



Exit 6

with
**Interstate 291
Safety Transportation Study**

January 2005
Final Report



Prepared by:
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Prepared in cooperation with the Executive Office of Transportation, the Massachusetts Highway Department and the U.S. Department of Transportation - Federal Highway Administration and the Federal Transit Administration.

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I. INTRODUCTION

The Pioneer Valley Planning Commission (PVPC) identified the intersection of the Massachusetts Turnpike Exit 6 with Interstate 291 as a candidate for a safety study as part of the 2003 Update to the Regional Transportation Plan for the Pioneer Valley Metropolitan Planning Organization (RTP). Improving safety is an emphasis area of the Federal Highway Administration. The RTP identifies areas with high crash rates that can be incorporated into the Pioneer Valley Unified Planning Work Program (UPWP) to develop recommendations for improvement.

The Massachusetts Highway Department (MassHighway) develops a list of the top 1000 crash locations in the Commonwealth on a regular basis. The intersection of the Massachusetts Turnpike Exit 6 with Interstate 291 appeared on the 2001 version of this list with a total of 48 police reported crashes from 1997 to 1999.

This study will review the recent crash history of the intersection of the Massachusetts Turnpike Exit 6 with Interstate 291 to identify the factors which contribute to safety problems in this area. Potential improvement alternatives will be identified and analyzed in order to give the Massachusetts Turnpike a variety of options on how to reduce the number of crashes at this intersection.

A. STUDY AREA

Exit 6 of the Massachusetts Turnpike (MassPike) intersects with Interstate 291 (I-291) and Burnett Road in the City of Chicopee to form a three-way intersection operating under traffic signal control. Interstate 291 is a limited access facility connecting the southeastern portion of Chicopee with Interstate 91 in Springfield. Burnett Road provides access to a variety of commercial and residential land uses and provides access to the Town of Ludlow.

A tandem trailer lot is located on the southeastern corner of the intersection. This parking facility is utilized as a temporary storage facility for tandem trailer units that are not permitted on local streets.

In the vicinity of the intersection, Exit 6 provides two exclusive left turn lanes and one exclusive right turn lane. Interstate 291 provides two through travel lanes and one exclusive right turn lane. Burnett Road provides one exclusive left turn lane and two through travel lanes.

The signalized intersection is coordinated with the intersection of Burnett Road with Johnny Cake Hollow Road and First Avenue. No sidewalks are provided in the vicinity of the intersection and pavement markings were noted to be in fair condition at the time of the field inventory.

II. EXISTING TRANSPORTATION CONDITIONS

This section provides a technical evaluation of the transportation components for the intersection of the MassPike Exit 6 with Interstate 291. It includes a presentation of the data collected, analysis of traffic operations, and a series of short-term recommendations to improve the overall performance and safety of the intersection.

A. DATA COLLECTION

1. *Hourly Vehicle Volume*

Manual turning movement counts were conducted for the intersection of the MassPike Exit 6 with Interstate 291. TMC's were conducted during the peak commuter periods. The weekday peak commuter period occurs during the morning hours of 7:00 AM to 9:00 AM and the afternoon hours of 4:00 PM to 6:00 PM. The TMC's were conducted to identify the peak four consecutive 15-minute periods of traffic through the intersection. These consecutive peak 15-minute periods constitute a location's Peak Hour Volume. The peak hour of traffic volume represents the most critical period for operations and will be the focus for some of the analyses conducted in this study.

The TMC data also identifies the number of heavy vehicles and pedestrians on the roadway. Heavy vehicles include trucks, recreational vehicles and buses. The percentage of heavy vehicles in the traffic flow is an important component in calculating the serviceability of a corridor or intersection. Trucks impact traffic flow because they occupy more roadway space than passenger cars and have poorer operating capabilities with respect to acceleration, deceleration and maneuverability.

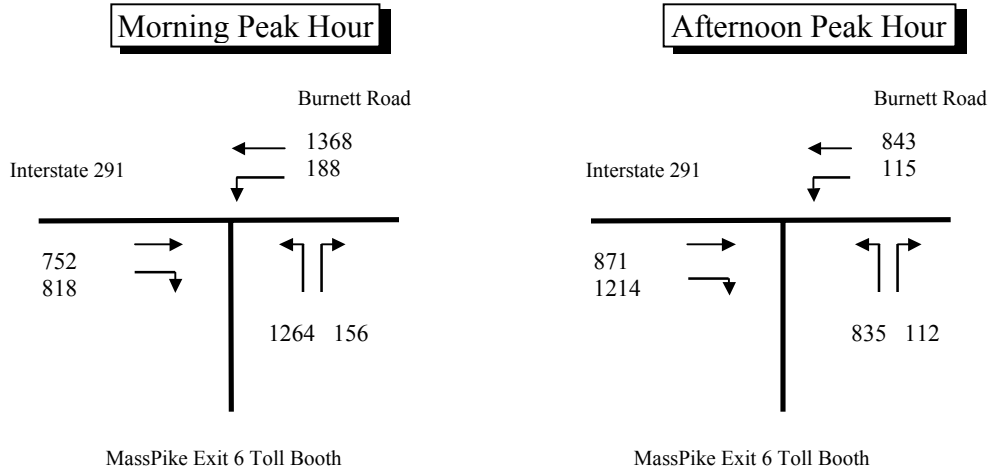
The TMC data was obtained during weekday peak periods. As traffic volumes tend to fluctuate over the course of the year, the Massachusetts Highway Department (MassHighway) develops traffic volume adjustment factors to reflect monthly variations. These factors were examined to determine how traffic conditions at the intersection of the MassPike Exit 6 with Interstate 291 compares to average month conditions. Turning movement count data for the morning and afternoon peak hours are summarized on Figure II-1.

2. *Crash Experience*

A crash history of the intersection was provided by the Massachusetts Highway Department (MassHighway). MassHighway also provided additional information for the 2002 calendar year based on research of the actual crash reports filed with the Massachusetts Registry of Motor Vehicles. This information is shown in Figure II-2. A total of 18 crashes were reported at this intersection in 2002, however only 9 of these crashes occurred at the intersection. The other 9 crashes occurred on the MassPike or Interstate 291 in the vicinity of the intersection.

As can be seen from the collision diagram, a total of 3 crashes involved a vehicle changing lanes and colliding with another vehicle exiting the tollbooths. There were also 3 angle-type crashes in the middle of the intersection, two of which involved a vehicle running a red light. The high traffic volumes at the intersection largely contribute to angle-type crashes as well as motorists entering the intersection on a red signal. Out of the 9 reported crashes in 2002, 4 involved a personal injury and there were no reported fatalities.

Figure II-1 Morning and Afternoon Peak Hour Traffic Volumes



Information provided by Manual Turning Movement Counts Performed by PVPC on April, 2004

3. Vehicles Running a Red Light

An additional manual turning movement count (TMC) was performed to monitor the number of motorists running a red light during the morning and afternoon peak hours. The purpose of this TMC was to determine if there was a correlation between the number of vehicles running the red light and the number of crashes at the intersection. Table II-1 presents the volumes of vehicles running a red light during the morning and afternoon peak hours. For the purpose of this study, a vehicle was considered to run the red light if it left the stop line after the signal turned red. The right turn movements onto the MassPike Exit 6 from Interstate 291 and onto Burnett Road from the MassPike Exit 6 were not included because these movements operate under “YIELD” control.

Table II-1 Vehicles Running a Red Light During Peak Hour

Location	7-9 AM Peak	4-6 PM Peak
MassPike Exit 6, WB, Left Movement	35	29
Interstate 291, NB Through Movement	1	6
Burnett Road, SB Through Movement	4	6
Burnett Road, SB Left Movement	20	33

*Information based on Manual Turning Movement Counts, April 2004
 Note: NB = Northbound, SB = Southbound, WB = Westbound*

The morning and afternoon volumes of cars running a red light are roughly the same. There are more vehicles running the red light traveling westbound in the morning than in the afternoon. There are more vehicles running the red light in the afternoon when traveling southbound and taking a left turn than in the morning. At the time of the study,

it was noted that slower trucks speeds can create problems for passenger vehicles immediately following them through the intersection. Vehicles driving directly behind large trucks may not be able to see the traffic signal head, especially when making a left turn from Burnett Road. Many large trucks may also run through the red light because they cannot stop safely at the intersection due to their existing travel speed. Some vehicles appear to run the red light out of frustration due to the relatively long traffic signal cycle length.

B. ANALYSIS PROCEDURES

1. Capacity Analysis

The intersection of the MassPike Exit 6 with Interstate 291 was examined with regard to capacity and delay characteristics to determine the existing Level of Service (LOS). LOS is an indicator of the operating conditions which occur on a roadway under different volumes of traffic and is defined in the 2000 Highway Capacity Manual by six levels, “A” through “F”. A number of operational factors can influence the LOS including geometry, travel speeds, delay, and the number of pedestrians.

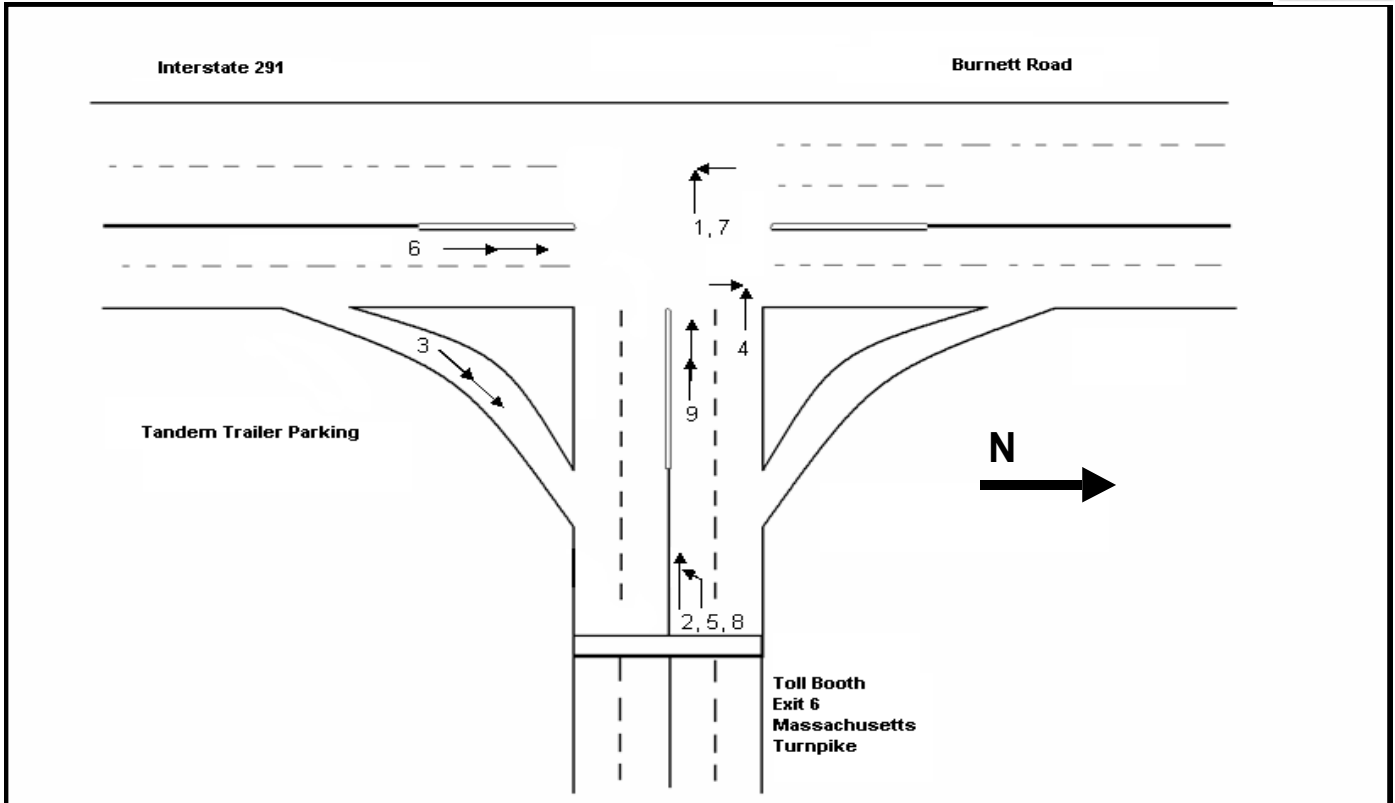
Depending on the time of day and year, a roadway may operate at varying levels. Level of Service “A” represents the best operating conditions and is an indicator of ideal travel conditions with vehicles operating at or above posted speed limits with little or no delays. Conversely, LOS “F”, or failure, generally indicates forced flow conditions illustrated by long delays and vehicle queues. Level of Service “C” indicates a condition of stable flow and is generally considered satisfactory in rural areas. Under LOS “D” conditions, delays are considerably longer than under LOS “C”, but are considered acceptable in urban areas. At LOS “E” the roadway begins to operate at unstable flow conditions as the facility is operating at or near its capacity. Using the Synchro software, the LOS for the intersection of the MassPike Exit 6 with Interstate 291 was calculated to operate at LOS “D” in the morning and an LOS “C” in the afternoon. Table II-2 presents the LOS for the morning and afternoon peak hours.

Table II-2 Level of Service Summary of Existing Signalized Intersection

Location	AM Peak		PM Peak	
	Delay*	LOS**	Delay*	LOS**
MassPike Exit 6, WB, Left Movement	>50	F	62.8	E
MassPike Exit 6, WB, Right Movement	0.1	A	0.1	A
Interstate 291, NB Through Movement	22.5	C	23.2	C
Interstate 291, NB Right Movement	1.8	A	7.3	A
Burnett Road, SB Through Movement	11.1	B	9.0	A
Burnett Road, SB Left Movement	41.8	D	40.7	D

Figure II-2 Collision Diagram

Intersection: MassPike Exit 6 with Interstate 291



Fixed Object		Symbols	
Angle		Pedestrian	
Rear End		Side Swipe	
Backing		Lane Change	
Head-on			

<u>Light Condition (L)</u>	
1. Daylight	
2. Dawn/Dusk	
3. Darkness	
4. Unknown	

Fatality	F
Personal Injury	PI
Property Damage	PD

<u>Road Condition (R)</u>	
1. Dry	
2. Wet	
3. Snow/Ice	

	DATE	TIME	SEV	L	R										
1	12/2/02	4:35 PM	PI	3	1										
2	11/4/02	8:10 AM	PD	1	1										
3	10/29/02	9:20 AM	PI	1	1										
4	10/21/02	11:05 PM	PI	3	1										
5	9/16/02	7:05 AM	PD	1	2										
6	7/24/02	1:37 PM	PD	1	1										
7	6/28/02	9:20 AM	PD	1	1										
8	5/15/02	8:50 AM	PD	1	1										
9	1/11/02	5:10 PM	PI	2	2										

As can be seen from the table, the movement with the highest amount of delay is the left turn from the MassPike Exit 6 onto Interstate 291. This movement was calculated to operate at LOS “F” in the morning and LOS “E” in the afternoon and can experience queues that extend into the toll booths. Left turns from the southbound approach of Burnett Road to enter the MassPike operate at LOS “D”, which is most likely due to the short amount of green time given for this movement.

III. CONCLUSIONS

Based on the results of this study, it appears that many of the crashes associated with this intersection may not have occurred at the actual intersection, but instead along the Exit 6 access/egress ramps at the Exit 6 toll booths. MassHighway has made numerous improvements to its crash record system since the development of the 1997-1999 Top 1000 High Crash Locations report. The PVPC will continue to monitor crash data at this intersection, however the intersection could be expected to drop off of the Top 1000 list based on the high percentage of crashes associated with the intersection in 2002 but found to have occurred elsewhere and as a result of the improvements to the MassHighway crash database. It will also be important to determine if the number of vehicles observed to run red lights at this intersection continue to increase and begin to contribute to serious crash problems.

Existing peak hour congestion can contribute to safety problems at this intersection and cause frustrated drivers to “run” red lights – particularly from the Exit 6 approach. It is recommended that the Massachusetts Turnpike consider modifying the existing traffic signal timing plan to reduce delay for the Exit 6 approach and exclusive left turn lane from Burnett Road. Both locations currently experience long queues during the peak travel hours that extend beyond the storage capacity of the turn lanes. This can create problems at the MassPike toll booths and interfere with through moving traffic traveling southbound on Burnett Road. The installation of queue detection equipment could also improve the efficiency of the existing traffic signal. Additional warning signs may also be required to warn vehicles exiting the toll booths of merging traffic.

It is suggested that the Massachusetts Turnpike perform an additional study to monitor the visibility of the lights and determine if back plates or the installation of additional traffic signal heads are required. The installation of dashed white lines across the intersection from Burnett Road to Interstate 291 would also help to remedy the existing alignment issues for through traffic. It is recommended that the Massachusetts Turnpike consider the feasibility of adding an additional exclusive left turn lane to the Burnett Road approach to the intersection. This could allow additional green time to be allocated to other movements and add more storage capacity for left turning vehicles.