

TOWN OF BROOKLINE

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

Right Turn On Red Restriction

For

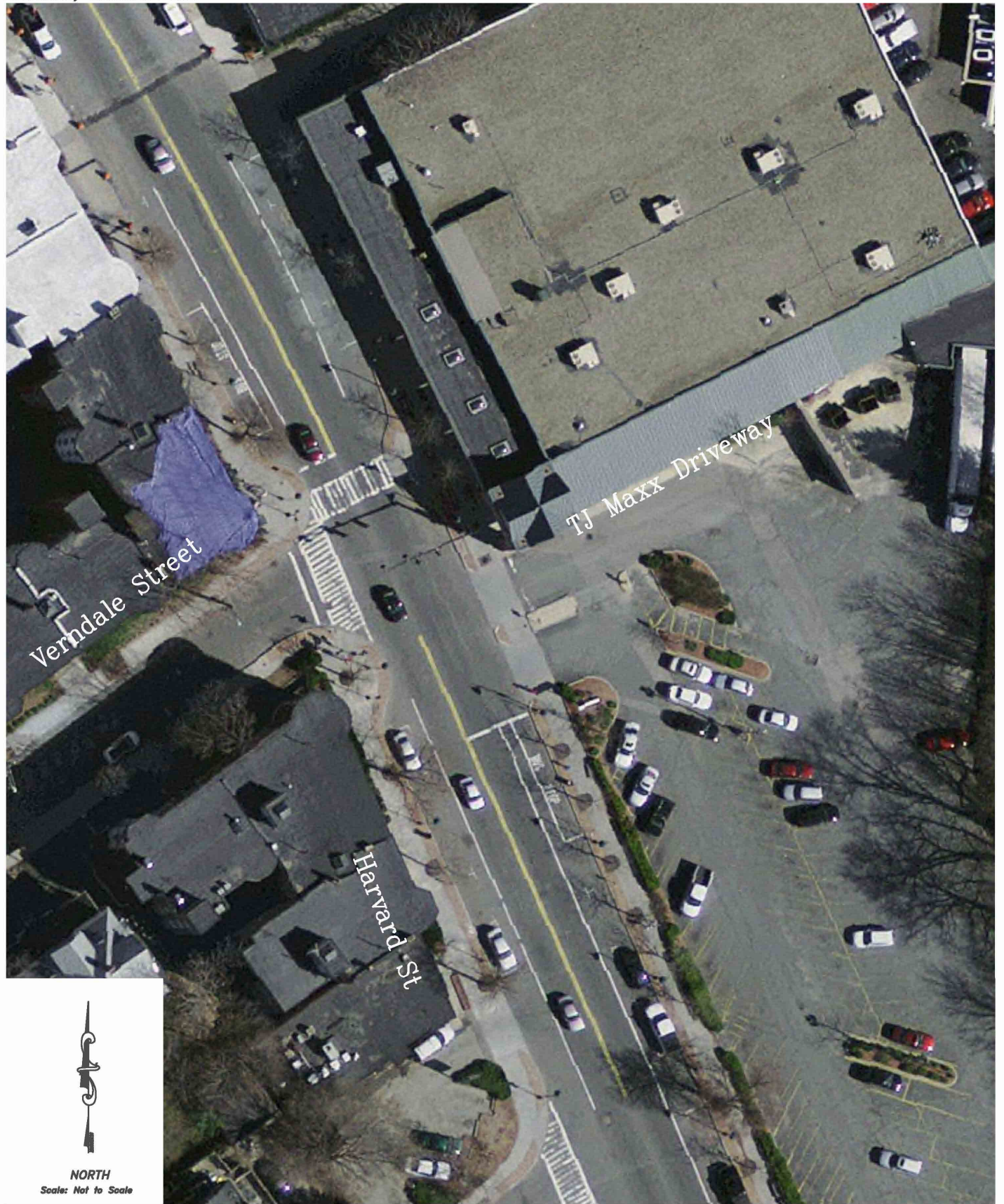
Harvard Street at Verndale Street

Date: May 17, 2011
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The purpose of this study is to determine if the right turn restriction on the TJ Maxx Driveway westbound approach at the Harvard Street at Verndale intersection is 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.

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 Harvard Street at Verndale Street: stopping sight distance (SSD) and intersection sight distance (ISD). Stopping sight distance pertains to roadway segments (i.e., Harvard Street) and intersection sight distance, as the name implies, relates specifically to intersections. Sight lines for right turning vehicle movements at the intersection of Newton Street at Clyde 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**.

<u>Approach /Travel Direction</u>	<u>Available Sight Distance</u>	<u>AASHTO Recommended¹ Posted Speed (30 mph)</u>
Stopping Sight Distance Harvard Street Northbound	>400'	205'
Intersection Sight Distance - Stop Control		
	Behind Crosswalk	Beyond Crosswalk
TJ Maxx Drive Looking South	<150'	235'
		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. Sight lines are blocked by on street parking. From the TJ Max driveway driver's view of pedestrians on the sidewalk on Harvard are obstructed by a building column increasing the potential for vehicle pedestrian conflicts. The MUTCD recommends no turn on red when there are restricted sight lines or an unacceptable number of pedestrian conflicts with right-turn-on-red maneuvers.

INTERSECTION GEOMETRY AND SKEW

Harvard Street meets Verndale Street at 90 degrees to form a four way signalized intersection. All The approaches provide a general purpose travel lane. Land use at the intersection consists of a mix of commercial and residential housing. Geometric characteristics would not prevent a right turn on red.

PEDESTRAIN CONFLICTS AND SIGNAL OPERATION

Pedestrian activity at the Harvard Street at Verndale Street intersection is heavy. The signal is in close proximity to MBTA bus stop TJ Maxx and other retail. The signal operates with an exclusive pedestrian phase. The MUTCD recommends no turn on red when an exclusive (“Barn Dance”) pedestrian phase is used or if an unacceptable number of pedestrian conflicts with right-turn-on-red maneuvers, especially involving children, older pedestrians, or persons with disabilities is present.

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**.

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

As summarized in **Table 2**, a total of five crashes occurred at the intersection of Harvard Street at Verndale 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 TJ Maxx Drive westbound 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 TJ Maxx westbound approach at the Harvard Street at Verndale intersection has restricted sight lines, an (“barn dance”) exclusive pedestrian phase and heavy pedestrian activity. The driver's view of pedestrians on Harvard street is obstructed by a building column. Using the MUTCD guidelines 1, 2 and 3 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		0		
Stop Control Right Turning/Crossing		287		
Yield Control Left Turning		0		
Yield Control Right Turning/Crossing		309		
Stopping Sight Distance		Speed		
		<u>Posted</u>	<u>Average</u>	<u>85th</u>
Northbound, Westbound & Southbound Stopping Sight D		205		
Eastbound Stopping Sight Distance		0		

<u>Inputs</u>	Northbound					
	Posted	Average	85th	Posted	Average	85th
Speed:	30					
Grade:	-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
2031639	BROOKLINE	29-Apr-2006	12:40 PM	Non-fatal injury	1	1	0	Single vehicle crash	V1:Southbound	V1: Collision with pedestrian	Dry	Daylight	Clear	HARVARD STREET / VERNDALE STREET					P2:Pedestrian



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
2276553	BROOKLINE	08-Jan-2007	12:10 PM	Property damage only (none injured)	2	0	0	Rear-end	V1: Slowing or stopped in traffic / V2:Not reported	V1:Westbound / V2:Westbound	V1: Not reported / V2: Not reported	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	Wet	Daylight	Rain	HARVARD STREET / VERNDAL STREET					
2348613	BROOKLINE	05-Nov-2007	12:45 PM	Not Reported	1	0	0	Angle	V1: Travelling straight ahead	V1:Westbound	V1: Not reported	V1: Passenger car	Dry	Daylight	Clear		525 HARVARD STREET			TJ MAXX	
2380394	BROOKLINE	12-Dec-2007	8:40 PM	Property damage only (none injured)	2	0	0	Angle	V1: Slowing or stopped in traffic / V2:Travelling straight ahead	V1:Northbound / 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	Dry	Daylight	Clear	HARVARD STREET / VERNDAL 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
2520015	BROOKLINE	22-Oct-2008	11:30 AM	Property damage only (none injured)	2	0	0	Angle	V1: Travelling straight ahead / V2: Making U-turn	V1: Southbound / V2: Not reported	V1: Not reported / V2: Not reported	V1: Not reported / V2: Not reported	Dry	Daylight	Cloudy		HARVARD STREET / VERNDALE STREET				