

TOWN OF BROOKLINE

Department of Public Works
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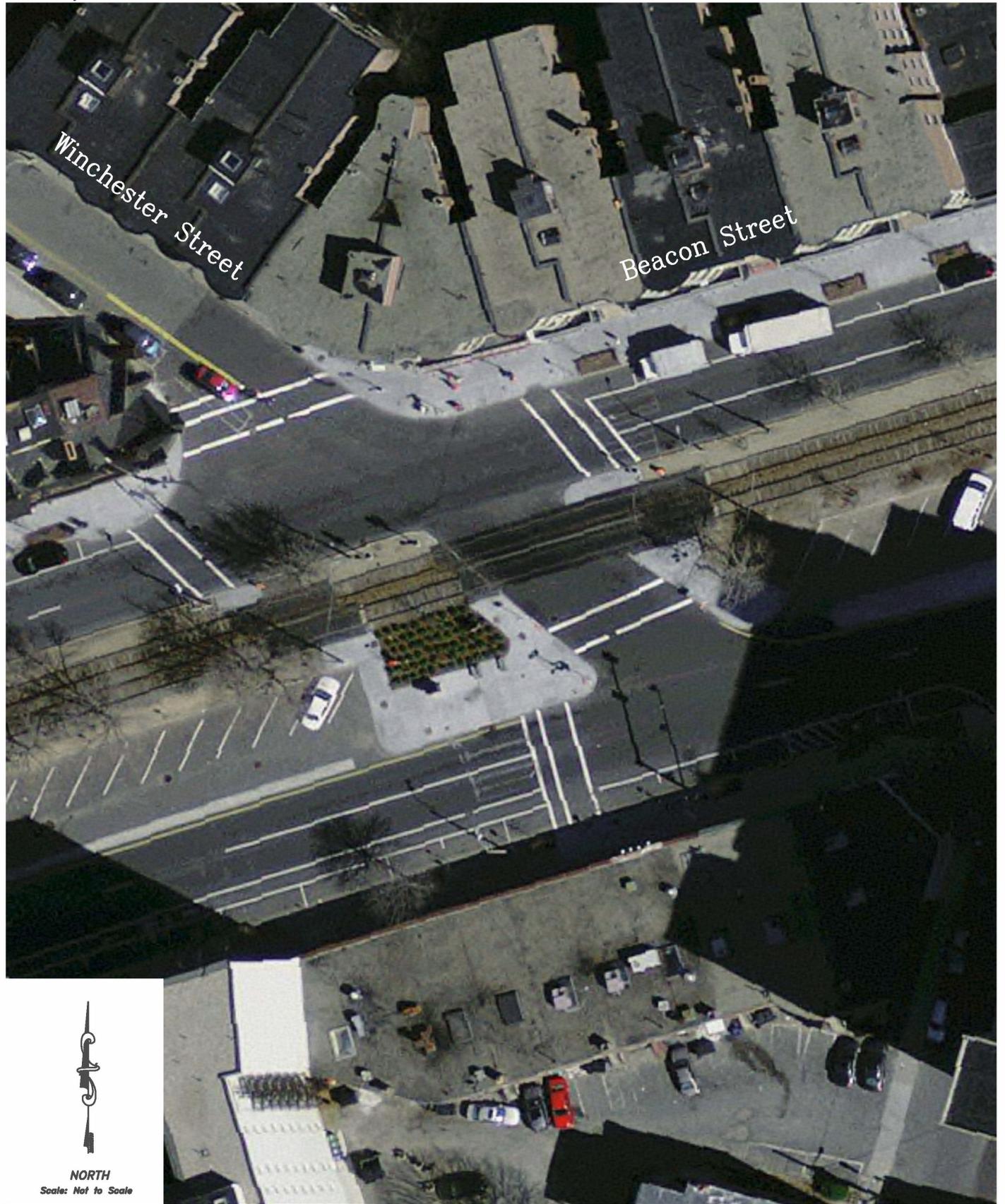
Right Turn On Red Restriction

For

Beacon Street at Winchester Street

The purpose of this study is to determine if the right turn restriction on the southbound and westbound approaches to the Beacon Street at Winchester Street intersection are 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.



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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 Beacon Street and Winchester 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 Beacon Street at Winchester 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		AASHTO Recommended ¹ Posted Speed (30 mph)
Stopping Sight Distance			
Beacon Street westbound	n/a		200'
Winchester Street Southbound	>400'		200'
Intersection Sight Distance - Stop Control			
	Behind Stop line	At Crosswalk	
Beacon Street westbound	n/a	n/a	290'
Winchester Street Southbound	120'	150'	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 Beacon Street westbound approach does not have applicable sight triangles because no vehicles are approaching from the left. The existing stopping sight distance is adequate on the southbound Winchester approach to the intersection; however the intersection sight distance is deficient. Intersection sight triangles are obstructed by on street parking. The MUTCD suggest restricting right turn on red movements when sight distance of vehicles approaching from the left is restricted.

GEOMETRIC AND OPERATIONAL CHARACTERISTICS

Beacon Street meets Winchester Street at 120 degrees to form a signalized t-intersection. The Winchester Street southbound approach provides one general purpose travel lane with no on street parking permitted. Beacon Street eastbound and westbound approaches both provide two through lanes on Street Parking is permitted. The MUTCD suggest restricting right turn on red when an approach to an intersection meets at a skew.

PEDESTRAIN CONFLICTS AND SIGNAL PHASING

Pedestrian activity at the Beacon Street and Winchester Street intersection is high. The signal phasing provides a concurrent pedestrian phase. The MUTCD suggest no turn on red be used when an unacceptable number of pedestrian conflicts with right-turn-on-red maneuvers, especially involving children, older pedestrians, or persons with disabilities are observed.

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

As summarized in **Table 2**, a total of seven crashes were reported for the Beacon Street at Winchester Street intersection for a three-year period studied from 2007 to 2009. One of the reported crashes was from a vehicle taking a right turn at the intersection. However right turn on red maneuvers are currently restricted on all approaches. 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 Southbound Winchester Street approach at the Winchester Street and Beacon Street intersection has restricted sight lines; heavy pedestrian usage, and skewed intersection geometry. Using the MUTCD guidelines 1, 2, and 4 the removal of the right turn on red restriction on the southbound approach would not be recommended.

The westbound Beacon Street approach at the Winchester Street and Beacon Street intersection has heavy pedestrian usage, and skewed intersection geometry. Using the MUTCD guidelines 2, and 4 the removal of the right turn on red restriction on the westbound approach would not be recommended.

Appendix

- Sight Line Calculations
- Accident Data

Sight Line Calculations

Winchester 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
2267164	BROOKLINE	01-Feb-2007	5:25 AM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1: Not reported / V2: Not reported	V1: Not reported / V2: Not reported	V1: Passenger car / V2: Passenger car	Dry	Dark - lighted roadway	Clear	BEACON STREET / WINCHESTER STREET					
2170686	BROOKLINE	30-Mar-2007	3:30 PM	Not Reported	5	0	0	Angle	V1: Not reported / V2: Not reported / V3: Not reported / V4: Not reported / V5: Not reported	V1: Not reported / V2: Not reported / V3: Not reported / V4: Not reported / V5: Not reported	V1: Not reported / V2: Not reported / V3: Not reported / V4: Not reported / V5: Not reported	V1: Passenger car / V2: Passenger car / V3: Passenger car / V4: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires / V5: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Clear	BEACON STREET / WINCHESTER STREET					
2375365	BROOKLINE	03-Oct-2007	4:50 PM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1: Westbound / V2: Westbound	V1: Not reported / V2: Not reported	V1: Passenger car / V2: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Clear	BEACON STREET / WINCHESTER 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	
2308759	BROOKLINE	01-Apr-2008	9:50 AM	Non-fatal injury	1	1	0	Single vehicle crash	V1: Turning right	V1:Southbound	V1: Collision with pedestrian	V1: Passenger car V1: Passenger car / V2:Light truck(van, mini-van, panel pickup, sport utility) with only four tires	Dry	Daylight	Cloudy	BEACON STREET / WINCHESTER STREET						P2:Pedestrian
2310204	BROOKLINE	16-Apr-2008	00:00 AM	Not Reported	2	0	0	Not reported	V1: Not reported / V2:Not reported	V1:Not reported / V2:Not reported	V1: Not reported / V2: Not reported		Not reported	Not reported	Not Reported	BEACON STREET / WINCHESTER STREET						
2490468	BROOKLINE	04-Sep-2008	1:30 PM	Non-fatal injury	2	1	0	Not reported	V1: Turning left / V2:Travelling straight ahead	V1:Not reported / V2:Not reported	V1: Not reported / V2: Not reported	V1: Passenger car / V2:Passenger car	Not reported	Not reported	Not Reported	WINCHESTER STREET / BEACON 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
2539985	BROOKLINE	15-Nov-2009	8:30 AM	Non-fatal injury	2	1	0	Rear-end	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1: Eastbound / V2: Eastbound	V1: Not reported / V2: Not reported	V1: Not reported / V2: Not reported	Wet	Daylight	Rain		BEACON STREET / WINCHESTER STREET				