The City of WORCESTER

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Multi-way Stop Warrant Analysis

Lovell Street and May Street intersection
April 24, 2023

Petition:	Mildred Bailey request installation of stop sign on May St. at the intersection of May St. and Lovell St. # 8g CC October 25, 2022
Scheduled Committee Hearing:	April 26, 2023 Traffic & Parking Committee, Item 8d
Prepared by:	Stephen S. Rolle, P.E., Commissioner

Summary

In response to a Council petition requesting multi-way stop control (aka all-way stop), The Department of Transportation & Mobility (DTM) has conducted an evaluation of conditions at the intersection of Lovell Street and May Street. Presently, the intersection operates with stop sign control on the minor street approaches of Lovell Street (northbound) only.

Multi-way stop control can be an effective way to address intersection safety under certain conditions. These include conflicts between road users - including pedestrians, bicyclists, and motorists - who experience difficulty navigating an intersection safely due to opposing traffic volumes or limited sight distance. Stop signs are not appropriate or effective at controlling traffic speeds or discouraging use of a route, and can reduce safety when applied in inappropriate conditions.

Installation of multi-way stop control is governed by criteria established by the Manual of Uniform Traffic Control Devices (MUTCD) and Massachusetts amendments to the manual promulgated by the Massachusetts Department of Transportation (MassDOT). The MUTCD is incorporated by reference in 23 Code of Federal Regulations (CFR), Part 655, Subpart F and is the national standard for all traffic control devices installed on any street, highway, bikeway, or private road open to public travel. Chapter 85 Section 2 of the Massachusetts Generals Laws further establishes that signs, traffic control signals, traffic devices, school zones, parking meters or markings on any way must be in conformance with the MUTCD, as amended.

Recommendation

Analysis of the intersection of Lovell Street and May Street indicates that three warrants for multi-way stop are met: Warrant B (Crash History), Warrant C (Volume) and Warrant D (80% combination) are satisfied. Taking into account the combination of warrants satisfied and observed conditions at the site, **DTM recommends installation of multi-way stop control**.

Background

May Street is a two-way street running generally east west with one travel lane provided in each direction. May Street has a functional classification of Urban Collector. Lovell Street is classified as a local street. The street accommodates two-way traffic south of May Street, but operates one-way northbound only (e.g. – traveling away from the intersection) north of May Street. Parking is prohibited on both side of the two-way segment to the south, but allowed on both sides of the street to the north.

Marked crosswalks are provided on the north and east legs of the intersection, connecting to the partial sidewalk network present in the area[1]. Statutory speed limits govern both streets, meaning that for Thickly Settled and Business Districts such as this the speed limit is 30 mph. A 20 mph curve advisory is posted on May Street to east of the intersection.

Figure 1: Aerial view of Lovell St – May St intersection.

[1] Crosswalk lines are faded and should be repainted. ADA ramps are present but do not confirm to current standards.

Figure 2: View westbound on May St approaching Lovell St (source: Google Streetview)

Traffic Characteristics and Data Sources

Traffic volumes and Speeds

Traffic volumes were acquired in April 2023 from Streetlight Insight, a transportation data and analytics platform, for the time period April-May and September-October 2019 in order to reflect pre-pandemic conditions. A cursory review of AADT estimates for 2019 through 2022 shows that traffic volumes have largely returned to pracademic levels.

Traffic volumes were prepared using Streetlight's single factor calibration index with available MassDOT traffic count data on nearby roadways used to calibrate volume estimates. Hourly counts were further factored to match 2019 AADT reported by Streetlight InSight. Hourly volume summaries are tabulated in Appendix A. The reported 2019 AADT entering the intersection is 4,481 on eastbound May St, 4,133 on westbound May St, and 3,111 on northbound Lovell St.

Bicycle and pedestrian volume data for trips on Lovell St crossing May Street were not available and are therefore not included in the minor street (Lovell St) volume estimate.

The reported 85th percentile speed on May Street ranges from 33 mph to 37 mph depending on the time period, exceeding the statutory speed limit of 30 mph.

Crash Data

Crash records for a five-year period from January 2018 through December 2022 were retrieved in April 2023 from the MassDOT IMPACT crash database. See Appendix B.

Sight distance and intersection configuration

Confirmed in the field and using city GIS imagery.

MUTCD

2009 edition incorporating revisions 1, 2, and 3, accessed online April 2023.

Massachusetts Amendments to MUTCD

2022 edition accessed online March 2023.

Warrant Evaluation

The MUTCD provides *guidance* that the decision to install multi-way stop control should be based on an engineering study that considers the criteria evaluated below. Massachusetts amendments add the *standard* (requirement) that YIELD or STOP signs shall not be used for speed control. Multi-way stop control may be considered for installation when one or more of the following warrants are met and installation of stop control has been determined through engineering judgement to be a preferred solution for addressing the identified issues.

Warrant A: 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 met – the location is not a candidate for a traffic signal.

Warrant B. 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.

Warrant is satisfied.

- *Five or more crashes of a type susceptible to correction occurred within a 12-month period between March 2018 – February 2019.*
- *Other 12-month periods included five or more crashes as well, but it is unclear from reported crash details whether all crashes would all be susceptible to correction by MWSC.*

Warrant C. This warrant is satisfied when both criteria 1 and 2 are met below, or if applicable, criterion 3 is met.

Warrant is satisfied - both C1 and C2 are satisfied.

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

   The major approach volume exceeds 300 vehicles per hour for 14 hours of the day, satisfying this criterion.

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

   The minor street approach total entering volumes averages 200 for the eight highest hours.

   Analysis of traffic operations for the PM peak hour using Synchro software demonstrates that delay for Lovell St approach is 76 seconds per vehicle (LOS F),

exceeding the 30 second threshold. Analysis also shows that conversion to All-way stop will result in LOS C or better operations for all approaches.

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 85th percentiles speed ranges from 33 to 37 mph.. The 70% reduction is not applicable.

Warrant D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.

Warrant D – Combination of factors – is satisfied.

80% of 5 crashes = 4 crashes. This criterion is satisfied. Four or more crashes of a type susceptible to correction occurred within a 12-month period between March 2018 – February 2019. Other 12-month periods included four or more crashes as well, but it is unclear from reported crash details whether all crashes would all be susceptible to correction by MWSC.

80% of 300 vehicles = 240 vehicles. The major street approach exceeds 240 vehicles for 15 hours.

80% of 200 entering volume = 160 entering volume. The minor street approach averages 200 entering volume over the 8 highest hours.

Other Optional criteria that may be considered in an engineering study:

1. The need to control left-turn conflicts;

   N/A - Left turn conflicts are not a factor at this intersection.

2. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;

   Pedestrian volumes are low at this location.

3. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop; and

   Adequate sight distance is present in all directions, although traffic turning left from May Street onto Lovell Street does not have gain full view of oncoming traffic until approaching the intersection due to a bend in the roadway. All way stop control will help drivers make this maneuver.

4. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.

N/A – Streets are of different character, functional class, and Dorchester Street carries significantly higher traffic volume.

Prepared by: SSR 4-24-23
Reviewed by: TMK 4-24-23

Appendix A

Traffic Volume Estimates

	Major Street	Minor Street	
	May St (NB + SB)		**Lovell St**
	Entering veh volume		Entering total volume
Midnight	54		
1:00 AM	34		
2:00 AM	19		
3:00 AM	18		
4:00 AM	42		
5:00 AM	88		
6:00 AM	228		155
7:00 AM	389		185
8:00 AM	500		285
9:00 AM	431		170
10:00 AM	393		143
11:00 AM	440		146
Noon	**501**		**173**
1:00 PM	**482**		**175**
2:00 PM	**667**		**217**
3:00 PM	**741**		**201**
4:00 PM	**709**		**229**
5:00 PM	**776**		**219**
6:00 PM	**621**		**217**
7:00 PM	**526**		**172**
8:00 PM	425		136
9:00 PM	265		93
10:00 PM	181		
11:00 PM	115		
Daily Total	9,085	Avg Minor St 8-Hr Volume	200

	Major street approach exceeds 300 vhp
	Major street approach exceeds 240 vph (80% warrant)
	Major street approach exceeds 210 vph (70% warrant), if applicable

Highest 8-hrs in bold.

Notes:

1. Obtained from Streetlight InSight database March 2023
2. Calibrated to traffic count data retrieved from MassDOT Transportation Data Management System March 2023.
3. Bicycle and pedestrian volumes too low to accurately estimate and therefore excluded from calculation.

Appendix B

Crash Summary

Crash Date	# of veh	Manner of Collision	First Harmful Event	Vehicle Actions
03/06/2018	2	Angle	Collision with motor vehicle in traffic	V1: Entering traffic lane / V2: Travelling straight ahead
03/15/2018	2	Rear-end	Collision with motor vehicle in traffic	V1: Slowing or stopped in traffic / V2: Travelling straight ahead
06/17/2018	2	Angle	Collision with motor vehicle in traffic	V1: Turning right / V2: Travelling straight ahead
06/28/2018	2	Angle	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Travelling straight ahead
07/15/2018	2	Angle	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Travelling straight ahead
08/29/2018	2	Rear-end	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Slowing or stopped in traffic
10/09/2018	2	Angle	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Travelling straight ahead
12/26/2018	2	Rear-end	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Travelling straight ahead
07/23/2019	2	Angle	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Travelling straight ahead
10/24/2019	1	Unknown	Collision with pedestrian	V1: Travelling straight ahead
11/06/2019	2	Rear-end	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Slowing or stopped in traffic
03/16/2020	2	Angle	Collision with motor vehicle in traffic	V1: Entering traffic lane / V2: Travelling straight ahead
11/06/2020	2	Angle	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Turning left
03/19/2021	3	Angle	Collision with motor vehicle in traffic	V1: Turning left / V2: Travelling straight ahead / V3: Slowing or stopped in traffic
04/01/2021	2	Rear-end	Collision with motor vehicle in traffic	V1: Slowing or stopped in traffic / V2: Travelling straight ahead
05/13/2021	1	Front to Rear	Collision with motor vehicle in traffic	V1: Travelling straight ahead
11/05/2021	2	Angle	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Unknown
04/15/2022	1	Single vehicle crash	Collision with curb	V1: Backing
10/06/2022	2	Angle	Collision with motor vehicle in traffic	V1: Entering traffic lane / V2: Travelling straight ahead
10/25/2022	1	Angle	Collision with pedalcycle	V1: Turning left

	Potentially correctable by installation of AWSC
	Unclear/unknown
	Unlikely to be correctable by installation of AWSC

Bold indicates 5 potentially correctable crashes occurring in a 12-month period.

Notes:

1. Retrieved from MassDOT IMPACT database April 21, 2023