



TOWN OF BROOKLINE

Department of Public Works
333 Washington Street
Brookline, MA 02445-6863

Right Turn On Red Restriction

For

St Paul Street at Freeman Street

Date: May 17, 2011
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The purpose of this study is to determine if the right turn restriction for the Freeman Street westbound approach, St Paul Street Northbound approach and St Paul Street Southbound approach at the St Paul Street and Freeman Street 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 St Paul Street and Freeman Street: 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 Cypress Street at Walnut Street are compared to minimum safe stopping sight distance (SSD) and intersection sight distance (ISD) guidelines for the regulatory speed limit below in **Table 1** below. Sight line calculations are provided in the **Appendix**.

Table 1
Sight Distance

Approach /Travel Direction	Available Sight Distance	<u>AASHTO Recommended</u> ¹ Posted Speed (30 mph)	
Stopping Sight Distance			
St Paul Street Northbound	280'	200'	
Freeman Street Eastbound	>400'	200'	
Freeman Street Westbound	>400'	200'	
Intersection Sight Distance - Stop Control			
	Behind Stop line	At Crosswalk	
Freeman Street Looking Southbound	400'	400'	290'
St Paul Street Looking Westbound	130'	400'	290'
St Paul Street Looking Eastbound	≤190'	≤280'	290'

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 stopping sight distance is adequate. However St Paul Street southbound intersection sight distances are restricted for a right turn on red movement by parked cars, signal controller box and vegetation. The St Paul Street northbound approach has intersection sight distances that are obstructed by a tree, wire fence and existing vegetation. The MUTCD recommends no turn on red when there are restricted sight lines. The Freeman Street westbound approach has intersection sight triangles that are greater than the recommended sight distance.

INTERSECTION GEOMETRY AND SKEW

St Paul Street meets Freeman Street at 90 degrees to form a four way signalized intersection. The intersection approaches all provide one general purpose travel lane. The intersection skew or geometry would not restrict a right turn on red.

PEDESTRIAN CONFLICTS AND SIGNAL OPERATION

Pedestrian activity for the St Paul Street at Freeman Street intersection is moderate. The signal operates with a ("Barn Dance") Exclusive pedestrian phase. Winthrop Square is in close proximity to the intersection. The MUTCD recommends no turn on red when an exclusive ("Barn Dance") pedestrian phase is used.

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 2006 through 2008. This data can be found in the **Appendix**. A summary of the crash data for the study intersection is detailed in **Table 2**.

<u>Data Category</u>	<u>Kent Street at Longwood Avenue</u>
Year:	
2006	1
2007	0
<u>2008</u>	<u>1</u>
Total	2
Type:	
Angle	0
Rear-End	1
Sideswipe	0
Right-Turn	0
Head-On	1
Pedestrian	0
Unknown/Other	0
Severity:	
P. Damage Only	2
Personal Injury	0
Fatality	0
Unknown/Other	0
Conditions:	
Dry	2
Wet	0
Snow/Ice	0
Other/Unreported	0
Time:	
7:00 AM to 9 AM	0
4:00 AM to 6 PM	0
Rest of Day	2

As summarized in **Table 2**, a total of two crashes occurred at the intersection of St Paul Street and Freeman Street for the three-year period studied from 2006 to 2008. None of the reported crashes involved right turning vehicles. However right turn on red maneuvers are currently restricted on the Freeman Street westbound approach, St Paul Street Northbound approach and St Paul 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.

CONCLUSION

The St Paul Street at Freeman Street intersection has moderate pedestrian activity. The signal operates with an (“barn dance”) exclusive pedestrian phase. The St Paul Street northbound and St Paul Street southbound approach have restricted intersection sight distances. Using the MUTCD guidelines 1 and 3 from above the removal of the no turn on red restrictions would not be recommended for the northbound and southbound approaches. The Freeman Street westbound approach has sight distances that exceed the recommended minimum guidelines. Based on sight lines the removal of the no turn on red restriction for the Freeman Street westbound approach is recommended.

Appendix

- Sight Line Calculations
- Accident Data

Sight Line Calculations

Intersection Sight Distance		Speed		
	<u>Posted</u>	<u>Average</u>	<u>85th</u>	
Stop Control Left Turning	331			
Stop Control Right Turning/Crossing	287			
Yield Control Left Turning	353			
Yield Control Right Turning/Crossing	309			
Stopping Sight Distance		Speed		
	<u>Posted</u>	<u>Average</u>	<u>85th</u>	
North & South bound Stopping Sight Distance	197			
West & East bound Stopping Sight Distance	197			

	North & South Bound			East & West Bound		
<u>Inputs</u>	Posted	Average	85th	Posted	Average	85th
Speed:	30			30		
Grade:	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 2006

Crash Number	City/Town Name	Crash Date	Crash Time	Crash Severity	Number of Vehicles	Total Nonfatal Injuries	Total Fatal Injuries	Manner of Collision	Vehicles Travel Directions	Most Harmful Events	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
2096151	BROOKLINE	04-Oct-2006	2:40 PM	Property damage only (none injured)	1	0	0	Rear-end	V1:Northbound	V1: Collision with tree	Dry	Daylight	Clear/Clear	SAINT PAUL STREET / FREEMAN 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
2373437	BROOKLINE	16-Sep-2008	10:05 PM	Property damage only (none injured)	2	0	0	Head-on	V1: Slowing or stopped in traffic / V2:Turning right	V1:Southbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Dark - lighted roadway	Cloudy	SANT PAUL STREET / FREEMAN STREET					