Improving Boston Transit: Expanding Bus Service in Allston-Brighton

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Projection: NAD 1983 Massachusetts Mainland State Plane

Data Sources:

Census Tracts: Tiger Line Shapefiles for Suffolk and Norfolk counties (accessed on census.gov) and Cambridge census tracts from Cambridge GIS (accessed on M drive)
Vehicle Ownership: "Household Size by Vehicle Available" American Community Survey 2010 5-Year Estimates (select tracts from Suffolk, Norfolk and Middlesex Counties) (accessed on census. gov)
Transportation Cost and Transit Ridership: Housing and Transportation Affordability Index tract data for Boston-Cambridge-Newton
Roads: MassGIS- MassDOT Roads layers for Boston, Brookline, Cambridge, Watertown, Somerville.
MBTA routes: Mass GIS- "MBTA Bus Route and Stops" and "MBTA Rapid Transit" layers
Predicted Routes for Travel by Transit or Car: Google Maps (Directions from 19-21 Portsmouth St to Longwood Playground Path)
Thumbnail of Boston Area: MassGIS- MA Towns (accessed on M drive)

Introduction

Boston's public transportation system is based on a radial pattern that creates access in and out of downtown from the North, West, and South. The MBTA green line splits into four paths the further west it gets, but it does not facilitate transit in the North-South direction. Currently, only a few bus routes (65, 66, and 86; Fig. 1) allow a rider to go from Cambridge, through Allston/Brighton, and to Brookline. Though faster than going downtown and back out again on the T, these routes are often slow because bus stops placed close together require frequent stopping, and riders usually need to make at least one transfer to get from point A to B in the Cambridge-Boston-Brookline (CBB) area. Current plans for expanding the MBTA focus on extending the green line through Somerville[1]. This will speed up travel in that area, but it does not solve the problem that it is difficult to move in the North-South direction west of Fenway.

My project proposes a new route, including the location of bus stops, to provide a faster public transportation option for residents of the CBB region. It locates a path largely in between current routes, to avoid inefficient overlaps and provide service to as many potential riders as possible. The bus travels a path similar to the recommended driving route, with the limitation that sometimes it must travel a less direct direction to avoid narrow residential roads. Fewer stops than current routes will make bus travel time more comparable to driving .

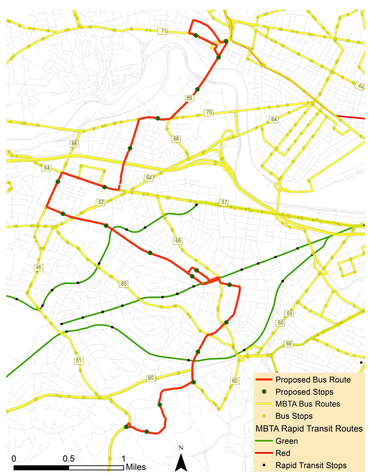

Figure 1: Proposed route and MBTA network, Bus Route Numbers shown

In addition to creating a new route, I show the importance of access to public transportation by looking at Census data related to transportation means in the region. Specifically, the smaller rate of vehicle ownership in urban areas and the annual savings associated with using transit (instead of a car) to commute to work support the creation of a new route. The bus route would encourage more residents to make use of the city's public transportation system, and provide more attractive travel options to current riders.

Methodology

Using MassGIS data, I overlaid the MBTA bus routes and stops, as well as the rapid transit lines and stops, on top of the roads in the CBB region. This revealed gaps in the transit system; I selected the roads where the bus would run, and saved the selection as a shapefile. To keep access high but travel time low, I created stops along the route about .4-.5 miles apart with the Draw toolbar.* I used Network Analyst in the MassDOT roads layer to buffer walking distance (.25 miles[2]) around my bus stops (Fig. 5), as well as .15 miles walking distance around the current bus stops (Fig 6).

To demonstrate the necessity of greater public transportation access, I used Census American Fact Finder data on vehicle number per household and calculated the percent of households with no vehicle available. I joined this attribute data to Tiger shapefiles of census tracts for my area of interest.

I also joined data from The Housing and Transportation Affordability Index to my geographic tracts to show the financial benefit of using public transit. Figure 4 shows that a sizable fraction of residents in the area commute on transit. The other map (Fig. 3) shows total annual transportation costs (car ownership and usage costs, plus transit costs) as a percentage of income for the typical household in each tract. This lets us compare transportation costs in terms of budget across households with different earnings.

Results and Recommendations

How does it Help?

The .15 mile areas around current bus stops frequently overlap, indicating that stops are usually less than .3 miles apart.** This is one of the reasons buses are much slower than driving a similar route[3]. On the new route, buffering shows that any place along the route is a comfortable walking distance from a stop, but the stops are not unnecessarily frequent. If you live directly in between consecutive stops, you'll be about .2-.25 miles from each.

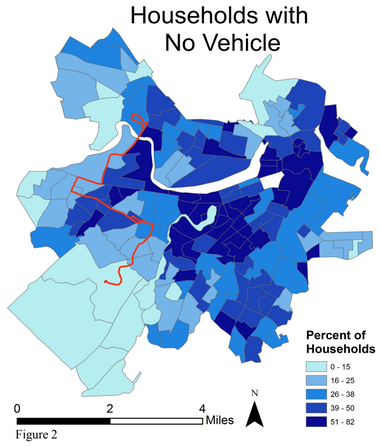

Figure 2

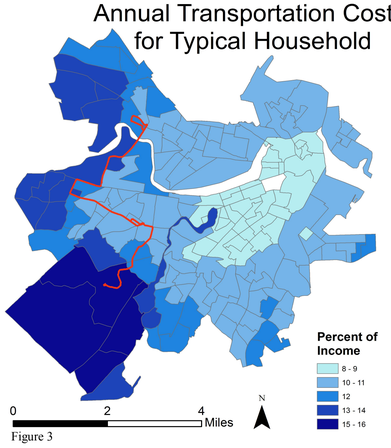

Figure 3

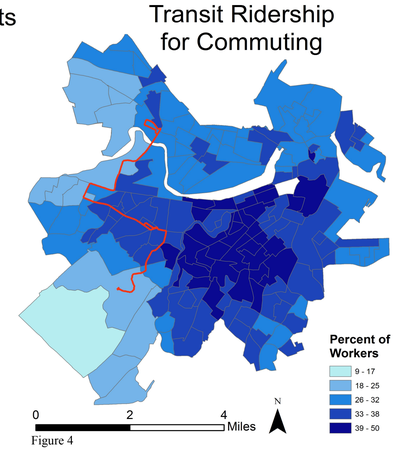

Figure 4

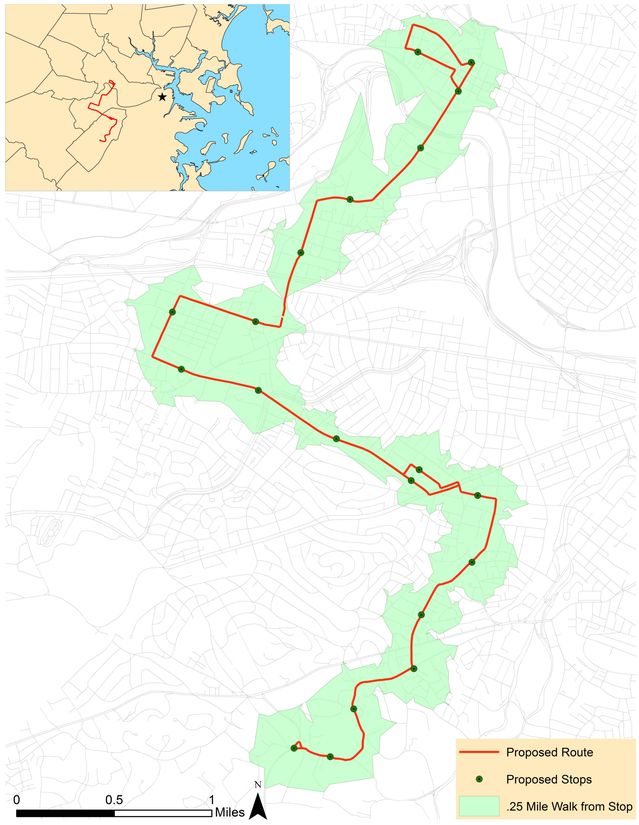

Figure 5: Proposed route and stops with "ped-shed" of walking distance from stops. Thumbnail of Boston metropolitan area

Additionally, a Google Maps analysis provides an example where my route would decrease travel time. The trip takes at least 34-38 minutes on current routes, with either 25 minutes of walking or a transfer required (Fig. 7). Using driving directions along my route, and adding .5min per stop[4] and walking time, I predict a travel time around 26 minutes (Fig. 8).

A more in-depth analysis of transit time for the proposed route would take into account variables such as traffic patterns, frequency of buses, and traffic lights along the route. This bus route should run more often during off-peak hours, because it could worsen traffic on smaller residential streets during more congested travel times.

Do We Need it?

In most of the tracts through which my proposed route runs, the percent of households without a vehicle is 16%-50% (Fig. 2). Residents of those households would benefit from a new route to expedite travel and/or reduce costs for commuting, plus accessing food sources and medical services, among other destinations. Also, in households with two or more adults and only one vehicle, residents must at least sometimes uses public transportation. Relating vehicle number and household size would provide a more in-depth analysis of the usage of public transit in the region.

The adjacent maps of annual transportation costs and workers who use transit (Figs. 3 and 4) make a compelling case for greater use of public transportation, especially to commute. In Allston-Brighton and northern Brookline the fraction of workers who use transit is especially high, frequently over 32%, and the relative transportation cost tends to be smaller. The opposite is also true, in tracts where the percent of workers commuting on transit is under 25%, the transportation costs are mostly over 13% of an household's yearly earnings.

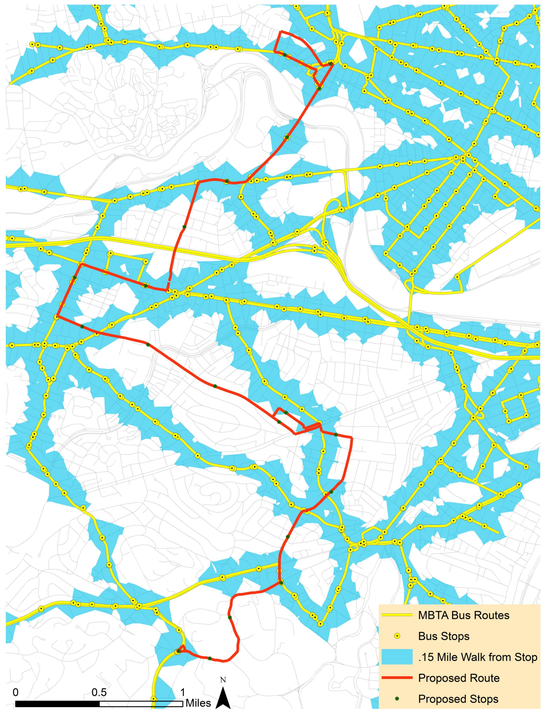

Figure 6: Current MBTA bus routes and stops with "ped-shed" of .15 mile walking distance from stops

Figure 7: Suggested transit route using Bus 66 (10-11 min) and 1.2 miles walking (25 minutes)

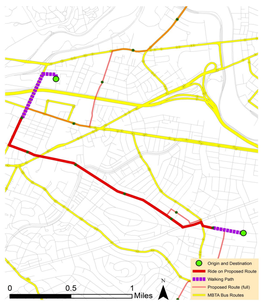

Figure 8: Path using new route (12-13 min) and .7 miles walking (14 min)

Attribute data of car ownership and transportation costs reveal the importance of attractive public transit systems in urban areas. The high travel time (compared to mileage) impedes usage of public transit for traveling North or South in the western neighborhoods of Boston. The proposed route provides easier access to residents currently in between bus routes, and the greater distance between stops will improve the overall speed of the bus.

Notes:
* To avoid clutter, I placed only one dot where I would need stops for both directions of travel. In just a few places the route splits because of one-way streets, where a dot actually represents a single bus stop.
** One of the reasons for the overlap in "walkability" radiuses is that the map includes bus stops for both directions along a route- which might not be directly across the street

References:
[1] "Project Documents." *Green Line Extension Project*. MBTA, MassDOT. Web. 27 June 2016.
[2] Walker, Jarett. "Basics: Walking Distance to Transit." *Human Transit*. 24 Apr. 2011. Web. 24 June 2016.
[3] Holeywell, Ryan. "Why Getting Rid of Bus Stops Can Improve Bus Service." *Governing*. 23 Dec. 2013. Web. 28 June 2016.
[4] "Designing Bus Routes and Schedules." *About.com Public Transport*. 10 May 2016. Web. 28 June 2016.