



TOWN OF BROOKLINE

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

Right Turn On Red Restriction

For

Kent Street at Longwood Avenue

Date: April 26, 2011
Prepared by: Daniel Martin

The purpose of this study is to determine if the right turn restriction on the Kent Street southbound approach, Longwood Avenue eastbound approach and the Longwood Avenue westbound approach at the Kent Street at Longwood Avenue 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 are restricted sight distances.



BROOKLINE ENGINEERING/TRANSPORTATION DIVISION
333 WASHINGTON ST 4TH FLOOR, BROOKLINE, MA
TELEPHONE : (617) 730-2319 FAX: (617) 284-6490



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 Kent Street and Longwood Avenue: stopping sight distance (SSD) and intersection sight distance (ISD). Stopping sight distance pertains to roadway segments (i.e., Kent Street and Longwood Avenue) and intersection sight distance, as the name implies, relates specifically to intersections. Sight lines for right turning vehicle movements at the intersection of Kent Street at Longwood 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			
Longwood Avenue Westbound	>500'	200'	
Kent Street Northbound	>500'	200'	
Kent Street Southbound	>500'	200'	
Intersection Sight Distance - Stop Control			
	Behind Stop line	At Crosswalk	
Kent Street Looking East	<100'	140'	290'
Longwood Avenue Looking south	<100'	<100'	290'
Longwood Avenue Looking north	<100'	140'	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 intersection sight distance is deficient for a right turn on red movement for the approaches that currently have right turn on red restrictions. Sight lines are obstructed by trees, shrubbery for the Longwood Avenue eastbound and westbound approaches. The Kent Street southbound approach is obstructed by a tree lawn and a heavily utilized parking lane. The MUTCD recommends no turn on red when there are restricted sight lines.

INTERSECTION GEOMETRY AND SKEW

Kent Street meets Longwood Avenue at 90 degrees to form a signalized four way 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 at the Kent Street and Longwood Avenue intersection is high with significant portion of disabled and older persons. The signal operates with a concurrent pedestrian phase. The Brookline housing authority and elderly housing is in close proximity to the intersection. The MUTCD recommends no turn on red when an unacceptable number of pedestrian vehicle conflicts occur, especially involving children, older pedestrians, or persons with disabilities.

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 Street at Longwood Avenue</u>
Year:	
2006	2
2007	3
<u>2008</u>	<u>3</u>
Total	8
Type:	
Angle	4
Rear-End	0
Sidewipe	0
Right-Turn	0
Head-On	0
Pedestrian	0
Unknown/Other	4
Severity:	
P. Damage Only	4
Personal Injury	2
Fatality	0
Unknown/Other	2
Conditions:	
Dry	7
Wet	1
Snow/Ice	0
Other/Unreported	0
Time:	
7:00 AM to 9 AM	3
4:00 AM to 6 PM	0
Rest of Day	5

As summarized in **Table 2**, a total of eight crashes occurred at the intersection of Kent Street at Longwood Avenue 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 southbound, eastbound 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 Kent Street at Longwood Avenue intersection has heavy pedestrian activity with a significant portion of older and disabled pedestrians. The approaches with right turn on red restrictions all have obstructed intersection sight distances. Using the MUTCD guidelines 1 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 & South bound Stopping Sight Distance	197			
West bound Stopping Sight Distance	197			

<u>Inputs</u>	North & South 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/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
2083675	BROOKLINE	21-Jun-2006	11:20 AM	Property damage only (none injured)	2	0	0	Angle	V1:Southbound / V2:Westbound	V1: Not reported / V2: Not reported	Dry	Dark - unknown roadway lighting	Clear	KENT STREET / LONGWOOD AVENUE					
2117594	BROOKLINE	27-Jul-2006	7:05 AM	Not Reported	2	0	0	Not reported	V1:Southbound / V2:Northbound	V1: Not reported / V2: Not reported	Dry	Daylight	Clear	KENT STREET / LONGWOOD 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
2172307	BROOKLINE	04-Apr-2007	7:25 AM	Property damage only (none injured)	1	0	0	Single vehicle crash	V1: Travelling straight ahead	V1: Eastbound	V1: Collision with tree	V1: Truck/trailer	Dry	Daylight	Cloudy		300 feet W from Intersection 141 LONGWOOD AVENUE / KENT STREET				
2298325	BROOKLINE	03-May-2007	7:50 AM	Not Reported	3	0	0	Not reported	V1: Travelling straight ahead / V2: Travelling straight ahead / V3: Travelling straight ahead	V1: Not reported / V2: Not reported / V3: Not reported	V1: Not reported / V2: Not reported / V3: Not reported	V1: Not reported / V2: Not reported / V3: Not reported	Dry	Daylight	Clear	KENT STREET / LONGWOOD AVENUE					
2297984	BROOKLINE	13-Sep-2007	7:54 PM	Non-fatal injury	2	1	0	Angle	V1: Travelling straight ahead / V2: Unknown	V1: Eastbound / V2: Northbound	V1: Not reported / V2: Not reported	V1: Passenger car / V2: Light truck/van, minivan, panel pickup, sport utility) with only four tires	Dry	Dark - unknown roadway lighting	Clear	LONGWOOD AVENUE / 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
2276687	BROOKLINE	03-Jan-2008	6:40 AM	Non-fatal injury	1	1	0	Single vehicle crash	V1: Travelling straight ahead	V1: Westbound	V1: Not reported	V1: Passenger car	Dry	Dawn	Cloudy/Cloudy	KENT STREET / LONGWOOD AVENUE					P2: Pedestrian
2483256	BROOKLINE	15-Jan-2008	10:15 AM	Property damage only (none injured)	2	0	0	Angle	V1: Slowing or stopped in traffic / V2: Backing	V1: Northbound / V2: Northbound	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		258 KENT STREET / LONGWOOD AVENUE				
2401983	BROOKLINE	01-Dec-2008	10:08 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: Eastbound / V2: Southbound	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	Daylight	Clear	LONGWOOD AVENUE / KENT STREET					