



WalkBostonTM



Green Hill Neighborhood Walk Audit Worcester, MA

November 2, 2019

With funding from the Massachusetts Department of Public Health Mass in Motion Program



MAKING MASSACHUSETTS MORE WALKABLE

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Background

On November 2, 2019, WalkBoston conducted a walk audit in the Green Hill Neighborhood of Worcester, MA. The Green Hill Neighborhood association was awarded a Transportation Justice grant from Transportation for Massachusetts (T4MA) to “reimagine” Lincoln Street from Brittan Square to the Nativity School. As a part of this grant project, Green Hill residents hope to improve the safety and comfort of the walking environment in their neighborhood. The neighborhood association has been working with students from Worcester Polytechnic Institute (WPI) to develop a re-design of Lincoln Street corridor that makes this street a better place for all road users with enhancements that support people walking, biking, and using transit.

This walk audit was completed through the Massachusetts Department of Public Health’s Mass in Motion Program, which grants funding and provides technical assistance to help communities improve access to healthy food and lead more active lifestyles. WalkBoston has been providing technical assistance to Mass in Motion projects throughout the state.

MassDOT’s crash data indicate 14 pedestrian-involved crashes in the Lincoln Street study area since 2016. In September 2019, there was a pedestrian fatality on Lincoln Street near the Catharine Street intersection. A map of the pedestrian-involved crashes along the walk audit route for the last three years is shown to the right.

The goal of the walk audit was to provide recommendations to make the Lincoln Street corridor of the Green Hill neighborhood a safe, comfortable place to walk. The Green Hill Neighborhood walk audit was conducted along Lincoln Street from Harlow Street to Catharine Street. This route was selected by the group for the focus of this walk audit due to recent pedestrian-involved crashes on this section of the corridor. Future plans of the Green Hill Neighborhood Association may include additional walk audits north on Lincoln Street to Brittan Square and around the Nativity School.



Dates: 01/01/2016-11/01/2019
-Blue circles with numbers indicate multiple pedestrian crashes have occurred at the location.
-Orange circles indicate one pedestrian crash has occurred at the location.

Key Recommendations

1. Install clearly marked, visible, accessible crosswalks at high pedestrian utilization locations along Lincoln Street
2. Enhance pedestrian visibility at existing Lincoln Street crosswalks
3. Improve the level of comfort for people walking in the Green Hill neighborhood by adding features that make Lincoln Street feel like a place for all modes of travel, not just cars
4. Implement traffic calming strategies to slow vehicle speeds on Lincoln Street
5. Improve the connection between the bus system and the pedestrian network to increase the safety of local transit users
6. Improve the connectivity and visibility of the neighborhood’s Green Hill Park entrance

Walk Audit Participants

| <u>Name</u> | <u>Organization</u> |
|-----------------------|----------------------------------------------------|
| Deb Bolz | Green Hill Neighborhood Association |
| Winifred Octave | Green Hill Neighborhood Association |
| Edith Morgan Froehlig | Green Hill Neighborhood Association |
| Yahaira Graxirena | Central Massachusetts Regional Planning Commission |
| Karin Valentine Goins | WalkBike Worcester |
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| Penelope Karambinakis | Worcester Division of Public Health |
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| Gabrielle Peloquin | Intern - Worcester Division of Public Health |
| Alyssa Llewelyn | Intern - Worcester Division of Public Health |
| Emilia Noyes | Intern - Worcester Division of Public Health |
| Amy Borg | UMass Medical School |
| Michael Montano | WPI |
| Brendan Kearney | WalkBoston |
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Walk Audit Route

Participants met at St. Bernard's Church of Our Lady of Providence Parish in the Green Hill neighborhood. WalkBoston led a Ped 101 presentation prior to the walk. Ped 101 is a pedestrian advocacy training that gives participants a basic overview of the elements of a safe walking environment and helps prepare people to speak up for walking in their community.

The walk audit started at the intersection of Lincoln Street and Harlow Street. The group traveled south on Lincoln Street to the Catharine Street intersection along the west-side sidewalk and then traveled back north on Lincoln Street on the east-side sidewalk to return to the church. Along the route, audit participants made observations and suggested recommendations to enhance the walkability of their neighborhood.



Neighborhood Characteristics

The Green Hill neighborhood is a diverse, vibrant community of Worcester that has a 480-acre public park and local restaurants and retail establishments within walking distance of many of the neighborhood’s residential streets. UMass Memorial Hospital at Haneman is also located in this neighborhood. The Green Hill neighborhood abuts Interstate 290 to the west and the Green Hill Park to the east and serves as one of the main access points to downtown Worcester. The main roadway through the Green Hill neighborhood is Lincoln Street, which is MassDOT-owned State Route MA-70.

Many residents of Green Hill neighborhood walk along Lincoln Street to access the neighborhood businesses, health care facilities, sober living houses, Worcester Regional Transit Authority (WRTA) buses, and public-school buses. Many Green Hill residents do not own personal vehicles and rely on walking and bus transit for commuting to work and accessing goods and services. A limited number of crosswalks, broken pedestrian signal heads, absent pedestrian infrastructure at bus stops, and a lack of separation from moving vehicle traffic create a low level of comfort when walking in this neighborhood.

Street Characteristics

Congestion and Speed

For most of the corridor, Lincoln Street is a two-lane minor arterial with one travel lane in each direction. Near the Catharine Street intersection and I-290, the street widens to two travel lanes in each direction. Lincoln Street has heavy traffic congestion during peak commuting times. Drivers often choose to cut through the residential streets in the Green Hill neighborhood to avoid this congestion. Residents expressed concern that vehicles travel at high speeds along this corridor during off-peak hours. On the day of the walk audit, participants used radar speed detection devices and recorded vehicle speeds in the range of 40-50 MPH, despite a 30 MPH speed limit on Lincoln Street. There are no speed limit signs posted anywhere within the study area. Wide lane widths, coupled with additional pavement to accommodate a bike sharrow and under-utilized on-street parking spaces, contribute to high vehicle travel speeds. On the morning of the walk audit, most on-street parking spaces were empty, leaving 20 feet of pavement for the vehicle travel lane.

People exiting or standing near their vehicles, parked in on-street parking spaces, have been struck by high speed vehicles on Lincoln Street. Such an incident resulted in two deaths in 2016, when two Green Hill residents were hit and killed while unloading groceries from their vehicle.



Walk audit participants recorded high vehicle speeds with radar detection devices



Lincoln Street has wide lane widths that contribute to high vehicle speeds

Sidewalks

Lincoln street has wide, well-maintained sidewalks on the west side of the corridor and many young street trees that will help separate people walking from moving vehicles once they reach full growth. The east side sidewalk is uneven in places and lacks a verge to separate people walking from moving vehicles. Lincoln Street has on-street parking along the length of the study area, with some time-limited parking spaces near the local businesses. Despite the presence of trees and on-street parking to separate people walking from vehicles, the sheer volume and speed of traffic make the walking environment feel uncomfortable.

Both the east and west sides of the Lincoln Street sidewalk have a number of street trees with tree pits in varying states of maintenance. Some tree pits have little mulch remaining and the depth of the exposed pits has created tripping hazards. A few of the tree pits also have overgrown weeds and vegetation. There are other sidewalk obstructions along the Lincoln Street corridor that include: overgrown vegetation at some residential properties, sandwich board marketing signs in front of businesses, fallen leaves, and litter.



Sandwich board signs are placed in front of business along Lincoln Street



Street trees separate people walking from moving vehicles. Additional mulch could minimize tripping hazard



The east side sidewalk of Lincoln Street is sloped in sections and is obstructed by overgrown vegetation and fallen leaves

Crosswalks

There are three crosswalks across Lincoln Street between Harlow Street and Catharine Street, which is a distance of 0.5 miles (2640 feet). Two of the three crosswalks are at signalized intersections (Harlow Street and Catharine Street) and one crosswalk is at the unsignalized intersection of Orne Street. The distance between the Harlow Street and Orne Street crosswalks is 0.2 miles (1056 feet) and the distance from the Orne Street to Catharine Street intersection is 0.3 miles (1584 feet). These distances exceed the National Association of City Transportation Officials (NACTO) recommended distance of 200 feet in highly utilized walking areas. The Orne Street crosswalk lacks advanced crosswalk signage and in-street signage, reducing the visibility of this crosswalk. Residents shared that there is poor visibility of pedestrians at these crosswalks in the evening due to dim street lighting. There are on-street parking

spaces that abut the Orne Street crosswalk, which also decreases visibility of people crossing Lincoln Street in this location.

Walk audit participants observed misalignment of tactile warning panels within curb ramps at many locations along Lincoln Street. The tactile warning panels were not aligned with the crosswalks, and instead led into vehicle travel lanes, posing a risk to persons with low-vision who utilize these panels for directional guidance when accessing crosswalks

The north-south crosswalks that allow pedestrians to cross over residential streets when moving in the north-south direction on Lincoln street have accessibility issues due to the hilly terrain of the Green Hill neighborhood. The steep slope to the east and west of Lincoln Street leads to severely slanted crosswalks in places, making it difficult to navigate for people walking with wheeled devices (wheelchairs, walkers, strollers, etc.)



Misaligned tactile warning panel at Harlow Street intersection



On-street parking is allowed to the edge of crosswalks on Lincoln Street, which limits the visibility of pedestrians



Crosswalks are steeply sloped on the hilly Lincoln Street terrain

Snow and Ice

Green Hill residents shared that snow and ice removal is a problem for people walking on Lincoln Street in the winter. Property owners are responsible for maintaining the sidewalk outside their residence or business. On the walk audit, participants observed puddled water at wheelchair ramps leading to crosswalks that likely freezes over in the winter, making much of the corridor inaccessible in both rain and snow. Residents shared that plowed snow mounds are not removed on this corridor and the stored snow causes issues with pedestrian visibility and creates a barrier to sidewalk and transit accessibility. The salting and plowing of roads also create issues with painted crosswalk and lane markings fading in the winter months.

Green Hill Park Access

Green Hill Park, a 480-acre, city-owned public green space, can be accessed from the Green Hill neighborhood via Green Hill Parkway. There is minimal signage that indicates the presence of this park and there is no wayfinding signage that would encourage people to access the park on foot. The

residents would like to see this park highlighted as a prominent feature of their neighborhood with wayfinding signage and other placemaking features. There is also a desire to include a midblock crossing at the intersection of Green Hill Parkway and Lincoln Street that would allow people to cross the street at this location to access the park.

WRTA and School Bus Service

There are three WRTA buses (Rt 14,23 and 26) that service Lincoln Street. In the study area, there is only one bus shelter at the stop near the Adcare Hospital campus. The other stops in the study area are signified by a metal post sign alone, with no places to sit and no shelter from weather. There are other bus stops along Lincoln Street that do have shelters (one near Northampton St and 2 in front of the UMass facilities at the north and south ends of the corridor). Many of the Green Hill bus stops do not have crosswalks, and transit users must navigate unsafe crossing of multiple vehicle travel lanes if they wish to cross Lincoln Street at a bus stop. Cars do not always stop for transit users who are attempting to cross the traffic lanes, creating a dangerous scenario for those walking to and from the bus on Lincoln Street.



Most Lincoln Street bus stops lack crosswalks, benches, and shelters

There is also school bus service on Lincoln Street with pickup locations that do not have marked crosswalks (at Henchman Street and Northampton Street). There is concern amongst residents for the visibility of students at bus stops and for cars that ignore the school bus STOP signs. The school bus depot is located on Crescent Street, which is to the west of Lincoln Street, leading to a high volume of school bus movement in the mornings and afternoons.



A Green Hill resident describes safety concerns for her grandchildren, who must cross Lincoln Street where this no crosswalk to get to the school bus stop

Lincoln Street Corridor-Wide Recommendations

1. Slow speeds:
 - Consider narrowing the width of the travel lanes - this could be accomplished by installing bike lanes, adding a dedicated bus lane, or moving the existing sharrow to a mid-lane position and repainting the fog line to tighten the travel lane.
 - Post 30 MPH speed limit signs along Lincoln Street and consider using speed feedback signs to slow vehicle speeds.

- Consider neighborhood slow streets approaches. More details can be found here: <https://www.boston.gov/departments/transportation/neighborhood-slow-streets>

2. Increase comfort:

- Enhance features of the verge to further separate pedestrians from vehicle traffic, especially in low parking utilization areas where street trees have not been planted. This could be done through planting more street trees or adding a protected bike lane.
- Work with the City Public Works Department to address the uneven east-side sidewalk.
- Add elements that make it feel like Lincoln Street is a place for walking for people of all ages. Age-Friendly features could include: benches for resting, pedestrian-scale lighting, and wayfinding signage.
- Evaluate city ordinances to reduce sidewalk obstructions (sandwich boards at businesses, fallen leaves, and vegetation overgrowth).
- Consider adding trash receptacles to manage littering along Lincoln Street



Reducing litter is a top concern for Green Hill residents



Vegetation overgrowth obstructs portions of the Lincoln Street sidewalk



A lighting pole and parking bollards obstruct the sidewalk at Honey Farms

3. Improve the safety and visibility of crossings:

- Evaluate the placement of additional enhanced mid-block crosswalks along Lincoln Street in high utilization areas, such as Green Hill Parkway, at bus stops, and at businesses.
- Increase the visibility of existing crosswalks with pedestrian scale lighting, raised crosswalks, in-crosswalk pedestrian signage, advanced pedestrian crossing signage, curb bump-outs to shorten the crossing distance, and rectangular rapid flashing beacons (RRFBs).
- Consider parking regulations to enhance pedestrian visibility, such as a no parking zone within 20 feet of a marked crosswalk.
- Ensure that tactile warning panels of curb ramps are ADA-compliant and appropriately aligned with marked crosswalks.

- Lengthen WALK signal time at signalized intersections to accommodate a walking speed of 3.5 feet/second. At Catharine Street, consider a 2.5-3 feet/second walking speed to give people in wheelchairs and Adcare Hospital patients and visitors longer crosswalk clearance times.
4. Snow and Ice Removal:
- Work with property owners on Lincoln Street to ensure that sidewalks are passible, crosswalks are accessible, and pedestrians are visible.
 - Consider contacting MassDOT District 3 Office to evaluate Lincoln Street/MA-70 as a pilot for the MassDOT sidewalk removal program pilot this winter.
5. Bus access:
- Enhance the pedestrian accommodations at bus stops along Lincoln Street. For the comfort of transit users of all ages, benches and weather protection could be considered at the bus stops of this corridor. Evaluate the addition of unsignalized, marked crosswalks at the marked bus stops on Lincoln Street. These crosswalks should include features that enhance visibility and safety (pedestrian scale lighting, raised crosswalks, in-crosswalk pedestrian signage, advanced pedestrian crossing signage, curb bump-outs, and rectangular rapid flashing beacons (RRFBs)).
 - At bus stops with shelters: consider including system maps and bus route information/schedules. At bus stops without shelters: consider installing new bus signs to replace those that are faded or in poor condition.

Key Intersections of Lincoln Street Study Area

Harlow Street and Lincoln Street

The Harlow Street and Lincoln Street intersection is located at the north end of the study area. This intersection has a recently upgraded signal with a pedestrian pushbutton and countdown WALK signs. These signals, however, are not Accessible Pedestrian Signals (APS) with tactical and audible crossing instructions. The crossing time at the Harlow Street intersection allows just 10 seconds to cross two vehicle travel lanes (42 feet of pavement). This pedestrian travel speed exceeds the recommended 3.5 feet/second travel time. This intersection has an exclusive pedestrian phase. No right turn is allowed at this intersection, which protects pedestrians from turning vehicles when crossing in the east-west direction at this intersection.



On-street parking within the Harlow Street intersection blocks visibility of pedestrians

The crosswalk at this intersection has high visibility continental striped crosswalk markings; however, visibility of this crosswalk is limited because parking is allowed up to the crosswalk marking. Parking is also allowed within the intersection itself, with one on-street parking spot located between the north

and south crosswalks of this intersection. The only lighting at this crosswalk, as with the rest of the corridor, is tall highway-scale street-lighting. The curb ramps had a lot of built up dirt, which led participants to infer that puddling occurs after rain or snow to block the ramp.

Intersection Recommendations

- 1. Upgrade the pedestrian signals to current APS standards.
- 2. Increase the WALK signal time to give people more time to cross at this intersection.
- 3. Adopt a parking ordinance that prohibits parking within 20 feet of a crosswalk and add features that prevent parking in this area such as flex posts or cement bollards.
- 4. Add additional pedestrian scale lighting, curb bump-outs, and a raised crosswalk at this intersection to improve the visibility of people walking.

Green Hill Parkway

The intersection of Lincoln Street and Green Hill Parkway is one of the main access points to Green Hill Park. There is no crosswalk at this intersection across Lincoln Street, and there is little signage to indicate the presence of the park.

Intersection Recommendations

- 1. Add an unsignalized, marked crosswalk at the intersection of Green Hill Parkway and Lincoln Street across Lincoln. This crosswalk should include features that enhance visibility and safety (pedestrian scale lighting, raised crosswalks, in-crosswalk pedestrian signage, advanced pedestrian crossing signage, curb bump-outs, and rectangular rapid flashing beacons (RRFBs)).
- 2. Consider placemaking features that signalize the entrance to the park such as pavement art, landscaping, and wayfinding signage.



Residents would like a midblock crossing at Green Hill Parkway



Residents want more visible signage to signify the entrance to Green Hill Park

Orne Street

The intersection of Orne Street and Lincoln Street has a marked crosswalk for people to cross Lincoln Street in the east-west direction at this location. Orne Street is in close proximity to one of the retail corridors of Lincoln Street. On-street parking is allowed to the edge of the crosswalk, which decreases the visibility of people crossing Lincoln Street at this location. There is no pedestrian crossing signage at this crosswalk.



The Orne Street crosswalk lacks elements to make it visible to drivers

Intersection Recommendations

1. This crosswalk needs features to enhance visibility and safety (pedestrian scale lighting, raised crosswalks, in-crosswalk pedestrian signage, advanced pedestrian crossing signage, curb bump-outs, and/or rectangular rapid flashing beacons (RRFBs)).

Catharine Street

The intersection of Catharine Street and Lincoln Street is at the south end of the walk audit study area. Adcare Hospital lies to the east of this intersection and Honey Farms, a convenience mart lies to the west. This intersection is also in close proximity to two WRTA bus stops. This intersection is one of the most heavily trafficked pedestrian crossing areas in the corridor and was the site of the September 2019 pedestrian fatality. This intersection is also listed as a HSIP location and one of the MA Top 200 Crash locations (2014-2016 MassDOT data)

The Catharine Street intersection has marked crosswalks at all approaches and four pedestrian pushbuttons. This is an exclusive phase signalized intersection that permits right turns on red from Catharine Street to Lincoln Street. The crossing signals at this intersection are not accessible pedestrian signals (APS). On the day of the audit, participants attempted to use the two west-side pedestrian pushbuttons, and neither were operable. One walk audit participant crossed the intersection to attempt use of the east-side pushbutton, which did work. By the time this individual had unsafely crossed the intersection to use a functional pushbutton, the



The Catharine Street intersection is a high-volume pedestrian crossing

group had waited 4 minutes and 40 seconds before we were given a WALK signal. Audit participants shared that drivers travel at high speeds down Catharine Street to catch a green light at the Lincoln Street intersection. Audit participants also shared that visibility in this intersection is very poor at night due to a lack of pedestrian scale lighting, which was a contributing factor on the night of the September 2019 pedestrian fatality.

This intersection has steep curb ramps (may not be ADA compliant) and WalkBoston staff observed an individual in a wheelchair trying to navigate the ramp when planning the walk audit. Due to the inaccessible slope of the curb ramp at the intersection's north crosswalk, the individual had to use the travel lane (after crossing four travel lanes) to access the curb ramp of the intersection's south crosswalk. Once at the curb ramp of the south crosswalk, the individual had to turn their wheelchair around in the crosswalk and reverse direction to get the leverage they needed to get up the ramp slope.

Intersection Recommendations

1. Upgrade the pedestrian signals to APS standards and allow 3.5 feet/second WALK times.
2. Evaluate signal timing and phasing of the traffic signal on Catharine Street to determine feasibility of prohibiting right turns on red.
3. Add pedestrian scale lighting to improve visibility of people walking at this intersection.
4. Evaluate the condition of the curb ramps to ensure ADA compliance.
5. Add additional features to enhance visibility and safety such as curb bump-outs.
6. Consider speed reduction strategies for Catharine Street, such as speed feedback signs

Appendix A. Terminology

Below are images and definitions of the terms used to describe the walking environment in this report.

Crosswalk and Stop Line

Crosswalks can be painted in a variety of ways, some of which are more effective in warning drivers of pedestrians. Crosswalks are usually accompanied with stop lines. These lines act as the legally mandated stopping point for vehicles, and discourage drivers from stopping in the middle of the crosswalk.



Crosswalk patterns
Source: USFHA



Crosswalk and stop line
Source: http://safety.fhwa.dot.gov/ped_bike/tools_solve/ped_scdproj/sys_impact_rpt/images/fig16.jpg

In-street Pedestrian Crossing Sign

In-street pedestrian crossing signs are used at the road centerline within crosswalks to increase driver awareness of pedestrians in the area. These signs are a relatively low-cost, highly effective tool in slowing traffic by the narrowing travel lanes. They are popular with road maintenance departments since they can be easily moved for snow removal.



Curb Ramp and Detectable Warning Strip

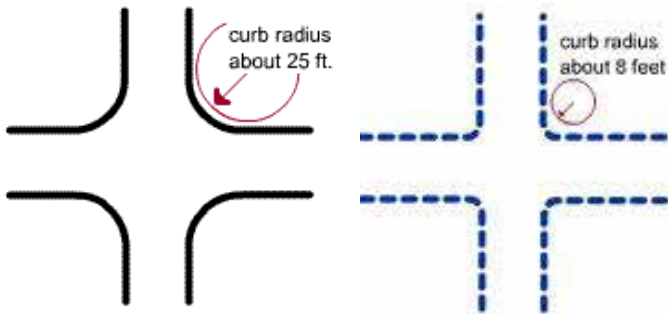
Curb ramps provide access from the sidewalk to the street for people using wheel chairs and strollers. They are most commonly found at intersections. While curb ramps have improved access for wheelchair-bound people, they are problematic for visually impaired people who use the curb as an indication of the side of the street. Detectable warning strips, a distinctive surface pattern of domes detectable by cane or underfoot, are now used to alert people with vision impairments of their approach to streets and hazardous drop-offs.



Curb ramp and detectable warning strip

Curb Radius

A longer curb radius (on the left in figure below) allows vehicles to turn more quickly and creates longer crossing distance for pedestrians. A shorter curb radius (on the right in the figure below) slows turning speeds and provides pedestrians shorter crossing distances.



There are two excellent examples of the shortening of curb radii in Woburn, MA. The first (A) is a low-cost solution using a gravel-filled zone between the original curb line and the newly established road edge. The second is a higher-cost solution using grass and trees and extending the sidewalks to the new curb. Both work to slow traffic.



(A) Gravel-filled curb extension



(B) Grass, trees and extended sidewalk in curb extension

Curb Extension/Curb Bulb-out

A sidewalk extension into the street (into the parking lane) shortens crossing distance, increases visibility for walkers and encourages eye contact between drivers and walkers.



Curb extensions are often associated with mid-block crossings

Fog Line

A fog line is a solid white line painted along the roadside curb that defines the travel lane. It narrows a driver's perspective and helps to slow traffic speeds. Fog lines are used in urban, suburban and rural locations.



Fog lines delineate the vehicular driving zone on wide roadways.