



TOWN OF BROOKLINE

Department of Public Works
333 Washington Street
Brookline, MA 02445

Right Turn On Red Restriction

For

Grove Street at South Street and Walnut Hill Road

Date: November, 2011
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The purpose of this study is to determine if the right turn restrictions on the southbound south street approach to the Grove Street at South Street and Walnut Hill Road intersection is warranted. The study location can be seen in **Figure 1**. Recommendations will be based on the guidelines found in the latest edition of the Manual of Uniform Traffic Control Devices (MUTCD). The MUTCD suggests the following factors should be considered for the implementation of a NO TURN ON RED restriction:

1. Sight distance of vehicles approaching from the Left;
2. Geometric or operational characteristics of the intersection that might result in unexpected conflicts;
3. An exclusive (“Barn Dance”) pedestrian phase;
4. An unacceptable number of pedestrian conflicts with right-turn-on-red maneuvers, especially involving children, older pedestrians, or persons with disabilities;
5. More than three (3) right-turn-on-red accidents reported in a 12 month period for the particular approach.

According to our files the Transportation Board, or it’s predecessor the Traffic Council, implemented the NO TURN ON RED restriction based on the fact that there was an exclusive “barn dance” pedestrian phase.



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Figure 1

Study Location

SIGHT DISTANCE

The American Association of State and Transportation Officials (AASHTO) standards reference two types of sight distances which are relevant for the intersection at Grove Street at South Street and Walnut Hill Road: stopping sight distance (SSD) and intersection sight distance (ISD). Stopping sight distance pertains to roadway segments and intersection sight distance, as the name implies, relates specifically to intersections. Sight lines for right turning vehicle movements at the intersection of Grove Street, South Street and Walnut Hill Road are compared to minimum safe stopping sight distance (SSD) and intersection sight distance (ISD) guidelines for the regulatory speed limit below in **Table 1**. Sight line calculations are provided in the **Appendix**.

Table 1
Sight Distance

Approach/Travel <u>Direction</u>	Available Sight <u>Distance</u>	AASHTO Recommended ¹ Posted Speed <u>(30 mph)</u>
Stopping Sight Distance Grove Street	270	200'
Intersection Sight Distance - Stop Control		
	Behind Stop line	At Crosswalk
South Street	270'	270'

¹Recommended sight distance based on A Policy on Geometric Design of Highways and Streets, AASHTO, 4th edition 2001. Based on driver height of eye of 3.5 feet to object height of 2.0 feet for SSD or 3.5 feet for ISD and adjustments for roadway grade.

The existing southbound South Street stopping sight distance and intersection sight distance meet AASHTO minimum recommended guidelines for a right turn on red. The MUTCD recommends no turn on red when the sight lines are restricted.

GEOMETRIC AND OPERATIONAL CHARACTERISTICS

South Street meets Grove Street at 132 degrees and Walnut Hill Road meets Grove Street at 55 degrees to form a five legged skewed signalized intersection. The South Street northbound and southbound approaches both provide one general purpose travel lane with no on street parking. The Grove Street eastbound and westbound approaches both provide one right-through travel lane and a left-through travel lane. Land use at the intersection is residential, commercial, and religious.

PEDESTRIAN CONFLICTS AND SIGNAL PHASING

Pedestrian activity at the Grove Street at South Street and Walnut Hill Road intersection is moderate with a large number of school aged children crossing during school hours. The Edith Baker School and Temple Emeth are in close proximity to the intersection. The MBTA has bus stops at the intersection. The signal timing provides an exclusive pedestrian phase during this time all vehicles should be stopped so pedestrians can cross. The MUTCD recommends no turn on red when an exclusive pedestrian phase is used or if an unacceptable number of pedestrian conflicts with right-turn-on-red maneuvers, especially involving children occur.

CRASH ANALYSIS

In order to identify accident trends and safety characteristics for the study intersection accident reports were obtained from MassDOT Highway Crash Database for a three-year period covering 2007 through 2009. This data can be found in the **Appendix**. A summary of the crash data for the study intersection is detailed in **Table 2**.

Table 2
Accident Summary

<u>Data Category</u>	<u>Grove St at South St</u>
Year:	
2007	5
2008	2
2009	<u>2</u>
Total	9
Type:	
Angle	3
Rear-End	2
Right-Turn	0
Head-On	0
Sideswipe	0
Pedestrian	0
Unknown/Other	4
Severity:	
P. Damage Only	4
Personal Injury	4
Fatality	0
Unknown/Other	1
Conditions:	
Dry	7
Wet	1
Snow/Ice	0
Other/Unreported	1
Time:	
7:00 AM to 9 AM	4
4:00 AM to 6 PM	2
Rest of Day	3

As summarized in **Table 2**, nine crashes were reported for the Grove Street at South Street and Walnut Hill Road intersection for the three-year period studied from 2007 to 2009. None of the reported crashes were from vehicles taking a right turn at the intersection. However right turn on red maneuvers are currently restricted on the South Street Southbound approach. The MUTCD warrants a right-turn-on-red restriction if three (3) or more accidents were caused by right turn on red maneuvers within 12 months.

CONCLUSIONS

The South Street Southbound approach at the Grove Street at South Street and Walnut Hill Road signalized intersection has moderate pedestrian usage with a large number of school age children using the intersection, an exclusive pedestrian interval at which time all vehicles should be stopped and pedestrians allowed to cross, a five legged intersection and skewed geometry. Using the MUTCD guidelines 2, 3, and 4 the removal of the right turn on red restrictions would not be recommended.

Appendix

- Sight Line Calculations
- Accident Data

Sight Line Calculations

South Street Southbound Approach

Intersection Sight Distance	Speed		
	<u>Posted</u>	<u>Average</u>	<u>85th</u>
<u>Looking East</u>			
Stop Control Left Turning	331	0	0
Stop Control Right Turning/Crossing	287	0	0
Yield Control Left Turning	353	0	0
Yield Control Right Turning/Crossing	309	0	0
<u>Looking West</u>			
Stop Control Left Turning	0	0	0
Stop Control Right Turning/Crossing	0	0	0
Yield Control Left Turning	0	0	0
Yield Control Right Turning/Crossing	0	0	0
Stopping Sight Distance	Speed		
	<u>Posted</u>	<u>Average</u>	<u>85th</u>
Eastbound Stopping Sight Distance	0	0	0
Westbound Stopping Sight Distance	197	0	0

Inputs	East Bound			West Bound		
	Posted	Average	85th	Posted	Average	85th
Speed:				30		
Grade:	0	0	0	0	0	0

Sight Distance Formulas - Source: AASHTO

$$\text{Intersection Sight Distance} = 1.47 \times V \times t$$

$$\text{Stopping Sight Distance} = (1.47 \times V \times s) + \frac{V^2}{(30 \times ((a/32.2) + (G/100)))}$$

Where:

s = Reaction Time (sec) = 2.5 s

V = Travel Speed (mph)

G = Roadway Grade

a = Deceleration Rate (ft/sec²) = 11.2 ft/s²

- t = Time Gap (sec) =
- Stop Control Left Turning = 7.5 s
 - Stop Control Right Turning = 6.5 s
 - Yield Control Left Turning = 8 s
 - Yield Control Right Turning = 7 s

MassHighway Crash Report for Brookline in the year 2007

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Distance from Nearest Roadway Intersection	Distance from Nearest Milemarker	Distance from Nearest Exit	Distance from Nearest Landmark	Non Motorist Type
2185313	BROOKLINE	09-May-2007	5:09 PM	Non-fatal injury	2	1	0	Not reported	V1: Travelling straight ahead / V2:Turning left	V1:Southbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Not reported	V1: Passenger car / V2:Passenger car	Not reported	Not reported	Not Reported	GROVE STREET / SOUTH STREET					
2383080	BROOKLINE	04-Oct-2007	7:00 AM	Not Reported	2	0	0	Single vehicle crash	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Not reported / V2:Not reported	V1: Not reported / V2: Not reported	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear	SOUTH STREET / GROVE STREET					
2261036	BROOKLINE	08-Nov-2007	7:50 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Northbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear	GROVE STREET / SOUTH STREET					
2256760	BROOKLINE	26-Nov-2007	3:35 PM	Property damage only (none injured)	2	0	0	Single vehicle crash	V1: Travelling straight ahead / V2:Turning left	V1:Southbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Light truck/ van, mini-van, panel pickup, sport utility) with only four tires	Dry	Daylight	Cloudy/Rain	GROVE STREET / SOUTH STREET					
2386647	BROOKLINE	06-Dec-2007	1:40 AM	Non-fatal injury	2	1	0	Rear-end	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:Not reported / V2:Not reported	V1: Not reported / V2: Not reported	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear	GROVE STREET / SOUTH STREET					

**MassHighway Crash Report for Brookline in the year 2008**

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Distance from Nearest Roadway Intersection	Distance from Nearest Milemarker	Distance from Nearest Exit	Distance from Nearest Landmark	Non Motorist Type
2518256	BROOKLINE	20-Mar-2008	7:20 AM	Non-fatal injury	2	1	0	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: Northbound / V2: Northbound	V1: Not reported / V2: Not reported	V1: Passenger car / V2: Passenger car	Dry	Dark - lighted roadway	Clear	SOUTH STREET / GROVE STREET					
2331305	BROOKLINE	05-Jun-2008	8:35 AM	Non-fatal injury	2	1	0	Angle	V1: Travelling straight ahead / V2: Turning left	V1: Westbound / V2: Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2: Light truck/van, minivan, panel pickup, sport utility) with only four tires	Wet	Daylight	Cloudy/Rain	GROVE STREET / SOUTH STREET					

**MassHighway Crash Report for Brookline in the year 2009**

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicle Action Prior to Crash	Vehicle Travel Directions	Most Harmful Events	Vehicle Configuration	Road Surface Condition	Ambient Light	Weather Condition	At Roadway Intersection	Distance from Nearest Roadway Intersection	Distance from Nearest Milemarker	Distance from Nearest Exit	Distance from Nearest Landmark	Non Motorist Type
2437149	BROOKLINE	05-Feb-2009	9:10 AM	Property damage only (none injured)	1	0	0	Single vehicle crash	V1: Travelling straight ahead	V1: Northbound	V1: Collision with motor vehicle in traffic	V1: Passenger car	Dry	Daylight	Cloudy	GROVE STREET / SOUTH STREET					
2553361	BROOKLINE	02-Dec-2009	5:40 PM	Property damage only (none injured)	2	0	0	Angle	V1: Turning left / V2: Travelling straight ahead	V1: Westbound / V2: Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Light truck/van, mini-van, panel, pickup, sport utility with only four tires / V2: Passenger car	Dry	Dark - lighted roadway	Clear	GROVE STREET / SOUTH STREET					