



Multi-Way Stop Warrant Analysis

Barry Rd at Barry Road Ext and Toronita Ave Intersection

September 1, 2023

Petition:	Peter Magerowski request installation of three-way stop sign at the intersection of Barry Rd., Barry Rd. Ext. and Toronita Ave. #9d CC June 15, 2021
Scheduled Committee Hearing:	September 20, 2023 Traffic & Parking Committee, Item 7a
Prepared by:	Stephen S. Rolle, PE, Commissioner Scott W. Galbraith, PE, Senior Traffic Engineer

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 Barry Road, Barry Road Extension, and Toronita Avenue. Presently, the intersection operates with stop-sign control on the westbound minor street approach of Toronita Avenue 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 for traffic calming purposes 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 General 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.

Summary

Through analysis of the Barry Road at Barry Road Extension and Toronita Avenue intersection, we found that traffic volume and crash experience warrants are not met.

However, staff noted several concerns associated with the unique configuration of this intersection and the potential for driver confusion:

- A large majority of eastbound traffic on Barry Road turns left onto Barry Road extension; Drivers stopped on the Toronita approach may not anticipate this heavy turning movement, which does not stop under the present configuration, and inadvertently proceed in front of turning traffic.
- Staff observed many of the left turning vehicles from Barry Road turning onto Barry Rd Extension taking the turn at a higher rate of speed that caused their vehicle to proceed into the opposing lane approaching the intersection.
- While most traffic on the Barry Rd Extension approach to the intersection turns right, the occasional left turning vehicle is problematic in that they must stop in the travel lane, which otherwise proceeds through a right-turn uninterrupted, in order to gauge whether there is an opening that will safely allow a left turn.

All of these movements would be accommodated in a more predictable manner with introduction of All Way Stop control at the intersection. Therefore, based on the optional criteria A, C and D specified in the MUTCD, **DTM recommends installation of a multi-way stop control** at this location facing all directions of traffic.

Background

The three-way intersection of Barry Road, Barry Road Extension, and Toronita Avenue is in a residential neighborhood with homes bordering all approaches to the intersection. A retirement community named The Willows is served by Barry Road and Barry Road Extension. Beyond serving the needs of the local residences, this intersection can also be used by vehicles travelling between Indian Lake neighborhoods and Salisbury Street/Tatnuck Square destinations.

Barry Road, Barry Road Extension, and Toronita Avenue are all classified under Local roadway functional class. All approaches to the intersection are two-way having one travel lane in each direction. Parking is prohibited statutorily within 20 feet of the intersection. There are no crosswalks at this intersection. There are asphalt sidewalks on Barry Road and Barry Road Extension. None of which are ADA compliant. There are no curb ramps from the sidewalk on the northwest corner of the intersection. Non-compliant ramps exist on the East side of the intersection serving pedestrians crossing Toronita Ave.

Statutory speed limits govern both streets, meaning that for Thickly Settled and Business Districts such as this the speed limit is 30 mph.



Figure 2: Aerial view of Barry Rd at Barry Rd Ext and Toronita Ave intersection. (Source: Google Earth)



Figure 3: View westbound on Toronita Ave approaching Barry Rd and Barry Rd Ext (source: 9/8/2023 DTM site visit)



Figure 4: View eastbound on Barry Rd approaching Barry Rd Ext and Toronita Ave (source: 9/8/2023 DTM site visit)



Figure 5: View southbound on Barry Rd Ext approaching Barry Rd and Toronita Ave (source: 9/8/2023 DTM site visit)

Traffic Characteristics and Data Sources

Traffic Volumes and Speeds

Traffic volumes were acquired in September 2023 from Streetlight InSight, a transportation data and analytics platform, for the time period of March 2021-May 2021 and September 2021-November 2021 (excluding the Thanksgiving holiday weekend). The reported AADT entering the intersection is 3,107 vehicles per day on Barry Road and Barry Road Extension with 182 vehicles per day entering the intersection from Toronita Avenue. The heaviest AM Peak turning movements at this intersection are left turns from Barry Road onto Barry Road Extension. Right turns from Barry Road Extension to Barry Road are the heaviest movements during the PM peak hour. Traffic entering the intersection from Toronita Avenue is much lower than along the other roadways

The reported 85th percentile vehicle speed reported on the major approaches to this intersection is 23 miles per hour, which is lower than the statutory speed limit of 30 miles per hour.

Crash Data

Crash records for a five-year period from January 2018 through December 2022 were retrieved in September 2023 from the MassDOT IMPACT crash database. Only a single crash at the subject intersection has been recorded during this time period. This is summarized in Appendix B.

Sight distance and intersection configuration

Confirmed in the field and using City GIS imagery.

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.

Not met – No 12-month period included 5 or more correctable crashes.

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

Not met – The requirement to meet both C1 and C2 is not satisfied, and C3 is not applicable.

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

During the highest 8 hours the combined major-street traffic averages 254 vehicles per hour. This criteria is, therefore, not met.

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

During the major street's peak 8 hours, the minor street averages 15 vehicles per hour. Conservatively assuming 10 pedestrians and bicycles per hour travel through the intersection, this volume is well below 200 units. This criteria is, therefore, not met.

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 average 85th percentile approach speed observed in the data is 23 miles per hour. This adjustment is therefore not appropriate to be made.

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.

Not met – Crashes and minor-street volume do not meet the 80-percent thresholds.

80% of 5 crashes = 4 crashes. This criterion is not satisfied. Only one potentially correctable accident was reported at this intersection for the five-year period.

80% of 300 vehicles = 240 vehicles. The major street approach exceeds 240 vehicles for 8 hours.

80% of 200 entering volume = 160 entering volume. The minor street approach averages 25 entering volume (vehicles + estimated pedestrians) over the 8 highest hours. The 80% threshold is not met.

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

A. The need to control left-turn conflicts;

The predominant movement at this intersection involves traffic from Barry Road making a hard, 90 degree turn onto Barry Road extension. This movement is currently uncontrolled, making it difficult for drivers on other legs to gauge whether approaching traffic is turning left or continuing straight. Further, left turning traffic has been observed commonly making the turn at a rate of speed that required encroaching into the opposing lane to negotiate the turn. Application of All Way Stop Control would effectively eliminate these two issues.

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

N/A - There are no evident high-pedestrian-volume generators in the area.

C. 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

While adequate sight lines relative to normally applicable standards were observed, additional perception time may be needed for drivers to effectively gauge the intent of oncoming traffic (turning or proceeding straight) when judging whether it is safe to proceed into traffic. An AWSC intersection would eliminate this concern.

D. 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.

Barry Road and Barry Road Extension function as a through route, but intersect at 90 degrees at a three-way intersection. Each is of the same classification and carries similar traffic volume. For the reasons stated above, AWSC would reduce uncertainty associated with opposing traffic movements and improve the orderly operation of traffic at this intersection location.

RECOMMENDATION

DTM staff recommends the following actions:

- Vote Approve installation of Multi-way Stop Control at the intersection facing all directions of travel.

Appendix A

Traffic Volume Estimates

Hour Start	Major Streets Entering vehicle volume			Minor Street Entering vehicle volume
	Barry Rd	Barry Rd Ext	Total Major Streets	Toronita Ave
Midnight	4	3	7	1
1:00 AM	2	1	3	0
2:00 AM	5	0	5	0
3:00 AM	2	2	4	0
4:00 AM	2	1	3	0
5:00 AM	21	2	23	2
6:00 AM	69	9	78	0
7:00 AM	218	33	251	1
8:00 AM	151	42	193	11
9:00 AM	125	58	183	12
10:00 AM	76	102	178	7
11:00 AM	78	88	166	8
Noon	87	98	185	15
1:00 PM	81	92	173	8
2:00 PM	92	130	222	10
3:00 PM	103	169	272	17
4:00 PM	117	195	312	27
5:00 PM	102	256	358	20
6:00 PM	81	159	240	17
7:00 PM	45	78	123	13
8:00 PM	21	51	72	8
9:00 PM	11	15	26	3
10:00 PM	6	10	16	1
11:00 PM	9	5	14	1
Daily Total	1,508	1,599	3,107	182
Average Top 8-Hour Volume (VPH)			254	15

- Major street approach exceeds 300 vph
 - Major street approach exceeds 240 vph (80% warrant)
 - Major street approach exceeds 210 vph (70% warrant), if applicable
- Highest Major-Street 8-hours in bold.**

Notes:




1. Obtained from Streetlight InSight database September 2023.

Appendix B

Crash Summary

Barry Road at Barry Road Ext and Toronita Avenue (2018-2022)

Crash Date	Number of Vehicles	Manner of Collision	First Harmful Event	Vehicle Actions
6/3/2022	2	Angle	Collision with motor vehicle in traffic	V1: Turning left / V2: Travelling straight ahead

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

Notes:

1. Retrieved from MassDOT IMPACT database August 31, 2023