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## **Memorandum**

**To:** Steve Palmer  
Public Works Director, City of Winooski

**From:** Jason Charest, E.I.T.  
Transportation Engineer/Planner

**Date:** November 6, 2009

**Subject:** Mallets Bay Avenue, West Lane, & Union Street Signal  
Warrants Analyses

### **Summary**

I have completed the relevant traffic signal warrants analyses for the subject intersection. The intersection is well below the traffic signal warrant thresholds. Therefore the existing signal could be removed following proper removal procedure and improving the corner sight distances.

### **Traffic Signal Warrants Analyses**

The State of Vermont uses the Manual on Uniform Traffic Control Devices (MUTCD) as its guideline for whether or not a traffic signal should be installed, or in this case, removed. The MUTCD defines eight unique warrants and their associated thresholds. It is important to note that meeting (or not meeting) one or more warrants does not necessitate the installation (or removal) of a traffic signal, but rather it establishes a case for either installation or removal. There may be extenuating circumstances that conflict with the warrant results. The MUTCD website (<http://mutcd.fhwa.dot.gov/>) provides detailed information on traffic signal warrant studies in Chapter 4C – Traffic Control Signal Needs Studies.

A total of three out of the eight warrants were evaluated for this report. These consisted of Warrants 1 (Eight-Hour Vehicular Volume), 2 (Four-Hour Vehicular Volume), and 3 (Peak Hour). The remaining five warrants deemed inapplicable were 4 (Pedestrian Volume), 5 (School Crossing), 6 (Coordinated Signal System), 7 (Crash Experience), and 8 (Roadway Network).

The volumes used for the warrants analyses were from an eleven-hour count conducted by the CCMPO on Tuesday, July 29, 2008. For simplicity, there were no adjustments made to the count data for the warrants analyses. Performing volume adjustments on the count data would not have an appreciable impact on the analysis findings. A summary of the warrants examined can be found in Table 1.

**Table 1: Warrants Analyses Summary**

Winooski: Mallets Bay Avenue/Union Street/West Lane Signal Warrants Analyses													
Hour	Major Street Volume (Mallets Bay Ave)	Highest Volume on Minor Street (Union St. or West Ln. approach)	Warrant Examined (Satisfied = Y(Yes) or N(No))										
			8 Hour Vehicular Volume						4 Hour Vehicular Volume		Peak Hour		
			1A @ 80%	1B @ 80%	1A @ 70%	1B @ 70%	1A @ 56%	1B @ 56%	2 @ 70%	3A	3B	3B @ 70%	
7:00 AM	202	55	N	N	N	N	N	N	N	N	N	N	N
8:00 AM	182	38	N	N	N	N	N	N	N	N	N	N	N
9:00 AM	181	51	N	N	N	N	N	N	N	N	N	N	N
10:00 AM	177	51	N	N	N	N	N	N	N	N	N	N	N
11:00 AM	213	51	N	N	N	N	N	N	N	N	N	N	N
12:00 PM	210	60	N	N	N	N	N	N	N	N	N	N	N
1:00 PM	175	61	N	N	N	N	N	N	N	N	N	N	N
2:00 PM	239	67	N	N	N	N	N	N	N	N	N	N	N
3:00 PM	237	59	N	N	N	N	N	N	N	N	N	N	N
4:00 PM	278	94	N	N	N	N	N	N	N	N	N	N	N
5:00 PM	301	108	N	N	N	N	N	N	N	N	N	N	N
# of Hours Satisfied			0	0	0	0	0	0	0	0	0	0	0
# of Hours Required			8	8	8	8	8	8	4	4	1	1	1
Satisfied Warrant			N						N		N		

As shown in Table 1, the intersection does not satisfy any of the applicable signal warrants. For this reason, the City may consider removing the existing traffic signal. The MUTCD outlines the proper course for removal of a traffic signal:

*If the engineering study indicates that the traffic control signal is no longer justified, removal may be accomplished using the following steps:*

- A. Determine the appropriate traffic control to be used after removal of the signal.
- B. Remove any sight-distance restrictions as necessary.
- C. Inform the public of the removal study, for example by installing an informational sign (or signs) with the legend TRAFFIC SIGNAL UNDER STUDY FOR REMOVAL at the signalized location in a position where it is visible to all road users.
- D. Flash or cover the signal heads for a minimum of 90 days, and install the appropriate stop control or other traffic control devices.
- E. Remove the signal if the engineering data collected during the removal study period confirms that the signal is no longer needed. Instead of total removal of the traffic

*control signal, the poles and cables may remain in place after removal of the signal heads for continued analysis.*

### **Two-Way Stop Analysis**

A two-way stop analysis with the main street being Mallets Bay Avenue was conducted as this would seem to be the most likely traffic control following potential removal of the signal. The highest concentration of vehicles occurred during the peak hour from 4:45 PM to 5:45 PM. During this time the side streets of West Lane and Union Street were shown to operate with minimal delay at an acceptable level of service (LOS) B.

### **Intersection Safety**

Research has shown that the removal of an unwarranted signal can have a positive effect on the safety of an intersection<sup>1</sup>. The removal of an unwarranted signal can eliminate unnecessary delay and disobedience of the signal. The key to success is to follow proper procedures for removal and ensure there is adequate sight distance.

Crash data from the Vermont Agency of Transportation (VTrans) was reviewed and there were 12 crashes in a 9 year period (2000-2008) involving the intersection. The intersection is not a high crash intersection but it is approximately 0.13 of a mile south of a high crash section recognized by VTrans.

Corner sight distances were examined as if the intersection was operating as a two way stop controlled intersection with Mallets Bay Avenue being uncontrolled. It was found that there are restrictions to a stopped vehicle's corner sight distance on all four corners of the intersection. The American Association of State Highway and Transportation Officials (AASHTO) recommend a corner sight distance of 280 feet onto a 25 mph roadway from a stopped position. A speed study on Mallets Bay Avenue was conducted north of the intersection and the 85<sup>th</sup> percentile speeds were found to be between 33 and 34 mph. Therefore the sight distance recommendation of 280 feet would be more of a minimum requirement due to the speeds greater than 25 mph. The following measures should be undertaken to increase the corner sight distances to at least 280 feet:

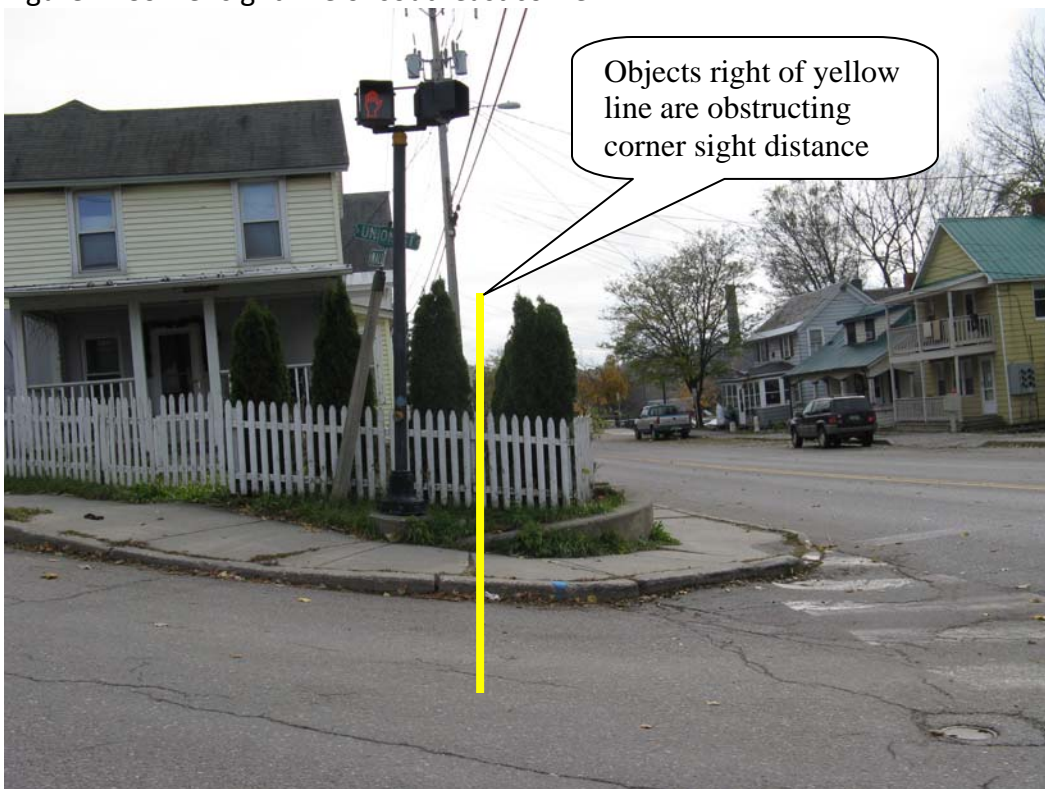
- On the southwest corner the no parking zone should be extended 40 feet southeast
- On the northwest corner the no parking zone should be extended 75 feet northwest to the first driveway northwest of the West Lane approach
- On the northeast corner the auto business should refrain from parking in the line of sight (see Figure 1)
- On the southeast corner the hedges and preferably fencing obstructing the line of sight should be removed (see Figure 2)

<sup>1</sup>[NCHRP Report 500 / Volume 12: A Guide for Reducing Collisions at Signalized Intersections - Strategy A7](#)

Figure 1: Corner sight line of northeast corner



Figure 2: Corner sight line of southeast corner



### ***Conclusion***

At this time the signal meets none of the applicable warrants and could be removed following the MUTCD procedures described above.

During the turning movement count the CCMPO's interns noted there were children playing in the immediate vicinity and a few nearby residents voiced their concern if the signal were to be removed. If speeds increase as a result of the signal being removed, the City may consider traffic calming measures to help mitigate speeding. Increasing corner sight distances will help as well. If resident concerns still exist the City may wish to install flashing lights on the stop control approaches and/or an overhead intersection control beacon to respond to these concerns. However, there is no indication that the removal of the signal will pose a problem for pedestrians. The street exhibits low volumes and suitable gaps are available for pedestrians to cross the street.