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Memorandum

To: Andy Legg, P.E.
Town Engineer, Town of Milton

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

Date: 9/8/08 3:05 PM

Subject: US 7 & Main Street Signal Warrants Analyses

Summary

I have completed the relevant traffic signal warrants analyses for the intersection of Main Street and US-7 in Milton. Initially the intersection did not satisfy any signal warrants. Upon further review it was discovered the intersection would satisfy warrants under what is known as the 70% factor which is available at intersections with approach speeds in excess of 40 mph. The current posted speed limit on US-7 is 35 mph and an initial speed study at the intersection found the 85th percentile speed was below 40 mph. If the town would like to further investigate the feasibility of a traffic signal at US-7 and Main St. a more extensive speed study could be conducted to better verify whether the location would be eligible to use the 70% factor for traffic signal warrants.

Traffic Signal Warrant Analysis

The Manual on Uniform Traffic Control Devices (MUTCD) governs where traffic signals can be installed in Vermont. The MUTCD defines eight unique warrants relating to different traffic flow conditions which can potentially be improved by a traffic signal. It is important to note that meeting one or more warrants does not necessitate installation of a traffic signal, only that the location may be eligible for a signal. The MUTCD website provides detailed information on traffic signal warrant studies in Chapter 4C – Traffic Control Signal Needs Studies. The text is available online at <http://mutcd.fhwa.dot.gov/>.

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

The volumes used for the warrants analyses were from a twelve-hour count conducted by the CCMPO on Wednesday, August 13, 2008. There were no adjustments made to the count data for the warrant analyses. A summary of the warrants examined and hours meeting the warrants can be found in Table 1. More detailed descriptions of the warrants evaluated are included below.

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Warrant 1, Eight-Hour Vehicular Volume

Warrant 1 consists of two conditions, A and B. Condition A is “intended for application at locations where a large volume of intersection traffic is the principal reason to consider installing a traffic control signal.” Condition B is “intended for application at locations where condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.” For the 100% basic minimum hourly volume; if either condition A or B is satisfied then the warrant is satisfied.

Neither condition A or B was satisfied under the 100% minimum volume factor. The next step was to take a look at the 80% factor under both conditions. For the warrant to be satisfied at 80%, both conditions A and B must be met. It was close but still not satisfied.

The 70% factor “may be used when the major-street exceeds 40 mph or in an isolated community with a population of less than 10,000.” The US Census estimated the population of Milton in 2007 was 10,539 which exceeds the population criteria limit. The current speed limit of US-7 at the intersection is 35 mph in each direction. A preliminary speed study was performed to see if the 85th percentile speeds exceeded 40 mph. 100 vehicles in each direction were sampled on Friday, August 29, 2008 between 9:30 am and 11:30 am. Approaching the intersection of Main Street, the 85th percentile was found to be 35 mph heading southbound on US-7 and 38 mph heading northbound on US-7. This analysis was meant to provide a general idea as to what the speeds are. The results of the speed study can be found in Figure 1. Since the speeds are not over 40 mph and the population is over 10,000 the intersection does not qualify to be examined under the 70% factor. The town may wish to conduct a more extensive speed study. Had the intersection qualified, condition B would have been met and Warrant 1 satisfied.

Warrant 2, Four-Hour Vehicular Volume

Warrant 2 is “intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.” To satisfy this warrant, any four hours of a given day must fall above the corresponding curve of Figure 4C-1 or Figure 4C-2 (70% Factor) in the MUTCD (Manual on Uniform Traffic Control Devices). Warrant 2 was again only satisfied under the 70% factor described above for Warrant 1 requiring either a population under 10,000 or speeds exceeding 40 mph.

Warrant 3, Peak Hour

Warrant 3 is “intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street”. Furthermore, “this signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.”

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Given these guidelines the reason this warrant was examined was because of the large number of employees at the nearby Husky Plant. Similar to Warrant 1, Warrant 3 consists of two conditions, A and B, of which only one has to be met. Warrant 3 was not satisfied under either of the two standard conditions. Continuing the trend, it was however satisfied under the 70% factor for condition B.

Warrant 7, Crash Experience

Warrant 7 is “intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.” The intersection of US 7 and Main Street lies within a high crash section defined by VTrans (The Vermont Agency of Transportation). Between the years of 2001 and 2005 the section experienced 27 crashes, 18 of which were injury. To satisfy Warrant 7, three criteria A, B, and C, must be met. Criteria A and B were not met and therefore the warrant was not satisfied.

Conclusion

At this time no warrants are satisfied for the intersection of US-7 and Main Street. If a more extensive speed study is conducted and reveals the 85th percentile speeds are above 40 mph on US-7, then Warrants 1, 2, and 3 would be satisfied under the 70% criteria.

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Table 1:

Milton: US 7 & Main Street Signal Warrants Analyses												
Hour	Major Street Volume (US 7)	Minor Street Volume (Main St.)	Warrant Examined									
			1A @ 80%	1B @ 80%	1A @ 70%	1B @ 70%	2	2 @ 70%	3A	3B	3B @ 70%	7
7:00 AM	641	122	Y	Y	Y	Y	N	Y				
8:00 AM	514	101	N (19)	N	N (4)	N (11)	N	N				
9:00 AM	456	94	N	N	N (11)	N	N	N				
10:00 AM	449	82	N	N	N (23)	N	N	N				
11:00 AM	525	115	N (5)	N	Y	Y	N	N				
12:00 PM	544	117	N (3)	N	Y	Y	N	Y				
1:00 PM	535	91	N	N	N (14)	Y	N	N				
2:00 PM	546	115	N (5)	N	Y	Y	N	Y				
3:00 PM	693	115	N (5)	Y	Y	Y	N	Y				
4:00 PM	914	158	Y	Y	Y	Y	Y	Y				
4:30 - 5:30 PM	949	181	---	---	---	---	---	---	N	N	Y	
5:00 PM	901	189	Y	Y	Y	Y	Y	Y	N	N	Y	
6:00 PM	640	96	N (24)	Y	N (9)	Y	N	Y				
# of Hours Satisfied			3	5	7	9	2	7				
# of Hours Required			8	8	8	8	4	4				
Satisfied Warrant			No		Yes		No	Yes	No	Yes	No	

Note: A number in parenthesis (i.e. (5)) indicates the volume of vehicles the hour was shy of satisfying the volume requirement. This was only indicated when the volume was within 25 vehicles of the threshold.

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Figure 1:

