US 7/Marsett Road/Bostwick Road Intersection Safety Analysis

CCMPO

February 2011

Introduction

The Town of Shelburne requested the Chittenden County Metropolitan Planning Organization's (CCMPO) assistance in reviewing and analyzing the crash history at the US 7 /Marsett Road/Bostwick Road intersection. The Shelburne Police have seen an increase in the number of crashes over the past year and would like to determine possible causes and mitigation strategies.

Background

The intersection is a four-way signalized intersection with one lane on three of four approaches accommodating left, through, and right movements. The Bostwick Road approach consists of two lanes, one accommodating left turning movements and the other accommodating through and right turns. US 7 is a principal arterial carrying a 2008 approximate annual average daily traffic (AADT) of 14,500 vehicles. Marsett Road is a major collector while Bostwick Road is a minor collector. In 2006 Marsett and Bostwick Roads had AADT's of 4000 and 2300 vehicles respectively. The intersection is situated at the crest of a hill.

Crash Data

Five years of crash data from 2005 to 2009 were provided to the CCMPO from the Shelburne Police for review and analysis. During that time frame a total of 36 crash incidences were recorded in the vicinity of the subject intersection. Rear end crashes accounted for 83% of the total crashes and were split evenly amongst the north and southbound approaches on US 7. The main causes of all the rear end crashes were inattention or following too closely. The approximate locations of the crashes can be seen in Figure 1. The crash rate has fluctuated over the study period as shown in Table 1.

The Vermont Agency of Transportation (VTrans) identifies High Crash Location (HCL) sections and intersections throughout the State using a ratio that compares the actual rate of crashes reported to the state to a calculated critical rate. When the actual crash rate exceeds the critical crash rate the intersection or section of roadway is classified as a HCL. Presently there are no identified HCLs near the study area. However an analysis of the crash data supplied by the Shelburne Police Department yielded an actual/critical ratio of 2.47 for a 0.3 mile section of US 7 that passes through the study intersection. Therefore the intersection may indeed lie within a HCL section.

Site Visit

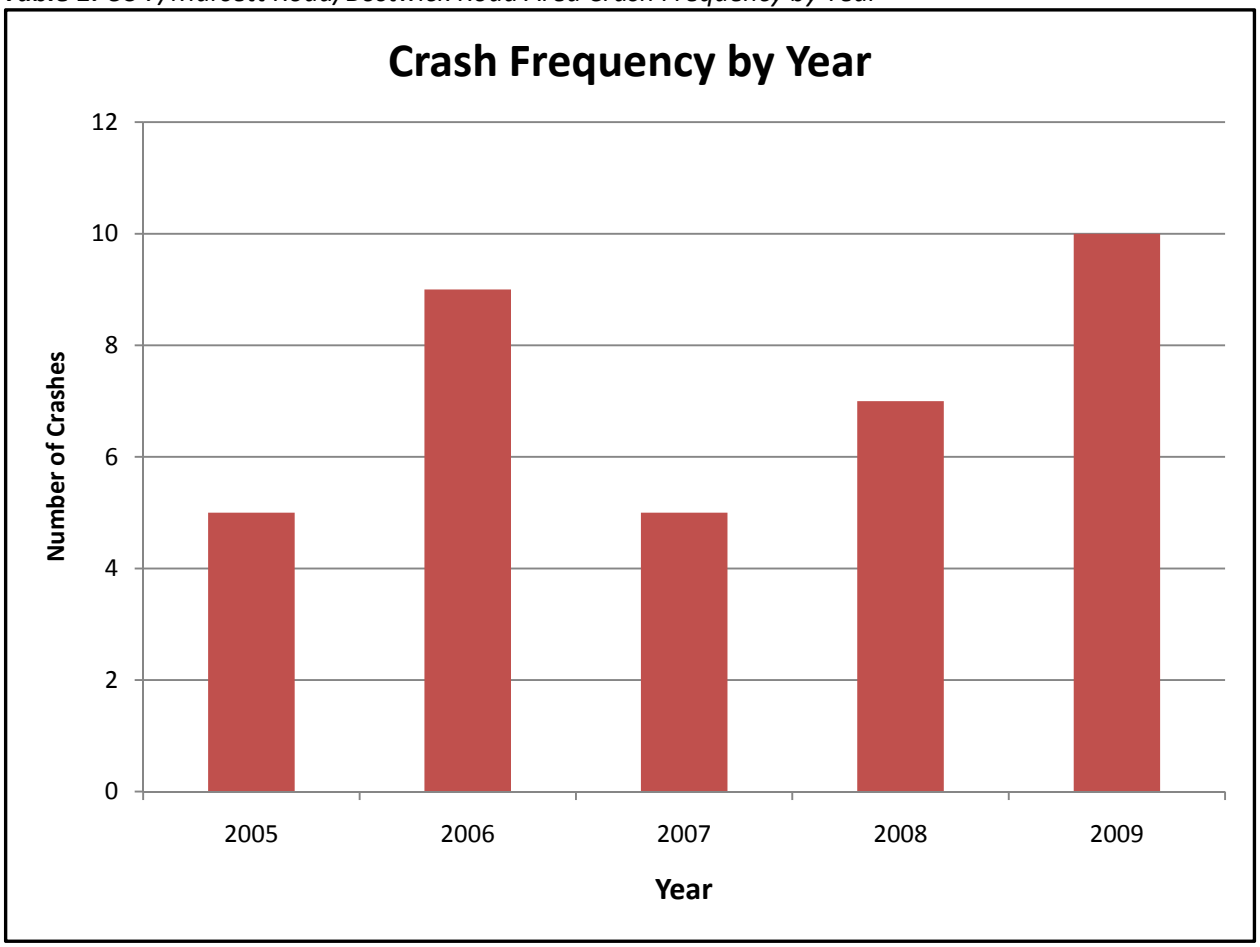
A site visit was conducted on August 18th, 2010 to observe the intersection in operation. The following items were noted:

- The east/west approaches (Marsett/Bostwick) experience limited sight distance of their opposing approach due to a sharp hill crest on either approach. The north/south approaches exhibit adequate advance sight distance.
- There is a crosswalk on the Marsett Road leg but there is no pedestrian phase for the intersection.

- The US 7 approaches have stop bars while the Marsett & Bostwick approaches do not.
- The intersection's signal is semi-actuated with vehicle detection on the minor approaches but is operating pre-timed because of what appears to be a failed detector.

Figure 1: *US 7/Marsett Road/Bostwick Road Approximate Crash Locations*

Table 1: *US 7/Marsett Road/Bostwick Road Area Crash Frequency by Year*



Analysis

After a thorough review of the crash data, a section of US 7 encompassing the US 7/Marsett Road/Bostwick Road intersection appears to qualify as a High Crash Location (HCL) with an actual/critical ratio of 2.47. This section has not been identified by VTrans because the Shelburne Police department only sends in crash reports to the DMV that result in an injury or exceed $1,000 in vehicular damage. VTrans encourages municipalities to send in all crash reports in order to maintain an accurate HCL list and assure that safety funds are being allocated to proper locations.

One factor that could be contributing to the above average crash rate is the operation of the traffic signal. During the site visit the signal was operating in a pre-timed mode. Therefore the US 7 approaches are stopped every cycle regardless of vehicle demand on Marsett or Bostwick Road. This subjects the US 7 approaches to more red light occurrences than would be necessary if the existing signal detectors were operational. Decreasing the amount of red light occurrences on US 7 would not solve the inattention problem but would serve to decrease the frequency to which vehicles are required to stop at the red light. This could possibly correlate to a decrease in the number of rear end crashes due to inattention or following too closely.

An inquiry to the operational status of the signal was filed with VTrans. VTrans was able to take a look at the signal and confirmed there was a failing detector on the Marsett Road approach. The

signal maintenance crew has been made aware of the problem and will determine what needs to be done to fix it.

While the opposing sight distances from Marsett and Bostwick Roads are somewhat limited, those approaches account for a low percentage of the total crashes. In addition the costs associated with fixing the grade of a roadway can be quite substantial.

Other options to mitigate crashes mainly involve attempting to get drivers to pay attention. Some of these methods include:

- Installation of an advanced warning flasher installed upstream of the US 7 approaches indicating traffic is stopped ahead (Figures 2 & 3)
- Installation of additional red signal section resulting in two side by side red signals per signal face (Figure 4)
- Restripe pavement markings with increased retroreflectivity

Figures 2 & 3: Applications of an advanced warning devices

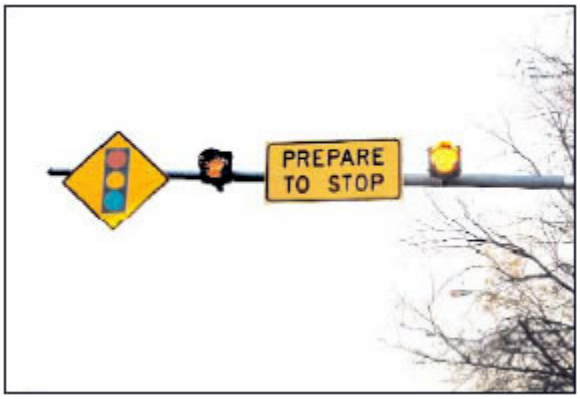


Figure 4: Application of an additional red signal section

Conclusion

The main cause of crashes in the vicinity of the US 7/Marsett Road/Bostwick Road intersection is inattention or following too closely which results in 83% of crashes being of the rear end crash type. Various strategies have been identified to mitigate the crash frequency. Desired improvements to move forward with should be discussed with VTrans as US 7 is a State owned and maintained arterial.

Next Steps

The next steps are outlined as follows:

- Share the report findings with VTrans
- Set up a meeting to go over possible strategies to mitigate the crash frequency
- Decide on a time frame to which strategies can be implemented
- Monitor improvements to determine their effectiveness and whether additional measures may be necessary

Attachment 1 - Meeting Notes

Shelburne Town Offices
November 4, 2010
2:00 PM

Attendees:

Mario Dupigny-Giroux, Nancy Avery, VTrans;
Bernie Gagnon, Paul Bohne, James Warden, Al Fortin, Town of Shelburne;
Jason Charest, David Roberts, CCMPO

Notes:

Following introductions, Paul Bohne started the discussion with a brief background of the intersection's first complaint coming from a Wake Robin resident. The resident had concerns about sight distances coming from Bostwick Road and their difficulty seeing opposing traffic on Marsett Road.

The question was raised as to the status of the broken loop mentioned in the report. There was no update at the time but VTrans representatives said they would check into the maintenance request.

Mario reviewed his emailed comments for the group [included as Attachment 2 to this memo]. He did recognize there was a significant number of crashes in the vicinity of the intersection, but his analysis found it may not be an actual High Crash Location.

A brief discussion ensued about the Town converting to the State's web based crash reporting system. The web based system had eliminated paper reporting in other municipalities resulting in time savings previously spent hand writing the reports. The web based system also made for easy transmittal to the DMV and researching the crash history of a particular intersection or roadway. James Warden indicated the Town planned to meet with Mandy White of VTrans to discuss the web based system and transition process in the near future.

VTrans reported there was a time limit for when crash reports could be submitted for recording into the state system. This was usually one year and therefore the Town would not be able to submit the history of crashes reviewed in this report in hopes of making onto the current High Crash Location list. VTrans encouraged the Town to use the web crash reporting system to report as many crashes as possible to provide better information for the next round of High Crash Location calculations and future safety analyses.

The Town requested if possible they would like the signal to go into flash mode at 11:00 PM as opposed to the existing 10:00 PM operation. This would be especially helpful in managing traffic flow following summer concerts at the Shelburne Museum. VTrans and CCMPO agreed it should not be a problem and VTrans indicated they would take care of this.

The Town reported US 7 was scheduled for paving in 2012 and they would like to be involved in the process. All agreed some minor enhancements to the alignment of the intersection might be achieved during the repaving. VTrans representatives suggested contacting the District Transportation Administrator Gil Newbury on this subject.

The Town expressed interest in the report recommendation for advanced flashing beacons on the US 7 approaches to notify vehicles traffic is stopped ahead when flashing.

Action Items:

- VTrans to check into the status of the broken loop maintenance request and possible funding for advanced flashing beacons or other safety improvements (e.g. signal back plates).
- CCMPO to incorporate any comments into the report and facilitate communications between VTrans and the Town.
- Town Police Department to meet with VTrans and discuss the web based crash system.
- Town to coordinate with VTrans on US 7 paving project to discuss the possibility of intersection alignment enhancements and wider shoulders for bicyclists.

Updates (12/01/10):

- VTrans Traffic Design Section has changed the flash start time from 10:00 PM to 11:00 PM.
- VTrans submitted two work orders to fix the broken signal detector and install signal backplates.
- VTrans submitted a work order to replace and update the signal ahead signs on the US 7 approaches.
- Shelburne Police Department met with VTrans to hear about the web based crash reporting system and has a training/trial period set for January 2011.

Attachment 2 – VTrans Comments

Mario Dupigny-Giroux
October 21, 2010

From: Dupigny-Giroux Mario [Mario.Dupigny-Giroux@state.vt.us]
Sent: Thursday, October 21, 2010 3:34 PM
To: Jason Charest; Schultz, Joshua; Lyman, Derek
Cc: David Roberts; Bell, Amy; Avery, Nancy
Subject: RE: Shelburne - US 7/Bostwick

Jason,

Here are some comments.

I used the methodology suggested in the Highway Safety Manual to determine if the intersection was really a bad crash location. I used the ADDTs that you quoted in your document.

I determined that the Actual Crashes per year were equaled to 2.40 crashes per year (the twelve crashes that you noted at the intersection divided by 5 years).

I determined the Predicted Crashes per year to be equaled to 4.70 crashes per year.

The predicted number of crashes is smaller than the observed number of crashes. The one thing that I did not do was to change the calibration factor. I did not estimate one for VT, I just used 1 (it is possible that the equation overpredicts crashes. We will have to develop calibration factors if we really get into using the HSM.

I continued with the HSM and used the EB method to determine the Excess Expected Average Crash Frequency.

In one of the webinars, they mentioned that the Excess Expected Average Crash Frequency was the difference between the predicted average crash frequency and the long-term EB adjusted expected average crash frequency for the same site. The larger the difference, the more potential the site has for improvement (so goes the theory).

I found the difference to be -1.67.

So from all this, the intersection would not be that bad.

Also, your high crash location calculation for the intersection resulted in a actual- to-critical ratio of less than 1. I do not think that the fact that the section would be an HCL matters here since we are talking about an intersection.

I am not diminishing the safety of the intersection, just trying to use the tools to put this in perspective. Visidata does show some skid marks or some sort of marks both in 2004 and 2008 on the south approach in the northbound direction. So there is definitely something going on.

When I looked at Shelburne in South Burlington as part of the HSIP last year, the main crash pattern there too was rear-end crashes (Heavy traffic, poor coordination during part of the analysis period and stop-and-go traffic).

Specific to what you mentioned in your draft.

The intersection's signal appears to be operating pre-timed as opposed to being actuated by vehicular demand.

This intersection is semi-actuated with loops on the side roads. The signal operates on two phases and has only one cycle throughout the day. As you mentioned in the analysis section, one of the loops was broken. Another reason why it would look like pre-time operation.

The crash rate has fluctuated over the study period as shown in Table 1.

One reason for this could be the regression-to-the-mean. Over a certain period, crashes will then to go to the mean. One year they might be low, the next, higher.

The crash frequency on the graph is for the entire segment not just for the intersection. Is the trend at the intersection following the same trend as the crashes away from the intersection? Highway Research defines the intersection on US 7 as going from mile point 1.16 to 1.180. Since the major concern is the intersection, it would be nice to have the graph show the frequency for the intersection.

This section has not been identified by VTrans because only crashes that result in an injury or exceed $1,000 in vehicular damage are sent to the State records.

All police departments are encourage to send all their crashes to DMV (most police department now uses the web crash application) and that Highway Research uses all available data for compiling their high crash locations. It is possible that the Shelburne Police has a policy of sending in only what is stated in the statues.

While the site distances from Marsett and Bostwick Roads are somewhat limited

How significant are the corner sight distance limitations? This is a signalized intersection, unless the signal is operated on flash at night, this is not an issue. If the limitations are significant then there should be no right turn on red allowed.

I would say that, as you suggested, the be prepared to sop sign with the flashing beacon synchs with the signal would be a good way to warn traffic of the upcoming stopping condition.

Adding backplates could also help. I do not know if the signal lenses are LEDs. If they are not, this could be another way to improve visibility. There is 4 seconds of yellow and 2 of all red, so we are theoretically good here.

This intersection is , however, not on our HSIP list, so funding improvements could be an issue, although the HSIP does have a system wide entry to treat intersection with poor visibility to the back of the queue. Something to check into.

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