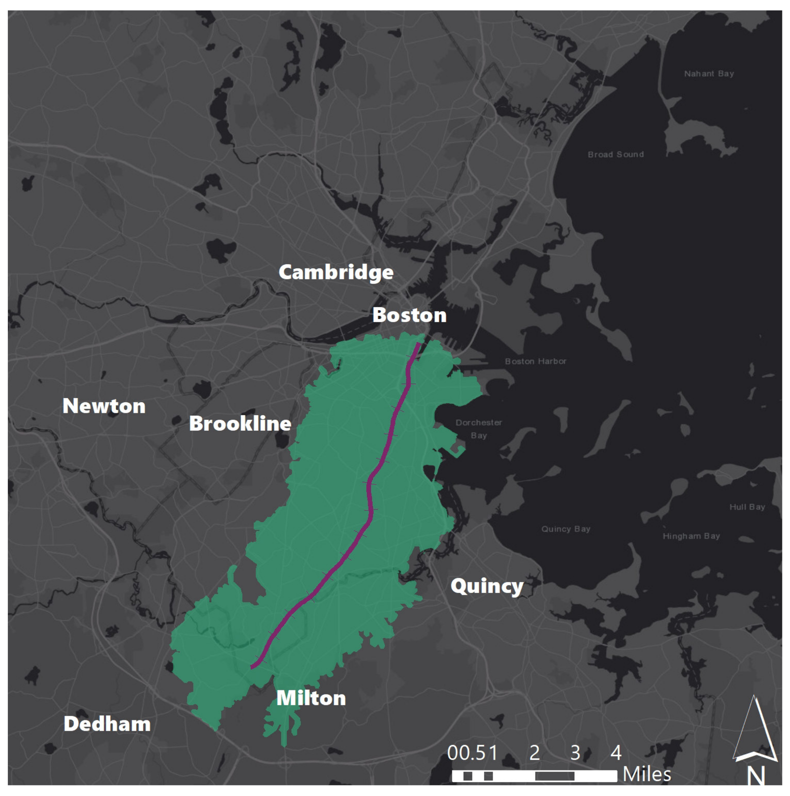
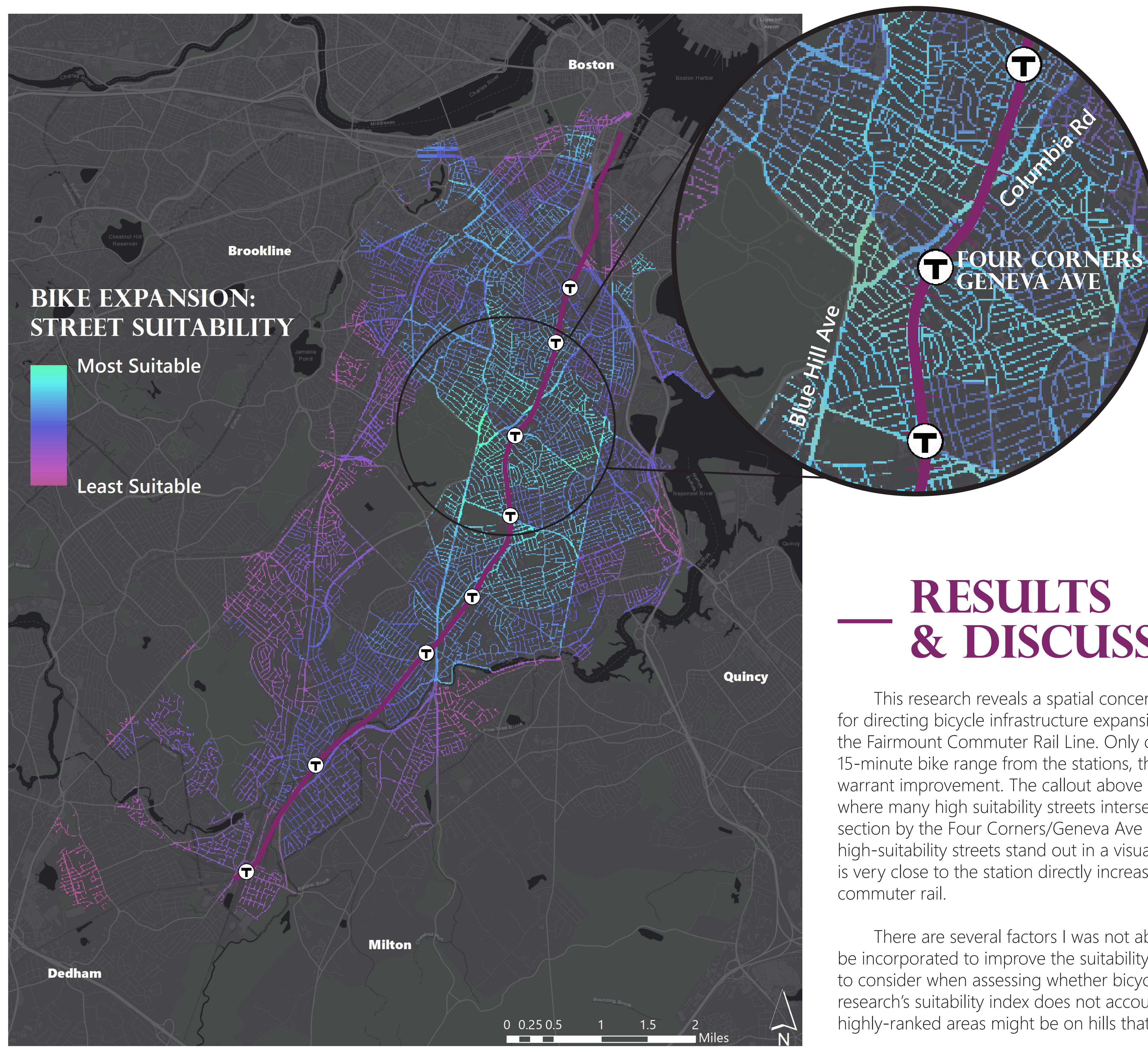
# EXTENDING THE RAIL

## A justice-oriented method for bike infrastructure expansion




## INTRODUCTION

The MBTA's Fairmount Commuter Rail line traverses the Boston neighborhoods of Dorchester, Roxbury, Mattapan, and Hyde Park, providing public transit access to downtown Boston for some of Boston's most isolated neighborhoods. The Fairmount Commuter Rail line has been the subject of much contention and advocacy, as it serves areas of Boston with high concentrations of Environmental Justice communities with limited public transportation options. Neighborhoods adjacent to the Fairmount Line have among the highest average commute times in Boston, lowest rates of car ownership, and low rates of car mode share commutes (Mattos 2019). More than 30 percent of commuters in Mattapan Square travel at least an hour to work each day compared to only 10 to 15 percent of commuters in a suburb like Needham or Newton (Mattos). Along with service improvements and new station construction, improving the bicycle infrastructure network around Fairmount Line stations will help more people utilize the commuter rail, and resolve at least a portion of the transportation deficit that burdens these neighborhoods (Kager, Bertolini, and Te Brömmelstroet 2016).

The goal of this research is to develop a method for assessing where new bike infrastructure should be prioritized. How can we expand bicycle infrastructure in a way that will be more equitable and useful for people living in the City of Boston along the MBTA's Fairmount Commuter Rail Line?

## METHODS

To identify suitable streets for bike infrastructure expansion I began by running **network analysis** using the Fairmount Line stations as nodes and streets as the network. Assuming a biking speed of 10mph, I generated **service areas** for 5 min, 10 min, and 15 min from the stations.

The 15 minute service area was used to bound the study area, and all proceeding layers were **clipped** to this 15 minute polygon.

The three distance polygons were **joined**, then **rasterized**. This resulted in a raster were pixels with values from 20 to 0. Pixels with high values indicated that they fell within the 5, 10, and 15 minute ride-sheds of multiple stations.

I used Social Explorer to retrieve the following ACS Data for Census Tracts that fell within the 15 minute bike ride service area: percentage of households with no vehicle, population density, and median income. I gathered data on bicycle Level of Traffic Stress, and the EPA's EJ Social Vulnerability Indicators.

The LTS data only included streets with bike infrastructure, so I **buffered** a TIGER streets layer and joined the LTS polylines onto the street buffers.

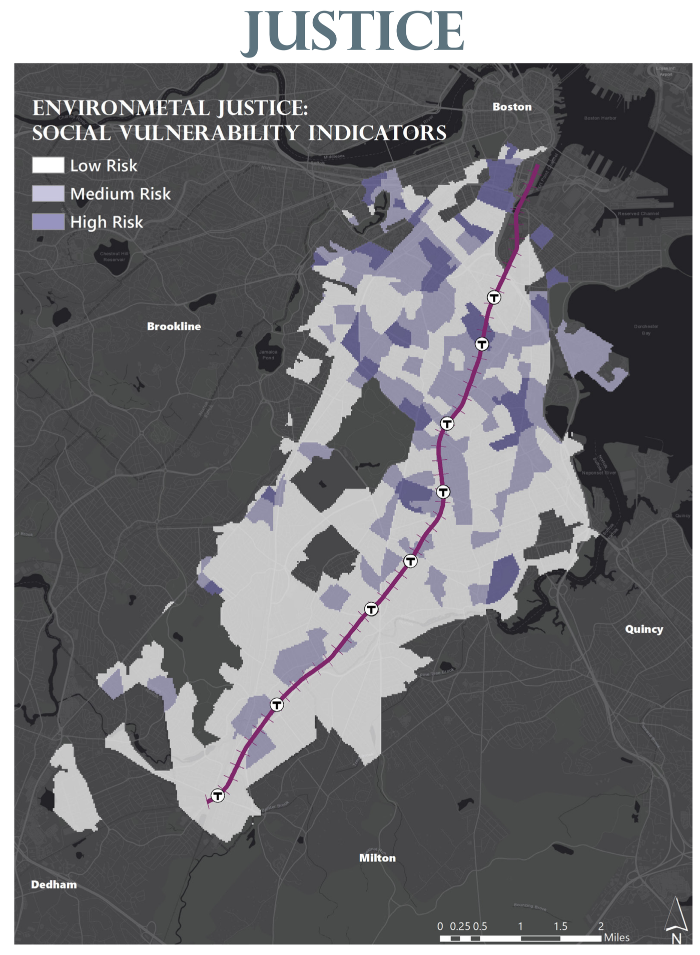
All of these layers were **converted to rasters**. These rasters were then reclassified and used in a **Raster Calculator** to identify streets with the combination of qualities that make them more or less suitable for bike infrastructure expansion.

### RASTER CALCULATOR

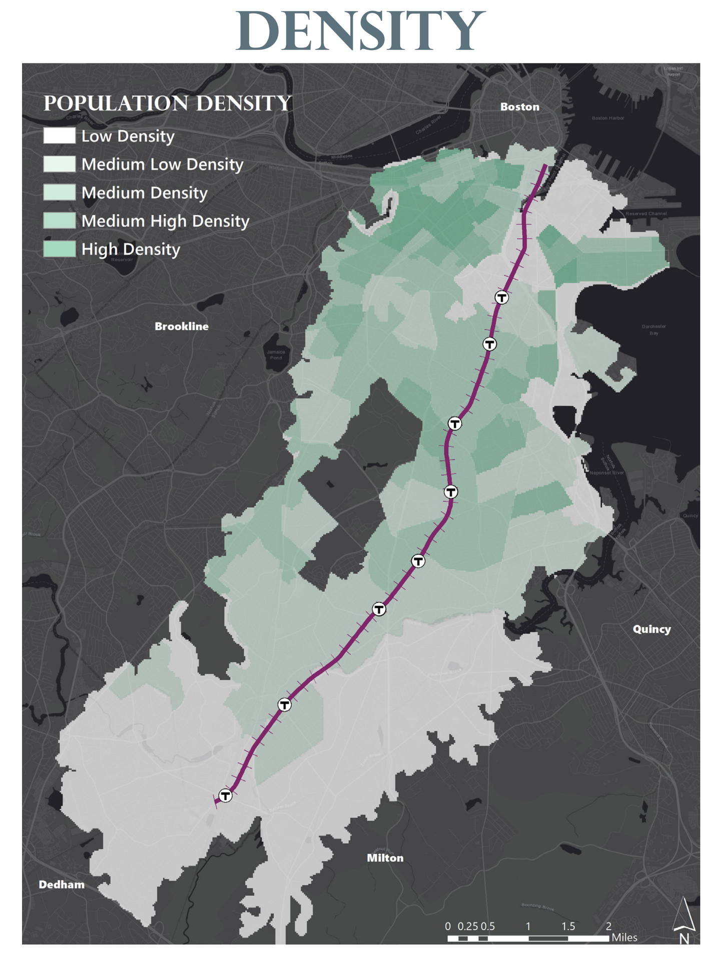
(Population Density x 50%) + (Percentage HH No Vehicle x 25%) + (Median Income x 50%) + (LTS x 20%) + (EJ Index x 50%) +(Proximity x 75%)

## SUITABILITY FACTORS

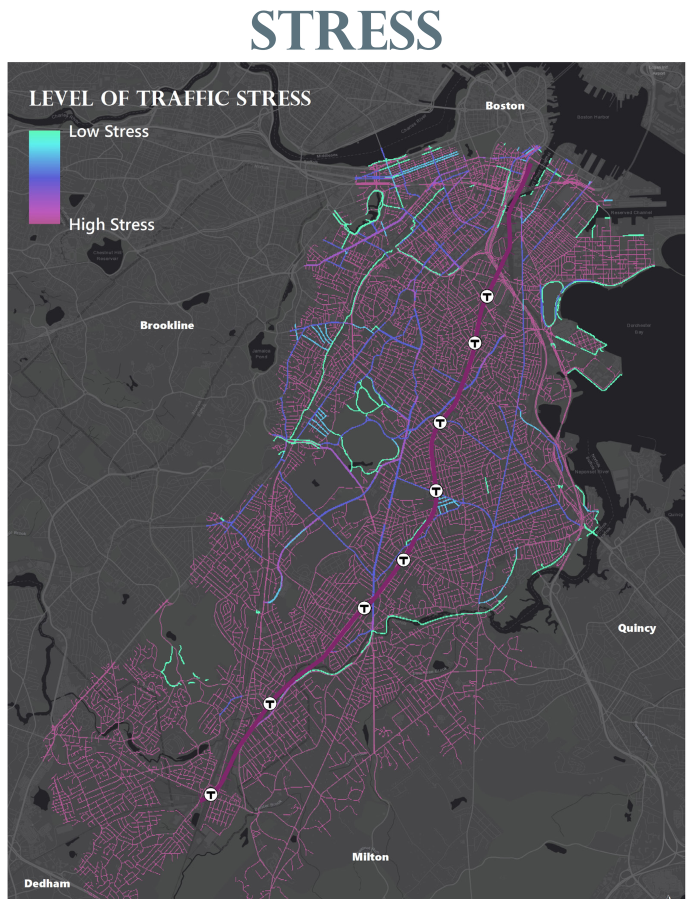
### ENVIRONMENTAL JUSTICE



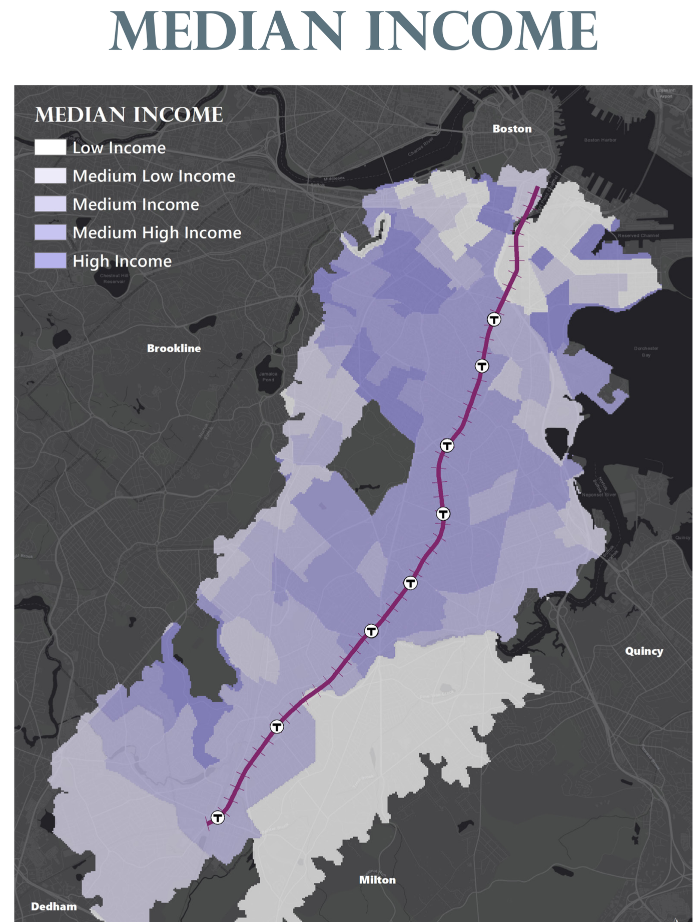

### POPULATION DENSITY



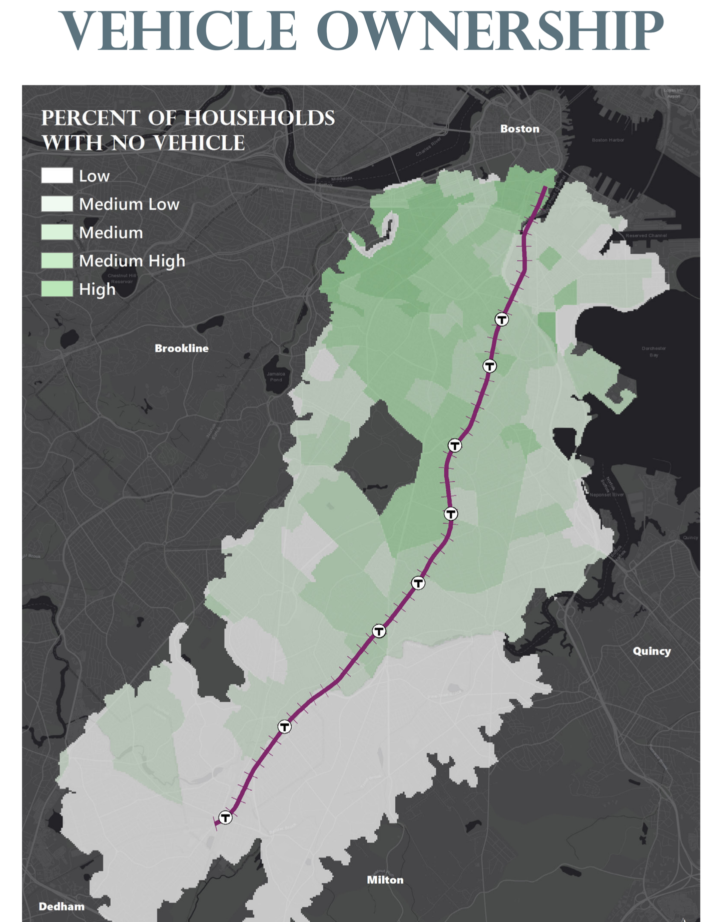

### LEVEL OF TRAFFIC STRESS



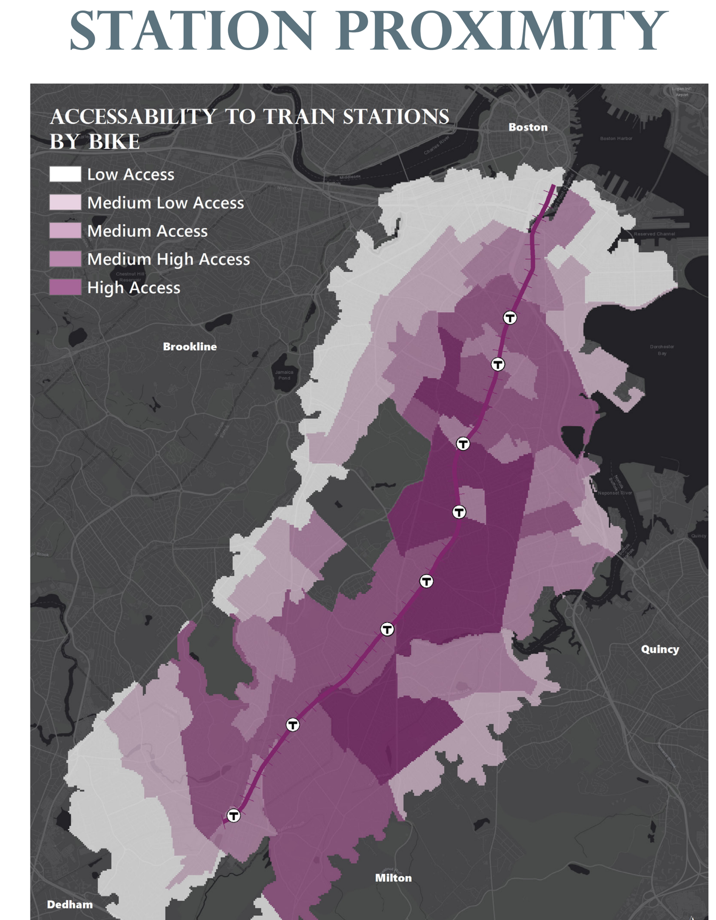

### MEDIAN INCOME




### VEHICLE OWNERSHIP




### STATION PROXIMITY




## RESULTS & DISCUSSION

This research reveals a spatial concentration of multiple important indicators for directing bicycle infrastructure expansion into the neighborhoods surrounding the Fairmount Commuter Rail Line. Only considering the roadways within a 15-minute bike range from the stations, there are already miles of roadways that warrant improvement. The callout above shows one of many sections of the map where many high suitability streets intersect. I call attention to this particular section by the Four Corners/Geneva Ave station because the concentration of high-suitability streets stand out in a visual assessment of the overall map, and it is very close to the station directly increasing the bike connections to the commuter rail.

There are several factors I was not able to include in this research, but could be incorporated to improve the suitability index. For example, slope is important to consider when assessing whether bicyclists will ride a particular route. This research's suitability index does not account for steep streets, so some of the highly-ranked areas might be on hills that are inhospitable to most bicyclists.

It is also necessary when proposing to add bicycle infrastructure that it is enmeshed in its cultural, spatial, and political surroundings (Hoffman, 2016). Activists, advocates, and researchers have drawn attention to the effects that urban infrastructure investment has on minority and marginalized populations that are frequently under resourced and left out of public decision making processes. Although the numbers might add up, and the data might point towards certain suitable areas, the local context and community should be considered in ways that are not incorporated into this research.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NAD 1983 StatePlane Massachusetts FIPS 2001 (US Feet)

Lambert Conformal Conic

Data Sources: 2017 ACS 5-Year Estimates, Analyze Boston, MassGIS


**References:**

Emery, J., Crump, C., & Bors, P. (2003). Reliability and Validity of Two Instruments Designed to Assess the Walking and Bicycling Suitability of Sidewalks and Roads. American Journal of Health Promotion, 18(1), 38–46. https://doi.org/10.4278/0890-1171-18.1.3.

Hoffmann, Melody L. (2016). Bike lanes are white lanes : Bicycle advocacy and urban planning.

Kager, R., Bertolini, L., & Te Brömmelstroet, M. (2016). Characterisation of and reflections on the synergy of bicycles and public transport. Transportation Research Part A: Policy and Practice, 85, 208–219. https://doi.org/10.1016/j.tra.2016.01.015

Larsen, J., Patterson, Z., & PhD, A. E.-G. (2013). Build It. But Where? The Use of Geographic Information Systems in Identifying Locations for New Cycling Infrastructure. International Journal of Sustainable Transportation, 7(4), 299–317. https://doi.org/10.1080/15568318.2011.631098

Lowry, M. B., Furth, P., & Hadden-Loh, T. (2016). Prioritizing new bicycle facilities to improve low-stress network connectivity. Transportation Research Part A: Policy and Practice, 86, 124–140. https://doi.org/10.1016/j.tra.2016.02.003

Mattos, T. (2019, March 28). Amidst rising commute times for all, a focus on neighborhood equity. Retrieved November 21, 2019, from https://www.bostonindicators.org/article-pages/2019/march/commute-time.