



**Multi-Way Stop Warrant Analysis**  
Southgate Street at Gardner Street Intersection  
September 6, 2023

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Petition:	Councilor Sarai Rivera request installation of a four-way stop sign at Southgate St. and Gardner St.  #7k CC November 23, 2021
Scheduled Committee Hearing:	September 20, 2023 Traffic & Parking Committee, Item 7b
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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 Southgate Street and Gardner Street. Presently, the intersection operates with stop sign control on the minor street approaches of Gardner Street 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 Southgate Street at Gardner Street intersection, we found that multi-way stop control warrants are not met due primarily to sufficient intersection sight distance and low traffic volumes.

## **Background**

The intersection of Southgate Street and Gardner Street is in a mixed-use neighborhood with mostly commercial and industrial uses surrounding the intersection. Southgate Street leads northeast from this location to Southbridge Street after passing under a railroad bridge. To the West, Southgate Street connects to a residential neighborhood. To the northwest, Gardner Street links Southgate Street to Canterbury Street along which the 825 WRTA bus line travels. Gardner Street also provides access to a cold-storage facility and Armory Street to the southeast.

In the neighborhood near this intersection, there are many multi-way stop-controlled intersections. Most of these intersections do not use the R1-P “ALL WAY” plaque underneath the STOP signs as required by the MUTCD [Section 2B.05]. These intersections may not have been studied using multi-way stop-control warrants previously. While it may seem that installation of more STOP signs will improve safety, the opposite can be true for locations where multi-way stop control is not warranted. Not only could unwarranted STOP signs increase crash rates, but if travelers approach a stop-controlled intersection assuming cross traffic will stop, they may proceed through the intersection with less caution.

Southgate Street and Gardner Street are both classified as Local roadways. All approaches to this intersection are two-way having one travel lane in each direction. Parking is prohibited statutorily within 20 feet of the intersection. This is reinforced by curb extensions on the eastbound Southgate Street approach. There are four crosswalks at this intersection with a mixture of ADA-compliant and non-compliant curb ramps.

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



**Figure 1: Aerial view of Southgate St-Gardner St intersection (source: Google Earth).**



**Figure 2: View westbound on Southgate St from Gardner St (source: 9/12/2023 DTM site visit)**





**Figure 3: View eastbound on Southgate St from Gardner St (source: 9/12/2023 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 2021 AADT entering the intersection is 930 vehicles per day on Southgate Street and 932 vehicles per day on Gardner Street. During the morning peak hour, the heaviest traffic movements are the through and right-turn movements from westbound Southgate Street. In the evening during the peak hour, the heaviest movements are left turns from southbound Gardner Street and right turns from westbound Southgate Street.

Based on land uses in the area and field observations in September 2023, we estimate there is low pedestrian volume through this intersection.

The reported 85<sup>th</sup> percentile vehicle speed reported for this intersection is 28 mile per hour, which is lower than the statutory speed limit of 30 mile 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. These are 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 five 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 – Criteria for Warrant C are not satisfied at this location.***

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 highest eight-hour volume on Southgate Street is 68 vehicles per hour.  
Therefore, this criteria is not satisfied.*

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 eight hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but

*The vehicular volume on the highest eight hours for the minor street approaches is 40 vehicles per hour. Conservatively assuming 10 pedestrians and bicycles per hour, the intersection's minor street volume is below the 200 units per hour threshold. This criterion 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 85<sup>th</sup> percentile approach speed observed in the data is 28 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 volumes on the intersection approaches do not meet the criteria for this warrant.***

*80 percent of five crashes = four crashes. This criteria is not met as only three possibly-correctable crashes occurred during the five year study period.*

*80 percent of 300 vehicles = 240 vehicles. This criteria is not met as only 68 vehicles per hour enter along the major street approach.*

*80 percent of 200 entering vehicles 160 entering vehicles. The minor street approaches average 50 entering pedestrian, bicycles and vehicles per hour which is below this threshold. This criteria is, therefore, not met.*

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

A. The need to control left-turn conflicts;

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

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

***N/A - Adequate sight lines are provided in all directions.***

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.

***N/A – The intersection is located in an industrial area. The residential collector classification does not apply.***

## **RECOMMENATION**

DTM staff recommends the following actions:

- Vote to FILE the request for installation of a Multi-way Stop Control at the intersection

## Appendix A

### Traffic Volume Estimates

	Major Street	Minor Street	
	Southgate St	Gardner St	
	Entering Volume (both approaches) on Major Street (VPH)	NB Entering Lower-Vol Approach on Minor Street (VPH)	SB Entering Higher-Vol Approach on Minor Street (VPH)
Midnight	6	0	3
1:00 AM	3	0	7
2:00 AM	2	0	5
3:00 AM	2	1	1
4:00 AM	16	0	3
5:00 AM	4	1	11
6:00 AM	45	0	22
7:00 AM	<b>52</b>	<b>1</b>	<b>41</b>
8:00 AM	<b>81</b>	<b>2</b>	<b>37</b>
9:00 AM	<b>61</b>	<b>8</b>	<b>40</b>
10:00 AM	52	7	45
11:00 AM	49	7	51
Noon	51	5	42
1:00 PM	<b>59</b>	<b>3</b>	<b>43</b>
2:00 PM	<b>68</b>	<b>6</b>	<b>101</b>
3:00 PM	<b>74</b>	<b>3</b>	<b>129</b>
4:00 PM	<b>68</b>	<b>7</b>	<b>103</b>
5:00 PM	<b>81</b>	<b>4</b>	<b>70</b>
6:00 PM	48	13	30
7:00 PM	35	7	18
8:00 PM	25	1	22
9:00 PM	20	1	17
10:00 PM	9	0	9
11:00 PM	17	0	5
Daily Total	930	Avg High-Vol Minor Street 8-Hour Volume	73

	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 (based on Major Street entering) in bold.**

Notes:

1. Obtained from Streetlight InSight database September 2023.

**Appendix B**  
 Crash Summary  
 Southgate Street at Gardner Street (2018-2022)

<b>Crash Date</b>	<b># of veh</b>	<b>Manner of Collision</b>	<b>First Harmful Event</b>	<b>Vehicle Actions</b>
02/05/2018	2	Angle	Collision with motor vehicle in traffic	V1: Travelling straight ahead / V2: Travelling straight ahead
05/07/2020	2	Angle	Collision with motor vehicle in traffic	V1: Unknown / V2: Unknown
09/24/2021	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 September 5, 2023.