



TOWN OF BROOKLINE

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

Right Turn On Red Restriction

For

Chestnut Hill Avenue at Dean Street

Date: April 26, 2011
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The purpose of this study is to determine if the right turn restriction on the Chestnut hill Street southbound approach and the Dean Street westbound approach at the Chestnut Street at Dead Street intersection is warranted. 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 DISTANCE

The American Association of State and Transportation Officials (AASHTO) standards reference two types of sight distances which are relevant for the intersection at Dean Street and Chestnut Hill Avenue: stopping sight distance (SSD) and intersection sight distance (ISD). Stopping sight distance pertains to roadway segments (i.e., Dean Street and Chestnut Hill Avenue) and intersection sight distance, as the name implies, relates specifically to intersections. Sight lines for approaches with right turn on red restrictions at the intersection of Dean Street at Chestnut Hill Avenue 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 ¹ Posted Speed (30 mph)	
Stopping Sight Distance			
Dean Street Westbound	>500'	195'	
Chestnut Hill Avenue Northbound	>500'	205'	
Intersection Sight Distance - Stop Control			
	Behind Stop Line	Within Crosswalk	
Chestnut Hill Avenue Looking West	<100'	140'	290'
Dean Street Looking South	130'	200'	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.

For the Chestnut Hill Avenue southbound approach the existing stopping sight distance is adequate. However intersection sight distance is deficient for a right turn on red movement. Sight lines are restricted by an existing Rockwall and trees. For the Dean Street westbound approach the existing stopping sight distance is adequate. However intersection sight distance is deficient for a right turn on red movement. Sight lines are restricted by existing shrubbery and trees.

INTERSECTION GEOMETRY AND SKEW

Chestnut Hill Avenue meets Dean Street at 90 degrees to form a four way signalized intersection. The northbound approach provides a left-thru lane and a right turn lane. The southbound, westbound and eastbound approaches all provide one general purpose travel lane. The intersection skew or geometry or would not restrict a right turn on red.

PEDESTRIAN CONFLICTS AND SIGNAL OPERATION

Pedestrian activity at the Chestnut Hill Avenue and Dean Street intersection is moderate. The signal operates with an exclusive pedestrian phase. Land use at the intersection consists of residential housing. 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**.

Table 2
Accident Summary

<u>Data Category</u>	<u>Dean Street at Chestnut Hill Ave</u>
Year:	
2006	5
2007	6
<u>2008</u>	<u>3</u>
Total	14
Type:	
Angle	2
Rear-End	7
Sidewipe	0
Right-Turn	0
Head-On	1
Pedestrian	1
Unknown/Other	3
Severity:	
P. Damage Only	6
Personal Injury	6
Fatality	0
Unknown/Other	2
Conditions:	
Dry	13
Wet	1
Snow/Ice	0
Other/Unreported	0
Time:	
7:00 AM to 9 AM	2
4:00 AM to 6 PM	1
Rest of Day	11

As summarized in **Table 2**, a total of eleven crashes occurred at the intersection of Chesnut Hill Avenue and Dean 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 northbound, southbound and westbound 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.

CONCLUSION

The Chestnut Hill Avenue and Dean Street intersection has moderate pedestrian activity. The signal timing has an exclusive pedestrian phase. Sight lines are restricted for right turn on red maneuvers for the Chestnut Hill Avenue southbound approach and the Dean Road westbound approach. Using the MUTCD guidelines 1, 3 and 4 from above the removal of the no turn on red restrictions would not be 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 bound Stopping Sight Distance	205			
West bound Stopping Sight Distance	190			

<u>Inputs</u>	North Bound			West Bound		
	Posted	Average	85th	Posted	Average	85th
Speed:	30			30		
Grade:	-3			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/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
1986660	BROOKLINE	28-Jan-2006	10:20 AM	Non-fatal injury Property damage only (none injured)	2	1	0	Rear-end	V1:Southbound / V2:Not reported	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	Dry	Daylight	Clear	CHESTNUT HILL AVENUE / DEAN ROAD					
2153075	BROOKLINE	23-Mar-2006	8:55 AM	Non-fatal injury Property damage only (none injured)	3	0	0	Rear-end	V1:Northbound / V2:Northbound / V3:Northbound	V1: Not reported / V2: Not reported / V3: Not reported	Dry	Daylight	Cloudy		505 CHESTNUT HILL AVENUE / DEAN ROAD				
2100691	BROOKLINE	28-Apr-2006	9:00 AM	Non-fatal injury Property damage only (none injured)	2	1	0	Rear-end	V1:Northbound / V2:Northbound	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	CHESTNUT HILL AVENUE / DEAN ROAD					
2229019	BROOKLINE	21-Sep-2006	10:30 PM	Non-fatal injury Property damage only (none injured)	2	1	0	Rear-end	V1:Northbound / V2:Northbound	V1: Not reported / V2: Not reported	Dry	Dark - lighted roadway	Clear	CHESTNUT HILL AVENUE / DEAN ROAD					
2193090	BROOKLINE	08-Dec-2006	10:00 AM	Non-fatal injury Property damage only (none injured)	2	0	0	Not reported	V1:Eastbound / V2:Not reported	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	DEAN ROAD / CHESTNUT HILL AVENUE					

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
2140106	BROOKLINE	06-Jan-2007	11:56 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2: Turning left	V1: Not reported / V2: Not reported	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Not reported / V2: Not reported	Wet	Daylight	Cloudy	DEAN ROAD / CHESTNUT HILL AVENUE					
2337527	BROOKLINE	07-Feb-2007	10:50 AM	Property damage only (none injured)	2	0	0	Not reported	V1: Not reported / 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	CHESTNUT HILL AVENUE / DEAN ROAD					
2172317	BROOKLINE	29-Mar-2007	11:50 AM	Property damage only (none injured)	1	0	0	Single vehicle crash	V1: Travelling straight ahead	V1: Northbound	V1: Collision with tree	V1: Single-unit truck (3-or-more axles)	Dry	Daylight	Clear		50 feet S from Intersection 504 CHESTNUT HILL AVENUE / DEAN ROAD				
2373906	BROOKLINE	03-May-2007	3:00 PM	Not Reported	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: Northbound / V2: Northbound	V1: Not reported / V2: Not reported	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	CHESTNUT HILL AVENUE / DEAN ROAD					
2338139	BROOKLINE	31-Jul-2007	1:30 AM	Non-fatal injury	2	1	0	Rear-end	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: Northbound / V2: Not reported	V1: Not reported / V2: Not reported	V1: Passenger car / V2: Not reported	Dry	Daylight	Clear	CHESTNUT HILL AVENUE / DEAN ROAD					
2242089	BROOKLINE	15-Oct-2007	4:25 PM	Property damage only (none injured)	2	0	0	Rear-end	V1: Backing / V2: Travelling straight ahead	V1: Northbound / V2: Southbound	V1: Collision with motor vehicle in traffic / V2: Collision with motor vehicle in traffic	V1: Passenger car / V2: Single-unit truck (2-axle, 6-tire)	Dry	Daylight	Clear	CHESTNUT HILL AVENUE / DEAN ROAD					

**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	
2286287	BROOKLINE	01-Feb-2008	8:40 PM	Non-fatal injury	2	1	0	Head-on	V1: Travelling straight ahead / V2: Turning left	V1: Eastbound / 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	Dark - lighted roadway	Rain	DEAN ROAD / CHESTNUT HILL AVENUE						
2513759	BROOKLINE	28-Jun-2008	12:30 PM	Not Reported	2	0	0	Angle	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: Eastbound / V2: Northbound	V1: Not reported / V2: Not reported	V1: Light truck(van, mini-van, panel, pickup, sport utility) with only four tires	Dry	Daylight	Cloudy	DEAN ROAD / CHESTNUT HILL AVENUE						
2404778	BROOKLINE	08-Dec-2008	3:20 PM	Non-fatal injury	1	1	0	Single vehicle crash	V1: Turning left	V1: Southbound	V1: Collision with pedestrian	V1: Passenger car	Dry	Daylight	Clear/Clear	CHESTNUT HILL AVENUE / DEAN ROAD						P2-Pedestrian