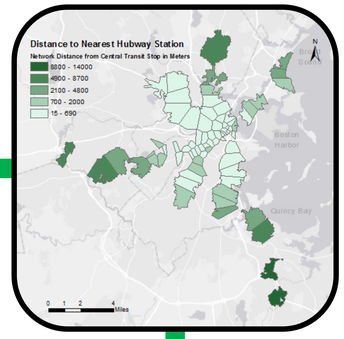
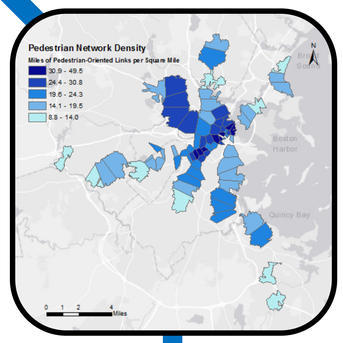
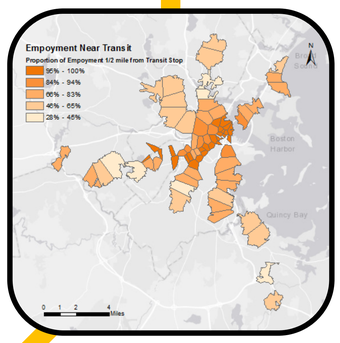
The road to Transit

Estimating the Modal Share of Access to Public Transportation in Metropolitan Boston







Introduction

Factors that affect the modal share of access to public transportation are relatively understudied due to the difficult nature of obtaining such data. Yet understanding what affects whether someone walks, cycles, or drives to a transit stop is crucial for developing a sustainable multimodal transportation system that discourages driving.

The recently completed MBTA systemwide passenger survey for 2015-2017 provides a prime opportunity for assessing which factors determine transit mode of access shares as the dataset obtained from the survey results contains transit mode of access share estimates for most stations in the MBTA network. These estimates can be used to verify and evaluate the accuracy of a model that attempts to estimate transit mode of access shares.

The following attempts to create such a model using the EPA Smart Location Database – a nationwide geographic data resource containing indicators of location efficiency.

Methodology

Only MBTA stations whose transit mode of access share estimates as determined by the systemwide passenger survey were within a 90% confidence interval were selected. Due to the large proportion of Silver Line stations below the confidence interval, the whole line was omitted from the study. Numerous Green Line stations were also not included in the model.

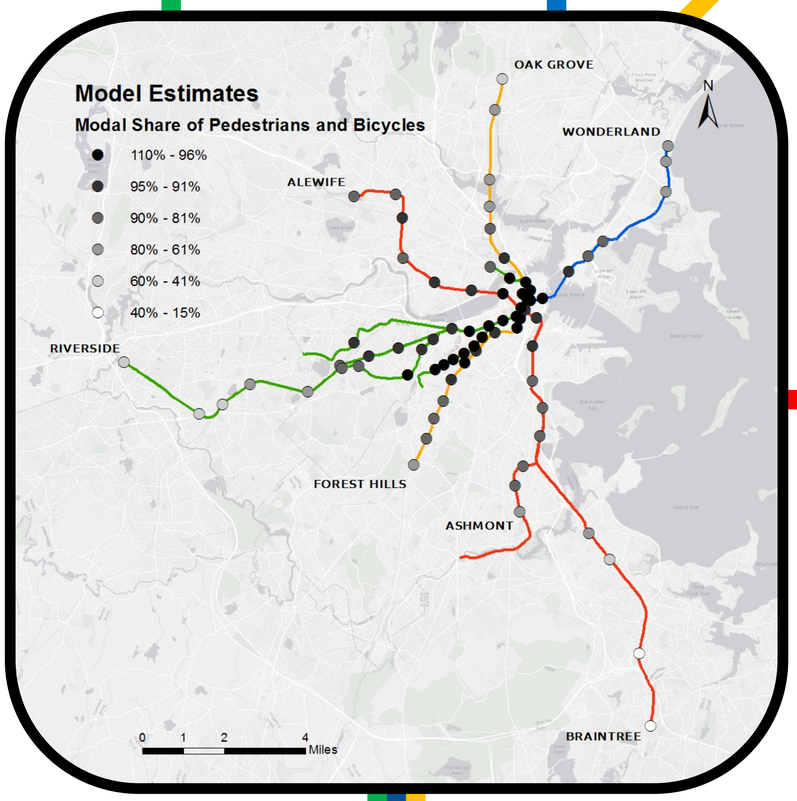
Station service areas were determined by intersecting thiessen polygons and one-mile network buffers. This ensured no service areas overlapped. A one-mile network buffer was chosen to account for potential pedestrian shortcuts not included in the network dataset. Highways and other non-walkable roadways were excluded.

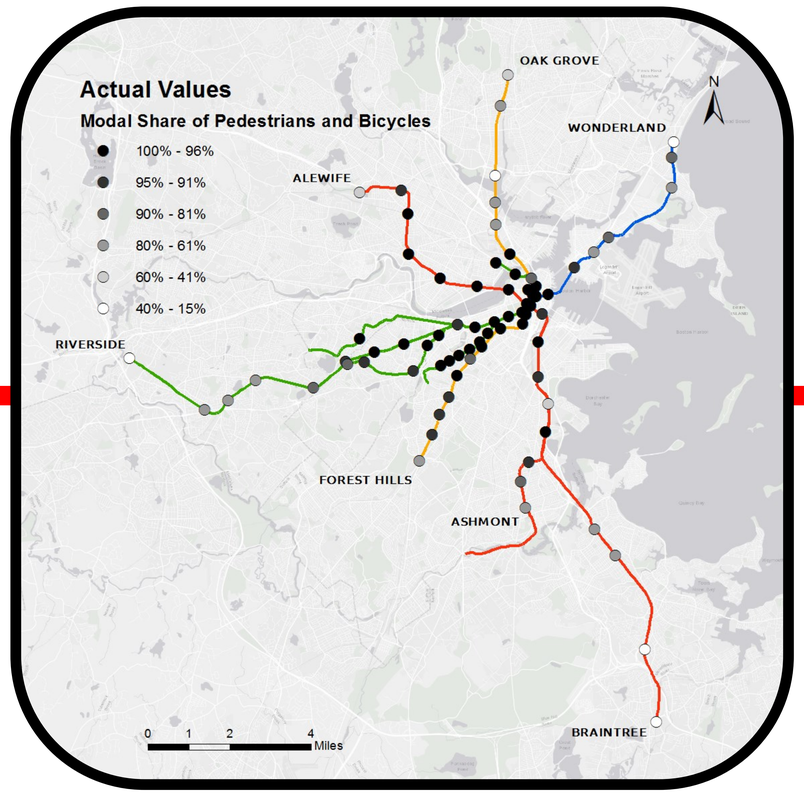
The location efficiency indicators for all of the partial or whole census block groups within the service area were averaged based on their proportional area. An ESDA was conducted to determine influential indicators. Numerous OLS models were developed, compared, and optimized.

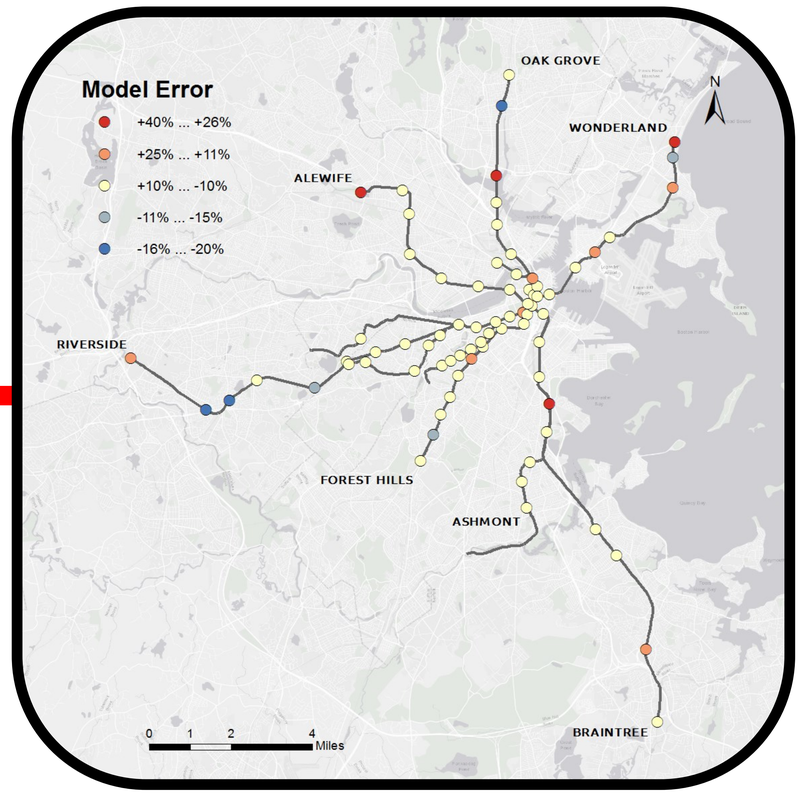
Results

Surprisingly, most indicators featured in the EPA Smart Location Database like housing density and various indicators of mixed land use were determined to be insignificant in estimating transit mode of access shares. Only two indicators – pedestrian network density and share of employment near transit – were determined to be significant. A model incorporating only those two indicators accounted for approximately 45% of the data.

To increase the accuracy of the model, two additional datasets were introduced – the number of parking spots available at each station and the network distance from the closest Hubway bike share station. Both indicators were determined to be significant but the number of parking spots was not included in the final model due to an uneven spatial distribution of errors. The final model accounts for 72% of the data and has a normal distribution of errors. Most errors are concentrated in the suburbs, suggesting these areas are in need of extended research.







Variable	Coefficient	Probability
Pedestrian Network Density *Miles of Pedestrian-Oriented Links Per Square Mile*	0.00572878	0.00701
Distance to Nearest Hubway Station *Network Distance from Central Transit Stop in Meters*	-4.78247×10^{-5}	0.00000
Employment Near Transit *Proportion of Employment 1/2 Mile from Transit Stop*	0.162178	0.03805

$R^2 = 0.721147$

$p < 0.05$

Uku-Kaspar Uustalu

GIS-0102 | 10 May 2018

Data Sources: MBTA, EPA, Hubway, ESRI

Coordinate System: NAD 1983 StatePlane Massachusetts Mainland
Projection: Lambert Conformal Conic

Tufts UNIVERSITY