MEMO

TO:	Lisa Schaeffler, Town of Williston Public Works
FROM:	Corey Mack, RSG
CC:	Jason Charest, CCRPC
DATE:	May 8, 2018
SUBJECT:	North Williston Road – Mountain View Road Multi-Way Stop Warrant Analysis

RSG has been retained by the Chittenden County Regional Planning Commission and the Town of Williston to complete an engineering assessment for multi-way stop traffic control at the North Williston Road – Mountain View Road intersection.

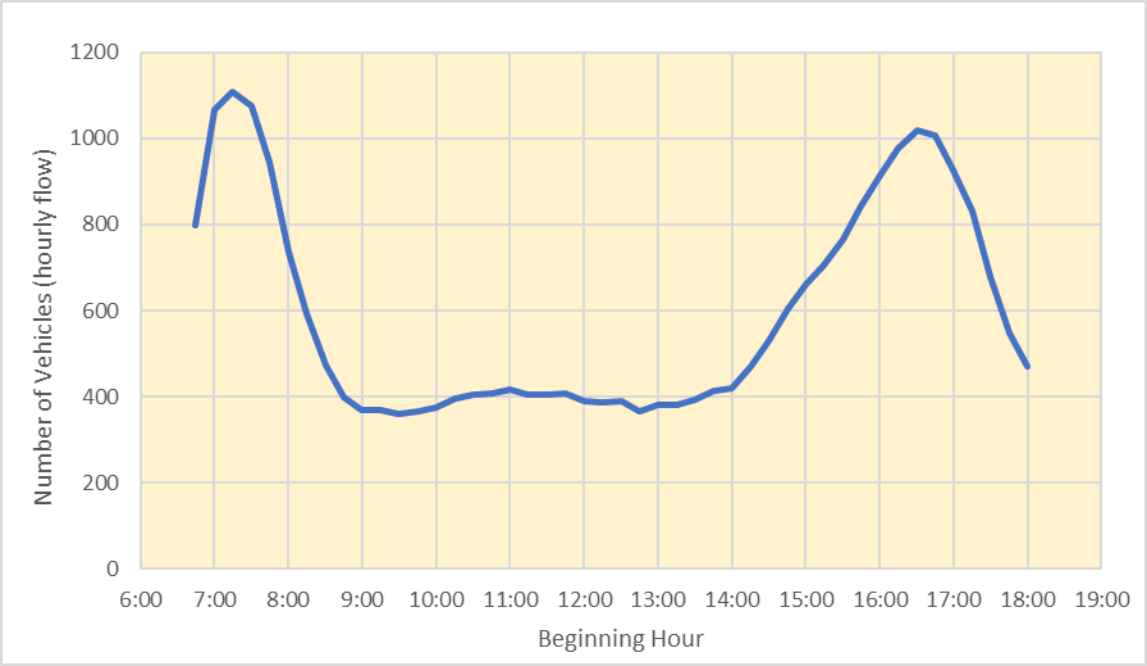
The following tasks were completed as part of this assessment:

- **Traffic Count**: 12-hour traffic count on Tuesday, March 27, 2018 using traffic video cameras. The videos were observed and manually transferred to an excel file.
- **Count Adjustments**: Reviewed and adjusted the observed traffic volumes to represent average day conditions for the analysis.
- **Multi-Way Stop Guidance Assessment**: Applied multi-way stop control warrants to the adjusted traffic volumes. The traffic volume warrants are described in the Manual of Uniform Traffic Control Devices, 2009 edition (current version). Section 2B.07[1] provides the specific reference guidance.

[1] https://mutcd.fhwa.dot.gov/htm/2009/part2/part2b.htm#section2B07

Traffic Count

FIGURE 1: HOURLY FLOW IN INTERSECTION (12 HR) – UNADJUSTED 27 MARCH 2018



The heaviest hour during the observation occurred between 7:15 and 8:15 in the morning with 1,109 vehicles passing through the intersection. The PM peak hour occurred between 4:15 and 5:15 with 1,017 vehicles.

Count Adjustments

Section 2B.07 of the MUTCD states that traffic volumes to be used for the analysis of multi-way stop control shall represent average day conditions. FHWA defines the average day as “a day representing traffic volumes normally and repeatedly found at a location, typically a weekday when volumes are influenced by employment or a weekend day when volumes are influenced by entertainment or recreation.”

To adjust to average day conditions, the count was adjusted with a factor from the Seasonal Adjustment Factor Grouping Study from the 2016 Vermont Agency of Transportation Continuous Traffic Counter Report (The Redbook, current version)[2]. The North Williston Road corridor is best described within the “Urban” group of The Redbook. The Monthly Day of Week factor for the Urban group for Tuesdays in March is 0.988.

The observed traffic volumes were multiplied by 0.988 to adjust the short-term count to represent an average day condition.

[2] http://vtrans.vermont.gov/sites/aot/files/operations/documents/traffic/Redbook2016web.pdf

Multi-Way Stop Guidance Assessment

Section 2B.07 of the MUTCD states “multi-way stop control is used where the volume of traffic on the intersecting roads is approximately equal.” While approximately 41% of the volume approaches from the north, 28% approaches from the west and 29% approaches from the south. It is reasonable to characterize these approach volumes as approximately equal.

The MUTCD provides the guidance for what a multi-stop control study shall consider. The guidance is commonly referred to as a ‘warrant’, whereby the following items are considered. The MUTCD states that the decision to install multi-way stop control should be based on an engineering study. This memo and the analysis summarized herein satisfies this criterion.

The following criteria should be considered in the engineering study for a multi-way STOP sign installation:

- Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.
    - Not applicable in this situation. This criterion is not met.
- Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.
    - There have been on average approximately two crashes per year occurring at this intersection. The crash and safety criterion is not met.
- Minimum volumes:
    - 1) The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and
    - 2) The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but
    - 3) If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.

The traffic volumes and delays on Mountain View Road were evaluated as it pertains to these criteria. The findings include:

a) The raw count data, unadjusted, met the average volume and delay threshold for both major and minor streets.

b) The adjusted “average day” count data met the average volume and delay threshold for both major and minor streets.

c) As stated in the North Williston Road Draft Scoping Report (CCRPC - RSG, 2016 on page 6), the 85th percentile speed was determined to be over 10 miles over the posted speed limit of 35 mph. The 2016 observations just north of Mountain View Road, the 85th percentile speed was in the 46-48 mph range. The volume warrant threshold for multi-way stop control may be reduced to 240 and 160 vehicles per hour on the major and minor street approaches, respectively.

   The reduction of the volume warrant threshold due to the observed speed near the intersection further increases the margin in which the multi-way stop control volume warrants are met.

Additional criteria for consideration in the multi-way stop control guidance includes “the need to control left-turn conflicts”. In the evening peak hours, the eastbound left turning volume often exceeds the major street volume in northbound and southbound approach directions combined. Application of multi-way stop control may reduce this left-turning conflict.

Conclusion

The multi-way stop control guidance defined by the MUTCD, section 2B.07 appears to be met on the basis of the volume warrant criteria:

- The observed and adjusted traffic flows on March 27, 2018 meet the standard volume thresholds warranting multi-way stop control.
- The 85th percentile speeds along North Williston Road have been recorded in the 46-48 mph range, exceeding the 40 mph threshold in the volume warrant. Therefore, the minimum volumes necessary to satisfy the warrant are reduced by 30%. Under this condition, the volume warrant is satisfied to a greater degree.
- Multi-way stop control may reduce the eastbound left turning conflict.

If the Town decides to implement multi-way stop control, the town is advised to implement short-term, high-visibility advance warning devices to alert drivers who may not expect the change in traffic control at this location. These short-term devices may include advance warning “STOP AHEAD” signs with supplementary reflective flagging, changeable message signs, or other devices as approved by the MUTCD.

Attachments

A. PC-Warrants Multi-Way Stop Warrant Worksheets

B. Observed Traffic Volumes

North Williston Road and Mountain View Road

Williston, VT

RSG

Study Name : **NWR - MVR**
Study Date : **03/27/18**
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Multi-Way Stop Warrant Report - Standard Volume Threshold

Major Street Approaches

Northbound: **North Williston Road**
Total Approach Volume: **2,277**
85% Speed < 40 MPH.

Southbound: **North Williston Road**
Total Approach Volume: **3,035**
85% Speed < 40 MPH.

Minor Street Approaches

Eastbound: **Mountain View Road**
Total Approach Volume: **2,263**

Westbound: **Governor Chittenden Road**
Total Approach Volume: **134**

Warrant Summary

Criteria A - Interim Measure ..... **Not Evaluated**
If traffic signals are justified, stop signs can be installed as an interim measure.

Criteria B - Crash Experience ..... **Not Satisfied**
Number of crashes (0) is less than the minimum required (5).

Criteria C - Minimum Volumes and Delays ..... **Satisfied**
Average Delay Per Vehicle (57) is more than minimum required (30).
Average of 8 highest hours exceeds volume criteria.

Criteria D - 80% of Volumes, Delays, and Crashes ..... **Not Satisfied**
Average Delay Per Vehicle (57) is more than minimum required (30).
Number of crashes (0) is less than the minimum required (4).
Average of 8 highest hours exceeds volume criteria.

Analysis of 8-Hour Volume Warrants:

Time	Major Total	Major Avg	Minor Total	Minor Avg	Crit C Major	Crit C Minor	Crit C Meets?	Crit D Major	Crit D Minor	Crit D Meets?
07:00 - 08:00	943	522.0	130	240.0	300-Yes	200-Yes	Both	240-Yes	160-Yes	Both
08:00 - 09:00	634		120							
16:00 - 17:00	541		370							
17:00 - 18:00	527		402							
18:00 - 19:00	522		408							
15:00 - 16:00	400		270							
14:00 - 15:00	308		133							
09:00 - 10:00	301		87							
11:00 - 12:00	299		124							
10:00 - 11:00	286		105							
12:00 - 13:00	277		128							
13:00 - 14:00	274		120							
23:00 - 00:00	0		0							
22:00 - 23:00	0		0							
21:00 - 22:00	0		0							
20:00 - 21:00	0		0							
19:00 - 20:00	0		0							
06:00 - 07:00	0		0							
05:00 - 06:00	0		0							
04:00 - 05:00	0		0							
03:00 - 04:00	0		0							
02:00 - 03:00	0		0							
01:00 - 02:00	0		0							
00:00 - 01:00	0		0							

North Williston Road and Mountain View Road

Williston, VT

RSG

Study Name : **NWR - MVR**
Study Date : **03/27/18**
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Multi-Way Stop Warrant Report - Reduced Volume Threshold

Major Street Approaches

Northbound: **North Williston Road**
Total Approach Volume: **2,277**
85% Speed > 40 MPH.

Southbound: **North Williston Road**
Total Approach Volume: **3,035**
85% Speed > 40 MPH.

Minor Street Approaches

Eastbound: **Mountain View Road**
Total Approach Volume: **2,263**

Westbound: **Governor Chittenden Road**
Total Approach Volume: **134**

Warrant Summary

Criteria A - Interim Measure ..... **Not Evaluated**
If traffic signals are justified, stop signs can be installed as an interim measure.

Criteria B - Crash Experience ..... **Not Satisfied**
Number of crashes (0) is less than the minimum required (5).

Criteria C - Minimum Volumes and Delays ..... **Satisfied**
Average Delay Per Vehicle (57) is more than minimum required (30).
Average of 8 highest hours exceeds volume criteria.

Criteria D - 80% of Volumes, Delays, and Crashes ..... **Not Satisfied**
Average Delay Per Vehicle (57) is more than minimum required (30).
Number of crashes (0) is less than the minimum required (4).
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07:00 - 08:00	943	522.0	130	240.0	210-Yes	140-Yes	Both	240-Yes	160-Yes	Both
08:00 - 09:00	634		120							
16:00 - 17:00	541		370							
17:00 - 18:00	527		402							
18:00 - 19:00	522		408							
15:00 - 16:00	400		270							
14:00 - 15:00	308		133							
09:00 - 10:00	301		87							
11:00 - 12:00	299		124							
10:00 - 11:00	286		105							
12:00 - 13:00	277		128							
13:00 - 14:00	274		120							
23:00 - 00:00	0		0							
22:00 - 23:00	0		0							
21:00 - 22:00	0		0							
20:00 - 21:00	0		0							
19:00 - 20:00	0		0							
06:00 - 07:00	0		0							
05:00 - 06:00	0		0							
04:00 - 05:00	0		0							
03:00 - 04:00	0		0							
02:00 - 03:00	0		0							
01:00 - 02:00	0		0							
00:00 - 01:00	0		0							

Time	Peds	SB Right	SB Thru	SB Left	SB UTrn	Peds	WB Right	WB Thru	WB Left	WB Utrn	Peds	NB Right	NB Thru	NB Left	NB UTrn	Peds	EB Right	EB Thru	EB Left	EB UTrn
06:45	0	31	10	0	0	0	0	0	0	0	0	0	12	8	0	0	4	0	2	0
07:00	0	65	49	0	0	0	1	1	0	0	1	0	25	29	0	0	8	0	6	0
07:15	0	89	80	0	0	0	1	4	2	0	0	3	26	30	0	0	7	1	10	0
07:30	0	117	85	0	0	0	0	3	2	0	0	0	25	34	0	0	19	2	14	0
07:45	0	121	82	0	0	0	1	2	6	0	0	0	36	47	0	0	27	0	13	0
08:00	0	90	56	0	0	0	0	5	3	0	0	0	18	31	0	0	12	0	16	0
08:15	0	87	53	1	0	0	0	1	2	0	0	1	25	27	0	0	9	0	18	0
08:30	0	61	41	1	0	0	0	1	1	0	0	2	19	18	0	0	10	4	12	0
08:45	0	41	30	0	0	0	0	0	1	0	0	0	17	15	0	0	9	1	15	0
09:00	0	27	23	0	0	0	0	1	0	1	0	0	13	9	0	0	1	0	14	0
09:15	0	31	18	0	0	0	0	0	0	0	0	0	19	8	0	0	10	0	15	0
09:30	0	40	24	0	0	0	0	1	0	0	0	2	9	6	0	0	5	0	14	0
09:45	0	21	25	0	0	0	0	0	0	0	0	0	18	8	0	0	10	1	15	0
10:00	0	20	15	1	0	0	0	3	0	0	0	2	18	5	0	0	9	0	18	0
10:15	0	23	18	0	0	0	0	1	1	0	0	0	20	9	0	0	6	0	12	0
10:30	0	27	19	0	0	0	0	1	1	0	0	1	17	10	0	0	8	0	17	0
10:45	0	24	28	0	0	0	2	0	0	0	0	1	14	14	0	0	8	2	16	0
11:00	0	21	26	0	0	0	1	0	1	0	0	2	15	14	0	0	12	0	15	0
11:15	0	19	22	0	0	0	0	0	1	0	0	0	20	12	0	0	7	1	15	1
11:30	0	17	22	0	0	0	1	0	0	0	0	3	25	4	0	0	9	1	23	0
11:45	0	22	17	0	0	0	0	0	1	0	0	0	21	17	0	0	13	1	22	0
12:00	0	14	21	1	0	0	0	1	1	0	0	0	17	10	0	0	12	0	21	0
12:15	0	16	17	1	0	0	0	0	2	0	0	1	25	9	0	0	4	1	22	0
12:30	0	37	16	0	0	0	0	0	0	0	0	1	16	5	0	0	5	1	32	0
12:45	0	21	20	0	0	0	1	1	2	0	0	3	21	5	0	0	5	1	16	0
13:00	0	17	16	0	0	0	1	2	0	0	1	1	27	3	0	0	4	0	24	0
13:15	0	13	21	0	0	0	0	0	1	0	0	0	29	12	0	0	6	0	17	0
13:30	0	20	18	0	0	0	0	0	1	0	0	0	17	2	0	0	9	0	21	0
13:45	0	25	20	1	0	0	0	1	1	0	0	0	21	11	0	0	7	0	25	0
14:00	0	17	17	0	0	0	0	1	0	0	0	2	16	12	0	0	5	0	28	0
14:15	0	17	21	0	0	0	0	3	0	0	0	3	31	7	0	0	11	0	19	1
14:30	0	22	19	0	0	0	0	0	0	0	0	3	26	7	0	0	11	1	21	0
14:45	0	23	20	0	0	0	1	0	1	0	0	2	30	13	0	0	10	0	21	0
15:00	0	18	22	0	0	0	2	0	1	0	0	4	28	7	0	0	17	2	44	0
15:15	0	20	27	3	0	0	0	0	2	0	1	0	34	15	0	0	21	1	47	0
15:30	0	27	38	1	0	0	0	1	1	0	0	2	38	8	0	0	16	1	48	0
15:45	0	22	25	0	0	0	1	2	3	0	0	0	47	14	0	0	11	0	49	0
16:00	0	28	22	0	0	0	1	0	0	0	0	2	57	11	0	1	21	1	45	0
16:15	0	26	31	0	0	0	0	1	1	0	0	4	55	13	0	0	19	4	73	0
16:30	0	41	49	0	0	0	0	1	0	0	0	2	65	13	0	0	25	1	57	0
16:45	0	21	25	1	0	0	0	0	0	0	0	0	67	8	0	0	32	3	85	0
17:00	0	22	36	0	0	0	2	2	1	0	0	3	69	10	0	1	34	1	73	0
17:15	0	24	34	2	0	0	2	3	2	0	0	0	69	23	0	0	31	3	75	0
17:30	0	24	26	1	0	0	1	4	1	0	0	2	62	17	0	0	34	1	73	0
17:45	0	11	29	0	0	0	0	0	1	0	1	2	49	12	0	0	12	3	43	0
18:00	0	24	49	0	0	0	0	6	0	0	1	2	93	16	0	0	16	4	103	0
18:15	0	18	36	2	0	0	2	2	4	0	0	2	67	10	0	0	36	2	45	0
18:30	0	20	22	0	0	0	0	2	0	0	1	2	59	16	0	0	22	4	81	0
18:45	0	18	20	0	0	0	0	6	2	0	0	2	34	10	0	0	12	0	59	0