

# TOWN OF BROOKLINE

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

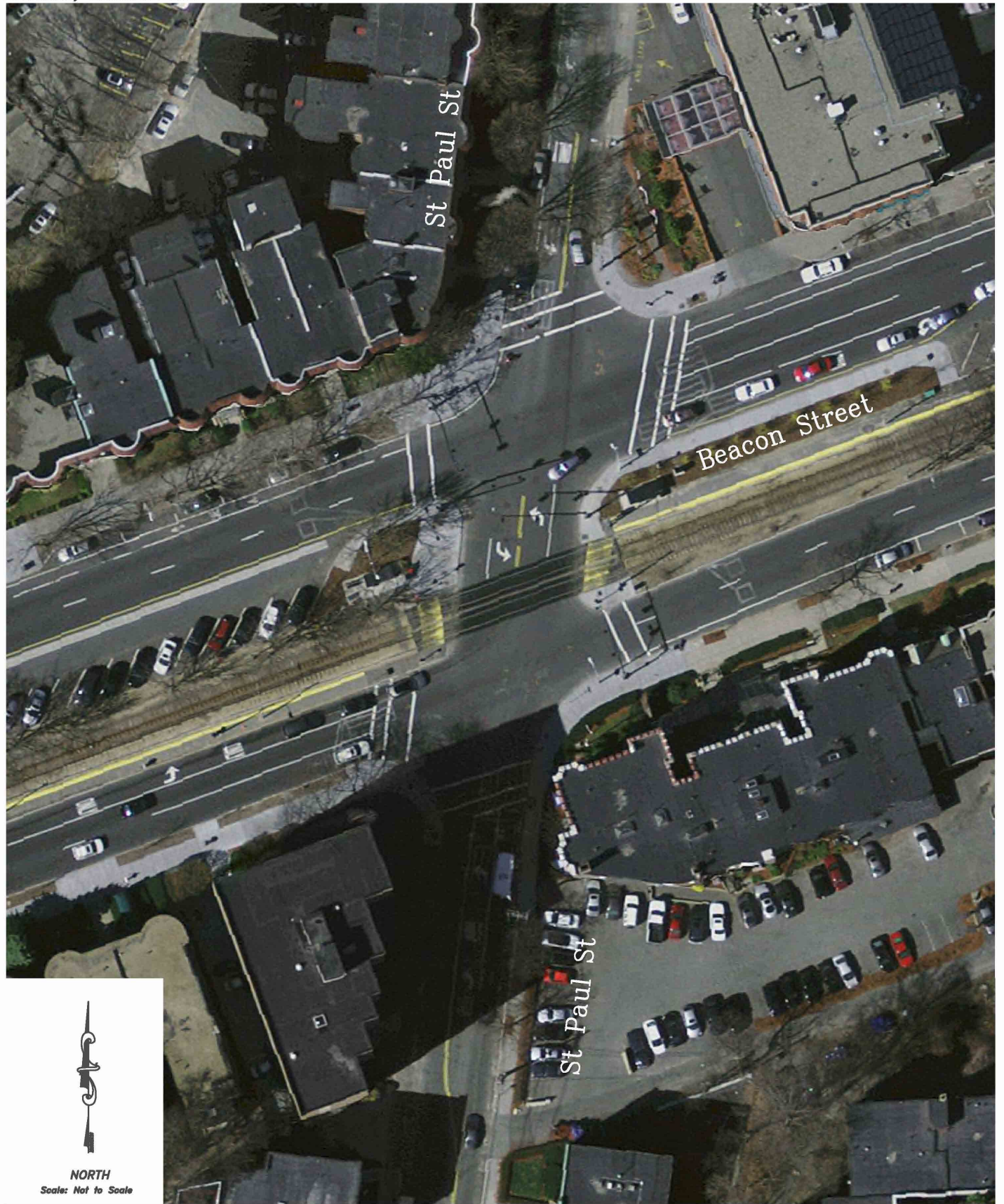
Right Turn On Red Restriction  
For  
Beacon Street at St Paul Street

Date: March 11, 2011  
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The purpose of this study is to determine if the existing NO TURN ON RED restriction at the intersection of St Paul Street and Beacon Street is warranted. Currently the restriction is in place for the right turn movement from Beacon Street eastbound onto St Paul Street and The St Paul 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 fact that there was an exclusive “barn dance” pedestrian phase.



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Figure 1

Study Location

## Sight lines

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 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 at the intersection of St Paul Street and Beacon Street are compared to minimum safe stopping sight distance (SSD) and intersection sight distance (ISD) guidelines for the regulatory speed limit. Sight line calculations are provided in the **Appendix**. Available and recommended sight lines are summarized below in **Table 1**.

Table 1  
Sight Distance

<u>Approach</u> <u>/Travel</u> <u>Direction</u>	<u>Available</u> <u>Sight</u> <u>Distance</u>	<u>AASHTO Recommended</u> <sup>1</sup> <u>Posted Speed</u> <u>(30 mph)</u>
Stopping Sight Distance		
St Paul St-Southbound	>500'	205'
Beacon St-Eastbound	>500'	215'
Intersection Sight Distance - Stop Control		
Beacon Street		
Looking Northbound	330'	290'
St Paul 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.

For the Beacon Street Eastbound approach the existing stopping sight distance is adequate. The available intersection sight is adequate. However the skew of the intersection causes adjacent vehicles to restrict intersection sight distance Forcing a vehicles making a right on red into the crosswalk.

For the St Paul Street Northbound approach the existing stopping sight distance is adequate. The available intersection sight distance deficient. Looking westbound sightlines are blocked by a building. If cars pull beyond the stop line and crosswalk sight lines are greater than recommended. But because of the heavy pedestrian activity it may be unsafe to have vehicles pulling in the crosswalk.

### Intersection Geometry and skew

St Paul Street meets Beacon Street at a 60 degree angle to form a four way signalized intersection. The Beacon Street approaches provides one left turn lane, one through lane, and a through-right turn lane. The St Paul Street approach provides one left turn lane and a through-right turn lane. Land use at the intersection consists of a residential housing. The MUTCD guidelines recommend a no turn on red when an intersection is skewed.

### Pedestrian Conflicts and Signal Operation

Pedestrian activity at the St Paul Street at Beacon Street Street intersection is high. There is an MBTA trolley stop in the center of the intersection and residential housing in close proximity to the intersection. The signal timing provides concurrent pedestrian movements. The MUTCD guidelines recommend 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>Harvard Street at Babcock Street</u>
Year:	
2006	21
2007	10
2008	6
Total	37
Type:	
Angle	18
Rear-End	4
Sidewipe	3
Right-Turn	1
Head-On	0
Pedestrian	0
Unknown/Other	11
Severity:	
P. Damage Only	25
Personal Injury	7
Fatality	0
Unknown/Other	5
Conditions:	
Dry	31
Wet	6
Snow/Ice	0
Other/Unreported	0
Time:	
7:00 AM to 9 AM	3
4:00 AM to 6 PM	10
Rest of Day	24

As summarized in **Table 2**, a total of thirty seven crashes occurred at the intersection of St Paul Street and Beacon Street for the three-year period studied from 2006 to 2008. One of the reported crashes involved a right turning vehicle from Beacon Street onto St Paul Street. However right turn on red maneuvers are currently restricted for the Beacon Street westbound approach and St Paul Street South bound 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 approach to Beacon St has restricted sight lines unless vehicles pull beyond the crosswalk, the intersection has heavy pedestrian use and pulling beyond the crosswalk poses an unacceptable number of pedestrian and vehicle conflicts. Using the MUTCD guidelines 2 & 4 from above the removal of the NO TURN ON RED restriction would not be recommended.

The Beacon Street eastbound approach to St Paul Street is skewed to create a situation in which sight lines are often blocked by stopped vehicles in adjacent travel lanes removing right turn on red restriction would require cars to pull into the crosswalk to see oncoming traffic, because of the high Pedestrian volume an unacceptable number of pedestrian and vehicle conflicts would occur. Using the MUTCD guidelines 2 & 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>	
South bound Stopping Sight Distance	214			
East bound Stopping Sight Distance	205			

<u>Inputs</u>	South Bound			East Bound		
	Posted	Average	85th	Posted	Average	85th
Speed:	30			30		
Grade:	-6			-3		

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
2137421	BROOKLINE	09-Jan-2006	10:15 AM	Property damage only (none injured)	2	0	0	Angle	V1:Southbound / V2:Eastbound	V1: Not reported / V2: Not reported	Wet	Daylight	Cloudy	SAINT PAUL STREET / BEACON STREET					
1985540	BROOKLINE	14-Jan-2006	9:10 AM	Non-fatal injury	2	2	0	Rear-end	V1:Eastbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Wet	Daylight	Rain/Cloudy		1200 BEACON STREET / SAINT PAUL STREET				
2057416	BROOKLINE	17-Jan-2006	7:50 AM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1:Eastbound / V2:Southbound	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	BEACON STREET / SAINT PAUL STREET					
1996984	BROOKLINE	20-Feb-2006	5:40 PM	Property damage only (none injured)	2	0	0	Angle	V1:Eastbound / V2:Southbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Dry	Daylight	Clear/Clear	SAINT PAUL STREET / BEACON STREET					
2094367	BROOKLINE	27-Feb-2006	5:45 PM	Property damage only (none injured)	2	0	0	Not reported	V1:Not reported / V2:Not reported	V1: Not reported / V2: Not reported	Dry	Dusk	Clear	SAINT PAUL STREET / BEACON STREET					
2008473	BROOKLINE	07-Mar-2006	9:50 AM	Property damage only (none injured)	1	0	0	Single vehicle crash	V1:Southbound	V1: Collision with light pole or other post/support	Dry	Daylight	Clear	SAINT PAUL STREET / BEACON STREET					
2077346	BROOKLINE	30-Mar-2006	7:15 PM	Property damage only (none injured)	2	0	0	Sideswipe, same direction	V1:Eastbound / V2:Eastbound	V1: Not reported / V2: Not reported	Dry	Dark - lighted roadway	Clear	BEACON STREET / SAINT PAUL STREET					
2114964	BROOKLINE	10-Apr-2006	9:12 AM	Property damage only (none injured)	2	0	0	Single vehicle crash	V1:Not reported / V2:Not reported	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	SAINT PAUL STREET / BEACON STREET					
2111056	BROOKLINE	01-May-2006	8:20 AM	Property damage only (none injured)	2	0	0	Angle	V1:Southbound / V2:Northbound	V1: Not reported / V2: Not reported	Dry	Daylight	Cloudy		SAINT PAUL STREET / BEACON STREET				
2037462	BROOKLINE	20-May-2006	2:29 AM	Property damage only (none injured)	2	0	0	Sideswipe, opposite direction	V1:Westbound / V2:Not reported	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Dry	Dark - lighted roadway	Clear/Clear	BEACON STREET / SAINT PAUL STREET					
2056934	BROOKLINE	08-Jun-2006	11:05 AM	Non-fatal injury	2	1	0	Single vehicle crash	V1:Northbound / V2:Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Wet	Daylight	Rain/Rain	BEACON STREET / SAINT PAUL STREET					
2059298	BROOKLINE	09-Jun-2006	9:37 PM	Property damage only (none injured)	2	0	0	Rear-end	V1:Eastbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Wet	Dark - lighted roadway	Cloudy/Cloudy	BEACON STREET / SAINT PAUL STREET					
2066913	BROOKLINE	05-Jul-2006	10:15 AM	Non-fatal injury	2	2	0	Angle	V1:Westbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Dry	Daylight	Cloudy/Cloudy	BEACON STREET / SAINT PAUL STREET					
2061411	BROOKLINE	14-Jul-2006	11:30 AM	Property damage only (none injured)	2	0	0	Angle	V1:Eastbound / V2:Southbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Dry	Daylight	Clear/Clear	BEACON STREET / SAINT PAUL STREET					
2118652	BROOKLINE	07-Aug-2006	7:45 PM	Property damage only (none injured)	2	0	0	Angle	V1:Northbound / V2:Not reported	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	SAINT PAUL STREET / BEACON STREET					
2132037	BROOKLINE	12-Aug-2006	7:00 PM	Property damage only (none injured)	2	0	0	Rear-end	V1:Westbound / V2:Westbound	V1: Not reported / V2: Not reported	Dry	Dusk	Clear	BEACON STREET / SAINT PAUL STREET					
2213739	BROOKLINE	15-Sep-2006	10:45 AM	Non-fatal injury	2	2	0	Not reported	V1:Southbound / V2:Northbound	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	SAINT PAUL STREET / BEACON STREET					
2089309	BROOKLINE	20-Sep-2006	5:45 PM	Property damage only (none injured)	2	0	0	Angle	V1:Northbound / V2:Not reported	V1: Collision with work zone maintenance equipment / V2: Collision with motor vehicle in traffic	Dry	Dusk	Clear/Clear	SAINT PAUL STREET / BEACON STREET					
2215158	BROOKLINE	22-Sep-2006	4:00 PM	Property damage only (none injured)	2	0	0	Angle	V1:Westbound / V2:Northbound	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	BEACON STREET / SAINT PAUL STREET					
2218212	BROOKLINE	29-Sep-2006	11:00 AM	Property damage only (none injured)	2	0	0	Angle	V1:Southbound / V2:Eastbound	V1: Not reported / V2: Not reported	Dry	Daylight	Cloudy/Rain	SAINT PAUL STREET / BEACON STREET					
2096919	BROOKLINE	04-Oct-2006	6:00 PM	Property damage only (none injured)	2	0	0	Angle	V1:Westbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Dry	Daylight	Clear	BEACON STREET / SAINT PAUL 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	
2144032	BROOKLINE	23-Jan-2007	3:00 PM	Non-fatal injury	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: Passenger car / V2:Passenger car	Dry	Daylight	Cloudy/Cloudy	BEACON STREET / SAINT PAUL STREET						
2153795	BROOKLINE	12-Feb-2007	2:54 PM	Non-fatal injury	2	2	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: Passenger car / V2:Passenger car	Dry	Daylight	Clear/Clear	BEACON STREET / SAINT PAUL STREET						
2317672	BROOKLINE	08-May-2007	12:15 PM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2:Travelling straight ahead	V1:Southbound / V2:Eastbound	V1: Not reported / V2: Not reported	V1: Light truck/van, mini-van, panel, pickup, sport utility with only four tires / V2:Passenger car	Dry	Daylight	Clear	SAINT PAUL STREET / BEACON STREET						
2185857	BROOKLINE	14-May-2007	5:00 PM	Property damage only (none injured)	2	0	0	Angle	V1: Turning right / V2:Travelling straight ahead	V1:Westbound / V2:Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear	SAINT PAUL STREET / BEACON STREET						
2347540	BROOKLINE	08-Jun-2007	12:00 PM	Not Reported	2	0	0	Not reported	V1: Travelling straight ahead / V2:Turning left	V1:Southbound / 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	SAINT PAUL STREET / BEACON STREET						
2227654	BROOKLINE	04-Aug-2007	5:00 PM	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:Light truck/van, mini-van, panel, pickup, sport utility with only four tires	Dry	Dusk	Clear	BEACON STREET / SAINT PAUL STREET						
2303644	BROOKLINE	04-Sep-2007	5:15 PM	Non-fatal injury	2	1	0	Not reported	V1: Leaving traffic lane / V2:Entering traffic lane	V1:Eastbound / V2:Southbound	V1: Not reported / V2: Not reported	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear	BEACON STREET / SAINT PAUL STREET						
2236711	BROOKLINE	02-Oct-2007	10:13 AM	Not Reported	2	0	0	Angle	V1: Backing / V2:Parked	V1:Not reported / V2:Not reported	V1: Collision with parked motor vehicle / V2: Collision with parked motor vehicle	V1: Passenger car / V2:Passenger car	Dry	Daylight	Clear/Clear		1240 BEACON STREET / SAINT PAUL STREET					
2246334	BROOKLINE	01-Nov-2007	7:45 PM	Not Reported	2	0	0	Angle	V1: Turning left / V2:Travelling straight ahead	V1:Southbound / 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	BEACON STREET / SAINT PAUL STREET						
2251948	BROOKLINE	08-Nov-2007	5:41 PM	Property damage only (none injured)	2	0	0	Angle	V1: Turning left / V2:Travelling straight ahead	V1:Southbound / V2:Eastbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Not reported / V2:Not reported	Dry	Dark - lighted roadway	Clear/Clear	SAINT PAUL STREET / BEACON 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	
2284465	BROOKLINE	23-Jan-2008	4:20 PM	Property damage only (none injured)	2	0	0	Angle	V1: Overtaking/passing / V2: Travelling straight ahead	V1: Northbound / V2: Northbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2: Passenger car	Dry	Daylight	Clear	SAINT PAUL STREET / BEACON STREET						
2311363	BROOKLINE	12-Apr-2008	10:30 PM	Property damage only (none injured)	2	0	0	Unknown	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1: Westbound / V2: Westbound	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	Wet	Dark - lighted roadway	Cloudy	BEACON STREET / SAINT PAUL STREET						
2507364	BROOKLINE	12-Jul-2008	2:00 AM	Not Reported	2	0	0	Not reported	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: Eastbound / V2: Eastbound	V1: Not reported / V2: Not reported	V1: Passenger car / V2: Not reported	Dry	Dark - lighted roadway	Clear	BEACON STREET / SAINT PAUL STREET						
2359566	BROOKLINE	15-Aug-2008	00:00 AM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: Westbound / V2: Westbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2: Passenger car	Dry	Dark - lighted roadway	Clear	BEACON STREET / SAINT PAUL STREET	1200 BEACON STREET					
2402211	BROOKLINE	26-Nov-2008	10:29 AM	Property damage only (none injured)	1	0	0	Single vehicle crash	V1: Turning left	V1: Southbound	V1: Collision with light pole or other post/support	V1: Passenger car	Dry	Daylight	Clear	BEACON STREET / SAINT PAUL STREET						
2412641	BROOKLINE	17-Dec-2008	8:35 AM	Property damage only (none injured)	1	0	0	Single vehicle crash	V1: Turning right	V1: Southbound	V1: Not reported	V1: Tractor/semi-trailer	Wet	Daylight	Cloudy/Rain	BEACON STREET / SAINT PAUL STREET						