts the intersection location and current traffic conditions. Intersection turning movement counts were conducted at this intersection during both the AM and PM peak hour periods and are shown below.

Table 4-11: Traffic Volume Comparison

Total Intersection Volume	1990 Composite	1996 Baseline	1998	2000	2002	2004
AM Peak Hour	n/a	n/a	n/a	n/a	n/a	668 vph
PM Peak Hour	n/a	n/a	n/a	n/a	n/a	604 vph

Figure 4-11: Existing Conditions Summary



Over 600 vehicles were observed at this intersection during the AM and PM peak hours. Intersection capacity analyses using the 2004 volumes were conducted for the AM and PM peak hour conditions. The intersection operates at LOS B during both the AM and PM peak hours.

5.0 INTERSECTION VOLUME AND CAPACITY SUMMARY

A summary of all intersection volumes (with comparisons where available) and a summary of all intersection capacity analysis results are provided in Tables 5-1 and 5-2. Figure 5-1 shows intersection and roadway count locations. Figures 5-2 and 5-3 illustrate the 2004 AM and PM peak hour traffic volumes, and daily volumes are also presented in the following pages.

Table 5-1a: Total Intersection Volumes – AM Peak Hour

Devens Traffic Monitoring Program **Total Intersection Volume Summary**								
Intersection	AM Peak Hour							
	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)**	1990 AM Composite Pk. Hr. (vph)	2015 AM No Build FEIR Pk. Hr. (vph)	2015 AM Full Build FEIR Pk. Hr. (vph)
1. Front St./Lancaster St./Leominster Rd./Center Rd., Shirley	802	861	803	738	**761**	n/a	n/a	n/a
2. Park St./Fitchburg Rd./Groton School Rd., Ayer	1210	1241	1157	1239	**1146**	1009	1242	2199
3. Park St./Main St./West Main St., Ayer	1492	1556	1361	1442	**1372**	1431	1297	2255
4. Groton-Harvard Rd./Central Ave., Ayer	864	941	880	990	**869**	n/a	n/a	n/a
5. Route 2A-110 (King St.)/I-495 Exit 30 NB Ramps, Littleton	1555	1703	1833	1941	**1482**	1494	1450	1626
6. Route 2A-110 (King St.)/I-495 Exit 30 SB Ramps, Littleton	1539	1714	1830	1782	**1583**	1272	1327	2146
7. Route 110-111 (Ayer Rd.)/Route 110/Route 111, Harvard	818	952	833	823	**875**	551	551	731
8. Route 70/Route 117 (Seven Bridge Rd.), Lancaster	1452	1582	1616	1597	**1564**	n/a	n/a	n/a
9. Route 70/Route 117 (Lunenberg Rd.), Lancaster	1471	1581	1652	1649	**1608**	n/a	n/a	n/a
10. Route 110 (King St.)/Route 119/Route 2A, Littleton Common	2085	2196	2225	2382	**2180**	n/a	n/a	n/a
11. Route 2A-110 (King St.)/Goldsmith St., Littleton Common	1469	1667	1674	1638	**1449**	n/a	n/a	n/a
12. Verbeck Gate/MacPherson Rd., Ayer	774	710	888	1014	**916**	936	936	1292
13. Grant Rd./West Main St., Ayer	n/a	n/a	n/a	n/a	**637**	n/a	n/a	n/a
14. Hospital Rd./Front St., Shirley	n/a	n/a	n/a	n/a	**668**	n/a	n/a	n/a

Table 5-1b: Total Intersection Volumes – PM Peak Hour

Devens Traffic Monitoring Program Total Intersection Volume Summary								
Intersection	PM Peak Hour							
	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)**	1990 PM Composite Pk. Hr. (vph)	2015 PM No Build FEIR Pk. Hr. (vph)	2015 PM Full Build FEIR Pk. Hr. (vph)
1. Front St./Lancaster St./Leominster Rd./Center Rd., Shirley	953	779	847	782	**850**	n/a	n/a	n/a
2. Park St./Fitchburg Rd./Groton School Rd., Ayer	1353	1523	1447	1487	**1482**	1210	1526	2460
3. Park St./Main St./West Main St., Ayer	1721	1547	1698	1646	**1699**	1602	1398	2334
4. Groton-Harvard Rd./Central Ave., Ayer	841	956	904	960	**854**	n/a	n/a	n/a
5. Route 2A-110 (King St.)/I-495 Exit 30 NB Ramps, Littleton	1675	1711	1656	1927	**1737**	1317	1292	1806
6. Route 2A-110 (King St.)/I-495 Exit 30 SB Ramps, Littleton	1844	1705	1814	1981	**1853**	1538	1547	2336
7. Route 110-111 (Ayer Rd.)/Route 110/Route 111, Harvard	869	1135	668	642	**710**	467	534	633
8. Route 70/Route 117 (Seven Bridge Rd.), Lancaster	1614	1685	1657	1570	**1636**	n/a	n/a	n/a
9. Route 70/Route 117 (Lunenberg Rd.), Lancaster	1578	1800	1679	1600	**1650**	n/a	n/a	n/a
10. Route 110 (King St.)/Route 119/Route 2A, Littleton Common	2809	2880	2574	2871	**2717**	n/a	n/a	n/a
11. Route 2A-110 (King St.)/Goldsmith St., Littleton Common	1758	1724	1588	1840	**1683**	n/a	n/a	n/a
12. Verbeck Gate/MacPherson Rd., Ayer	726	669	926	959	**936**	1246	631	1498
13. Grant Rd./West Main St., Ayer	n/a	n/a	n/a	n/a	**662**	n/a	n/a	n/a
14. Hospital Rd./Front St., Shirley	n/a	n/a	n/a	n/a	**604**	n/a	n/a	n/a

Table 5-2a: Intersection Capacity Analysis Level Of Service Summary AM Peak Hour

Unsignalized Intersections	1996 AM Peak		1998 AM Peak		2000 AM Peak		2002 AM Peak		2004 AM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Location 1 - Front/Lancaster/Leominster/Center										
All movements from Lancaster Northbound	B	6	B	8	D	26	C	15	B	12
All movements from Center Southbound	B	10	C	20	E	48	D	29	C	19
Left turn from Leominster Eastbound	A	2	A	2	A	8	A	7	A	7
Left turn from Front Street Westbound	A	3	A	3	A	8	A	8	A	8
Location 2 - Park/Fitchburg/Groton School										
Left/Right from Groton School Eastbound	F	>120	F	>120	F	102	E	44	C	20
Left turn from Fitchburg Road Southbound	A	3	A	3	A	8	A	8	A	9
Location 3 - Park/Main/West Main										
All movements from Park Street Northbound	B	9	B	8	n/a	n/a	C	16	B	14
All movements from Park Street Southbound	F	>120	F	>120	F	>120	F	>120	F	>120
Left turn from West Main Street Eastbound	A	4	A	5	A	9	A	9	A	9
Left turn from Main Street Westbound	A	3	A	3	n/a	n/a	A	8	A	8
Location 4 - Groton-Harvard/Central										
All movements from Groton-Harvard Northbound	B	8	C	12	C	18	C	18	B	14
All movements from Groton-Harvard Southbound	C	12	F	>120	F	80	F	118	D	26
Left turn from Central Eastbound	A	3	A	3	A	8	A	8	A	8
Left turn from Central Westbound	A	3	A	3	A	8	A	8	A	8
Location 5 - Route 2A-110/I-495 Northbound Ramps										
Left turn from Ramps Northbound	C	16	C	19	E	106	E	36	C	23
Right turn from Ramps Northbound	C	15	C	17	F	n/a	F	106	C	23
Left turn from Route 2A-110 Westbound	B	5	B	6	B	11	B	10	A	9
Location 6 - Route 2A-110/I-495 Southbound Ramps										
Left turn from Ramps Northbound	F	>120	F	>120	F	>120	F	>120	F	>120
Right turn from Ramps Northbound	B	6	B	8	C	21	C	18	B	13
All movements from Murray Street Southbound	E	35	F	>120	F	>120	F	>120	F	88
Left turn from Route 2A-110 Eastbound	A	3	A	3	A	8	A	8	A	8
Left turn from Route 2A-100 Westbound	B	6	B	10	B	12	B	12	A	10
Location 7 - Route 110-111(Ayer Road)/Still River										
All movements from Still River Road Eastbound	C	11	C	19	E	47	D	28	C	22
All movements from Still River Road Westbound	C	12	E	30	F	>120	D	31	D	27
Left turn from Ayer Road Northbound	A	3	A	3	A	8	A	8	A	8
Left turn from Ayer Road Southbound	A	3	A	3	A	8	A	8	A	8
Location 8 - Route 70/Route 117 (Seven Bridge Road)										
All movements from Seven Bridge Road Eastbound	F	88	A	3	A	< 8				
Left turn from Seven Bridge Road Westbound	B	10	B	8	B	11	B	11	B	11
Left turn from Route 70 Northbound	B	7	F	>120	F	>120	F	>120	F	76
Left turn from Route 70 Southbound	n/a	n/a	C	17	E	43				
Location 9 - Route 70 (Lunenberg Road)/Route 117										
All movements from Lunenberg Road Southbound	F	>120	F	>120	F	>120	F	>120	F	>120
Left turn from Route 117 Eastbound	A	4	A	4	A	9	A	9	A	8

Table 5-2a (Continued)

Unsignalized Intersections	1996 AM Peak		1998 AM Peak		2000 AM Peak		2002 AM Peak		2004 AM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Location 11 - Route 2A-110/Goldsmith										
All movements from Goldsmith Northbound	F	>120	F	489	F	117	F	69	D	30
Left turn from Route 2A-110 Westbound	B	9	B	10	B	12	B	12	B	10
Location 12 - Verbeck Gate/MacPherson/West Main										
All movements from MacPherson Northbound	B	7	B	6	C	20	F	>120	C	19
All movements from MacPherson Southbound	B	6	B	9	A	< 5	F	62	C	20
All movements from West Main Eastbound			A	2	A	< 5	A	8	A	8
All movements from West Main Westbound	A	4	A	4	A	9	A	9	A	9
Location 13 - Grant/West Main										
All movements from Grant Road Northbound									B	12
Left turn from Front Street Westbound									A	8
Location 14 - Hospital/Front										
All movements from Hospital Road Northbound									B	13
Left turn from Front Street Westbound									A	8
Signalized Intersection	**1996 AM Peak**		**1998 AM Peak**		**2000 AM Peak**		**2002 AM Peak**		**2004 AM Peak**	
	LOS	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**	**LOS**	**Delay**
Location 10 - Littleton Road/Great Road										
Left turn from Littleton Road Eastbound	F	66	F	>120	F	>120	F	>120	F	>120
Through/Right from Littleton Road Eastbound	C	17	D	37			F	>120	F	>120
Left turn from Littleton Road Westbound	D	38	F	>120			E	77	D	48
Through/Right from Littleton Road Westbound	B	13	C	19			C	24	E	62
Left turn from Great Road Northbound	B	6	B	7			A	6	B	10
Through/Right from Great Road Northbound	B	7	B	8			C	20	C	29
Left turn from Great Road Southbound	A	4	A	4			A	10	B	12
Through/Right from Great Road Southbound	B	14	C	17			B	12	F	>120

Table 5-2b: Intersection Capacity Analysis Level Of Service Summary PM Peak Hour

Unsignalized Intersections	1996 PM Peak		1998 PM Peak		2000 PM Peak		2002 PM Peak		2004 PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Location 1 - Front/Lancaster/Leominster/Center										
All movements from Lancaster Northbound	B	9	B	7	C	23	C	17	C	18
All movements from Center Southbound	C	12	B	10	C	24	C	22	D	25
Left turn from Leominster Eastbound	A	3	A	3	A	8	A	8	A	8
Left turn from Front Street Westbound	A	3	A	3	A	8	A	8	A	8
Location 2 - Park/Fitchburg/Groton School										
Left/Right from Groton School Eastbound	F	>120	F	>120	F	>120	F	>120	F	>120
Left turn from Fitchburg Road Southbound	B	6	B	8	B	11	B	10	B	11
Location 3 - Park/Main/West Main										
All movements from Park Street Northbound	C	10	D	21			D	26	D	31
All movements from Park Street Southbound	F	>120	F	>120	F	>120	F	>120	F	>120
Left turn from West Main Street Eastbound	B	8	C	11	B	10	B	11	B	12
Left turn from Main Street Westbound	A	3	A	3			A	8	A	8
Location 4 - Groton-Harvard/Central										
All movements from Groton-Harvard Northbound	C	10	D	24	D	34	F	64	D	33
All movements from Groton-Harvard Southbound	B	10	D	25	D	34	F	67	C	21
Left turn from Central Eastbound	A	3	A	3	A	8	A	8	A	8
Left turn from Central Westbound	A	2	A	3	A	8	A	8	A	8
Location 5 - Route 2A-110/I-495 Northbound Ramps										
Left turn from Ramps Northbound	F	73	F	>120	F	94	F	>120	F	162
Right turn from Ramps Northbound	B	6	B	7	C	16	C	16	C	18
Left turn from Route 2A-110 Westbound	A	4	A	4	A	9	A	9	A	9
Location 6 - Route 2A-110/I-495 Southbound Ramps										
Left turn from Ramps Northbound	F	>120	F	>120	F	>120	F	>120	F	>120
Right turn from Ramps Northbound	B	5	B	6	B	14	B	14	B	14
All movements from Murray Street Southbound	F	49	E	41	F	78	F	85	F	93
Left turn from Route 2A-110 Eastbound	A	5	A	5	A	9	A	10	A	10
Left turn from Route 2A-100 Westbound	B	5	B	6	A	9	B	10	B	10
Location 7 - Route 110-111(Ayer Road)/Still River										
All movements from Still River Road Eastbound	C	11	C	11	C	18	C	15	C	21
All movements from Still River Road Westbound	B	9	B	10	C	23	C	18	C	24
Left turn from Ayer Road Northbound	A	3	A	3	A	8	A	8	A	8
Left turn from Ayer Road Southbound	A	3	A	3	A	8	A	8	A	8
Location 8 - Route 70/Route 117 (Seven Bridge Road)										
All movements from Seven Bridge Road Eastbound	F	>120	B	6	A	10				
Left turn from Seven Bridge Road Westbound	C	14	A	4	A	9	C	22	A	9
Left turn from Route 70 Northbound	A	4	F	>120	F	>120	F	>120	F	>120
Left turn from Route 70 Southbound	B	5	D	22	E	36				
Location 9 - Route 70 (Lunenberg Road)/Route 117										
All movements from Lunenberg Road Southbound	F	>120	F	>120	F	>120	F	>120	F	>120
Left turn from Route 117 Eastbound	B	7	B	9	B	11	B	11	B	11

Table 5-2b (Continued)

Unsignalized Intersections	1996 PM Peak		1998 PM Peak		2000 PM Peak		2002 PM Peak		2004 PM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Location 11 - Route 2A-110/Goldsmith										
All movements from Goldsmith Northbound	F	>120	F	>120	F	58	F	>120	F	156
Left turn from Route 2A-110 Westbound	B	7	B	7	A	9	B	11	B	10
Location 12 - Verbeck Gate/MacPherson/West Main										
All movements from MacPherson Northbound	B	7	B	8	E	44	F	54	F	56
All movements from MacPherson Southbound	B	7	C	12	C	16	C	16	C	20
All movements from West Main Eastbound	A	3	A	3	A	8	A	8	A	8
All movements from West Main Westbound	A	3	A	3	A	8	A	8	A	8
Location 13 - Grant/West Main										
All movements from Grant Road Northbound									B	13
Left turn from Front Street Westbound									A	8
Location 14 - Hospital/Front										
All movements from Hospital Road Northbound									B	13
Left turn from Front Street Westbound									A	8

Signalized Intersection	1996 AM Peak		1998 AM Peak		2000 AM Peak		2002 AM Peak		2004 AM Peak	
	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Location 10 - Littleton Road/Great Road										
Left turn from Littleton Road Eastbound	F	>120	F	>120	F	>120	F	95	F	136
Through/Right from Littleton Road Eastbound	B	7	B	9			B	15	B	16
Left turn from Littleton Road Westbound	B	11	C	17			F	86	B	19
Through/Right from Littleton Road Westbound	B	15	C	17			C	27	D	48
Left turn from Great Road Northbound	E	60	E	59			F	15	A	10
Through/Right from Great Road Northbound	D	39	D	37			F	15	F	>120
Left turn from Great Road Southbound	E	55	F	>120			C	24	A	8
Through/Right from Great Road Southbound	E	13	D	32			F	>120	E	59

Figure 5-1: External Count Locations – June 2004

Figure 5-2: AM Peak Hour Traffic Volumes – 2004 Conditions

Figure 5-3: PM Peak Hour Traffic Volumes – 2004 Conditions

6.0 AUTOMATIC TRAFFIC RECORDER COUNTS

6.1 48 – Hour Counts

A series of 48-hour automatic traffic recorder (ATR) counts were included as part of the traffic monitoring program to conduct a comparison of daily and hourly directional traffic on critical study area roadways. Count stations were provided at the locations listed below during the noted dates.

	Location	Dates
1.	Route 111 at Boxborough/Harvard Town Line	5/12/04-5/13/04
2.	Route 2A at Ayer/Shirley Town Line	5/12/04-5/13/04
3.	Route 111 at Ayer/Groton Town Line	5/12/04-5/13/04
4.	Sandy Pond Road East of Central Avenue, Ayer	5/12/04-5/13/04
5.	Groton-Harvard Road at Ayer/Groton Town Line	5/12/04-5/13/04
6.	Front Street West of Ayer Street, Shirley	5/12/04-5/13/04
7.	Jackson Gate	5/12/04-5/13/04
8.	Verbeck Gate	5/12/04-5/13/04
9.	Shirley Gate	5/12/04-5/13/04
10.	Barnum Gate	5/12/04-5/13/04
11.	Grant Road Gate (New Location)	5/12/04-5/13/04
12.	Poor Farm Road East of Route 110-111, Harvard	5/12/04-5/13/04
13.	Carleton Rotary (all approaches and exits)	5/12/04-5/13/04 5/25/04-5/27/04*
14.	Route 110-111 South of Route 2, Harvard	5/12/04-5/13/04

* The northbound approach of the Carleton Rotary was counted during these three days.

All of the data was collected prior to school ending for the summer.

A summary of the average weekday (24-hour total) traffic, as well as AM and PM peak hour volumes, is provided in the following tables (6-1a – 6-1c). The average weekday volumes are also illustrated in Figure 6-1 provided at the end of this section.

Table 6-1a: Automatic Traffic Recorder (ATR) Summary – Average Weekday Daily Traffic

Location	1996 AWDT (vpd)	1998 AWDT (vpd)	2000 AWDT (vpd)	2002 AWDT (vpd)	2004 AWDT (vpd)
1. Route 111 at Boxborough/Harvard Town Line	4,480	n/a	4,859	5,508	6,847
2. Route 2A at Ayer/Shirley Town Line	9,316	8,643	7,667	8,537	8,463
3. Route 111 at Ayer/Groton Town Line	6,482	5,497	5,120	5,764	5,609
4. Sandy Pond Road east of Central Ave., Ayer	5,529	n/a	5,907	5,939	5,921
5. Groton-Harvard Road at Ayer/Groton Town Line	4,922	n/a	4,705	5,602	6,064
6. Front St. west of Ayer St., Shirley	5,651	5,790	5,509	5,872	5,677
7. Jackson Gate	3,578	4,854	6,398	7,405	8,508
8. Verbeck Gate	2,354	3,363	4,655	6,134	4,798
9. Shirley Gate	n/a	533	1,104	731	1,927
10. Barnum Gate	2,172	2,766	3,418	5,966	4,587
11. Grant Road Gate	n/a	n/a	n/a	n/a	638
12. Poor Farm Rd. east of Route 110/111, Harvard	1,351	1,442	1,255	1,709	1,659
13. Carlton Rotary					
Route 2A/110 east of rotary	14,472	15,229	14,131	17,677	16,258
Sandy Pond Road north of rotary	4,701	6,505	3,798	4,301	5,030
Route 2A/111 west of rotary (WB)	10,355	10,650	9,629	10,352	10,806
Route 2A/111 west of rotary (EB)	9,951	10,394	9,483	9,796	10,101
Barnum Road south of rotary	3,186	2,694	3,418	5,966	5,326
Route 110/111 south of rotary	13,837	14,533	13,475	15,677	16,127
14. Route 110/111 south of Route 2, Harvard	7,440	8,140	7,279	8,302	8,591

Table 6-1b: Automatic Traffic Recorder (ATR) Summary AM Peak Hour

Location	1996 AM Pk. Hr. (vph)	1998 AM Pk. Hr. (vph)	2000 AM Pk. Hr. (vph)	2002 AM Pk. Hr. (vph)	2004 AM Pk. Hr. (vph)
1. Route 111 at Boxborough/Harvard Town Line	448	n/a	540	552	715
2. Route 2A at Ayer/Shirley Town Line	852	740	723	743	816
3. Route 111 at Ayer/Groton Town Line	596	540	426	469	580
4. Sandy Pond Road east of Central Ave., Ayer	445	n/a	502	498	471
5. Groton-Harvard Road at Ayer/Groton Town Line	473	n/a	546	549	500
6. Front St. west of Ayer St., Shirley	412	403	429	495	441
7. Jackson Gate	324	462	812	770	836
8. Verbeck Gate	217	264	470	492	441
9. Shirley Gate	n/a	48	70	53	232
10. Barnum Gate	159	193	260	384	418
11. Grant Road Gate	n/a	n/a	n/a	n/a	67
12. Poor Farm Rd. east of Route 110/111, Harvard	129	162	132	180	168
13. Carlton Rotary					
Route 2A/110 east of rotary	1,023	978	1,071	1,215	1,158
Sandy Pond Road north of rotary	307	441	325	403	433
Route 2A/111 west of rotary (WB)	537	459	519	488	622
Route 2A/111 west of rotary (EB)	1,056	1,054	1,034	1,040	940
Barnum Road south of rotary	220	181	260	384	401
Route 110/111 south of rotary	1,075	1,148	1,121	1,202	1,346
14. Route 110/111 south of Route 2, Harvard	658	678	672	695	783

Table 6.1c: Automatic Traffic Recorder (ATR) Summary PM Peak Hour

Location	1996 PM Pk. Hr. (vph)	1998 PM Pk. Hr. (vph)	2000 PM Pk. Hr. (vph)	2002 PM Pk. Hr. (vph)	2004 PM Pk. Hr. (vph)
1. Route 111 at Boxborough/Harvard Town Line	538	n/a	530	549	714
2. Route 2A at Ayer/Shirley Town Line	905	787	704	805	789
3. Route 111 at Ayer/Groton Town Line	554	541	406	483	554
4. Sandy Pond Road east of Central Ave., Ayer	538	n/a	575	550	551
5. Groton-Harvard Road at Ayer/Groton Town Line	438	n/a	453	493	536
6. Front St. west of Ayer St., Shirley	492	458	471	482	506
7. Jackson Gate	369	434	579	631	853
8. Verbeck Gate	206	252	380	506	421
9. Shirley Gate	n/a	53	122	36	179
10. Barnum Gate	172	224	367	430	454
11. Grant Road Gate	n/a	n/a	n/a	n/a	72
12. Poor Farm Rd. east of Route 110/111, Harvard	147	152	124	164	152
13. Carlton Rotary					
Route 2A/110 east of rotary	1,248	1,257	1,133	1,326	1,324
Sandy Pond Road north of rotary	456	558	320	363	449
Route 2A/111 west of rotary (WB)	1,232	1,182	1,043	1,137	1,142
Route 2A/111 west of rotary (EB)	611	555	581	507	636
Barnum Road south of rotary	261	170	367	430	532
Route 110/111 south of rotary	1,222	1,269	1,098	1,210	1,338
14. Route 110/111 south of Route 2, Harvard	760	766	600	640	736

6.2 Week Long Counts

Due to disruptions with most of the ATR's, only locations 4 and 5 below were counted for a continuous seven days from Monday to Sunday. All of the counts at the other locations below were combined with days from different weeks to develop the average weekday daily traffic. All of the data was initially collected prior to school ending for the summer. As previously mentioned, an election was held on May 11th in Shirley, but no variation was found in the data. The following is a list of the week-long count locations and the dates that they were counted.

	Location	Dates
1.	Route 110-111 North of Route 2, Harvard	Mon. May 10th, Fri May 14th – Sun. May 16th, Tues. June 8th – Thur. June 10th
2.	Route 2A-110 at Ayer/Littleton Town Line	Fri. May 14th – Sat May 15th Sun. May 23rd – Thur. May 27th
3.	Route 2 East of I-495, Littleton	Wed May 12th (PM), Sun May 16th, Mon. May 24th – Wed. May 26th (AM)
4.	Route 2 West of I-495, Littleton	Thur. May 13th – Wed. May 19th
5.	Route 2 West of Route 70	Mon. May 10th –Sun May 16th
6.	Route 2 West of I-90, Leominster	Fri. May 10th – Thur. May 13th, Fri. May 14th – Sun. May 16th (EB), Fri. May 21st – Sun May 23rd (WB)

A summary of traffic volume characteristics associated with each of these roadways is provided in the following table.

Table 6.2: Automatic Traffic Recorder (ATR) Summary – 7 Day Counts

Location	1996 ADT (vpd)	1998 ADT (vpd)	2000 ADT (vpd)	2002 ADT (vpd)	2004 ADT (vpd)	1996 AWDT (vpd)	1998 AWDT (vpd)	2000 AWDT (vpd)	2002 AWDT (vpd)	2004 AWDT (vpd)
1. Route 110-111 North of Route 2, Harvard	11,912	11,524	13,258	13,471	13,378	13,185	12,813	14,748	14,986	14,961
2. Route 2A-110 at Littleton/Ayer Town Line*	8,567	10,681	12,039	12,126	11,721	9,598	11,958	12,039	13,470	13,084
3. Route 2 East of I-495, Littleton	36,141	38,979	43,851	42,076	52,876	40,233	43,328	50,195	46,033	59,095
4. Route 2 West of I-495, Littleton**	40,510	44,620	42,485	51,083	60,066	44,720	49,076	46,707	58,944	67,145
5. Route 2 West of Route 70, Lancaster	41,441	41,981	NA	NA	51,628	43,940	45,581	43,870	NA	57,989
6. Route 2 West of I-190, Leominster***	51,857	55,982	58,650	64,339	70,414	55,588	60,966	64,482	71,263	75,706
Location	**1996 AM Peak Hr. (vph)**	**1998 AM Peak Hr. (vph)**	**2000 AM Peak Hr. (vph)**	**2002 AM Peak Hr. (vph)**	**2004 AM Peak Hr. (vph)**	**1996 PM Peak Hr. (vph)**	**1998 PM Peak Hr. (vph)**	**2000 PM Peak Hr. (vph)**	**2002 PM Peak Hr. (vph)**	**2004 PM Peak Hr. (vph)**
1. Route 110-111 North of Route 2, Harvard	1,083	969	1,201	1,252	1,156	1,169	1,092	1,237	1,222	1,230
2. Route 2A-110 at Littleton/Ayer Town Line*	799	890	1,030	1,054	1,004	725	911	940	1,003	1,111
3. Route 2 East of I-495, Littleton	3,886	3,896	4,374	4,064	5,430	3,872	3,964	5,133	3,962	4,860
4. Route 2 West of I-495, Littleton**	4,096	4,666	4,486	4,931	6,120	4,008	4,080	4,052	5,028	5,787
5. Route 2 West of Route 70, Lancaster	4,143	4,610	****	****	6,040	3,858	3,868	****	NA	4,443
6. Route 2 West of I-190, Leominster***	4,701	5,417	5,556	5,567	6,150	4,625	5,082	5,313	5,766	6,135
Location	**1996 Sat. (vpd)**	**1998 Sat. (vpd)**	**2000 Sat. (vpd)**	**2002 Sat. (vpd)**	**2004 Sat. (vpd)**	**1996 Sat. Peak Hr. (vph)**	**1998 Sat. Peak Hr. (vph)**	**2000 Sat. Peak Hr. (vph)**	**2002 Sat. Peak Hr. (vph)**	**2004 Sat. Peak Hr. (vph)**
1. Route 110-111 North of Route 2, Harvard	10,175	9,209	10,641	11,167	10,916	880	764	875	933	958
2. Route 2A-110 at Littleton/Ayer Town Line*	6,597	8,270	*	10,033	9,659	553	653	*	814	776
3. Route 2 East of I-495, Littleton	27,235	30,428	28,399	34,232	44,822	2,047	2,240	2,227	2,454	3,294
4. Route 2 West of I-495, Littleton**	30,194	37,623	33,015	38,747	40,606	2,383	2,972	2,341	2,954	3,011
5. Route 2 West of Route 70, Lancaster	35,527	35,321	****	****	30,552	2,553	2,732	****	****	2,237
6. Route 2 West of I-190, Leominster***	43,925	*	46,368	53,238	62,260	3,174	*	3,592	4,198	4,695
Location	**1996 Sunday (vpd)**	**1998 Sunday (vpd)**	**2000 Sunday (vpd)**	**2002 Sunday (vpd)**	**2004 Sunday (vpd)**	**1996 Sunday Peak Hr. (vph)**	**1998 Sunday Peak Hr. (vph)**	**2000 Sunday Peak Hr. (vph)**	**2002 Sunday Peak Hr. (vph)**	**2004 Sunday Peak Hr. (vph)**
1. Route 110-111 North of Route 2, Harvard	7,282	7,403	8,442	11,167	7,926	628	587	828	933	815
2. Route 2A-110 at Littleton/Ayer Town Line*	5,380	6,722	*	10,033	6,969	491	532	*	814	625
3. Route 2 East of I-495, Littleton	24,582	25,805	27,591	34,232	29,835	1,989	2,149	2,436	2,454	2,583
4. Route 2 West of I-495, Littleton**	29,775	29,340	30,834	38,747	44,132	2,499	2,307	2,616	2,954	3,708
5. Route 2 West of Route 70, Lancaster	32,387	30,644	****	****	40,889	2,642	2,735	****	****	3,429
6. Route 2 West of I-190, Leominster***	41,133	40,936	30,834	53,238	52,103	3,310	3,391	3,592	4,198	4,227

** 2 day count in 2000*

*** 5 day count in 2002*

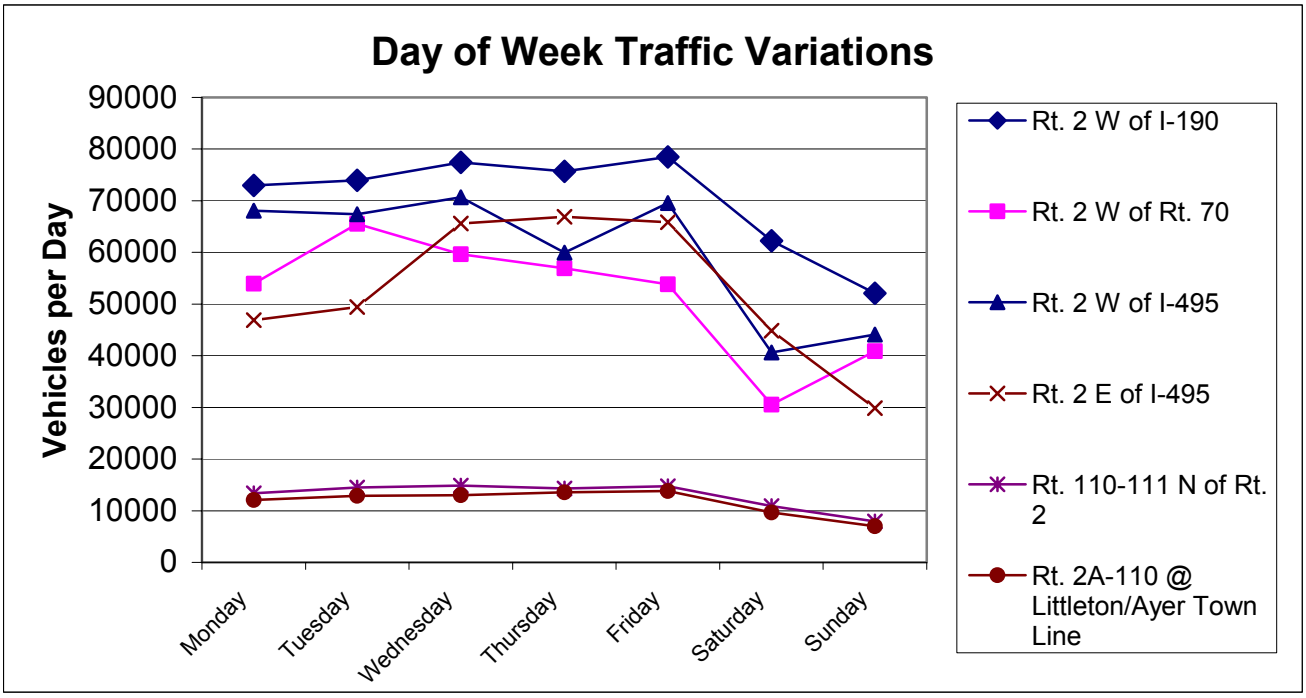
**** 6 day count in 2002*

***** Data not available from MHD permanent count locations.*

Day of week variations in traffic volumes on these roadways are illustrated in the chart below.

Figure 6-1: Average Weekday Daily Traffic – 2004 Conditions

Figure 6-2: Day of Week Traffic Variations



As was shown in previous reports, it can be seen that despite the differences in traffic volume, these roadways all follow an expected pattern of increasing traffic from Monday to Friday, with decreased Saturday and Sunday volumes. These characteristics are less apparent but still evident on the local roadways such as Route 2A-110, where the component of local traffic represents a higher percentage of overall daily volumes.

6.3 Vehicle Classification

A series of vehicle classification counts were conducted to monitor heavy vehicle volumes. The two-directional vehicle classification counts were conducted at the following locations during the specified dates:

	Location	Dates
1.	Barnum Gate	5/12/04-5/13/04
2.	Verbeck Gate	5/12/04-5/13/04
3.	Jackson Gate	5/12/04-5/13/04
4.	Grant Road Gate (New Location)	5/12/04-5/13/04
5.	Shirley Gate	5/12/04-5/13/04
6.	Route 110/111 North of Route 2, Harvard	6/8/04-6/10/04*

* Counts were originally conducted on May 12th and 13th, but were redone due to questionable data.

These vehicle classification counts were conducted for a 48-hour period and were programmed to identify the 13 different Federal Highway Administration vehicle classifications. For simplicity in reporting, these results have been summarized into four categories: motorcycles, passenger vehicles, single unit trucks and buses, and tractor-trailers. The full vehicle classifications printouts are provided in the Appendix.

The charts provided on the following pages depict the hourly distribution of two-way truck traffic at each location where vehicle classification counts were conducted. Both total volume and time of day were expressed as important issues by residents concerned with noise and other impacts associated with truck traffic.

Figure 6-3: Truck Traffic Distribution, Route 110-111, Harvard

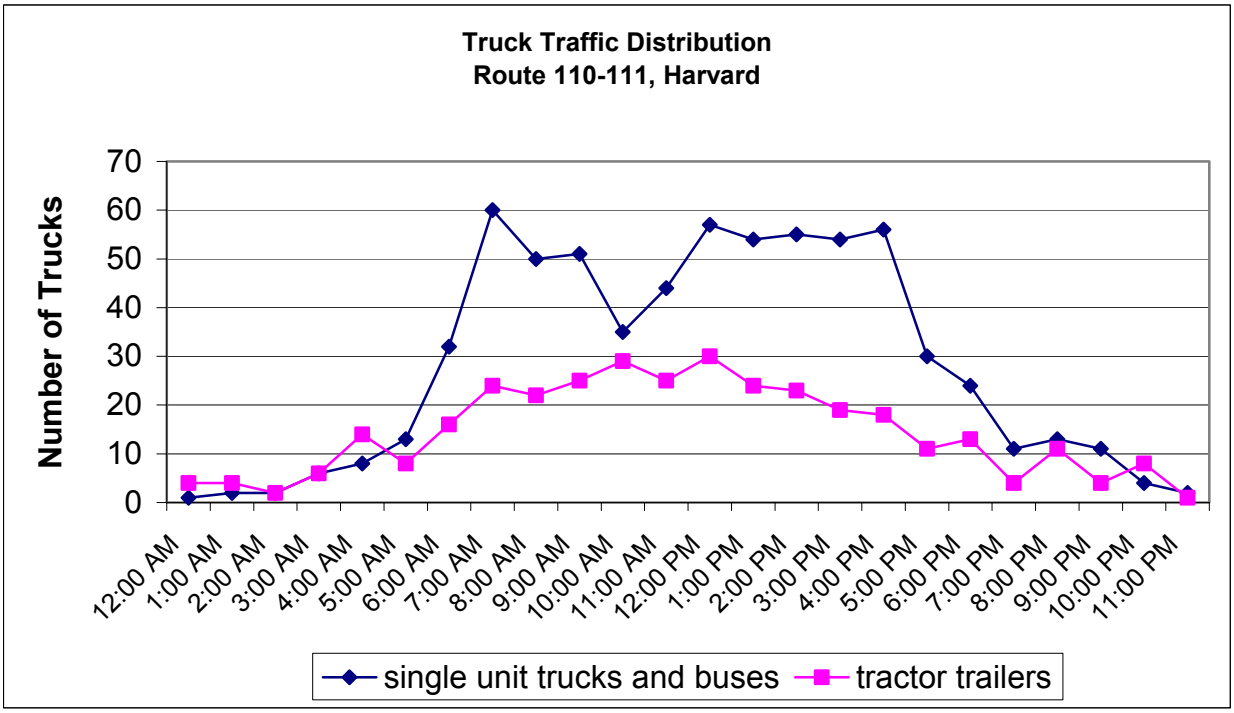


Figure 6-4: Vehicle Classification Count, Route 110-111/Harvard

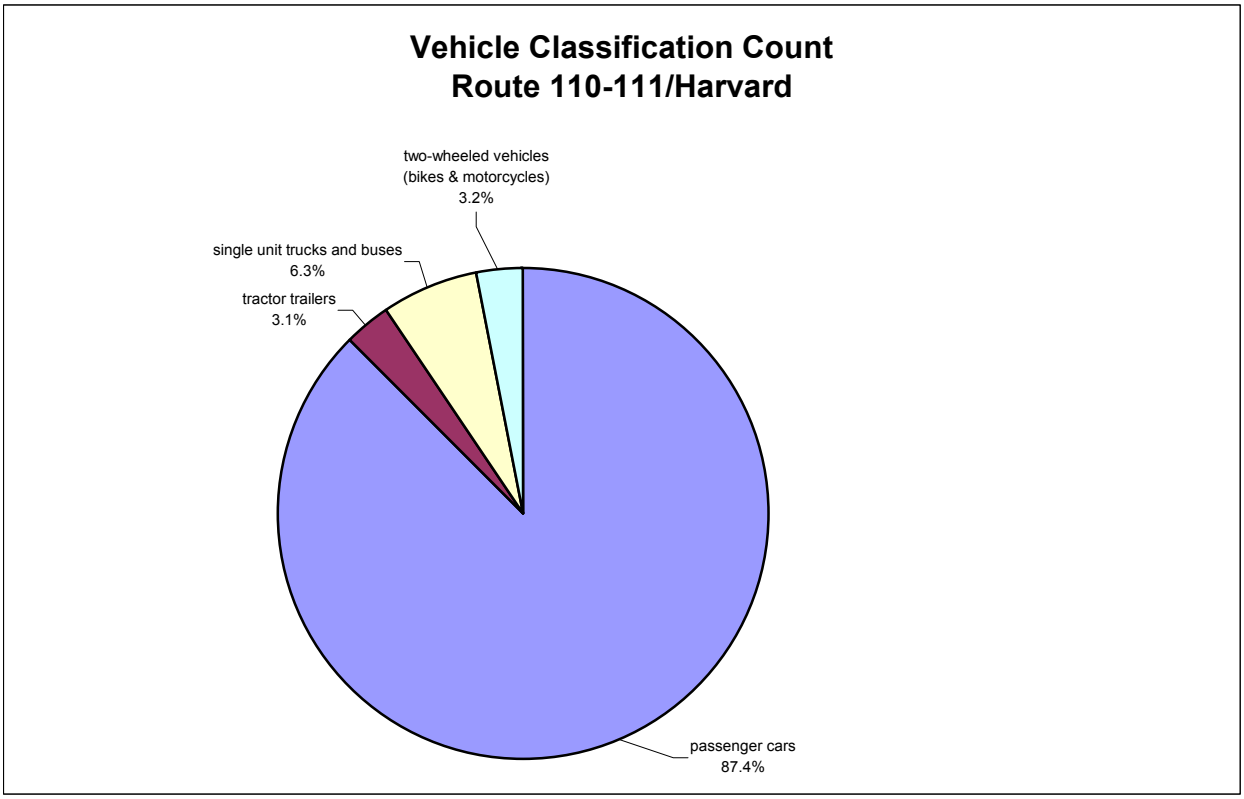


Figure 6-5: Truck Traffic Distribution, Jackson Gate

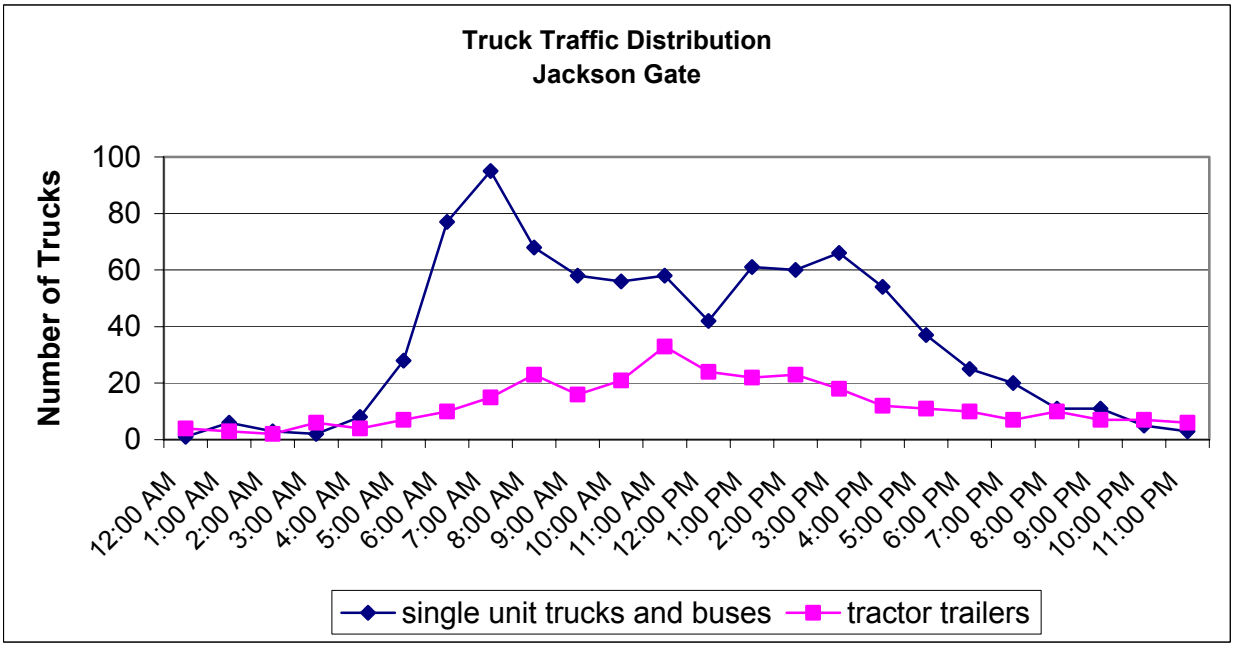


Figure 6-6: Truck Traffic Distribution, Verbeck Gate

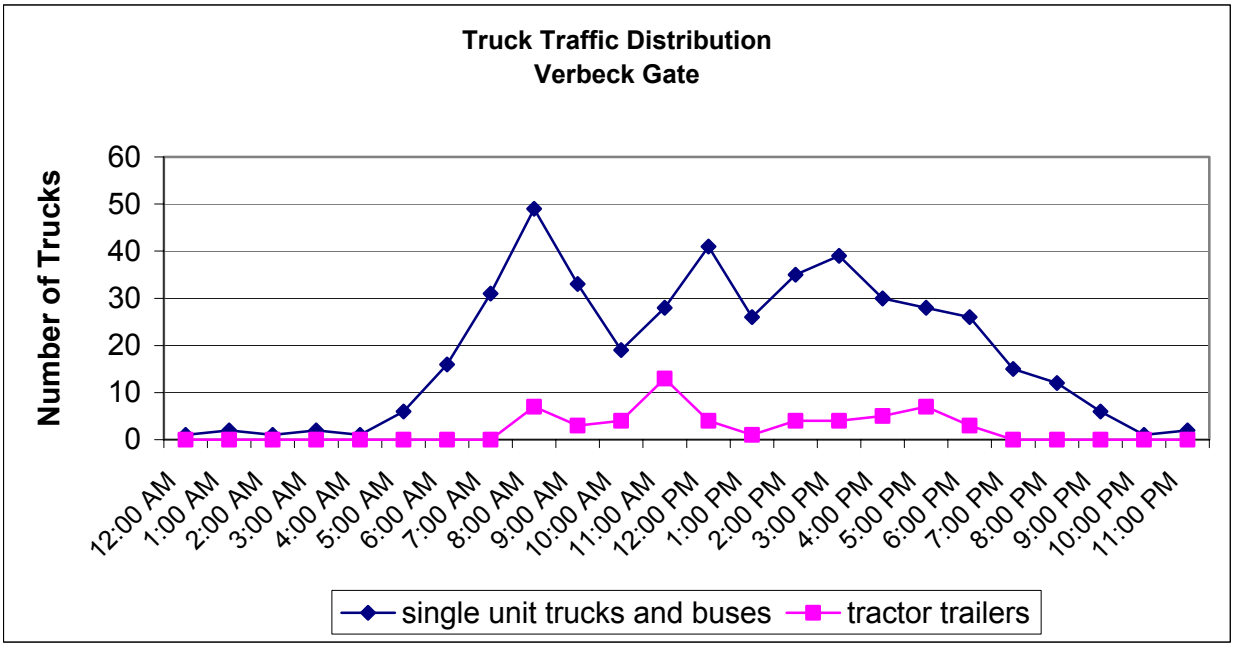


Figure 6-7: Truck Traffic Distribution, Barnum Gate

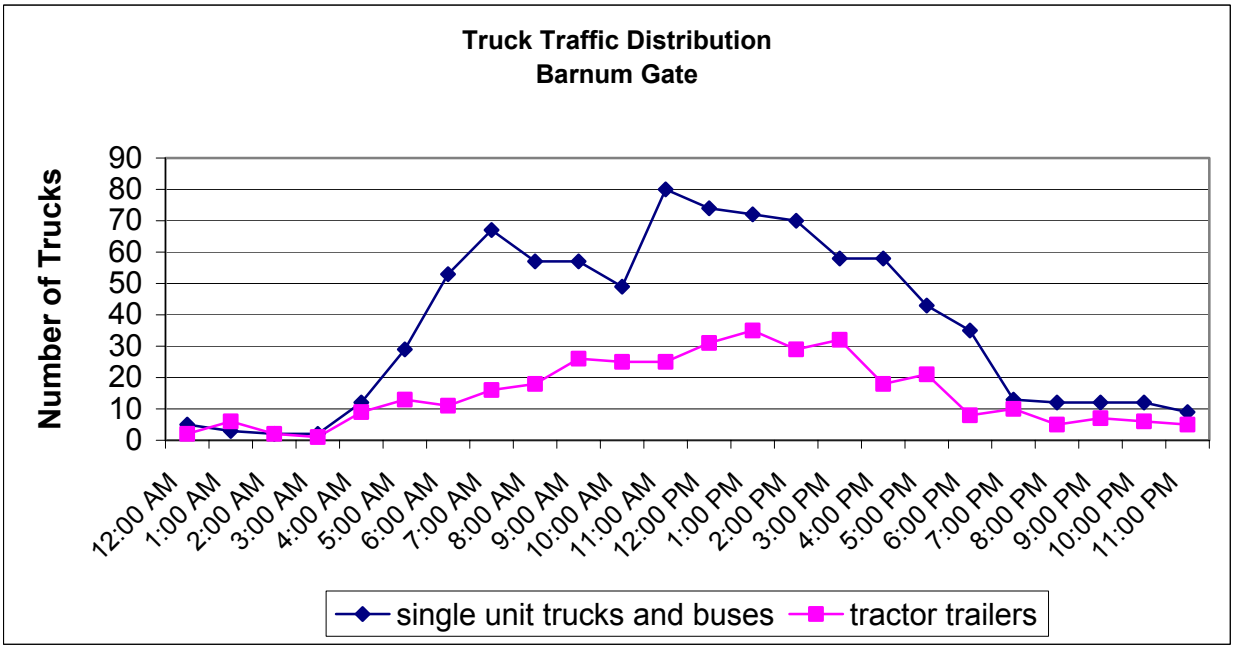


Figure 6-8: Truck Traffic Distribution, Grant Road Gate

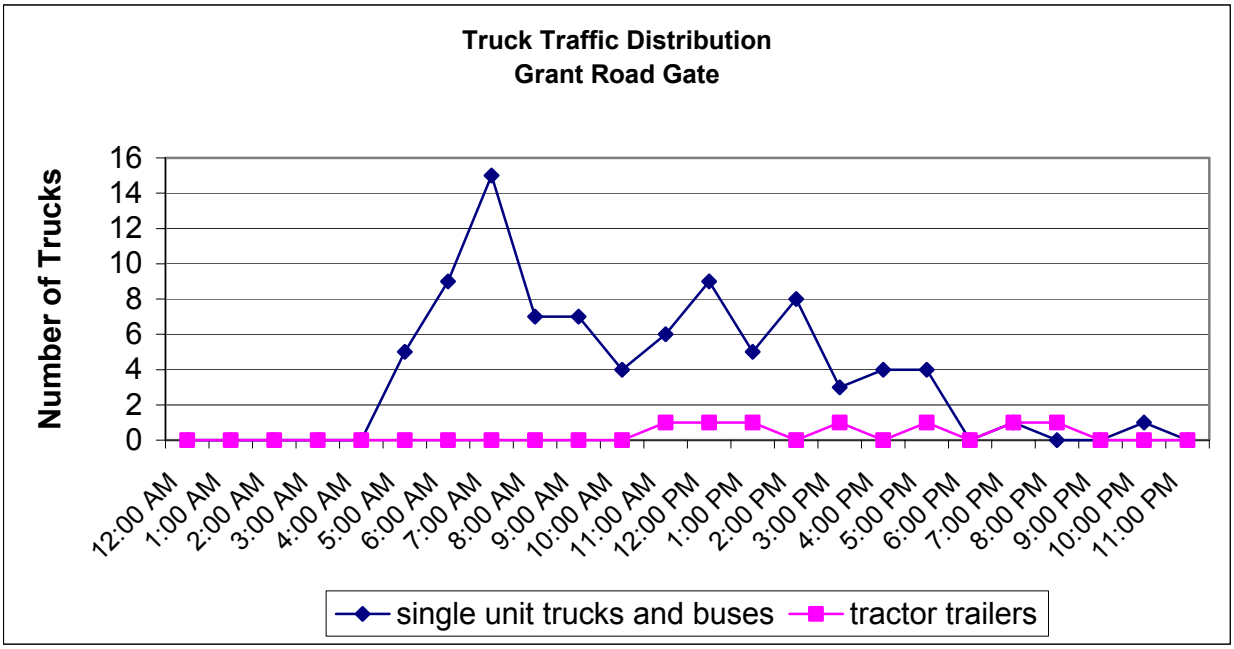


Figure 6-9: Truck Traffic Distribution, Total of Combined Gates

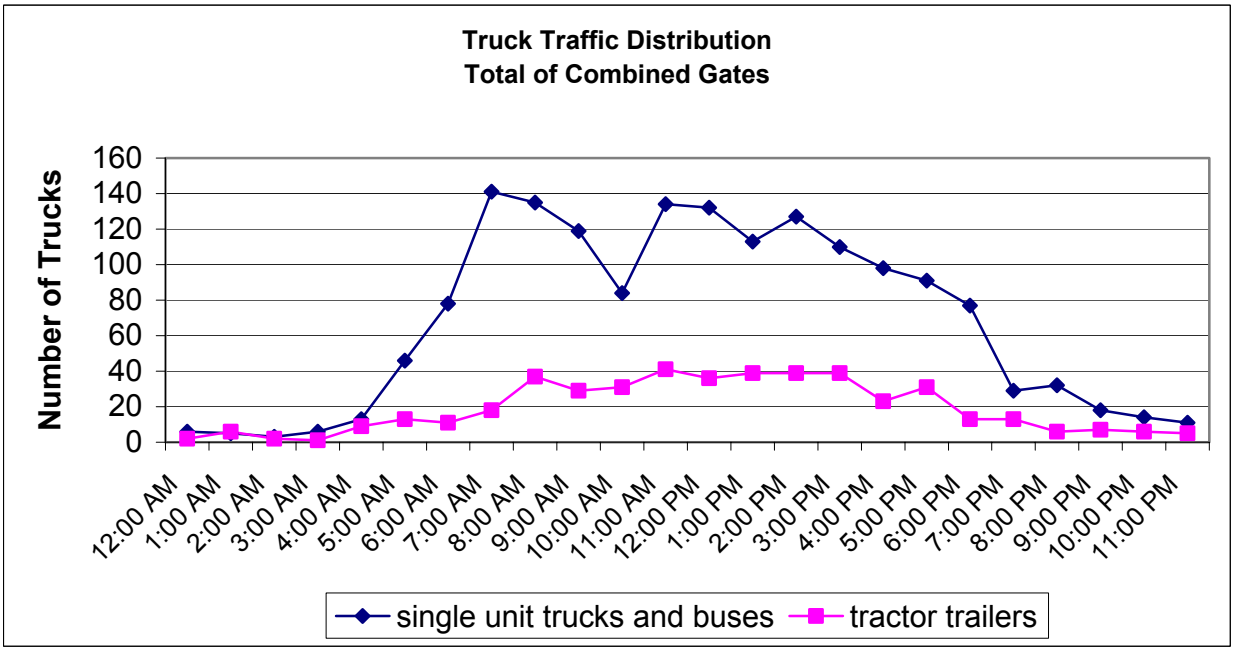


Figure 6-10: Vehicle Classification Summary, All Gates

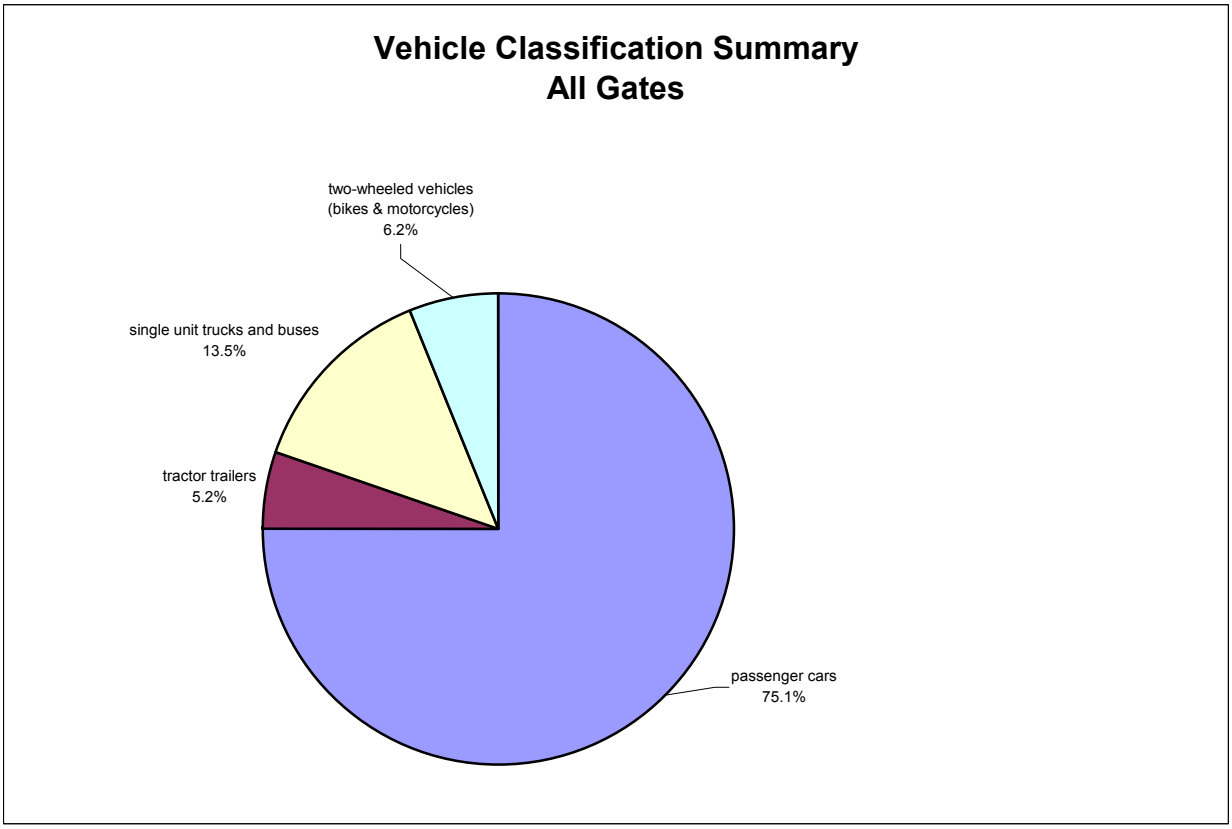
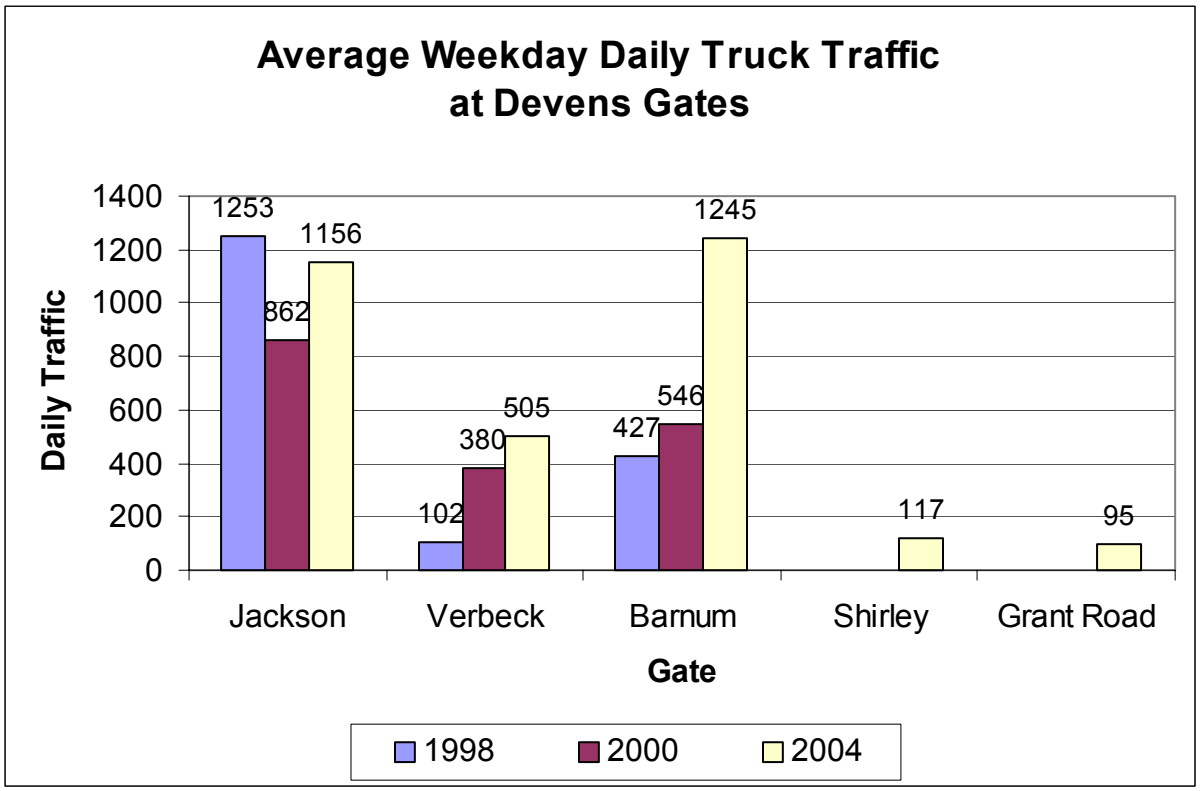


Figure 6-11 shows the average weekday daily truck volumes at Devens gates for the years 1998, 2000, and 2004. The total daily truck traffic through all gates was about equal for 1998 and 2000 (approximately 1,800 truck trips). The number of daily truck trips (3,118) increased significantly (+74%) between 2000 and 2004. The most dramatic difference occurred at the Barum Gate where truck traffic increased from 546 trips in 2000 to 1,245 trips in 2004, more than double. The increase in truck traffic may be in relation to the increased development that has occurred at Devens between 2000 and 2004. It is noted that no truck traffic used the Shirley and Grant Road gates in 1998 and 2000.

Figure 6-11: Average Weekday Daily Truck Traffic at Devens Gate



7.0 CARLTON ROTARY/TRAFFIC VOLUMES AND TRIP DISTRIBUTION REVIEW

Traffic counts were performed at the Carlton Rotary for a 48-hour period on all approaches and exits. The daily unadjusted volumes recorded at each leg of the rotary have already been summarized in previous tables. However, due to the physical configuration of the rotary approaches and the logistical requirements of ATR placement, these volumes must be adjusted to report equivalent traffic volumes entering and exiting the rotary. These balanced weekday volumes are summarized in the following table.

Table 7-1: Carlton Rotary – Weekday Volumes – Entering/Exiting (balanced)

	1996 Entering (vpd)	1998 Entering (vpd)	2000 Entering (vpd)	2002 Entering (vpd)	2004 Entering (vpd)
Route 2A-110, East of Rotary	7,200	7,500	6,994	8,844	8,512
Route 110-111, South of Rotary	7,400	7,200	6,775	7,920	8,571
Barnum Road	1,650	1,200	1,704	3,048	2,740
Route 2A-111 EB, West of Rotary	10,350	10,200	9,489	9,751	10,645
Route 2A-111 WB, West of Rotary	n/a	n/a	n/a	n/a	n/a
Sandy Pond Road	2,650	3,900	2,003	2,337	2,190
Total	29,250	30,000	26,965	31,900	32,659
	1996 Exiting (vpd)	**1998 Exiting (vpd)**	**2000 Exiting (vpd)**	**2002 Exiting (vpd)**	**2004 Exiting (vpd)**
Route 2A-110, East of Rotary	7,600	7,500	7,140	8,842	8,181
Route 110-111, South of Rotary	6,750	7,200	6,693	7,764	7,994
Barnum Road	1,550	1,500	1,713	2,921	2,726
Route 2A-111 EB, West of Rotary	n/a	n/a	n/a	n/a	n/a
Route 2A-111 WB, West of Rotary	10,350	11,100	9,625	10,409	10,806
Sandy Pond Road	3,000	2,700	1,794	1,964	2,952
Total	29,250	30,000	26,965	31,900	32,659
	1996 Total (vpd)	**1998 Total (vpd)**	**2000 Total (vpd)**	**2002 Total (vpd)**	**2004 Total (vpd)**
Route 2A-110, East of Rotary	14,800	15,000	14,134	17,686	16,693
Route 110-111, South of Rotary	14,150	14,400	13,468	15,684	16,565
Barnum Road	3,200	2,700	3,417	5,969	5,466
Route 2A-111 EB, West of Rotary	10,350	10,200	9,489	9,751	10,645
Route 2A-111 WB, West of Rotary	10,350	11,100	9,625	10,409	10,806
Sandy Pond Road	5,650	6,600	3,797	4,301	5,142
Total	58,500	60,000	53,930	63,800	65,318

The AM and PM peak hour entering and exiting volumes were also balanced and are summarized in the following tables.

Table 7-2: Carlton Rotary – AM Peak Hour Volumes – Entering/Exiting (balanced)

	1996 AM Peak Entering (vph)	1998 AM Peak Entering (vph)	2000 AM Peak Entering (vph)	2002 AM Peak Entering (vph)	2004 AM Peak Entering (vph)
Route 2A-110, East of Rotary	332	328	658	469	520
Route 110-111, South of Rotary	441	455	586	440	558
Barnum Road	86	85	252	170	205
Route 2A-111 EB, West of Rotary	1,143	1,122	518	999	997
Route 2A-111 WB, West of Rotary	n/a	n/a	n/a	n/a	n/a
Sandy Pond Road	150	141	186	288	243
Total	2,152	2,131	2,200	2,366	2,522
	1996 AM Peak Exiting (vph)	**1998 AM Peak Exiting (vph)**	**2000 AM Peak Exiting (vph)**	**2002 AM Peak Exiting (vph)**	**2004 AM Peak Exiting (vph)**
Route 2A-110, East of Rotary	716	639	413	758	668
Route 110-111, South of Rotary	651	661	515	775	820
Barnum Road	141	107	118	216	208
Route 2A-111 EB, West of Rotary	n/a	n/a	n/a	n/a	n/a
Route 2A-111 WB, West of Rotary	476	426	1,019	509	622
Sandy Pond Road	168	298	135	108	204
Total	2,152	2,131	2,200	2,366	2,522
	1996 AM Peak Total (vph)	**1998 AM Peak Total (vph)**	**2000 AM Peak Total (vph)**	**2002 AM Peak Total (vph)**	**2004 AM Peak Total (vph)**
Route 2A-110, East of Rotary	1,048	967	1,071	1,227	1,188
Route 110-111, South of Rotary	1,092	1,116	1,101	1,215	1,378
Barnum Road	227	192	370	386	413
Route 2A-111 EB, West of Rotary	1,143	1,122	518	999	997
Route 2A-111 WB, West of Rotary	476	426	1,019	509	622
Sandy Pond Road	318	439	321	396	676
Total	4,304	4,262	4,400	4,732	5,044

Table 7-3: 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)
Route 2A-110, East of Rotary	820	817	359	762	778
Route 110-111, South of Rotary	809	789	438	776	874
Barnum Road	110	110	45	282	312
Route 2A-111 EB, West of Rotary	579	601	1,063	502	713
Route 2A-111 WB, West of Rotary	n/a	n/a	n/a	n/a	n/a
Sandy Pond Road	169	177	228	175	188
Total	2,487	2,494	2,133	2,497	2,865
	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)**
Route 2A-110, East of Rotary	458	449	703	563	630
Route 110-111, South of Rotary	443	499	678	452	558
Barnum Road	61	75	210	146	254
Route 2A-111 EB, West of Rotary	n/a	n/a	n/a	n/a	n/a
Route 2A-111 WB, West of Rotary	1,232	1,222	443	1,148	1,142
Sandy Pond Road	293	249	99	188	281
Total	2,487	2,494	2,133	2,497	2,865
	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)**
Route 2A-110, East of Rotary	1,278	1,266	1,062	1,325	1,408
Route 110-111, South of Rotary	1,252	1,288	1,116	1,228	1,432
Barnum Road	171	185	255	428	566
Route 2A-111 EB, West of Rotary	579	601	1,063	502	713
Route 2A-111 WB, West of Rotary	1,232	1,222	443	1,148	1,142
Sandy Pond Road	462	426	327	363	469
Total	4,974	4,988	4,266	4,994	5,730