



# TOWN OF BROOKLINE

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

Right Turn On Red Restriction

For

Beacon Street at Kent Street and Powell Street

The purpose of this study is to determine if the right turn restriction at the Kent Street and Powell Street at Beacon Street intersection is warranted. Currently the restriction is in place for the Powell Street Southbound approach onto Beacon Street. The study location can be seen in **Figure 1**. Recommendations will be based on the guidelines found in the latest version 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 Inability of cross street to sustain traffic.



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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 for Powell Street and Kent Street at Beacon Street: stopping sight distance (SSD) and intersection sight distance (ISD). Stopping sight distance pertains to roadway segments (i.e., Beacon Street) and intersection sight distance, as the name implies, relates specifically to intersections. Sight lines for right turning vehicle movements from Kent Street onto Beacon 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**. Sight line calculations are provided in the **Appendix**.

Table 1  
Sight Distance

Approach /Travel Direction	Available Sight Distance	AASHTO Recommended <sup>1</sup> Posted Speed (30 mph)
Stopping Sight Distance		
Beacon Street eastbound	>500'	200'
Intersection Sight Distance - Stop Control		
Powell Street Looking westbound	<100'	290'

<sup>1</sup>Recommended sight distance based on A Policy on Geometric Design of Highways and Streets, AASHTO, 4<sup>th</sup> 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 the intersection sight distance is deficient if operating under stop control. Looking south-east Intersection sight triangles are obstructed by trees and parked cars. The MUTCD recommends no turn on red when there are restricted sight lines.

## INTERSECTION GEOMETRY AND SKEW

Kent Street and Powell Street meet Beacon Street at 90 degrees to form a four way signalized intersection. The Kent Street and Powell Street approaches provide one general purpose travel lane. The Beacon Street Eastbound approach provides one through lane and one general purpose travel lane. The Beacon Street Westbound approach provides one left turn lane and through lane and one through-right turn lane. Land use at the intersection consists of residential housing. No Geometric or operational Characteristics would restrict a right turn on red.

## PEDESTARIAN CONFLICTS AND SIGNAL OPERATION

Pedestrian activity at the Powell Street and Kent Street at Beacon Street Street intersection is high. There is residential housing in close proximity to the intersection. The signal timing provides concurrent pedestrian movements. The MUTCD recommends no turn on red when there is heavy pedestrian activity at the intersection.

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**.

Table 2  
Accident Summary

<u>Data Category</u>	<u>Kent St/Powell St at Beacon Street</u>
Year:	
2006	6
2007	3
2008	<u>6</u>
Total	15
Type:	
Angle	3
Rear-End	2
Sidewipe	7
Right-Turn	0
Head-On	1
Pedestrian	1
Unknown/Other	1
Severity:	
P. Damage Only	9
Personal Injury	4
Fatality	0
Unknown/Other	2
Conditions:	
Dry	9
Wet	5
Snow/Ice	1
Other/Unreported	0
Time:	
7:00 AM to 9 AM	0
4:00 AM to 6 PM	2
Rest of Day	13

As summarized in **Table 2**, a total of fifteen crashes occurred at the intersection of Kent and Powell at Beacon 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 for the Powell 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 Powell Street approach to Beacon St has restricted sight lines and heavy pedestrian usage. Using the MUTCD guidelines 1 & 4 from above the removal of the NO TURN ON RED restriction would not be recommended.

## Appendix

- Sight Line Calculations
- Accident Data

- Sight Distance Calculations

### 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>	
Northeast bound Stopping Sight Distance	197			
Southwest bound Stopping Sight Distance	197			

<u>Inputs</u>	East Bound			West Bound		
	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/sec<sup>2</sup>) = 11.2 ft/s<sup>2</sup>

- 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

- Accident Data



### 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
1994507	BROOKLINE	14-Feb-2006	4:25 PM	Non-fatal injury	2	1	0	Rear-end	V1:Not reported / V2:Not reported	V1: Not reported / V2: Not reported	Dry	Daylight	Cloudy		1180 BEACON STREET / POWELL STREET				
2088495	BROOKLINE	11-Mar-2006	1:41 PM	Non-fatal injury	2	1	0	Rear-end	V1:Northbound / V2:Northbound	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	BEACON STREET / KENT STREET					
2031390	BROOKLINE	07-Apr-2006	4:00 PM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1:Eastbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Dry	Daylight	Cloudy/Rain		300 feet E from Intersection 1200 BEACON STREET / POWELL STREET				
2081906	BROOKLINE	11-May-2006	11:00 AM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1:Southbound / V2:Southbound	V1: Not reported / V2: Not reported	Dry	Daylight	Cloudy		POWELL STREET / BEACON STREET				
2069909	BROOKLINE	12-May-2006	8:45 AM	Property damage only (none injured)	2	0	0	Angle	V1:Not reported / V2:Not reported	V1: Not reported / V2: Not reported	Dry	Daylight	Rain		1180 BEACON STREET / POWELL STREET			PIERCE PHARMACY	
2216592	BROOKLINE	29-Sep-2006	1:30 AM	Property damage only (none injured)	2	0	0	Angle	V1:Eastbound / V2:Not reported	V1: Not reported / V2: Not reported	Dry	Daylight	Cloudy		1120 BEACON STREET / KENT STREET				

**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
2168226	BROOKLINE	24-Mar-2007	10:39 PM	Property damage only (none injured)	2	0	0	Head-on	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: Westbound / V2: Not reported	V1: Unknown / V2: Unknown	V1: Passenger car / V2: Passenger car	Wet	Dark - lighted roadway	Snow/Rain	BEACON STREET / KENT STREET					
2188225	BROOKLINE	20-May-2007	00:00 AM	Not Reported	1	0	0	Single vehicle crash	V1: Travelling straight ahead	V1: Northbound	V1: Collision with tree	V1: Passenger car	Wet	Dark - lighted roadway	Rain	KENT STREET / BEACON STREET					
2338609	BROOKLINE	22-Aug-2007	2:45 AM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1: Entering traffic lane / V2: Travelling straight ahead	V1: Northbound / V2: Northbound	V1: Not reported / V2: Not reported	V1: Passenger car / V2: Not reported	Dry	Daylight	Cloudy		1180 BEACON STREET / KENT 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	All Roadway Intersection	Distance from Nearest Roadway Intersection	Distance from Nearest Milemarker	Distance from Nearest Exit	Distance from Nearest Landmark	Non Motorist Type	
228549	BROOKLINE	06-Feb-2008	10:43 AM	Non-fatal injury Property damage only (none injured)	2	1	0	Single vehicle crash	V1: Travelling straight ahead / V2:Slowing or stopped in traffic	V1:Eastbound / V2:Eastbound	V1: Collision with pedestrian / V2: Other	V1: Light truck/van, mini-van, panel, pickup, sport utility with only four tires / V2:Single-unit truck (2-axle, 6-tire)	Wet	Daylight	Rain/Rain	BEACON STREET / KENT STREET						P3:Pedestrian
2506810	BROOKLINE	14-Mar-2008	8:20 PM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1: Slowing or stopped in traffic / V2:Not reported	V1:Eastbound / V2:Not reported	V1: Not reported / V2: Not reported	V1: Not reported / V2:Not reported	Wet	Dark - lighted roadway	Rain	BEACON STREET / POWELL STREET						
2435750	BROOKLINE	29-Apr-2008	11:45 AM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1: Travelling straight ahead / V2:Entering traffic lane	V1:Southbound / V2:Southbound	V1: Not reported / V2: Not reported	V1: Light truck/van, mini-van, panel, pickup, sport utility with only four tires / V2:Passenger car	Wet	Daylight	Rain	POWELL STREET / BEACON STREET						
2322083	BROOKLINE	16-May-2008	1:30 PM	Non-fatal injury Property damage only (none injured)	2	1	0	Angle	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Northbound / V2:Westbound	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:Light truck/van, mini-van, panel, pickup, sport utility with only four tires	Dry	Daylight	Clear	POWELL STREET / BEACON STREET						
2492968	BROOKLINE	21-Jul-2008	12:00 PM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Westbound / V2:Westbound	V1: Not reported / V2: Not reported	V1: Not reported / V2:Not reported	Dry	Daylight	Clear	BEACON STREET / POWELL STREET						
2414317	BROOKLINE	21-Dec-2008	6:30 PM	Not Reported	3	0	0	Sideswipe, same direction	V1: Parked / V2:Parked / V3:Not reported	V1:Not reported / V2:Not reported / V3:Not reported	V1: Collision with parked motor vehicle / V2: Collision with parked motor vehicle / V3: Not reported	V1: Passenger car / V2:Passenger car / V3:Not reported	Snow	Dark - lighted roadway	Snow/Blowing sand, snow		1 POWELL STREET / BEACON STREET					