

**From:** Todd Kirrane  
**Sent:** Tuesday, November 27, 2018 4:24 PM  
**To:** Maria Morelli  
**Cc:** Peter Ditto; Daniel Martin; Alison Steinfeld  
**Subject:** 1299 Beacon: Followup Traffic Impact Comments

Maria,

Following our review of the latest Traffic Impact Assessment completed by VAI Consulting as well as a meeting between staff, VAI, and the Peer Review consultant we offer the following comments that we hope the Zoning Board of Appeals will take into account for the project.

1) The Longwood @ Sewall Avenue and Longwood @Harvard intersections are part of the MassDOT/FHWA 2006-2015 HSIP Crash Clusters for both Pedestrians and Cyclists. The HSIP Crash Clusters are developed based on equivalent property damage only rating which is a method of combining the number of crashes with the severity of crashes based on a weighted scale where a fatal crash is worth 10, an injury crash is worth 5 and a property damage only crash is worth 1. Those clusters are created for locations where crashes are within the top 5% in the region (map attached). Contrary to the statements in the TIA, the intersections in the area pose a safety concern for both pedestrians and cyclists in the current conditions and any additional, unmitigated, motor vehicle trips will only add to this problem. These safety concerns are also highlighted in a Walk Audit Report issued by MassDOT, MassBike, and Walk Boston (see attached) and by the Brookline Pedestrian Advisory Committee (see attached). While the developer is not responsible for the current issues, they will further exasperate the problems and therefore should be required to contribute mitigation toward addressing it. At the very least the developer should be responsible for fully funding construction of the attached safety improvements at the intersection of Sewall & Longwood given that all motor vehicle access to the site garage and service areas will impact this intersection.

2) Since the ZBA assumes the authority and responsibility of the Transportation Board when it comes to managing the public parking supply and impact that these projects have on them, we request that they take into account the practices of the Transportation Board when considering removal of the limited, and high demand, public parking supply on Sewall Avenue. That supply and the current usage of this small section of Sewall Avenue is heavily used by the post office, Trader Joes, residential needs including guests tradesmen & care takers, and those attending services or educational classes at Temple Sinai. In fact this public parking supply has been the discussion of several T-Board meetings and numerous neighborhood meetings over the past 5 years that have included neighbors, representatives from Neenas & Temple Sinai, Town Meeting Members, staff from Planning & Police, staff from State Senator Creem's office, staff from Representative Kennedy's office, and representatives from the Post Master General's office. It is our understanding that the peer review consultant will seek removal of several curbside parking spaces in order to meet the AASHTO guidelines for a driveway site lines. In an urban environment like North Brookline almost no driveway (residential, multi-use, or commercial) meets these AASHTO standards and doing so would eliminate virtually all on-street parking in the dense portions of town like Sewall Avenue. Because of this the Transportation Board & Transportation Division staff have consistently opposed the removal of the public parking supply (especially in high demand areas as Sewall Ave) for sightlines alone. The Board has set the

standard that removal for these types of non-40B projects be kept to a minimum and only be removed to allow vehicle access into and out of the driveway site. This project will eliminate the off-site parking supply currently used by Trader Joes at the Neena's surface lot which means the limited public parking supply on-street will become even more competitive. Constantly circling vehicles throughout the day, double & triple parking, etc. caused when the demand far outweighs the supply poses more of a safety threat than not meeting AASHTO site lines standards for a driveway. Eliminating it, without any plan to offset the loss, to benefit access to this development is a concern for staff. Therefore, if the ZBA takes the recommendation of the Peer Review consultant and votes to remove parking to meet AASHTO site lines we would recommend that an equal amount of spaces be made available in the garage for use by the general public. If the garage capacity or operations are unable to meet this shared parking usage model to offset the parking loss then we request that the ZBA approve mitigation for improvements for pedestrians and cyclists to affect mode shift to make up the difference including bicycle facilities on Sewall Avenue and Charles Street between Harvard Street and Beacon Street.

3) The proposed TDM should be required to comply with the Town's Transportation Access Plan Guidelines and, among other things,

a. include transit screens in the lobby (an example is in our Public Library and operated via <https://transitscreen.com/>)

b. extend to employees of the building as well as employees of the retail tenants

c. commit to the required minimum of 30% subsidy for MBTA/Blue Bike subsidies

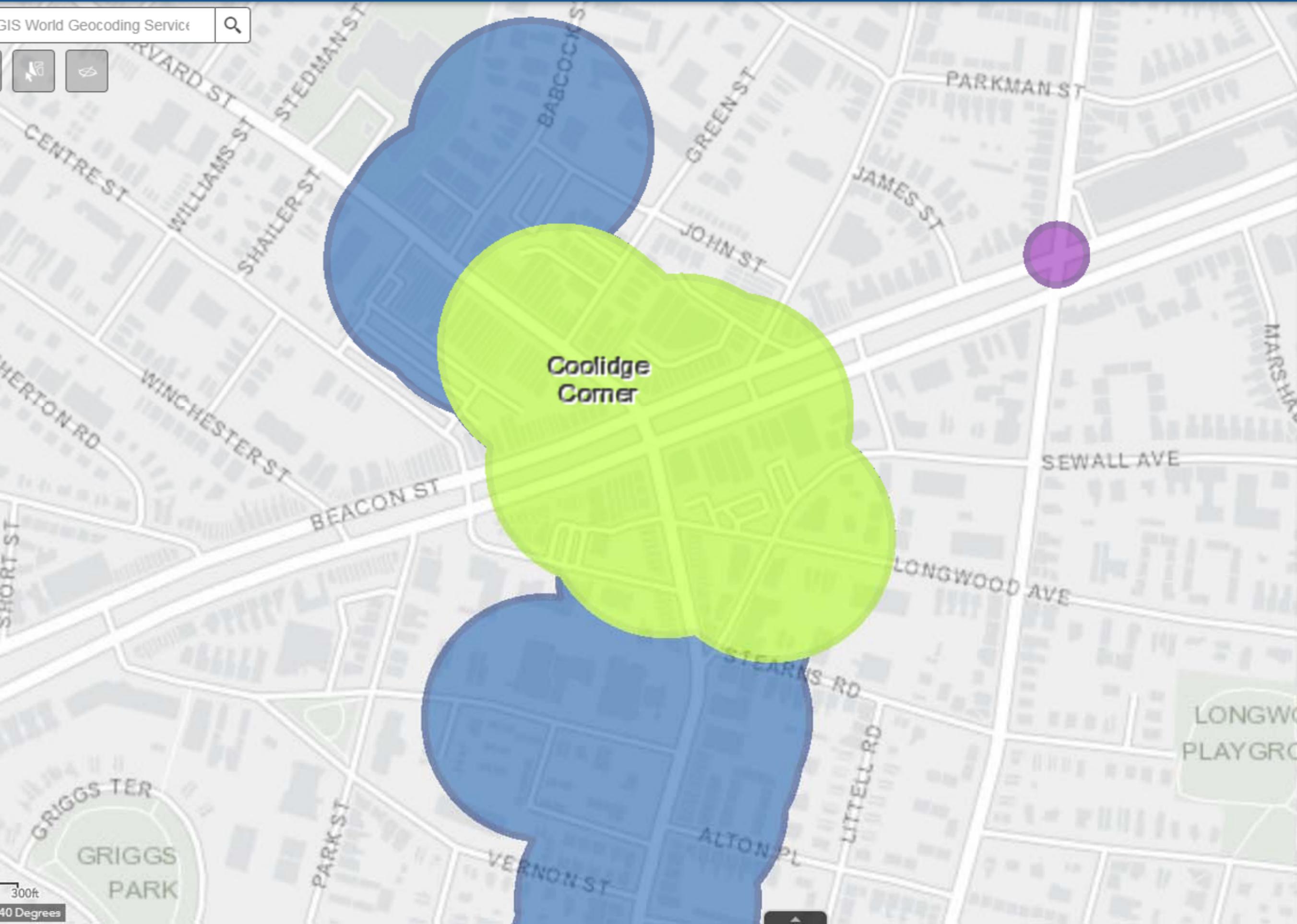
d. meet the requirement for EV Charging stations which is "either one parking space or 2% of parking

spaces (whichever is greater) be installed with electric vehicle charging stations and that an additional 15% of parking spaces have conduit to accommodate the installation of electric vehicle charging stations in the future."

Thank you,

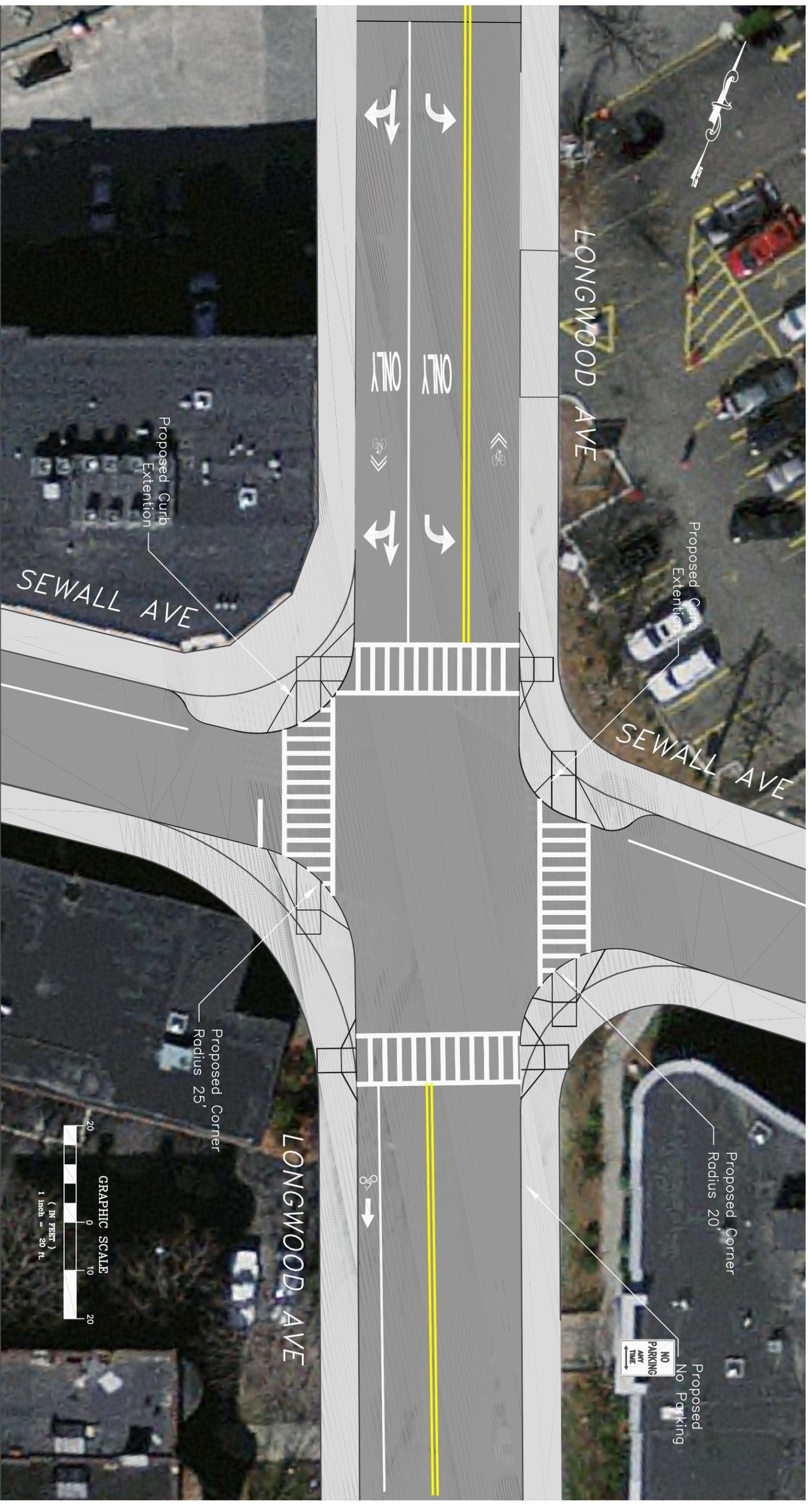
Todd

GIS World Geocoding Service



Legend

- CrashClusters**
- Top 200 Intersection Cluster 2
- 2013-2015 HSIP Cluster
- 2006-2015 HSIP Bicycle Clust
- 2006-2015 HSIP Pedestrian Cl



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Longwood Avenue at Sewall Avenue  
Proposed Intersection Improvements

# Longwood Avenue from a Pedestrian Perspective

*A study performed by the Brookline Pedestrian Advisory Committee*

**June 2018**



*Longwood & Kent during morning rush*

David Trevvett, Project Director

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## **Brookline Pedestrian Advisory Committee**

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Tracy Bare

Allison Pincus-Jacobs

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## I. Introduction and Summary of Findings

Brookline's history has produced a network of mostly narrow streets obeying no particular grid. While North Brookline has long provided sidewalks that facilitate pedestrian travel *along* its streets, there is a need for more attention to the dangers involved in *crossing* those streets. At the same time, we should ensure that our pedestrian pathways are pleasant and inviting, and that we mitigate unnecessary risks to those who are most vulnerable – including increased populations of the very old and the very young. Even the desirable trend of increased cycling in the Town means that there are more moving objects of different types that pedestrians – including those who are visually impaired – must be aware of.

The recently-formed Pedestrian Advisory Committee (PedAC) to the Transportation Board decided – with Board approval and support – to focus on the half-mile length of Longwood Avenue from Harvard Street to Chapel Street as its first study of a specific Brookline street. This is an important and heavily-used transportation corridor for pedestrians, as well as for vehicles and cyclists, connecting Coolidge Corner with the Longwood medical area. Lawrence School lies just off this corridor, leading to heavy foot traffic with many children crossing the street at school start and end periods, while at Coolidge Corner there is substantial congestion at Harvard Street and near the Trader Joe's parking lot. The heavy volume<sup>1</sup> and multi-modal nature of the corridor creates many potential conflicts and risks.

Over the course of several months in early 2018, PedAC members surveyed static conditions along Longwood as well as behaviors and issues at special time periods or weather conditions. The good news is that overall, Longwood Avenue sidewalks and intersections are in relatively decent shape and function reasonably well. Crosswalks exist on all sides of most intersections, three of the six intersections are controlled with traffic signals, sidewalks are in a reasonable state of repair and, apart from the exceptions noted in this report, have adequate width. There are several benches along this stretch.

That said, the Committee observed a number of safety and accessibility issues that should be addressed.

Many are maintenance, repair, and seasonal enforcement issues that fall within the Department of Public Works (DPW) responsibilities. PedAC members are becoming more active in reporting these via BrookONline. Examples include the following:

- A. Tree wells, both active and abandoned, that present too large a drop-off from sidewalk levels, often 2"-3". These could cause turned ankles and falls, which are especially hazardous for older pedestrians, and are particularly dangerous for the vision-impaired. Similar drop-offs exist around some utility poles.
- B. Hedges that encroach on sidewalks, sometimes narrowing the pathway enough to make it impassable for someone using a wheelchair or walker, or for a large baby carriage. Also a hazard for the vision-impaired.
- C. Broken or heaved sidewalks with cracks and level changes that can trip pedestrians and make it harder for wheelchairs or even grocery carts to proceed.
- D. Faded crosswalks that are not sufficiently visible, especially in rainy nighttime conditions.
- E. Snow banks that block access to crosswalks after winter storms.

Other issues require longer-term professional study, planning, budgeting, and scheduling:

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<sup>1</sup> See data examples in Exhibits A and B at end of this Section.

- F. There is a need for better materials for tree wells, to balance an allowance for tree growth / root protection with mitigation of the risk of pedestrian falls due to dangerous changes in sidewalk levels at the edges of wells.
- G. Many handicap ramps along Longwood lack detectable pavement; some seem makeshift with asphalt surfaces, not well positioned for entry to both crosswalks at the corner.
- H. The intersection of Kent and Longwood deserves a professional engineering study because of congestion associated with a very high volume of automobile, bicycle, and pedestrian traffic. Especially during the morning rush, this intersection is important because it serves many pedestrians traveling to the Longwood Medical area -- it was the busiest intersection we observed in terms of foot traffic. There are multiple issues:
  - The staging areas for pedestrians waiting to cross Longwood or Kent are extremely tight for such a high volume of pedestrian traffic (see top photo on title page of this report), even though some areas already encroach on private property. While this is enough space much of the time, the addition of a baby carriage, a suitcase, or a wheelchair can result in overflow, with no buffer separating pedestrians from vehicles.
  - Handicap ramps are substandard and do not always feed properly into crosswalks.
  - Areas of sidewalks are asphalt and have sunk at one corner, creating a tripping risk.
  - Pedestrians seem unaware that the walk signals across Kent are delayed to allow vehicles to turn; they begin walking as soon as the signals for westbound vehicle traffic on Longwood turn green, thereby blocking turning vehicles which in turn block the intersection, exacerbating congestion. A "DELAYED WALK SIGNAL. WAIT" sign could help -- there is already a sign to warn eastbound vehicles, but none for pedestrians.
- I. Two intersection locations currently lack crosswalks: at Longwood & Chapel on the west side of the intersection, also across Marshall at Longwood.
- J. Some crosswalks are not well aligned with sidewalks, and thereby with the direction of pedestrian travel, leading pedestrians either to detour or to walk outside the crosswalks (but see also item L below)
- K. Some crosswalks that are now slanted could be "squared off" to reduce pedestrian street-crossing distance and times – e.g. at Longwood and Sewall, also Longwood and Harvard.

Finally, there are larger-scale design and engineering issues that require deeper study and creative thinking to address:

- L. The existence of storm drain grates at multiple corners along Longwood (e.g., at Marshall and at Kent) prevents handicap ramps from being placed in the most sensible and accessible locations. Often this is the cause of crosswalks not being properly aligned with sidewalks. Some rethinking of how best to resolve these competing needs is required.
- M. Pedestrians can be particularly at risk from left-turning vehicles at non-controlled intersections – e.g., southbound drivers on Harvard Street turning left onto Longwood. Drivers may be focused primarily on oncoming vehicles and cyclists from the opposite direction, then hasten to make their left turn when there's a gap in approaching traffic, paying too little attention to pedestrians in the crosswalk they're about to drive over, especially when those pedestrians are entering the crosswalk from behind the driver's field of view. How can the Town place a warning to left-turning vehicles?
  - If a traffic signal can be suspended over the center of an intersection, as at St. Paul and Longwood, perhaps a warning sign could be similarly suspended?
- N. At multiple intersections along Longwood there are obstacles that stand in the way of pedestrian pathways – utility poles, fire alarm boxes, traffic signal poles, even mail boxes and

utility boxes. The Town's goal should be to reduce the number of such obstacles. This may require finding different ways to mount such objects, or different locations for some of them.

- O. Some intersections have large turning radii, which encourage drivers to make turns at higher speeds and/or not stop completely. If not needed for expected large-vehicle or fire equipment traffic, these should be reduced to help slow turning vehicles.
- P. The Town's strategies of street lighting and tree placement / maintenance need serious review, because today they often work against each other, making sidewalks more dangerous at night for pedestrians. While sidewalks and intersections along Longwood Avenue are for the most part well lit, there are a number of instances in which shadows cast by trees create dark stretches on sidewalks. Most street lights are positioned high above the streets, and spaced widely apart, while many trees have relatively low, leafy branches – these low branches block the higher light sources. The irony is that the presence of trees makes streets more inviting, yet causes shadows that increase the risks of walking at night. If street lights were lower, and/or lower branches of trees were removed, sidewalks could be much safer for pedestrians. Better long-term coordination among the Town Departments responsible for trees and street lighting is clearly called for. One saving grace on Longwood is the steady flow of vehicle traffic, even at night -- their headlights often help illuminate the sidewalks. But in the absence of such traffic, the lighting in the darker sections is insufficient.

*[Tree trunks also cast shadows, which can be a serious issue when street lights are positioned close to large trees – the resulting shadows can hide the very pavement sections most likely to be heaved and broken by tree roots. “Luckily” Longwood only has a few of these very large trees, and the sidewalks themselves are in reasonable condition, so trunk shadows are less of an issue along Longwood than on other Brookline streets.]*



*Above photo shows Longwood & Kent during morning rush.  
Note the narrow staging area.*

## EXHIBIT A. Morning Rush Pedestrian Counts at Kent and Longwood

### Monday, March 5, 7:15 – 8:15am

Conditions: 35° cloudy, clear pavement    One PedAC Observer

Time →	7:15 – 8:00	8:00 – 8:15	Total Hour
Pedestrians	423	202	<b>625</b>
Strollers	2	4	<b>6</b>
Bicycles	49	16	<b>65</b>

The rush hour is 7:30 – 8:30am. Note that with one observer, it's difficult to get an accurate count.

### Friday, March 9, 7:15 – 8:45am    *(counts contain some duplicates, see note below \*)*

Conditions: 30° Sunny (1 day after no-school day for 6" snowfall)

Two PedAC observers, on opposite corners

Time →	7:15	7:30	7:45	8:00	8:15	8:30	Total
SE Pedestrians	7	29	35	38	24	25	<b>158</b>
NE Pedestrians	17	28	65	32	30	32	<b>204</b>
SW Pedestrians	6	4	4	25	12	13	<b>64</b>
NW Pedestrians	35	56	80	86	83	93	<b>433</b>
Total Pedestrian Counts*	<b>65</b>	<b>117</b>	<b>184</b>	<b>181</b>	<b>149</b>	<b>163</b>	<b>859</b>
Bicycles	5	6	12	16	16	6	<b>61</b>

\*Tabulations are for anyone waiting on a corner to cross. Thus there are some duplications between these two corners of the intersection, as some pedestrians waited at one observer's corner, then crossed to the other corner where they were again counted.

## EXHIBIT B. End of School Day Counts at Marshall, Crossing Longwood

### Monday, March 12, 2:30 – 3:05pm

Conditions: 41° overcast, clear pavement    One PedAC observer

Time →	2:30 – 2:45	2:45 – 3:00	3:00 – 3:05	Total
Pedestrians walking to the school	14	7	3	24
Pedestrians walking from the school	64	33	15	112
Total	78	40	18	136

Police officer arrived at 2:29pm.

First child crossed at 2:34pm; the flow stopped quickly at about 3:00pm.

There were 7 baby carriages.

Two groups of preschoolers came by holding ropes with adults in reflective vests (not in totals).

(10 with 2 adults, 4 with 1 adult)

## II. Photos Illustrating Types of Problems Observed

Excessive drop-off at edge of tree well, Longwood near Chapel



Excessive drop-off at utility well, Longwood Ave near Sewall – see safer approach below



Hedge encroaching on sidewalk, pathway by tree well too narrow, Longwood near Marshall



Utility well filled in with concrete, Longwood near Chapel



NE corner of Kent & Longwood, sunken pavement by curb could trip someone



Near 102 Longwood Ave, broken pavement



St Paul & Longwood, no detectable pavement, crosswalk leads to pole & curb across street



Kent & Longwood, makeshift partial handicap ramp, no detectable pavement, paint fading



Longwood & St Paul, no detectable pavement on makeshift ramp, ramp doesn't readily lead to both crosswalks



Longwood & Sewall – E-W crosswalk not aligned w/ pedestrian path



Large utility box & pole narrow sidewalk, Longwood & St Paul



Longwood & Sewall – wide radius NE corner, crosswalk not well aligned w/ N-S ped travel



Storm drain at NW corner Longwood & Marshall forces crosswalk and ramp to the left



Longwood & Chapel – no crosswalk on west side of intersection



Longwood & Kent – we warn drivers to wait for delayed green, we should warn pedestrians to wait for delayed walk



Longwood-Kent – westbound traffic has green, peds should wait for delayed green but many don't



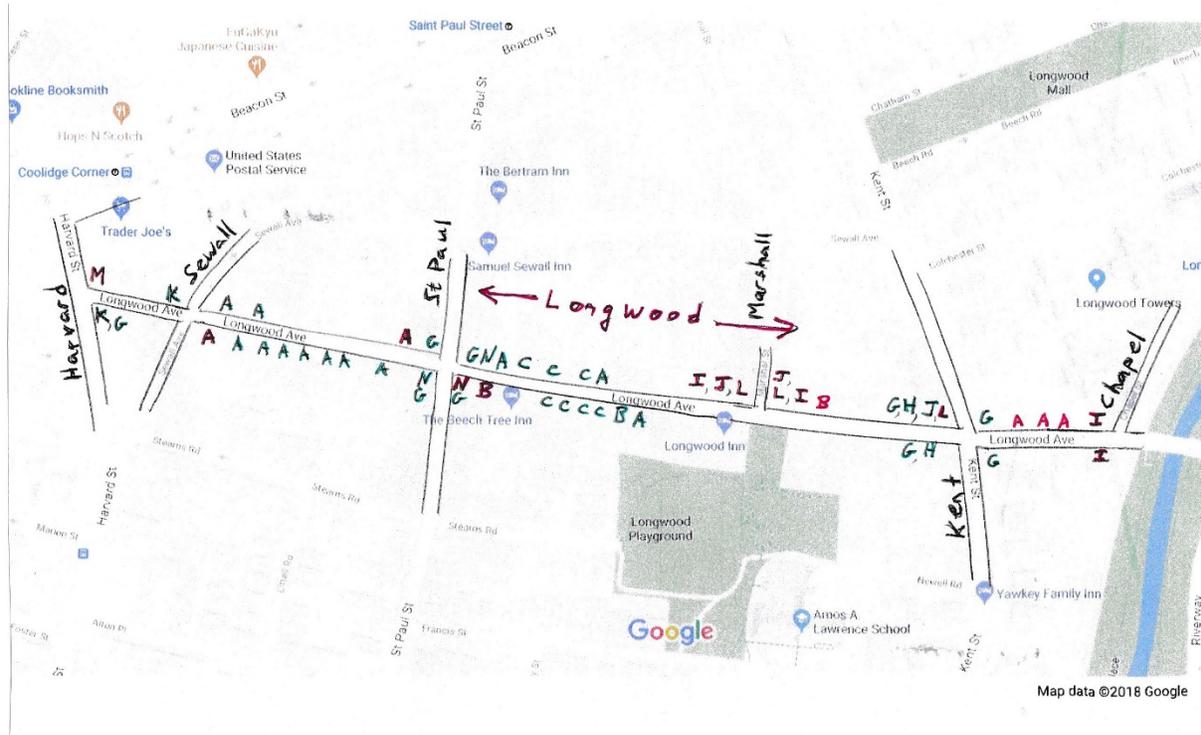
150 Longwood, oddly placed tree on property side of sidewalk. Unexpected hazard for the visually impaired when it grows larger?



Broken asphalt sidewalk mid-way between 150 Longwood and Kent



### III. Map Indicating Where Instances of Problems Were Observed



*This diagram is not intended to be complete, but just to show where many issues occur.*

**Key:**

- A. Tree well or utility pole well needs additional fill
- B. Hedge or overhanging branches narrow or obscure part of sidewalk
- C. Broken pavement surface, heaved or uneven sidewalk
- G. Detectable pavement missing from handicap ramps
- H. Kent & Longwood intersection has multiple issues, needs professional study
- I. One side of intersection lacks a crosswalk
- j. Crosswalk(s) not aligned well with sidewalk direction
- K. Slanted crosswalk could be “squared” to reduce pedestrian crossing distance
- L. Storm drain grates at corner impedes best positioning of handicap ramps
- M. Vehicles turning left across crosswalk pose danger to pedestrians
- N. Physical obstacles at intersections stand in pedestrian pathway

## IV. Conclusions and Recommendations

The major conclusions and recommendations of this study are as follows:

- The Transportation Board should request an engineering review and study of the conflict between storm drain grates and proper placement of handicap ramps at intersection corners, potentially using the north corners of the Marshall-Longwood intersection as a test case.
- The Transportation Board should request a professional engineering study of the Kent & Longwood intersection. Goals should include steps that could be taken to mitigate the risks caused by congestion and pedestrian-bicycle-vehicle conflicts, expanded pedestrian staging areas, and up-to-standard handicap ramps that provide direct entry into crosswalks. [Note that the one specific warning sign for pedestrians recommended earlier in this report could be implemented near-term without waiting for this engineering study.]
- The Transportation Board should request estimates of the cost and difficulty of creating and displaying a sign that warns left-turning southbound vehicles from Harvard to Longwood to yield to pedestrians, and assuming that these are acceptable, proceed with implementation.

As noted earlier, a large number of the safety and accessibility issues identified in this study are reportable to DPW and fall within their current responsibilities for maintenance, repair, and storm cleanup. However, in between these and the several major recommendations above lie a host of other issues that require substantial planning and effort by Town departments. These include reducing curb radii, reducing the number of obstacles in pedestrians' paths in future intersection reconstructions, redrawing crosswalks to reduce crossing distances and to align better with sidewalks, adding detectable pavement to handicap ramps that lack them, improving makeshift (often asphalt) handicap ramps with something better, rethinking street lighting to minimize shadows cast by trees, and searching for better fill materials for tree and utility wells both to allow for tree growth and to reduce the risk of pedestrian falls. All the above are included in the list of findings in Section I of this report.

The Longwood Avenue corridor is a busy one and becoming busier, by all modes of transportation. Planning for long-term walkability and safety is essential. The particular types of issues observed in this study are likely to be replicated all over (North) Brookline, therefore the lessons learned in this initial study by the Pedestrian Advisory Committee will also help inform its future activities.

**APPENDIX A. Checklists Used in Study**

<b>PedAC - Longwood Ave Data Collection - Along Sidewalks</b>			
<b>Street Segment (from, to):</b>			<b>Side (N or S):</b>
<b>Date &amp; time period:</b>		<b>Observer(s):</b>	
<b>Sidewalk condition (weather-independent)</b>			
Width as constructed (general adequacy)			
Sidewalk separation from traffic? (Tree lawn, grassy berm, parking lane, etc)			
State of repair (breaks, rough upheavals, etc) (list problems, locations)			
Excessive slope (list locations)			
Encroachments, other narrowings (list type, location) (bushes, trees, utility poles, mailboxes, etc)			
Other obstacles (list type, location)			
Tree well status for pedestrians (list locations)			
Grates (good, but slippery when wet)			
Unfilled - below sidewalk level			
Shade tree coverage?			
<b>Street Furnishings / Facilities</b>			
Trash receptacles?			
Benches, other nearby places to rest?			
Potential locations for added benches?			
Trees (aesthetics, shade)? Other plantings?			
Newspaper stands (Metro, etc)			
<b>Other safety, accessibility, or usability issues (list description &amp; location)</b>			
Inadequate drainage			
Driveway hazards, Other			
<b>Potential or recommended remedies</b>			
Need for mid-block crosswalk?			
Addl protections from traffic?			

<b>PedAC - Longwood Ave Data Collection - Intersections</b>		
<b>Intersection: Longwood at</b>		
<b>Date &amp; time period:</b>		<b>Observer(s):</b>
<b>Traffic Controls</b>	<b>Crosswalks</b>	<b>Handicap ramps</b>
Traffic signals? Visible to peds?	In place? w/ correct line markings?	Present?
Walk signals? Count-down?	Design - 2 lines, ladder, stamped, pavers, raised?	Condition?
Pedestrian activated?	Condition of paint?	Location? (center vs each side)
Crossing time sufficient?	In line with sidewalks?	Detectable pavement/ strips?
Wait time for walk?	Any obstacles? (e.g. utility poles)	Slope ok?
Leading pedestrian interval?	Staging space at corner?	Crosswalk connect w/ ramp?
Stop signs? Where?	Yield to ped, or other signage?	
Right turn on red permitted?	Curb extensions / bump-outs?	<b>Sight lines / Visibility</b>
Stop signs? Where?	Speed tables? Raised elements?	Parking allowed nr intersection?
Other signage? Flashing lights?	Pedestrian refuge islands?	Can drivers see crosswalks?
<b>Other safety, usability, accessibility issues?</b>	<b>Fixes needed?</b>	<b>Other recommendations?</b>

## APPENDIX B. Detailed List of All Observations

*(the most significant issues in the following are in red, less severe ones in blue)*

### A. Static Issues & Other Observations, by Street Section

#### General

There's a bike lane along the south side of Longwood (eastbound)

Sidewalk widths generally ok, except as noted below (encroachments, tree wells, etc)

Partial shade tree cover, esp south side of street, but some sections with few street trees

Several benches available along this street

Most (but not all) intersections do have crosswalks on all sides, though paint is fading on many

Stop lines at intersections seem ineffective, drivers pause on top of crosswalk to look for oncoming traffic. (Do stop lines still serve a purpose?)

Quite a few tree wells (some w/ trees, others w/o trees) need additional fill to close the level gap

Many handicap ramps at intersections are asphalt w/o detectible pavement

The existence of storm drain grates at a number of corners prevents the best siting for handicap ramps

#### Intersection at Harvard (very busy)

Insufficient signage to warn southbound vehicles turning left onto Longwood about pedestrians crossing Longwood, especially heading south

Crosswalk across Harvard is angled, so crossing distance exceeds street width

Only one crosswalk across Harvard, on south side of Longwood. Why not another on north side?

Handicap ramps lack detectable pavement

Lacking a warning to northbound Harvard vehicles not to block Longwood intersection

[Large yellow ped crosswalk warning sign faces northbound Harvard traffic Longwood]

["Yield to Peds" stanchion facing southbound traffic stands on crosswalk across Harvard]

[Stop sign faces east on Longwood]

#### Harvard to Sewall

Sidewalk conditions ok for entire length, both N & S sides of street

Many pedestrians walk through Trader Joe's lot to reach back entrance, dodging moving cars.

Should there be a marked pedestrian path through the lot?

#### Intersection at Sewall

2 crosswalks not in line with sidewalk:

West side crossing N-S      South side crossing E-W

Would be good to reduce radii to slow turning vehicles at SW, SE, NE corners

(Minor?) obstacles at several corners: fire call boxes, fire hydrant

[Stop sign in place on SE corner, facing northbound Sewall traffic]

[No stop signs on Longwood - should there be?]

#### Sidewalks - Sewall to St Paul

30 Longwood, small abandoned tree well needs to be filled in

46 Longwood, 2+ inch drop at tree well should be filled

Abandoned tree well close to St Paul on N side, needs to be filled in

21 Longwood, 2"-3" drop from sidewalk level around utility pole, worse than 2 months ago

Smaller drop at utility pole near 29 Longwood, should fill at same time as above

29 Longwood, asphalt covering abandoned tree well has sunk, some additional fill needed

A number of other tree wells in this block could use additional fill, e.g. 5-6 in front of large apartment building at 45 Longwood, also at 63 Longwood

63 Longwood, sidewalk sloped a bit, probably ok

[Several steps down from sidewalk level are 2 nearby benches in front of 45 Longwood]  
[S side of street lined with trees, many fewer on N side, except within private yards]  
[Between 36 & 60 Longwood, wood fence lining sidewalk seems unfriendly, not pleasant]

#### Intersection at St Paul (busy)

[Traffic-signal controlled, camera monitors present]  
Walk signals present, but not count-down, not pedestrian-activated  
Traffic signal poles in pedestrians' path on NW & SE corners  
SE corner has large (electrical?) utility box obstruction in ped path, exacerbated by signal pole  
SW corner has utility pole plus street light pole plus fire alarm box  
Handicap ramps in medium condition, no detectable pavement, may need rebuilding  
E.g., "ramp" on SW corner heading east seems makeshift  
[An earlier BrooklineCAN sidewalk safety project found that residents of 90 Longwood consider right turn on red to be a pedestrian safety hazard]

#### Sidewalks - St Paul to Marshall

73-75 Longwood, bushes encroaching on sidewalk, narrows walkway too much by tree  
Near 89 Longwood (S side), 2 sections of broken pavement, 4 other small sections between 83 & 89  
121 Longwood, a few bushes overhang sidewalk, should be easy to cut back  
123 Longwood, east end of tree well has 2" drop from sidewalk level  
East of 90 Longwood (N side), breaks in pavement (just before 102 Longwood)  
[PedAC observers saw that residents of 90 Longwood w/ shopping carts have difficulty w/ even minor sidewalk irregularities near St Paul St]  
East end of 102 Longwood, tree on building side of walk has heaved walk in a couple of places  
Heaving sidewalk at 106 Longwood  
Unfilled tree wells at 90 & 106 Longwood (each 2-3" deep), also 124 Longwood (1.5")  
[One or more trash receptacles in this section]  
[Benches at entrance to park by Lawrence School near Marshall intersection, also 90 Longwood]

#### Intersection at Marshall

[No traffic signal or walk signals]  
Yellow pedestrian crosswalk warning sign(s) in place  
Handicap ramps on either side of Marshall St (NW & NE corners) have multiple problems:  
Existence of a storm drain grate at each corner has forced the ramps to be further up Marshall St, so NOT in line with E-W walking direction.  
At current locations, there's a much greater than average drop from sidewalk level to street  
As a result, the ramps seem too steep  
No detectable pavement  
There are also deteriorated cement and breaks in the curb at these corners  
Probably requires a complete rebuild for E-W ped traffic on north side of intersection  
Needs an engineering study to see what changes are feasible  
Only one crosswalk across Longwood, on west side of intersection – slanted because of drain  
No crosswalk across Marshall  
Outside of peak school crossing times, cars appear to travel fast along this section of Longwood  
[Officer is on duty at crosswalk at peak school start and stop times]

#### Sidewalks - Marshall to Kent

East of 156 Longwood - low tree and bush branches hang over sidewalk, need to be cut back  
Fence is also leaning towards sidewalk. Not a danger yet, but could become one.

From 156 Longwood to Kent - asphalt sidewalk has unexpected (hard to see) ups and down, probably heaved by former street or private trees. **Sidewalk broken in one spot, a tripping danger.**

165 Longwood - somewhat uneven sidewalk (all asphalt here), not too bad

165 Longwood - earlier reported "branches in your face, vines encroaching on sidewalk" probably by tree at 173 Longwood. As of 5/7/18 appears to have been cut back, pathway clear

#### Intersection at Kent (**very busy**)

Traffic signals in place, walk signals present, **but not countdown**

Walk signal on SE corner was turned out of position, not facing correctly, harder to see (reported)

**Ped staging space at corners, esp NE, limited at busy times;** parent w/ stroller & child blocks sidewalk

No detectable pavement on handicap ramps

SW corner, (asphalt) ramp doesn't lead into N-S crosswalk; also broken asphalt

NE corner ramp also asphalt, SE ramp is concrete, each located at middle of corner

**NW corner, no real ramp for E-W ped traffic because of storm drain grate, just a south-facing ramp**

E-W walk signals on both sides of Longwood have delayed start to allow vehicles a chance to turn; **need pedestrian warnings, e.g., "DELAYED WALK SIGN – WAIT", similar to that for vehicles**

NE corner, sidewalk is sunk next to curb, creating a tripping hazard; needs to be filled

#### Sidewalks - Kent to Chapel

**Along Longwood Towers property, several tree wells are too deep, need fill to reduce level gap**

203 Longwood , broken curb by former tree well (no tree currently), needs fill at east end

#### Intersection at Chapel

**No crosswalk across Longwood on west side of intersection**

NW corner has large turning radius

Controlled by traffic signal, w/ walk signals for the two existing crosswalks

[5/7/18 - both walk signals came on at same time w/o button being pressed]

No detectable pavement on handicap ramps (NE ramp is asphalt, others concrete)

### **B. Dynamic (behavioral, seasonal) Issues at Key Points Along Longwood**

#### Intersection at Harvard

3:45pm 3/1/18 - complex, busy, congested. **Major issue: southbound cars turning left onto Longwood**  
**Such cars are mainly focused on oncoming (northbound) vehicles and cyclists, as a result they can overlook pedestrians southbound in crosswalk. [Some begin the left turn, spot a pedestrian, stop as required, but are then blocking travel on Harvard.]**

No police officer on duty at this time

#### Trader Joe's lot (with bank parking lot adjacent to it, so 2 driveways close together)

Thurs 3/1/18 3:55pm - even at this time, substantial volume, major ebbs & flows.

**Eastbound vehicles waiting to enter lot can back up all the way into the Harvard intersection**

Eastbound vehicles trying to continue eastbound along Sewall can be blocked by waiting cars

Sometimes westbound vehicles waiting to enter TJ lot back up across Sewall intersection

Some parking lot attendants are better than others at paying attention to pedestrians, making cars wait until peds have crossed the driveway; others aren't as aware

Overall, this area works better at this time of day than one might expect.

Wed 4/11/18 6:30pm

Most bike stand places filled, though car spaces available - **need more focus on bikes?**

No parking lot attendants at this time; other times, can be 2 on duty

#### Intersection at Sewall

From Sewall onto Longwood, cars don't stop at stop sign, rather pause on top of crosswalk or stopline

#### Intersection at Marshall St at School Start Time

Police officer present starting at 7:43am      3 baby carriages observed

A cyclist failed to yield to a pedestrian in the crosswalk. Two adults jaywalked

Traffic was heavy in both directions. Cars seemed to be driving faster than in the afternoon

North sidewalk and south bike lanes have more traffic (towards Medical area)

Policeman did not think any pedestrian improvements are needed at this intersection

#### Intersection at Marshall St at School Closing Time

Police officer present starting 2:29pm, 1st child crossed 2:34pm, flow stopped about 3pm

7 baby carriages observed

136 pedestrians observed: 112 walking from school, 24 walking towards the school

In addition, 2 groups pre-schoolers holding ropes, in reflective vests: 10 w/ 2 adults, 4 w/ 1 adult

On another day after substantial snow, intersection & sidewalks were thoroughly plowed

#### Intersection at Kent - General

Major issue: pedestrians and turning cars are always conflicting. Cars may turn right into ped path

#### Intersection at Kent during Morning rush to Longwood Medical Area (see Exhibit A for counts)

3/5/18 - Between 7:15am & 8:15am, observed 625 pedestrians, 6 strollers, 65 bicycles

Rush hour is 7:30am - 8:30am. It's a very busy intersection

Issue: no sign alerting pedestrians to "Delayed Green" for east-bound vehicles, green arrow for west-bound cars turning left onto Kent, and delayed walk signs across Kent on both sides

Result: peds start across Kent as soon as Kent lights turn red, cutting off turning cars

3/9/18 - Between 7:15am & 8:30am, observed 859 pedestrians (some counted twice), 61 bicycles

First day after 6" snowfall, 2 people slipped on ice at NW corner

3/14/18 - 2nd snow day from 15" storm on 3/13

All 4 corners plowed 2 feet wide, leaving little room for peds to congregate

Issue: Corners plowed to crosswalk in only one direction (e.g, along Longwood as opposed to across it). This forces peds to walk in street to get around snow banks

Most of the time corners seemed to provide sufficient space for pedestrians to congregate while waiting for the light to change (maximum no. observed at one time was 7)

#### Intersection at Chapel Street

One report was "Unclear to peds that a button needs to be pressed to get a walk signal"

But 5/7/18 observation: walk signs came on regularly w/o button being pressed]

Long wait for walk sign, encourages peds to cross w/o waiting for signal

#### Longwood Avenue Lighting at Night – 6/3/18

Longwood sidewalks and intersections generally well lighted; exceptions noted below

Trees now fully filled out with leaves, cast shadows that obscure sidewalk sections here:

Towards the east end of the large apartment building at 45 Longwood

Near 57, 59, and 63 Longwood; also near 44 Longwood

By 95 Longwood, between 111 and 115 Longwood

Along 159 Longwood

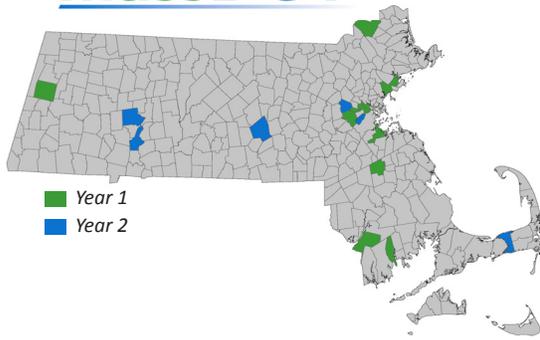
Near 165 Longwood (shadow makes the curved walk around a large tree less visible)

Between Kent & Chapel, west of Longwood Towers, in middle of block

In addition, there are some street light absence or placement issues:

Only one street light at the intersection of Longwood & St Paul

No streetlights on Marshall anywhere near Longwood, E-W crossers harder to see?



## Bicycle and Pedestrian Infrastructure Assessments Brookline, MA

### Harvard Street Corridor: Longwood Avenue to Shailer Street

Brookline is one of 18 communities participating in the MassDOT multi-disciplinary program to improve bicycle and pedestrian safety in Massachusetts. One of the components of the MassDOT program is to conduct walk and bike assessments that identify infrastructure challenges to walking and biking and recommend short- and long-term improvements. These assessments are also a means of building local knowledge of the importance of well-designed pedestrian and bicycle facilities. WalkBoston and MassBike conducted an assessment of Harvard Street in Brookline, MA.

### Corridor-wide Recommendations

#### Short-term Recommendations:

1. Conduct a traffic analysis of the corridor and surrounding street network for potential mitigation of traffic flow along the corridor.
2. Reduce pedestrian tripping hazards by replacing sidewalk panels and further implementing the Town's pervious tree grate program.
3. Develop strategies to improve the quality and health of street trees, such as installation of permeable pavement.
4. Identify citizen or business sponsors to install, program, and maintain parklets in high pedestrian area.
5. Add bicycle left-turn queue boxes, where feasible.
6. Modify the "WALK YOUR BIKE" signs or rotate the signs to clarify the circumstances in which bicyclists should walk their bikes.
7. Install additional bike parking or on-street bike corrals in convenient and visible locations throughout the study area.

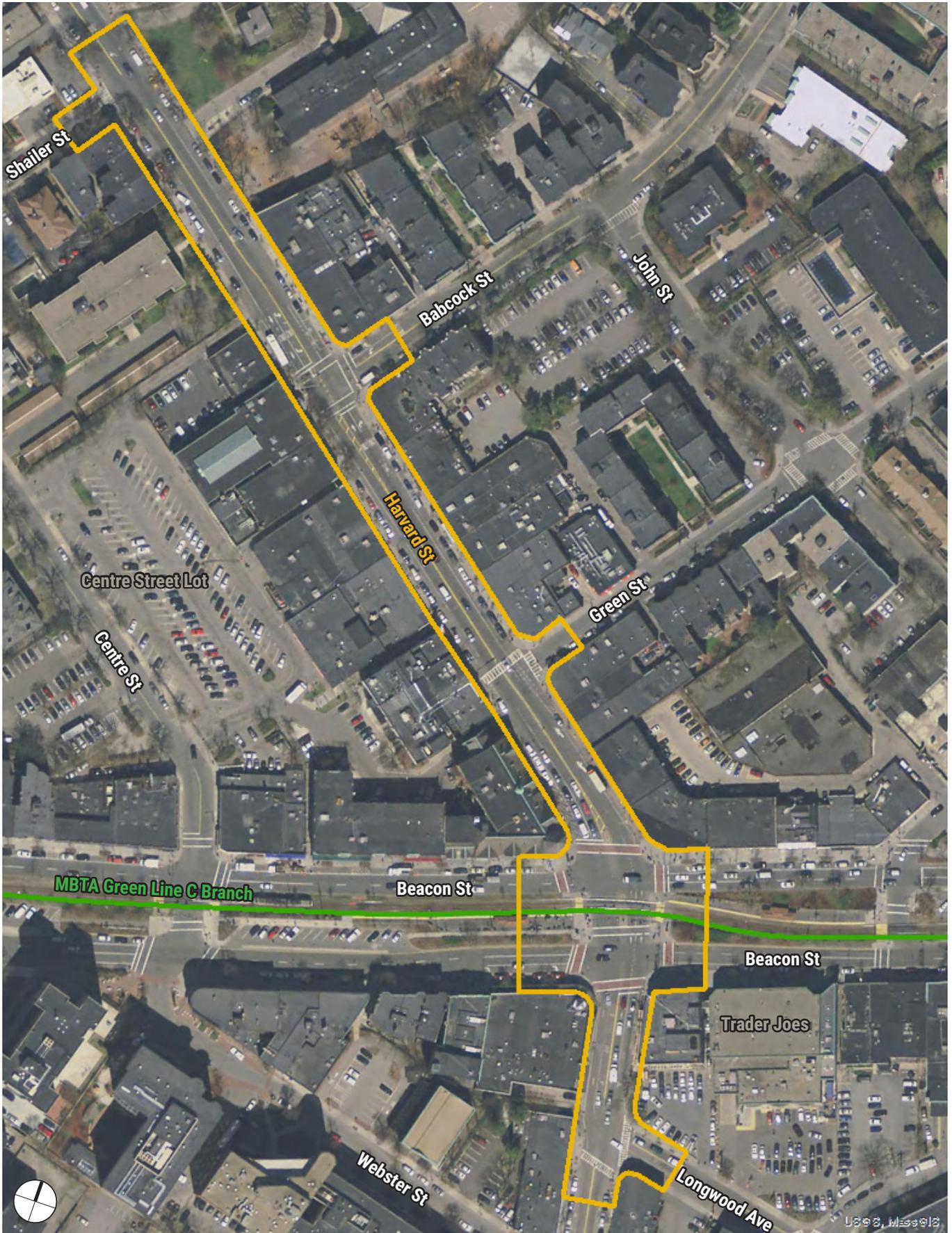
8. Install pedestrian countdown indications at signalized intersections.
9. Review or reevaluate far-side bus stops to replace existing near side bus stops.

#### Long-term Recommendations:

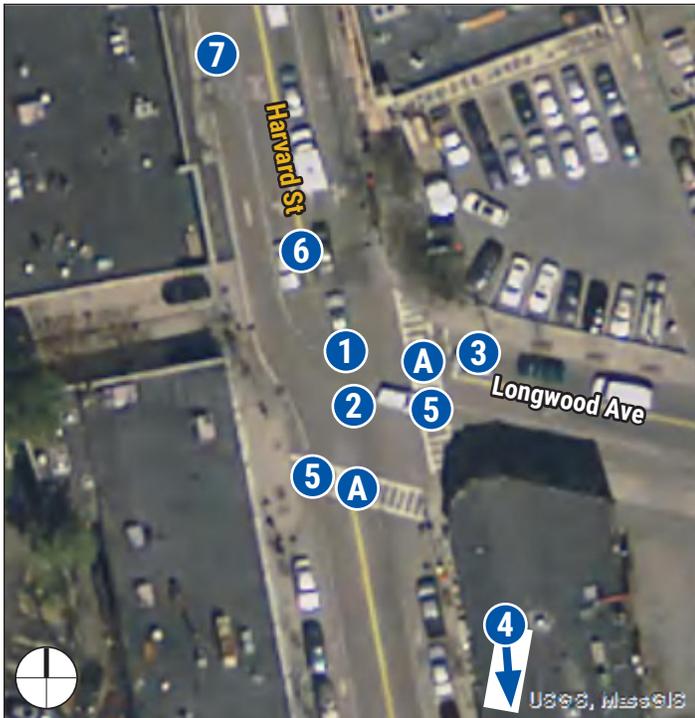
10. Provide continuous separated bike lanes or bike lanes throughout the study area by conducting further analysis on the potential to narrow travel lanes, remove travel lanes, or remove parking
11. Further study feasibility of relocating on-street parking north of Beacon Street to Centre Street parking lot to provide wider sidewalks and high quality bicycle facilities.
12. Provide bicycle facilities on nearby Centre Street, Winchester Street, and Park Street which may provide an alternate route for bicyclists routing around Coolidge Corner.
13. Reconstruct curb ramps to meet accessibility standards.
14. Shorten crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.



## Assessment Area



## Intersection Recommendations



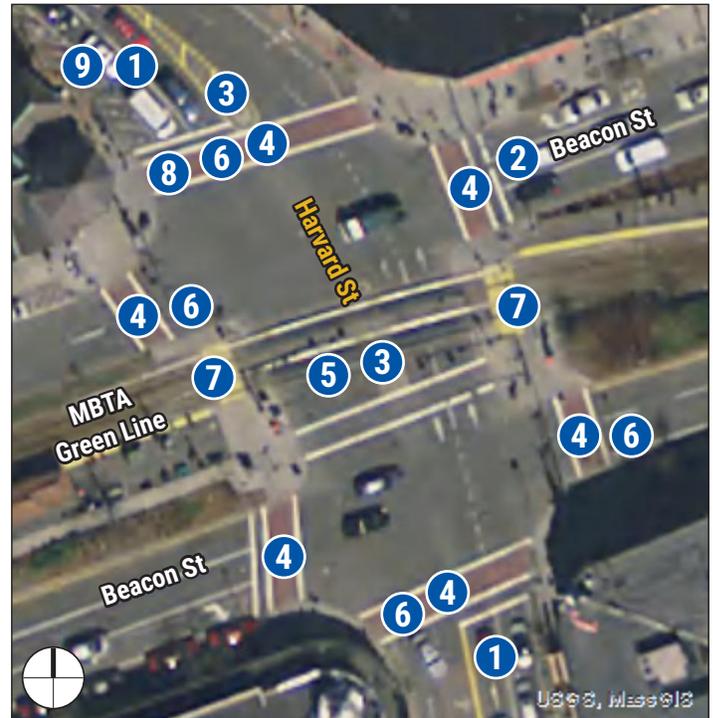
### Harvard St at Longwood Ave

#### Short-term:

1. Further study the potential to signalize the intersection and coordinate with the intersection of Beacon Street.
2. Add 'Don't Block the Box' markings and signs that conform to the latest version of the MUTCD.
3. Restrict left turns from Longwood Avenue onto Harvard Street southbound.
4. Further evaluate the intersection of Harvard Street/Sewall Avenue for an increase in left turning vehicles.
5. Install in-street warning signs on the Harvard Street and Longwood Avenue crosswalks.
6. Widen bicycle lane by reducing width of travel lanes and install flexposts.
7. Remove warning signs and replace with a bike lane sign.

#### Long-term:

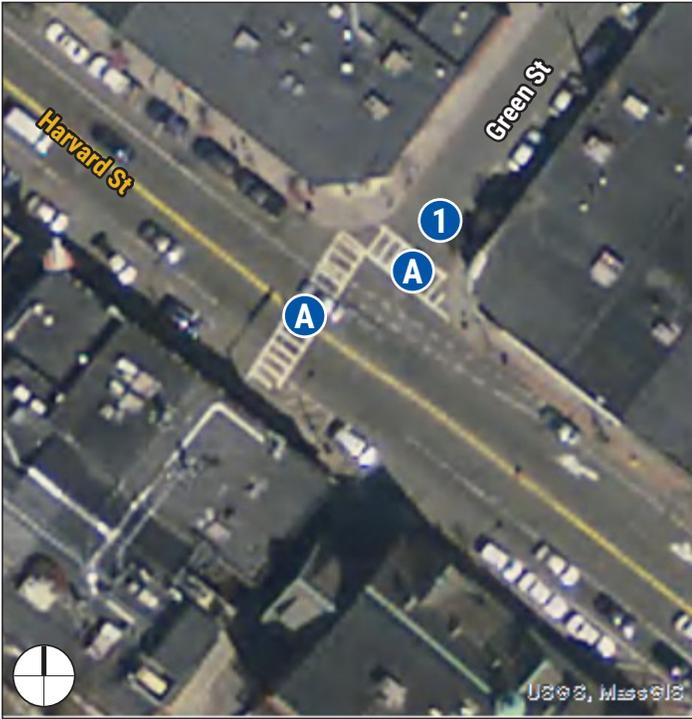
- A. Shorten crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.



### Harvard St at Beacon St

#### Short-term:

1. Reduce width of travel lanes to provide continuous bike lanes.
2. Reallocate the space for bicycle facilities for the Beacon Street westbound approach.
3. Remove the two existing small medians and reallocate space to other users.
4. Replace the existing crosswalks with high visibility ladder style crosswalks.
5. Further study the feasibility of providing one stage crossings across Beacon Street.
6. Extend leading pedestrian intervals.
7. Maximize pedestrian crossing times for all approaches.
8. Install bicycle box for the Harvard Street southbound approach to Beacon Street.
9. Install wayfinding signage on southbound Harvard Street north of Beacon Street to inform drivers of the need to position for a left turn onto Longwood Avenue prior to Beacon Street.



## Harvard St at Green St

### Short-term:

1. Evaluate adding contraflow bicycle lane on Green Street and potential intersection improvements at Harvard Street and Green Street.

### Long-term:

- A. Shorten crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.

## Harvard St at Babcock St

### Short-term:

1. Adjust pavement markings to provide a minimum of a 5-foot bike lane by narrowing the travel or parking lane.
2. Modify signal to lagging left-turn instead of leading left turns to allow people waiting to cross first.
3. Close exit driveway from Centre Street parking lot or restrict parking by removing adjacent parking meters, adding no parking pavement markings, and adding no parking signs.

### Long-term:

- A. Coordinate intersection improvements with the selected Babcock Street alternative.



## Walk/Bike Assessment

### Harvard Street

Brookline, MA

September 14, 2016

Prepared for the Massachusetts Department of Transportation Bicycle and Pedestrian Safety Awareness and Enforcement Program

## Introduction

WalkBoston and MassBike conducted an assessment of pedestrian and bicycle infrastructure along Harvard Street in the Town of Brookline on Tuesday, August 9, 2016. The assessment focused on Harvard Street between Longwood Avenue to the south and Shailer Street to the north in the Coolidge Corner area of Brookline, MA.

## Key Findings

During the Harvard Street assessment, several key themes were repeated from members of the assessment team such as the high volume of all users, traffic congestion, lack of continuous bicycle facilities, and high pedestrian signal delay. Sidewalks are generally in good condition and are fairly wide, however the sidewalks cannot always accommodate the high pedestrian volumes along the corridor. In addition, several sidewalk panels and tree pits create tripping hazards for pedestrians.

Other key recommendations along the length of the corridor include reducing the length of crossings by narrowing travel lanes and installing curb extensions, improving signal operations and coordination, upgrading equipment with pedestrian countdown indications, improving sight distance by restricting parking prior to crosswalks, and improving accessibility at intersections.

## Summary of MassDOT Bicycle and Pedestrian Safety and Awareness Program

The Town of Brookline is one of 18 communities participating in the Massachusetts Department of Transportation's (MassDOT) multi-disciplined program to improve bicycle and pedestrian safety in Massachusetts in 2016. One of the components of the MassDOT program is to conduct walk and bike assessments. The assessments have three goals:

1. Foster stakeholder awareness of the infrastructure elements which contribute to the biking and walking environment;
2. Evaluate the safety and quality of the biking and walking environment along the route; and
3. Recommend short and long-term infrastructure improvements.

One of the goals of this program is to identify if the built environment or infrastructure is contributing to the high incidence of crashes and/or poor behaviors resulting in crashes in the described locations. The results of this assessment can be used to identify safety issues and promote infrastructure improvements along this major north/south corridor in the Town of Brookline. The assessments are not meant to be a complete inventory of infrastructure deficiencies, nor are they meant to provide specific designs for every improvement. WalkBoston and MassBike lead the assessments as a means to build local capacity for improving the built environment for walking and biking. This report may be used as a resource for municipal staff, traffic engineers, and design professionals engaged by municipalities to design and implement policies, programs, and infrastructure improvements.

The Brookline Police Department (BPD) received a grant to conduct enforcement and awareness activities at the intersection of Harvard Street and Beacon Street, a location known to have high incidences of bicycle and pedestrian crashes or violations. Police Officers are stopping all road users (drivers, bicyclists, and pedestrians) who are engaging in dangerous behaviors for three reasons:

1. To inform the road user of the rules of the road;
2. To determine if there is a built environment (or infrastructure) reason that someone is not following the rules; and
3. To gather qualitative data about the reasons why people are behaving the way they are.

The data collected from the police coupled with the results of the infrastructure assessments will identify deficiencies and propose recommendations to improve the safety and quality of the walking and biking environment along Harvard Street in Brookline, Massachusetts. In addition, MassBike conducted a weekend pre-assessment site visit during which it was observed all bicyclists were traveling within the roadway in the correct direction of travel. MassBike also noted that existing bicycle racks in the area were occupied at the time of the pre-assessment site visit.

The Town of Brookline supports complete streets design and implemented a Complete Streets policy in May of 2016. The policy states that the “Town will create a comprehensive transportation network that sufficiently accommodates people of all ages and abilities, whether traveling by foot, bicycle, wheelchair, mass transit, or motor vehicle.” In addition, the Town of Brookline has an active Brookline Bicycle Advisory Committee.

Toole Design Group (TDG) is working with WalkBoston and MassBike to complete the assessment reports. TDG prepared this report, which summarizes the observations made by members of the assessment team and makes recommendations for improvements to the built environment to increase walkability and bikeability. The observations vary from specific infrastructure deficits, such as faded crosswalks or uneven sidewalks, to general comments on traffic speeds or land use patterns (e.g., vacant storefronts). Likewise, the recommendations range from specific fixes (e.g., paint crosswalk) to suggestions for further study (e.g., evaluate the feasibility of travel lane removal) to non-infrastructure items such as education and enforcement.

## Assessment Team

Representatives from the Town of Brookline including municipal staff and volunteer committee members, BPD, MassDOT, Metropolitan Area Planning Council (MAPC), Massachusetts Bay Transportation Authority (MBTA), WalkBoston, MassBike, and TDG participated in the assessment. The members and their affiliations are provided in **Table 1**.

**Table 1 - Assessment Team**

Team Member	Agency/Affiliation	Email Address
Scott Englander	Brookline Transportation Board	scottenglander1@gmail.com
Dan Martin	Town of Brookline, Engineering	dmartin@brooklinema.gov
John Canney	Brookline Police Department	JJCanney@brooklinema.gov
Kara Brewton	Town of Brookline, Planning	kbrewton@brooklinema.gov
Cynthia Snow	Brookline Bicycle Advisory Committee	csnow2@verizon.net
Frank Caro	Brookline Community Aging Network	frank.g.caro@gmail.com
Brian Francis	MBTA	bfrancis@mbta.com
Courtney Dwyer	MassDOT District 6	courtney.dwyer@state.ma.us
Zachary Jamous	MassDOT District 6	zachary.jamous@state.ma.gov
Lisa Schletzbaum	MassDOT Safety Division	lisa.schletzbaum@state.ma.us
Michelle Deng	MassDOT Safety Division	michelle.deng@state.ma.us
Stacey Beuttell	WalkBoston	sbeuttell@walkboston.org
Dorothy Haas	WalkBoston	dhaas@walkboston.org
David Watson	WatsonActive / MassBike	david@watsonactive.com
Richard Fries	MassBike	richard@massbike.org
Michelle Danila	Toole Design Group	mdanila@tooledesign.com

### Assessment Location

On November 19, 2015, WalkBoston, MassBike, and MassDOT met with a group of stakeholders including representatives from the Town of Brookline’s Public Works Department and Transportation Division, and Brookline Police Department (BPD) to discuss Brookline’s participation in the MassDOT Bicycle and Pedestrian Safety Enforcement and Awareness Program. The program includes stepped up enforcement and awareness activities by the Brookline Police Department at locations where there is a high incidence of bicycle and pedestrian crashes. In addition to the police efforts, the safety program provides an assessment of a high crash area or corridor with the goals of identifying aspects of the built environment that may contribute to the high incidence of crashes, and making recommendations for safety improvements.

The Town of Brookline Engineering Department identified Coolidge Corner, specifically the Harvard Street corridor, as their preferred location for the assessment. Harvard Street has two intersections of concern that the police identified for their enforcement and awareness activities: Harvard Street/Beacon Street and Harvard Street/Washington Street (outside the assessment area). The Town of Brookline has studied traffic volumes on Harvard Street in Coolidge Corner with improvements to the traffic signal timing and Green Street intersections proposed. The results of this assessment can be used to validate and enhance those proposals and promote infrastructure improvements along this major pedestrian, bicycle, and vehicle corridor in Brookline.

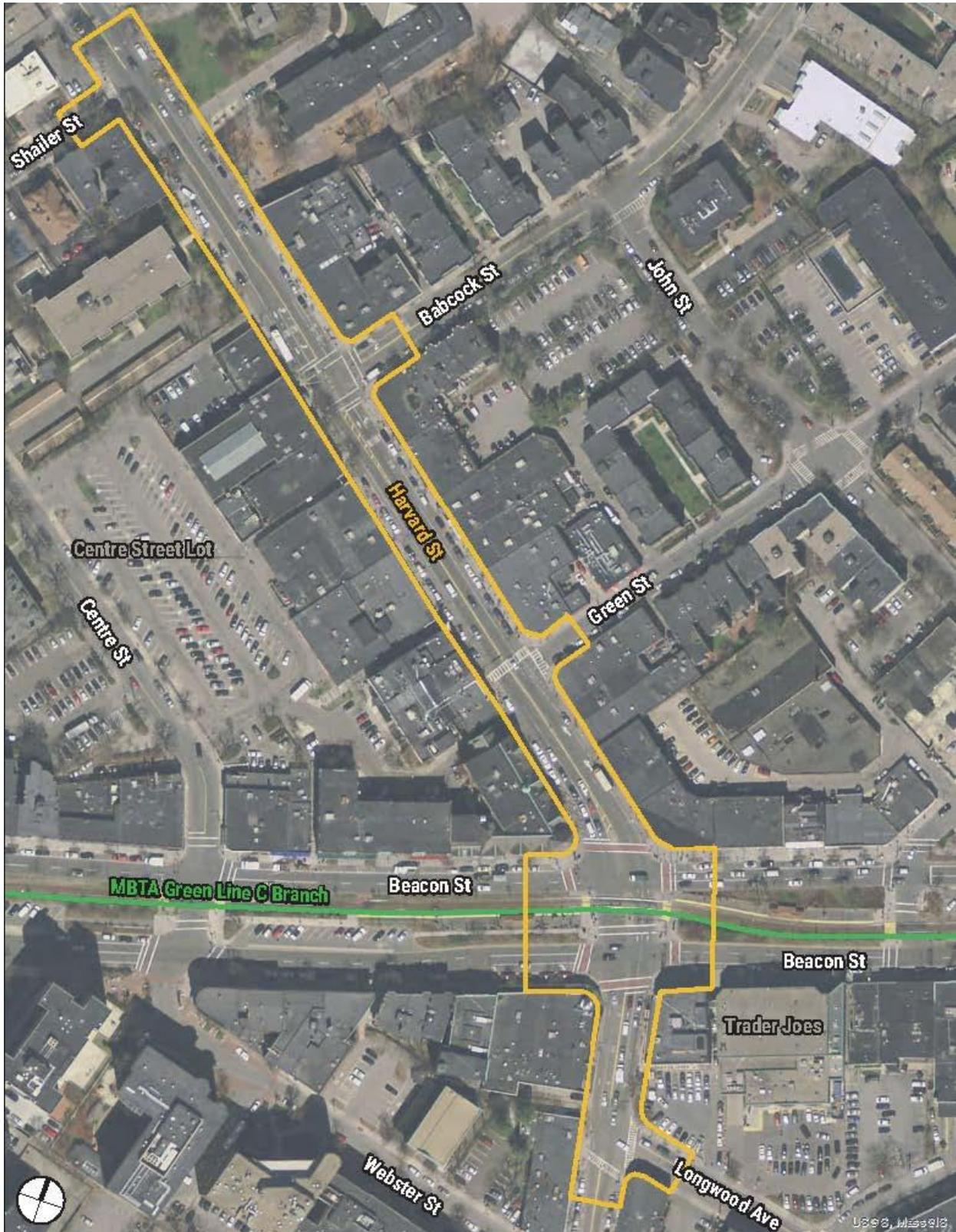
Although Harvard Street exemplifies some of the best bicycle and pedestrian facilities in the MassDOT assessment program, there are opportunities for improvement. Harvard Street is a main thoroughfare servicing all modes through Brookline's busy Coolidge Corner neighborhood. Coolidge Corner is a major destination for Brookline residents and visitors with significant retail offerings, a cinema, restaurants, and a post office. The study area selected for the bike and walk assessment includes the Harvard Street corridor between Longwood Avenue and Shailer Street, which includes the following intersections:

- Harvard Street at Longwood Avenue;
- Harvard Street at Beacon Street;
- Harvard Street at Green Street;
- Harvard Street at Babcock Street; and
- Harvard Street at Shailer Street.

The Harvard Street Corridor is identified in Brookline's Green Routes Bicycle Network Plan as a major connector for bicyclists traveling to and from destinations north and south of Brookline (such as Jamaica Plain or Allston/Brighton). Harvard Street is classified in the Green Routes Bicycle Network Plan as a level 4 roadway, with defining characteristics including high through traffic volume, significant commercial activity, and a high parking turnover rate. Because of these factors, Harvard Street has been identified as a high-priority corridor for projects that contribute to safe bicycling networks throughout Brookline.

The study area is illustrated in **Figure 1**. In addition, MassDOT provided crash data and collision diagrams which are provided in **Appendix D**.

Figure 1: Assessment Study Area



## Harvard Street Corridor Assessment

The assessment was conducted on Tuesday, August 9, 2016 and took between three and four hours. Before the assessment, WalkBoston and MassBike presented an introduction about the assessment process and a brief summary of pedestrian and bicycle infrastructure. The group spent about an hour and a half in the field and regrouped for a discussion of observations and potential recommendations.

During the assessment, the topics covered included the potential for narrowing and reducing the number of travel lanes and/or parking lanes; providing improved accessibility at intersections; providing clarity in pavement marking and signage; improving signal timing operations; providing improved crossings throughout the corridor; providing continuous bicycle facilities, and improving transit access. The following sections discuss area-wide recommendations as well as location-specific recommendations.

## Harvard Street Corridor-wide Observations and Recommendations

### Existing Conditions and Observations

Harvard Street is a Town-owned roadway classified by the MassDOT Office of Transportation Planning as a principal arterial. Harvard Street runs north-south through Brookline connecting from Washington Street to the south to the City of Boston line to the north. For the assessment, the study area consisted of Harvard Street between Longwood Avenue to the south and Shailer Street to the north. Within the study area, Harvard Street is a high-volume corridor passing through one of Brookline's busiest commercial areas known as Coolidge Corner. Harvard Street is a key bus route for the Massachusetts Bay Transportation Authority's (MBTA) route 66 that connects Harvard Square and Dudley Station. The cross section of Harvard Street varies throughout the study area ranging from one to two travel lanes in each direction and on-street parking.

### *Crash Summary*

MassDOT provided crash data and collision diagrams representing crashes reported by the BPD to the Massachusetts Registry of Motor Vehicles (RMV). Crash data collected between 2012 and 2014 demonstrated a total of 33 crashes, with the highest occurrence of crashes reported in 2014 (18 crashes). A relatively even split between types of crashes were reported, including vehicle-vehicle crashes, vehicle-bicycle crashes, and vehicle-pedestrian crashes. Noted common causes of vehicle-bicycle crashes included typical 'right-hook' incidents involving motorists turning quickly for a parking space or involving an MBTA bus. Commonly noted causes of vehicle-pedestrian crashes included incidents of drunk driving and turning vehicles. Though 33 crashes were reported between 2012 and 2014, the BPD has noted that reporting standards have changed to be inclusive of all crashes, not just crashes with injury. In the past, non-injury crashes were not reported as often, if at all. In addition, it was noted during the assessment by BPD Officer Canney that the crash data available through the RMV may not be accurate due to electronic transfer issues that have since been resolved. It would be prudent to compare the crash data available through the BPD data with the RMV data to report an accurate summary of the reported crashes within the assessment area.

### *Traffic Data*

According to the “Pedestrian Actuated Signal Study: Harvard Street at Green Street, Brookline, MA” prepared by WorldTech for the Town of Brookline, dated November 2015, Harvard Street north of Beacon Street has approximately 17,400 vehicles per weekday according to data collected in June 2014. Traffic volumes during the morning and evening peak hour on Harvard Street are approximately 950 vehicles and 1,160 vehicles, respectively. Pedestrian and bicycle counts conducted on a Saturday in June 2014 show that between noon and 2pm approximately 130 bicyclists traveling along Harvard Street and pedestrian can peak to over 3,200 people on a block. The highest pedestrian volumes were counted on Harvard Street between Beacon Street and Green Street.

The assessment team discussed the difficulty of vehicles making left turns towards the east from Harvard Street in the southbound direction. Left turns are allowed onto Babcock Street, restricted at Green Street, restricted at Beacon Street, and allowed onto Longwood Avenue. The assessment team observed that limiting the left turns creates challenges at the intersections that allow left turns, especially Longwood Avenue. A traffic analysis of the corridor and surrounding street network should be conducted to determine potential mitigation to traffic flow along the corridor.

### *Sidewalks*

Conditions and characteristics of the sidewalks along Harvard Street were noted during the assessment. In general, Harvard Street experiences high pedestrian volumes. Though the assessment was conducted during the summer when pedestrian volumes are at their lowest, the volume of pedestrians on the street was still high. Recently, the Town and adjacent businesses have made an effort to activate and change the character of the sidewalk environment by adding tables and chairs to the sidewalk. Sidewalks throughout the study area are generally too narrow for the volume of pedestrians they serve. At very busy times, pedestrians are sometimes observed walking in the street instead of on the sidewalk. The Town will be further studying removing parking within the study area to make more room for additional walking and biking infrastructure. The assessment team agreed with this recommendation.

The presence of street trees, tree pits, and upheaved sidewalk panels in combination with high pedestrian volumes can create the potential for pedestrian tripping hazards. The assessment team noted that several street trees along the corridor appeared to be dead. The team discussed working with Brookline’s Parks & Open Space Division to develop strategies to improve the quality and health of the street trees.

In key volume pedestrian areas, the Town should consider adding on-street parklets. Parklets can be installed with permanent or temporary structures that occupy the space of an on-street parking space. Parklets may contain tables and chairs, bike racks, or other street furniture to expand sidewalk width. Residents and business groups have sponsored temporary parklets within on-street parking spaces. Sponsorship of maintenance, insurance, and programming needs to be identified prior to permanent installations.

### *Bicycle Facilities*

Bicycle facilities provided through the study area are varied and inconsistent. Bicycle facilities drop prior to intersections forcing bicyclists to make high-stress merges into traffic. Based on roadway dimensions provided by the Town of Brookline, continuous bike lanes can be provided throughout the assessment area by narrowing travel lanes. In addition, separated bike lanes may be provided by removing travel lanes or removing parking. Continuous bicycle facilities have been proven to reduce wrong way riding, which was observed on Harvard Street in the study area. Beacon Street westbound to the west of Harvard Street will be undergoing a road diet pilot to remove a travel lane and add buffered bicycle lane. This future treatment may increase westbound bicycle traffic through Coolidge Corner. The Town should continue its ongoing study of traffic patterns to determine if reducing travel lanes and on-street parking is feasible.

The assessment team also noted that left turns are difficult for bicyclists at signalized intersections. The assessment team recommends consideration of left-turn queue boxes at signalized intersections.

The Town of Brookline recently added 'WALK YOUR BIKE' signs at crosswalks throughout the assessment study area. The signs were intended to discourage bicyclists from riding on the sidewalk. The assessment team noted that the signs are interpreted by users to mean 'do not ride your bike across the street.' Signs should be modified or rotated to clarify the intent of the signs.

The assessment area has several bike racks. The assessment team noted that the existing racks are heavily used. Additional bike parking or on-street bike corrals in convenient and visible locations are recommended in high demand area as determined by the Town, businesses, and residents. In addition, according to the Green Routes Bicycle Network Map, nearby Centre Street, Winchester Street, and Park Street are identified for future bicycle facilities. The assessment team noted that Centre Street and Winchester Street operate parallel to Harvard Street to the west and may provide an alternate route for bicyclists routing around Coolidge Corner.

### *Curb Ramps*

Members of the assessment team noted that some of the pedestrian ramps within the study area do not appear to meet accessibility standards. Curb ramps should be reconstructed to meet current accessibility standards. The assessment team discussed shortening crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.

### *Signal Operations*

At signalized intersections, concurrent pedestrian phases are generally provided along the Harvard Street corridor. Accessible pedestrian signals were observed at signalized intersections within the study area. However, countdown pedestrian indications were not provided. The assessment team recommends replacing the pedestrian signal indications with countdown indications.

### *On-Street Parking*

The Town continues to make policy changes to increase the turnover of on-street parking, including wayfinding, changing the length of time of parking meters at on-street and off-street parking areas, increasing parking rates, and making off-street parking areas easier to use. Following the implementation of these latest policy changes, the Town should conduct a parking utilization study to assess parking availability as well as how much traffic is generated from circling visitors and employees looking for available meters.

### *Transit Facilities*

Harvard Street is a key bus route for the MBTA Route 66. Bus stops are located at several intersections along the assessment area. The team considered reviewing if far-side bus stops can replace near-side bus stops. Far-side bus stops are recommended to allow for buses to drop passengers off after a signalized intersection without impeding traffic while simultaneously allowing pedestrians to cross behind the bus at a crosswalk.

### **Short-term Recommendations:**

- Conduct a traffic analysis of the corridor and surrounding street network for potential mitigation of traffic flow along the corridor;
- Reduce pedestrian tripping hazards by replacing sidewalk panels and further implementing the Town's pervious tree grate program;
- Develop strategies to improve the quality and health of street trees, such as installation of permeable pavement;
- Identify citizen or business sponsors to install, program, and maintain parklets in high pedestrian areas;
- Add bicycle left-turn queue boxes, where feasible;
- Modify the "WALK YOUR BIKE" signs or rotate the signs to clarify the circumstances in which bicyclists should walk their bikes;
- Install additional bike parking or on-street bike corrals in convenient and visible locations throughout the study area;
- Install pedestrian countdown indications at signalized intersections; and
- Review or reevaluate far-side bus stops to replace existing near side bus stops.

### **Long-term Recommendations:**

- Provide continuous separated bike lanes or bike lanes throughout the study area by conducting further analysis on the potential to narrow travel lanes, remove travel lanes, or remove parking;
- Further study feasibility of relocating on-street parking north of Beacon Street to Centre Street parking lot to provide wider sidewalks and high quality bicycle facilities;
- Provide bicycle facilities on nearby Centre Street, Winchester Street, and Park Street which may provide an alternate route for bicyclists routing around Coolidge Corner;
- Reconstruct curb ramps to meet accessibility standards; and



- Shorten crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.

## Harvard Street at Longwood Avenue

### Existing Conditions and Operations

Longwood Avenue serves as a key connection to the Longwood Medical Area. The intersection of Harvard Street and Longwood Avenue is transitional, as the roadway lanes are differentiated to the north and south of the intersection. South of Longwood Avenue, a parking lane, painted bicycle lane, and through lanes are provided in each direction. North of Longwood Avenue, a bicycle lane, through lane, and left turn lane are provided in the southbound direction, while a through lane and shared through/right turn lane is provided in the northbound direction. Illegally parked trucks on the west side of Harvard Street between Longwood Avenue and Beacon Street complicate traffic operations and create a hazard for bicyclists. The assessment team discussed the potential to signalize the intersection and coordinate it with Beacon Street due to the high number of left turning vehicle from Harvard Street to Longwood Avenue. The assessment team noted that the close proximity of the intersection with Beacon Street causes vehicles to block Longwood Avenue while queued at Beacon Street. The assessment team discussed adding 'Don't Block the Box' markings and signs to mitigate this issue.

Longwood Avenue intersects Harvard Street at a skew. The assessment team noted that this alignment creates challenging sight lines, especially for vehicles trying to turn left out of Longwood Avenue. The assessment team discussed restricting left turns from Longwood Avenue onto Harvard Street southbound. With this restriction, an increase in vehicles turning left from Sewall Avenue is anticipated. Additional analysis is required to evaluate the intersection of Harvard Street/Sewall Avenue which is outside the study area of this assessment.

Pedestrians are currently accommodated via an unsignalized crosswalk across Harvard Street as well as a crosswalk across Longwood Avenue. The BPD staffs a Police Officer at the intersection every weekday during peak evening hours to assist and direct traffic. The assessment team noted that the length of the crosswalks contribute to high pedestrian exposure. Curb extensions or pedestrian crossing islands should be considered to reduce the crossing distance where such treatments would not interfere with current or future bicycle facilities, which are presently under consideration by the Brookline Transportation Board.

During off-peak times, pedestrians are at potential risk when using the crosswalk on Longwood Avenue. Drivers wait and inch through the crosswalk when trying to turn left from Longwood Avenue to Harvard Street. These drivers are looking for gaps in vehicular traffic on Harvard Street and not people walking in the crosswalk. The assessment team saw several near misses despite the presence of two police officers. The assessment team recommends additional pedestrian improvements such as in-street warning signs. In-street warning signs should be installed on both the Harvard Street and Longwood Avenue crosswalks.

The assessment team noted that the southbound bicycle lane approaching Longwood Avenue is often blocked by delivery trucks. The team discussed narrowing travel lanes to widen the bicycle lane and allow for the installation of delineator flexible posts (flexposts) to restrict illegal parking. The assessment team noted that 'Warning Bicycle' signs are installed where existing bike lanes are present. The warning signs should be removed and replaced with a bike lane sign.

The Bicycle Advisory Committee is currently working on a recommendation to install a bike box across both travel lanes on Harvard Street at Beacon Street southbound. The left-lane bike box would indicate on the ground that bicyclists should stay in the left lane to make a left onto Longwood Avenue or use the right lane bike box for through or right turn movements. The assessment team supports the bicycle box and recommends that the Town submit a formal MUTCD experimental request for the bicycle box.

### Short-term Recommendations

- Further study the potential to signalize the intersection and coordinate with the intersection of Beacon Street;
- Add 'Don't Block the Box' markings and signs that conform to the latest version of the MUTCD ;
- Restrict left turns from Longwood Avenue onto Harvard Street southbound;
- Further evaluate the intersection of Harvard Street/Sewall Avenue for an increase in left turning vehicles;
- Install in-street warning signs on the Harvard Street and Longwood Avenue crosswalks;
- Widen bicycle lane by reducing width of travel lanes and install flexposts;
- Remove warning signs and replace with a bike lane sign; and  
Install wayfinding signage on southbound Harvard Street north of Beacon Street to inform drivers of the need to position for a left turn onto Longwood Avenue prior to Beacon Street.

### Long-term Recommendations

- Shorten crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.

## Harvard Street at Beacon Street

### Existing Conditions and Operations

The intersection of Harvard Street and Beacon Street is a complex signalized intersection. The intersection accommodates motor vehicles on Harvard Street and Beacon Street, pedestrian movements, bicyclists, and the MBTA's Green Line. The MBTA Green Line light rail operates along the center of Beacon Street. The Town informed the assessment team that observed vehicle speeds averaged between 12-14 mph for vehicles traveling on Harvard Street between Beacon Street and Green Street. All approaches to the intersection add travel lanes to accommodate turning lanes that are dropped following the intersection. The assessment team questioned if these turning lanes were necessary or if they could be modified to add bike lanes.

The assessment team noted that motorists do not often utilize the marked right turn lane on the Beacon Street westbound approach. The assessment team discussed reallocating the space for bicycle facilities. The Town of Lexington is piloting a lane removal on Massachusetts Avenue with flexposts and temporary pavement markings. The Town of Brookline may want to use this strategy to test the change in travel lanes. In addition, the assessment team discussed that left-turn queue boxes may be added for the Beacon Street approaches to be used by bicyclists turning left from Harvard Street to Beacon Street.

Within the intersection and on the Harvard Street southbound approach, small median islands are provided. The assessment team discussed removing the islands and reallocating the space to other users or redesign them as pedestrian crossing islands.

### *Pedestrian Crossings*

The assessment team noted that the crosswalks at the intersection of Harvard Street and Beacon Street consist of the longitudinal white lines with red imprinted brick pattern between the lines. The assessment team discussed replacing the crosswalks with high visibility ladder style crosswalks similar to the rest of the assessment area. This could be done when existing crosswalks are scheduled for repainting.

The assessment team noted high pedestrian delay at the intersection of Harvard Street and Beacon Street. Pedestrians were observed crossing against the pedestrian indications. The assessment team suggested that pedestrians should be able to cross Beacon Street in one stage and not wait within the Green Line reservation. The assessment team noted that conflicts occur between right turning vehicles and concurrent crossing pedestrians. The intersection has leading pedestrian intervals (LPIs). The assessment team noted the LPIs should be extended at this intersection.

The assessment team observed opportunities where pedestrians could be crossing but were not provided with the walk pedestrian indication. The assessment team discussed that the pedestrian crossing times should be maximized for all approaches.

The assessment team observed and discussed that motorists make quick changes in lanes as they approach Longwood Avenue from the north. The team suggested adding wayfinding signs on southbound Harvard Street north of Beacon Street to better inform drivers of the need to position for a left turn onto Longwood Avenue prior to Beacon Street.

### **Short-term Recommendations**

- Reduce width of travel lanes on Harvard Street and Beacon Street to provide continuous bike lanes;
- Remove right-turn lane and allocate the space for bicycle facilities for the Beacon Street westbound approach;
- Install left-turn queue boxes on Beacon Street for bicyclists to turn left from Harvard Street;
- Remove or redesign the two existing small islands on the Harvard Street at Beacon Street intersection;



- Replace the existing crosswalks with high visibility ladder style crosswalks;
- Study providing one stage pedestrian crossings across Beacon Street; and
- Extend leading pedestrian intervals;
- Maximize pedestrian crossing times for all approaches; and
- Install bicycle box for the Harvard Street southbound approach to Beacon Street.

## Harvard Street at Green Street

### Existing Conditions and Operations

The intersection of Harvard Street and Green Street is an unsignalized intersection with Green Street operating as a one-way street from Harvard Street. South of the intersection with Green Street, Harvard Street transitions to and from additional travel lanes to accommodate turning lanes through the intersection of Beacon Street. Green Street has a marked crosswalk on the north side of Green Street where Harvard Street narrows back to one travel lane in each direction with bike lanes and on-street parking on both sides. Flexposts are provided along the double yellow center line to restrict vehicles traveling southbound on Harvard Street from turning left onto Green Street. The Town has conducted a study at this intersection and continues to evaluate the recommendations.

The assessment team noted that pedestrians waiting to cross Harvard Street at Green Street towards the east are blocked by parked vehicles. The assessment team discussed adding curb extensions and restricting parking 20 feet prior to the crosswalk to increase pedestrian visibility. If such treatments are installed, they should not interfere with current or future bicycle facilities.

The assessment team discussed evaluating adding a contraflow bicycle lane on Green Street to facilitate two-way bicycle connectivity to and from the BU Bridge. If a contraflow bicycle lane is added to Green Street, additional intersection improvements may be necessary at Beacon Street and Harvard Street.

### Short-term Recommendations

- Evaluate adding contraflow bicycle lane on Green Street and potential intersection improvements at Harvard Street and Green Street.

### Long-term Recommendations

- Shorten crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.

## Harvard Street at Babcock Street

### Existing Conditions and Observations

The intersection of Harvard Street and Babcock Street is a signalized intersection. The Harvard Street southbound approach has an exclusive left-turn travel lane, a through travel lane, and bike lane. The Harvard Street northbound approach has a through travel lane and an exclusive right turn lane. Due to the offset intersection, a hatched out area is provided in the middle of the roadway creating a narrowing 2.5-foot bike lane. The assessment team discussed adjusting the pavement markings to provide a minimum of a 5-foot bike lane.

The current signal operation has a leading left-turn phase. The assessment team discussed switching to a lagging left-turn phase to reduce pedestrian delay. People waiting for the pedestrian signal don't always realize that there is a green arrow for left-turning vehicular traffic. A lagging left-turn phase would allow the pedestrian WALK signal begins a few seconds before the vehicular green for turning movement to reduce the conflict of left-turning vehicle and pedestrians.

The assessment team discussed the presence of the Centre Street parking lot exit driveway located north of the intersection of Harvard Street and Babcock Street. The team noted concerns with sight distance and conflicts between pedestrians, bicyclists, and motorists. The assessment team discussed the potential to close the parking lot exit to Harvard Street allowing vehicular access onto Centre Street only. If closing the exit driveway isn't feasible, the assessment team discussed restricting parking by removing adjacent parking meters, adding no parking pavement markings, and adding no parking signs to increase visibility exiting drivers and oncoming motorists and bicyclists.

The assessment team discussed the existing driveway from the Centre Street parking lot. The Town of Brookline is undertaking a comprehensive alternatives analysis for potential improvements to the Babcock Street corridor. The assessment team noted that coordination is necessary at the intersection with Harvard Street based on the selected Babcock Street alternative.

### Short-term Recommendations

- Adjust pavement markings to provide a minimum of a 5-foot bike lane by narrowing the travel or parking lane;
- Modify signal to lagging left-turn instead of leading left turns to allow people waiting to cross first; and
- Close exit driveway from Centre Street parking lot or restrict parking by removing adjacent parking meters, adding no parking pavement markings, and adding no parking signs.

### Long Term Recommendations

- Coordinate intersection improvements with the selected Babcock Street alternative.

**Appendix A** lists all the observations and recommendations that were discussed during the assessment and described in the previous sections. The observations and recommendations are divided by location. For each observation and recommendation, the appendix includes the estimated time frame for completion, estimated construction costs, and the responsible agency. The time frame is categorized as short-term (0 to 3 years) or long-term (>3 years). The costs are categorized as low (<\$10,000), medium (\$10,001 to \$50,000), or high (>\$50,000).

**Appendix B** provides a toolbox of pedestrian facilities that summarizes typical treatments and provides a description. The treatments may or may not be recommendations outlined in this report. This toolkit may be used by the Town of Brookline to assist in developing a more pedestrian-friendly town.



**Appendix C** provides a toolbox of bicycle facilities that summarizes typical treatments and provides a description. The treatments may or may not be recommendations outlined in this report. This toolkit may be used by the Town of Brookline to assist in developing a more bicycle-friendly town.



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## Appendix A: Table of Recommendations

Location	Issue	Recommendation	Time Frame	Cost	Agency
Corridor-wide	Traffic Congestion	Conduct a traffic analysis of the corridor and surrounding street network for potential mitigation of traffic flow along the corridor.	Short-term	Medium	Town of Brookline
	Pedestrian Accommodations	Further study feasibility of relocating on-street parking north of Beacon Street to Centre Street parking lot to provide wider sidewalks and high quality bicycle facilities.	Long-term	Medium	Town of Brookline
		Reduce pedestrian tripping hazards by replacing sidewalk panels and further implementing the Town’s pervious tree grate program.	Short-term	Medium	Town of Brookline
		Develop strategies to improve the quality and health of street trees, such as installation of permeable pavement.	Short-term	Medium	Town of Brookline
		Identify citizen or business sponsors to install, program, and maintain parklets in high pedestrian areas.	Short-term	Medium	Town of Brookline
		Shorten crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.	Long-term	High	Town of Brookline
	Bicycle Accommodations	Provide continuous separated bike lanes or bike lanes throughout the study area by conducting further analysis on the potential to narrow travel lanes, remove travel lanes, or remove parking.	Long-term	Medium	Town of Brookline



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Location	Issue	Recommendation	Time Frame	Cost	Agency
Corridor-wide (continued)	Bicycle Accommodations (continued)	Provide bicycle facilities on nearby Centre Street, Winchester Street, and Park Street which may provide an alternate route for bicyclists routing around Coolidge Corner.	Long-term	Medium	Town of Brookline
		Add bicycle left-turn queue boxes, where feasible.	Short-term	Low	Town of Brookline
		Modify the 'WALK YOUR BIKE' signs or rotate the signs to clarify the circumstances in which bicyclists should walk their bikes.	Short-term	Low	Town of Brookline
		Install additional bike parking or on-street bike corrals in convenient and visible locations.	Short-term	Low	Town of Brookline
	Curb Ramps	Reconstruct curb ramps to meet accessibility standards.	Long-term	High	Town of Brookline
	Signal Operations	Install pedestrian countdown indications at signalized intersections.	Short-term	Medium	Town of Brookline
	Transit Services	Review or reevaluate far-side bus stops to replace existing near side bus stops.	Short-term	Medium	Town of Brookline/ MBTA
Harvard Street/ Longwood Avenue	Signal Operations	Further study the potential to signalize the intersection and coordinate with the intersection of Beacon Street.	Short-term	Medium	Town of Brookline
	Pavement Markings	Add 'Don't Block the Box' markings and signs.	Short-term	Low	Town of Brookline
	Intersection Operations	Restrict left turns from Longwood Avenue onto Harvard Street southbound.	Short-term	Low	Town of Brookline
		Further evaluate the intersection of Harvard Street/Sewall Avenue for an increase in left turning vehicles.	Short-term	Medium	Town of Brookline



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Location	Issue	Recommendation	Time Frame	Cost	Agency
Harvard Street/ Longwood Avenue (continued)	Pedestrian Accommodations	Install in-street warning signs on the Harvard Street and Longwood Avenue crosswalks.	Short-term	Low	Town of Brookline
		Shorten crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.	Long-term	High	Town of Brookline
	Bicycle Accommodations	Widen bicycle lane by reducing travel lanes and install flexposts.	Short-term	Low	Town of Brookline
		Remove warning signs and replace with a bike lane sign.	Short-term	Low	Town of Brookline
Harvard Street/ Beacon Street	Signage	Install wayfinding signage on southbound Harvard Street to inform drivers of the need to position for a left turn onto Longwood Avenue in order to enter westbound Beacon Street traffic	Short-term	Low	Town of Brookline
	Bicycle Accommodations	Reduce the width of travel lanes to provide continuous bike lanes.	Short-term	Medium	Town of Brookline
		Reallocate the space for bicycle facilities for the Beacon Street westbound approach.	Short-term	Low	Town of Brookline
		Remove the two existing small medians at the intersection and reallocate space to other users.	Short-term	Medium	Town of Brookline
		Install bicycle box for the Harvard Street southbound approach to Beacon Street.	Short-term	Low	Town of Brookline



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Location	Issue	Recommendation	Time Frame	Cost	Agency
Harvard Street/ Beacon Street (continued)	Pedestrian Accommodations	Replace the existing crosswalks with high visibility ladder style crosswalks.	Short-term	Medium	Town of Brookline
		Provide one-stage pedestrian crossings across Beacon Street.	Short-term	Low	Town of Brookline
		Extend leading pedestrian intervals.	Short-term	Low	Town of Brookline
		Maximize pedestrian crossing times for all approaches.	Short-term	Low	Town of Brookline
Harvard Street/ Green Street	Bicycle Accommodations	Evaluate adding contraflow bicycle lane on Green Street and potential intersection improvements.	Short-term	Low	Town of Brookline
	Pedestrian Accommodations	Shorten crosswalks with curb extensions or pedestrian crossing islands where such treatments would not interfere with current or future bicycle facilities.	Long-term	High	Town of Brookline
Harvard Street/ Babcock Street	Bicycle Accommodations	Adjust pavement markings to provide a minimum of 5-foot bike lane.	Short-term	Low	Town of Brookline
	Signal Operations	Modify signal to lagging left-turn instead of leading left-turns.	Short-term	Low	Town of Brookline
	Access Management	Close exit driveway from Centre Street parking lot or restrict parking by removing adjacent parking meters, adding no parking pavement markings, and adding no parking signs.	Short-term	Low	Town of Brookline
	Project Coordination	Coordinate intersection improvements with the selected Babcock Street alternative.	Long-term	Low	Town of Brookline

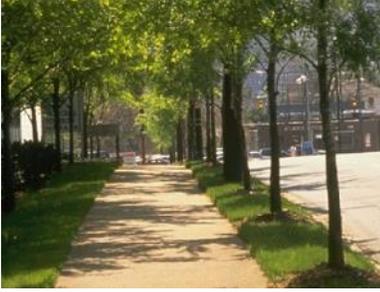
## Appendix B: Pedestrian Facility Toolbox

Facility Type	Description	Sample Photo
<p><b>Accessible Pedestrian Signals</b></p>	<p>Accessible pedestrian signals systems are the components used at a signalized intersection to alert pedestrians when they may cross a roadway. Accessible pedestrian signals may include audible and vibrating features to assist visually-impaired pedestrians.</p>	
<p><b>Crosswalk</b></p>	<p>Crosswalks indicate to pedestrians the appropriate place to cross the street and inform drivers of potential pedestrian movements in the street.</p>	
<p><b>Curb Ramp and Detectable Warning Panels</b></p>	<p>ADA-compliant curb ramps provide ramped access and detectable warning for persons with disabilities. Curb ramps are typically at least 5 feet wide with a level landing pad. Detectable warning panels should be a contrasting color to the adjacent surface.</p>	
<p><b>Curb Extensions</b></p>	<p>A curb extension is an extension of the sidewalk at intersections or mid-block to reduce the pedestrian crossing distance and provide greater visibility for pedestrians waiting to cross a street.</p>	
<p><b>Curb Radii</b></p>	<p>Modifications to curb lines or edges of the pavement at an intersection. These modifications typically are used to decrease crossing distances for pedestrians or to reduce vehicular speed by tightening the turning radii at the intersection corners.</p>	

Facility Type	Description	Sample Photo
<p><b>Edge Lines</b></p>	<p>Edge lines are solid white lines painted along the roadside curb that defines the driving lane and visually narrows the travel lane. In some cases, edge lanes may be used to create bicycle lanes.</p>	
<p><b>In-Street Pedestrian Crossing Sign</b></p>	<p>A removable high-visibility sign placed on the centerline of a street prior to a crosswalk to alert motorists to yield when pedestrians are present in the crosswalk.</p>	
<p><b>Leading Pedestrian Interval</b></p>	<p>A pedestrian crossing indication that permits pedestrians to move into the intersection 3-7 seconds before a green light is given to turning motorists that may cross the crosswalk.</p>	
<p><b>Parklet</b></p>	<p>Permanent or temporary gathering area installed in the street adjacent to the curb as an extension of sidewalk space.</p>	
<p><b>Pedestrian Hybrid Beacon</b></p>	<p>An overhead flashing beacon activated by pedestrians. The flashing lights alert motorists to yield and increase visibility of pedestrians in the crosswalk.</p>	

Facility Type	Description	Sample Photo
<p><b>Pedestrian Crossing Island</b></p>	<p>Raised median or island that provides in-street refuge at a pedestrian crossing. The crosswalk may be angled at refuge to encourage pedestrians to make eye contact with oncoming traffic.</p>	
<p><b>Pedestrian-Scale Lighting</b></p>	<p>Light fixtures used to illuminate a sidewalk or pathway typically closer to the ground and placed closer together than roadway lighting.</p>	
<p><b>Raised Intersection</b></p>	<p>A crosswalk or entire intersection raised from street-level to sidewalk-level. This elevated crossing increases pedestrian priority and visibility and slows approaching vehicles.</p>	
<p><b>Rectangular Rapid Flash Beacon</b></p>	<p>An on-demand activated flashing beacon with a “wig-wag” pattern that alerts motorists to pedestrians in the crosswalk. Typically used on lower volume and lower speed streets.</p>	
<p><b>Shared Street</b></p>	<p>The road surface is typically at the same level as the sidewalk surface to create a continuous pedestrian space. A shared street is for motorists, pedestrians, and bicyclists.</p>	



Facility Type	Description	Sample Photo
<b>Shared-use Path</b>	A two-way path that is open for bicyclists, pedestrians, and other non-motorized users. The path is typically ADA-compliant and ranges between 10 to 14 feet wide.	
<b>Sidewalk</b>	A concrete pathway adjacent to the roadway. Sidewalks must meet minimum dimensions and smoothness for ADA-compliance. They may have decorative paving or plantings and should be wider where high pedestrian volumes are present or desired.	

## Appendix C: Bicycle Design Toolbox

Facility Type	Description	Sample Photo
<p><b>Shared Lane Markings</b></p>	<p>Designate positioning for cyclists within shared travel lanes and alert drivers to the presence of cyclists. Shared lane markings should be considered temporary measures until future improvements can provide full bicycle facilities.</p>	
<p><b>Bicycle Lane</b></p>	<p>Exclusive travel lane for bicycles, typically located along the right side of the travel lanes on a two-way street, however may be located on either side of a one-way street.</p>	
<p><b>Buffered Bicycle Lane</b></p>	<p>Bicycle lane with a painted buffer separating cyclists from adjacent vehicle traffic and/or adjacent parking lanes.</p>	
<p><b>Separated Bicycle Lane</b></p>	<p>Bicycle lane protected from vehicle traffic by adjacent vertical elements, including flex posts, planters, parked cars, curbs, or raised medians.</p>	
<p><b>Bicycle Box</b></p>	<p>Advance stop bar allows bicyclists to stop at a traffic signal ahead of vehicle traffic to increase visibility and allow for left turns.</p>	

Facility Type	Description	Sample Photo
<p><b>Two-Stage Turn Queue Box</b></p>	<p>Turn box typically provided between the bicycle lane and the cross-street crosswalk allows cyclists to turn out of the bicycle lane and complete a left turn after the traffic signal cycles to the side street green phase.</p>	
<p><b>Bicycle Traffic Signal</b></p>	<p>Exclusive traffic signal for bicycle facilities allows for time separation between cyclists and vehicles, especially at locations with high turning volumes.</p>	
<p><b>High Capacity Bicycle Parking</b></p>	<p>Large bicycle racks at key locations. Bicycle racks should always be placed in areas of high visibility in order to maximize use and provide increased security.</p>	
<p><b>Bicycle Corral</b></p>	<p>Bicycle racks placed within the parking lane of a roadway. A single corral can replace one vehicle parking space with 10 to 12 bicycle parking spaces.</p>	
<p><b>Post and Ring Bicycle Parking</b></p>	<p>Individual bicycle racks typically placed along sidewalks to provide incremental bicycle parking throughout a larger area.</p>	



Facility Type	Description	Sample Photo
<b>Bicycle Wayfinding</b>	Signage provides guidance for cyclists on recommended routes to key destinations.	
<b>Curb Extensions</b>	Curb and associated accessible sidewalk ramp is extended to the edge of the bicycle lane or travel lane in order to reduce through vehicle speeds and increase visibility for pedestrians.	

## **Appendix D: Crash Data and Collision Diagrams**

SYMBOLS		TYPE OF CRASH	SEVERITY
	Moving Vehicle		# Injury
	Backing Vehicle		# Fatal
	Non-Involved Vehicle		# Property Damage Only
	Involved Pedestrian		
	Non-Involved Bicycle		
	Involved Animal		
	Direction of Motion Parked Vehicle		
	Fixed Object		

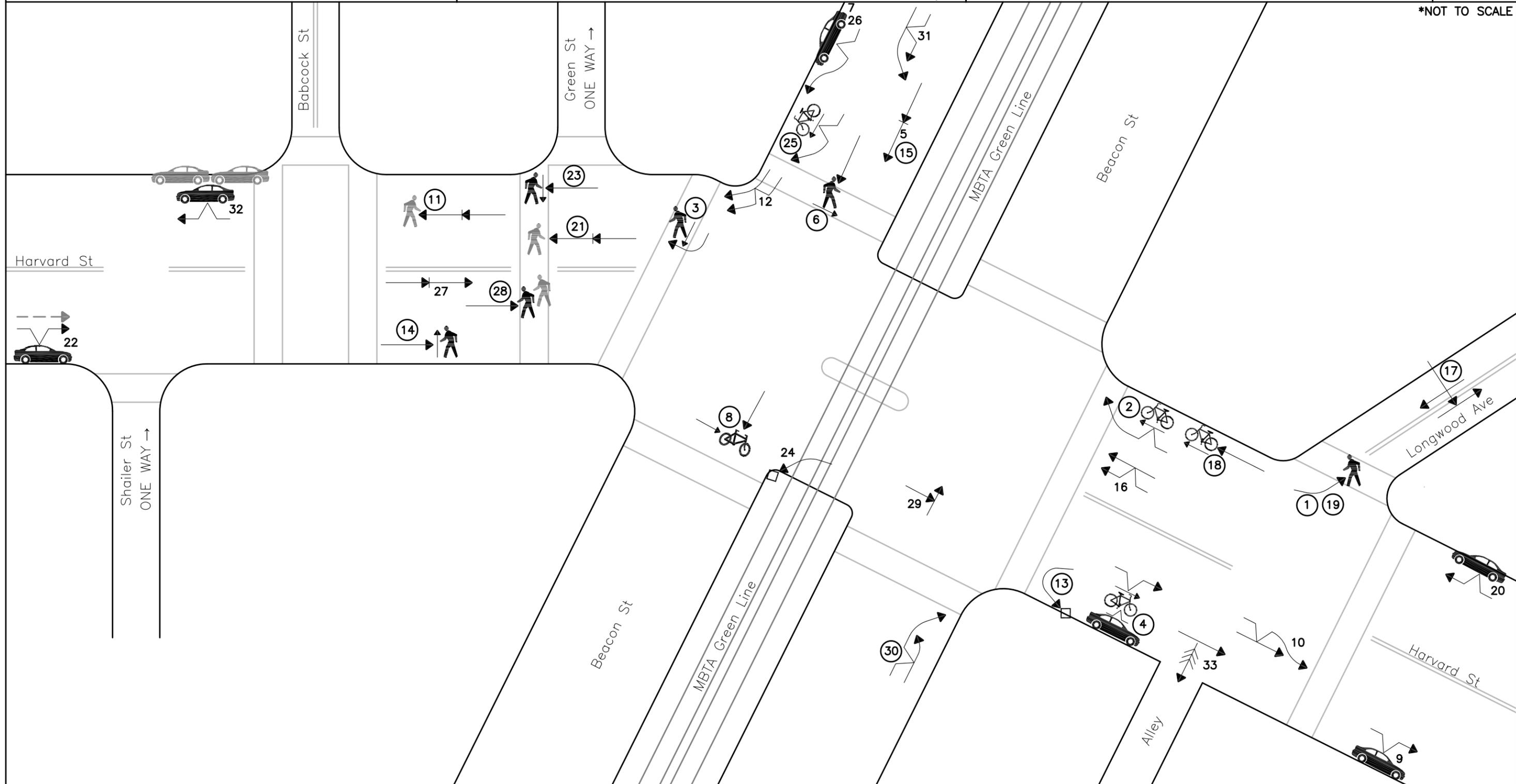
**BROOKLINE, MA**  
 HARVARD ST FROM LONGWOOD AVE TO SHAILER ST  
 REGION: MAPC

TIME PERIOD ANALYZED: 2012-2014  
 SOURCE OF CRASH REPORTS: BROOKLINE POLICE  
 DATE PREPARED: 3/31/2016  
 PREPARED BY: David Posner

SHEET 1 OF 1

COLLISION DIAGRAM

\*NOT TO SCALE



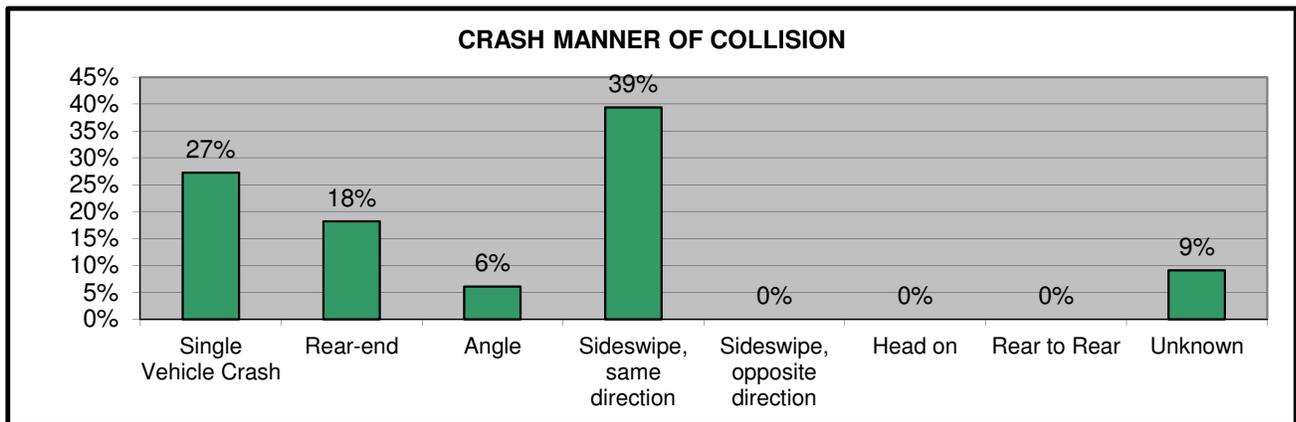
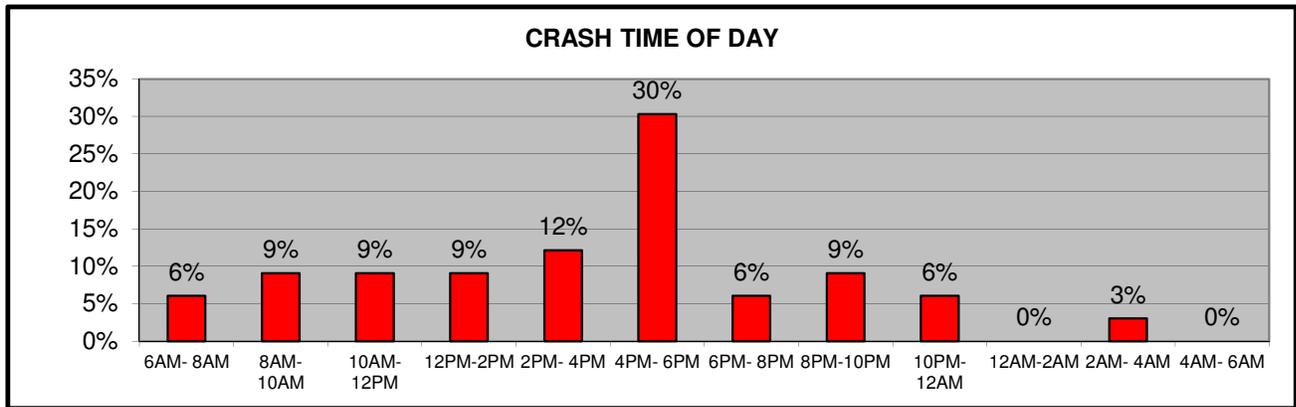
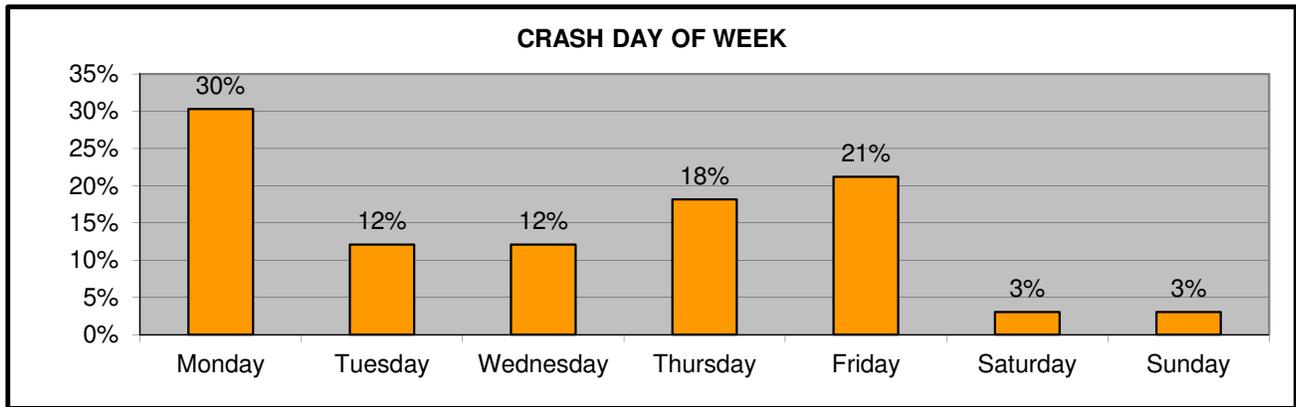
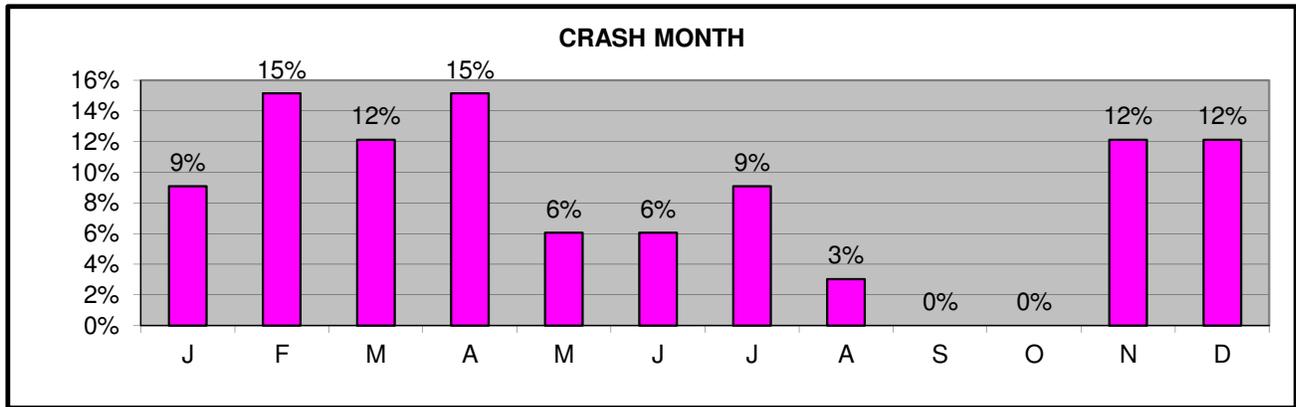
# Crash Data Summary Table

Harvard St from Longwood Ave to Shailer St, Brookline, MA  
2012-2014

Crash Diagram Ref #	Crash Date	Time of Day	Manner of Collision	Light Condition	Weather Condition	Road Surface	Driver Contributing Code	Ages		Comments	
1	01/17/2012	5:38 PM	Single Vehicle Crash	Dark - lighted roadway	Rain	Unknown	Failed to yield right of way	53	31	Driver stated they "never saw the pedestrian"	
2	02/02/2012	9:40 PM	Sideswipe, same direction	Dark - lighted roadway	Clear	Dry	No Improper Driving	23	20	Veh went around stopped bus, sideswiped motorized bike while merging into right lane to make a right turn	
3	02/12/2012	12:20 PM	Unknown	Daylight	Clear	Dry	Unknown	78	58	Distracted ped (wearing headphones) in crosswalk with "DON'T WALK" indication walked into the side of a right-turning veh	
4	04/13/2012	11:00 AM	Sideswipe, same direction	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	38	23	27	Cyclist hit head on illegally parked tractor trailer, while riding between truck and through vehicle in left-turn lane
5	05/08/2012	10:10 AM	Rear-end	Daylight	Cloudy	Dry	Followed too closely	60	27		
6	05/14/2012	4:11 PM	Single Vehicle Crash	Daylight	Rain	Wet	Failed to yield right of way	76	42	Through veh hit ped using wheelchair in crosswalk, did not see ped	
7	11/16/2012	2:00 PM	Sideswipe, same direction	Daylight	Cloudy	Dry	Failure to keep in proper lane or running off road	54		U-Haul truck sideswiped parked veh	
8	11/21/2012	5:47 PM	Single Vehicle Crash	Dark - lighted roadway	Clear	Dry	No Improper Driving	25	23	WB veh still in intersection from previous green, moving slowly with traffic; SB bike had just received green	
9	02/04/2013	1:55 PM	Sideswipe, same direction	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	40	Unk	Parked veh was town truck with amber strobe on; hit and run	
10	02/11/2013	7:20 PM	Sideswipe, same direction	Dark - lighted roadway	Snow	Wet	Failure to keep in proper lane or running off road	39	52	V1 attempted to go through from the left-turn lane, sideswiped V2 while merging right	
11	03/18/2013	11:38 AM	Rear-end	Daylight	Clear	Dry	Swerving or avoiding due to wind, slippery surface, vehicle, object, non-motorist in roadway, etc.	34	23	V1 stopped for ped crossing mid-block, not at crosswalk; was rear-ended by V2	
12	04/02/2013	2:30 PM	Sideswipe, same direction	Daylight	Clear	Dry	No Improper Driving	50	39	Truck turning right from middle lane sideswiped veh turning right from right lane	
13	07/12/2013	2:30 AM	Single Vehicle Crash	Dark - lighted roadway	Clear	Dry	Made an improper turn	24		Illegal U-turn	
14	07/29/2013	10:30 PM	Single Vehicle Crash	Dark - lighted roadway	Cloudy	Dry	No Improper Driving	39	24	Drunk ped "just ran from the sidewalk into the lane of traffic without looking"	
15	08/16/2013	5:18 PM	Rear-end	Daylight	Clear	Dry	Unknown	29	57	Lead veh stopped to allow non-involved veh to parallel park	
16	01/10/2014	5:47 PM	Sideswipe, same direction	Dark - lighted roadway	Rain	Wet	Unknown	57	50		
17	01/30/2014	3:15 PM	Unknown	Daylight	Clear	Dry	Failed to yield right of way	76	71	23	Veh pulling out of driveway hit WB veh, then EB veh
18	02/19/2014	4:05 PM	Rear-end	Daylight	Rain	Wet	Operating Vehicle in erratic, reckless, careless, negligent, or aggressive manner	Unk	30		
19	03/01/2014	8:55 AM	Single Vehicle Crash	Daylight	Cloudy	Dry	Failed to yield right of way	54	40		
20	03/14/2014	7:58 AM	Sideswipe, same direction	Daylight	Clear	Dry	Failure to keep in proper lane or running off road	34	43		
21	03/31/2014	1:29 PM	Rear-end	Daylight	Rain	Wet	Followed too closely	48	47		
22	04/14/2014	9:30 AM	Sideswipe, same direction	Daylight	Clear	Dry	Failure to keep in proper lane or running off road	42		Driving in bike lane between parked cars and traffic	
23	04/24/2014	4:59 PM	Single Vehicle Crash	Daylight	Clear	Dry	Disregarded traffic signs, signals, road markings	77	33		
24	04/24/2014	6:00 PM	Angle	Daylight	Clear	Dry	Wrong side or wrong way	47		Single veh crash; Ambulance with lights and siren activated made illegal left turn, passing on the wrong side of the median, hit crosswalk signal pole	
25	06/02/2014	5:48 PM	Single Vehicle Crash	Daylight	Clear	Dry	Failed to yield right of way	59		Veh turning right into parallel parking space sideswiped bike	
26	06/09/2014	3:15 PM	Sideswipe, same direction	Daylight	Cloudy	Dry	Made an improper turn	21		Hit and run	
27	07/17/2014	9:00 PM	Rear-end	Dark - lighted roadway	Clear	Dry	Followed too closely	29	29		
28	11/03/2014	7:00 AM	Single Vehicle Crash	Daylight	Clear	Dry	Glare	54	49	Stopped for first ped, did not see second ped due to glare	
29	11/26/2014	11:00 PM	Angle	Dark - lighted roadway	Sleet, Hail, Freezing Rain	Wet	Unknown	29	28	Both drivers report having green	
30	12/11/2014	4:36 PM	Sideswipe, same direction	Dark - lighted roadway	Rain	Wet	Failure to keep in proper lane or running off road	34	40	Veh turning right from center (through only) lane sideswiped taxi pulling out of taxi stand	
31	12/16/2014	8:45 PM	Sideswipe, same direction	Dark - lighted roadway	Rain	Wet	Unknown	60	37	V1 pulling out of parallel parking space; hit and run	
32	12/17/2014	9:20 AM	Sideswipe, same direction	Daylight	Rain	Wet	Other improper action	65	31	Veh sideswiped garbage truck stopped in bike lane, truck was un-occupied, as the driver was emptying trash cans at the time	
33	12/26/2014	5:47 PM	Unknown	Dark - lighted roadway	Clear	Dry	Failed to yield right of way	46	52		

Summary based on Crash Reports obtained from the Brookline Police Department

**Crash Data Summary Tables and Charts**  
Harvard St from Longwood Ave to Shailer St, Brookline, MA



**Crash Data Summary Tables and Charts**  
Harvard St from Longwood Ave to Shailer St, Brookline, MA

