The Car Is No Longer King: An Analysis of Potential Demand for Cycling Infrastructure in Boston, MA

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Overview

The benefits of cycling for both public health and environmental sustainability are well known. Regular cycling has been shown to improve cardiovascular health and help maintain a healthy body weight.[1] When enough people cycle regularly in a city or town, cycling can also minimize vehicle traffic congestion, decrease air and noise pollution, and reduce greenhouse gas emissions.[2]

Still, bicycle rideshare in the US is extremely low– only 0.5% of commuting trips and 1% of all trips in the US are made by bicycle.[3] To increase bicycle rideshare, policymakers have begun to focus on installing bike lanes and other cycling-specific infrastructure in cities across the US. The City of Boston is no exception to this trend. Over the last several years, policymakers in Boston have installed dozens of miles of bike lanes, implemented the popular Hubway bike-sharing program, and increased efforts to educate cyclists and drivers about road safety.

Boston Bikes, the City agency tasked with planning for and promoting cycling in Boston, is currently in the process of drafting a bicycle network plan with the assistance of the Toole Design Group. My analysis aims to explore a GIS-based method for visualizing potential demand for cycling infrastructure. I hope that this analysis can help policymakers and bicycle transportation planners visualize ways to prioritize the placement and installation of new bicycle infrastructure.

Research Questions + Assumptions

My overall research question is this: Are there parts of Boston where the availability of cycling facilities is low, and potential demand for cycling infrastructure is high? This inquiry breaks down into two separate questions:

- Where is potential cycling demand highest in Boston?
- How does the existing bike network compare to potential demand?

For this analysis, I assume that people are more likely to choose bicycling as a mode of transportation for short trips of 2 miles or less. I also assume that people will choose cycling for both commuting and recreational/casual use, so my choices of cycling "trip attractors" reflect this assumption. For "trip generators," I have based my choices on the cycling literature – a range of socio-demographic characteristics have been associated with higher cycling frequency. My final assumption is that people are more likely to choose cycling when they can easily connect to the public transit network.

References

[1] Reynolds, Conor C.O., M. Anne Harris, Kay Teschke, Peter A. Cripton, and Meghan Winters. 2009. "The impact of transportation infrastructure on bicycling injuries and crashes: a review of the literature." Environmental Health, 8(47). DOI: 10.1186/1476-069X-8-47.

[2] Buehler, Ralph and John Pucher. 2012. "Cycling to work in 90 large American cities: new evidence on the role of bike paths and lanes." Transportation, 39: 409-432. DOI: 10.1007/s11116-011-9355-8.

[3] Chen, Li, Cynthia Chen, Raghavan Srinivasan, Clair McKnight, Reid Ewing, and Matthew Roe. 2012. "Evaluating the Safety Effects of Bicycle Lanes in New York City." American Journal of Public Health, 102(6): 1120-1127. DOI: 10.2105/AJPH.2011.300319.

[4] Kim, Dohyung and Nate Baird. 2011. "Bicycle Facility Demand Analysis using GIS: A Los Angeles County Case Study." Accepted for publication in *International Journal of Urban and Extraurban Studies.* 17pp.

Map data sources: ReferenceUSA, MassGIS, City of Boston DoIT, Boston Bikes, US Decennial Census 2010, American Community Survey 5-year estimates 2011.

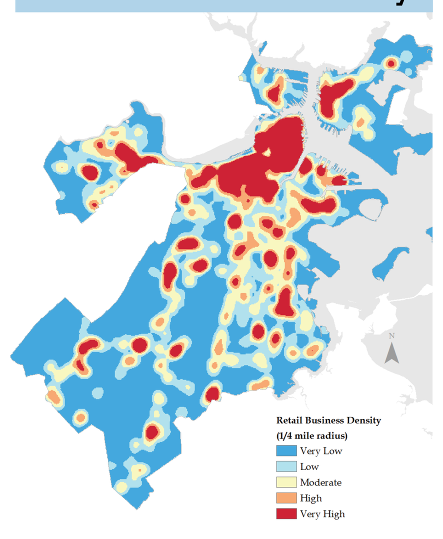
Projection: NAD_1983_StatePlane_Massachusetts_Mainland_ FIPS_2001_Feet

Analysis

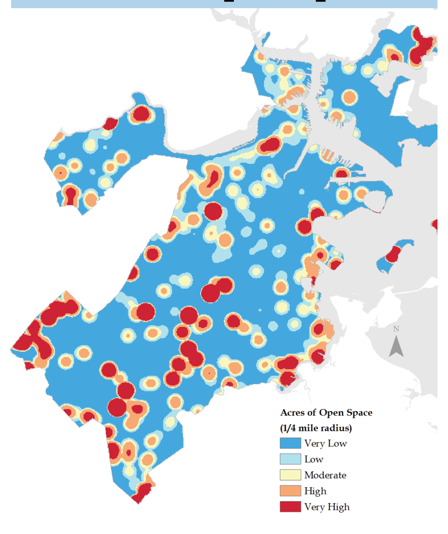
To answer my first research question, I calculated bicycle demand from a number of different data sources. I used a spatial feasibility analysis model developed by Kim and Baird (2011) in their analysis of the Los Angeles bike network as a "jumping off point" for my own analysis of cycling demand in Boston.[4]

I began by identifying cycling *trip attractors* – specific locations or parts of the city that are potential destinations for cyclists. This category was comprised of 8 different factors, including retail business density and parks.

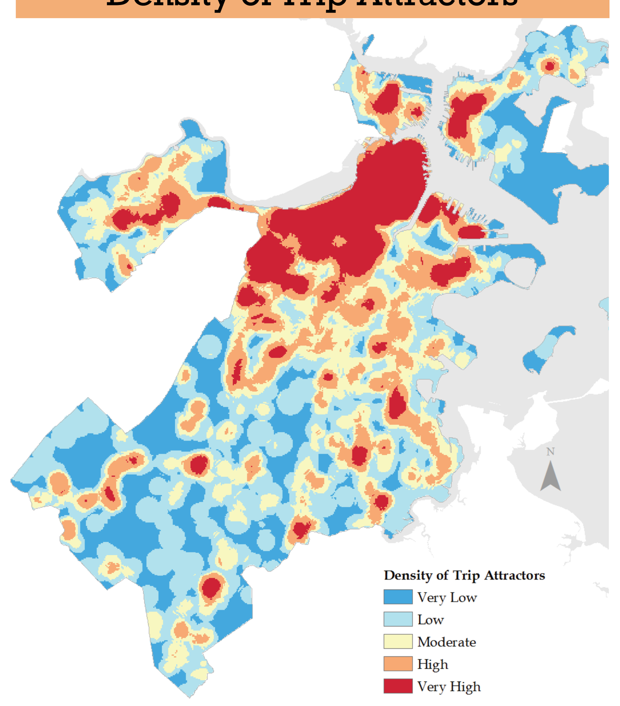
Retail Business Density



Acres of Open Space

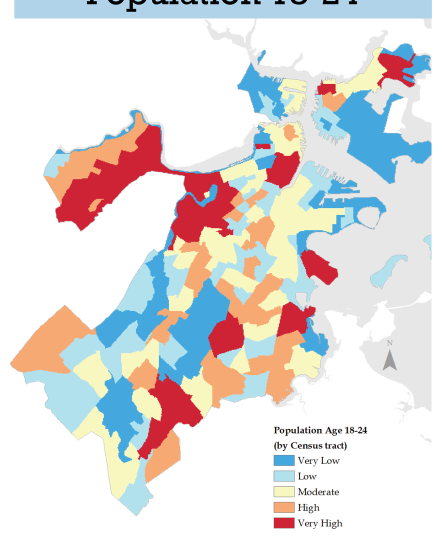


Density of Trip Attractors

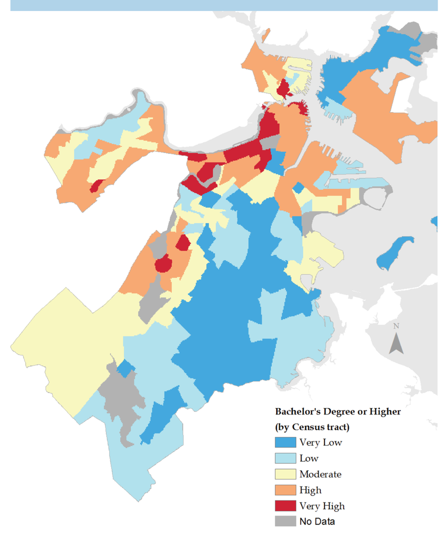


Next I identified *trip generators* – the socio-demographic characteristics that could potentially increase demand for cycling. This category was comprised of 7 different factors from the American Community Survey (ACS) and the US Decennial Census, including population age 18-24 and educational attainment .

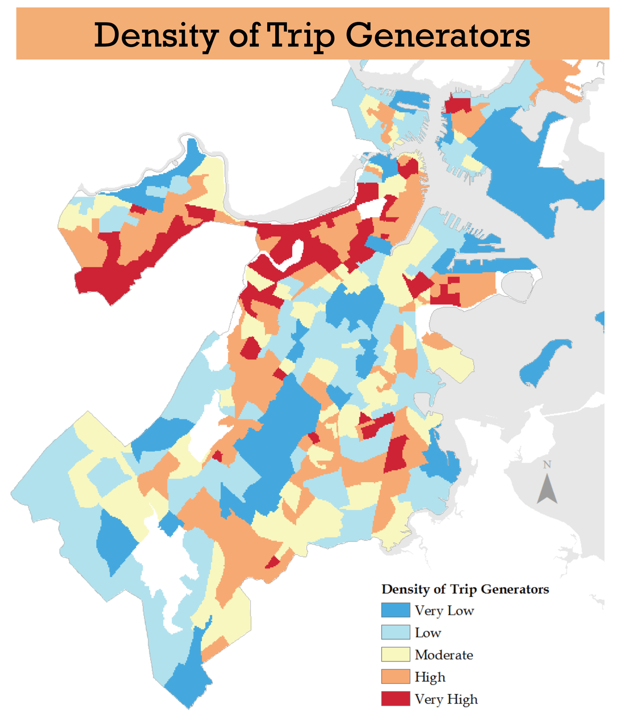
Population 18-24



Educational Attainment

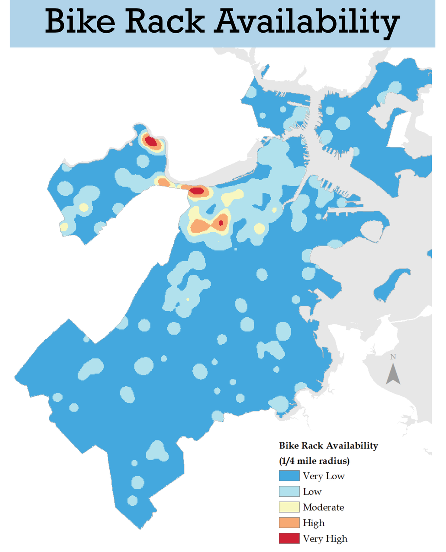


Density of Trip Generators

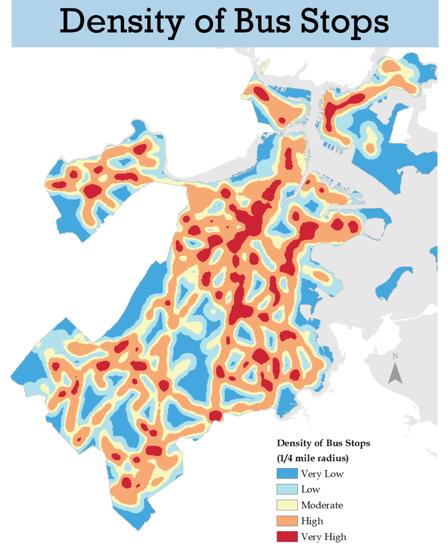


Finally, I identified 4 factors that represented *transit accessibility*. The availability of bike parking and the number of MBTA bus stops are two examples of factors in this category.

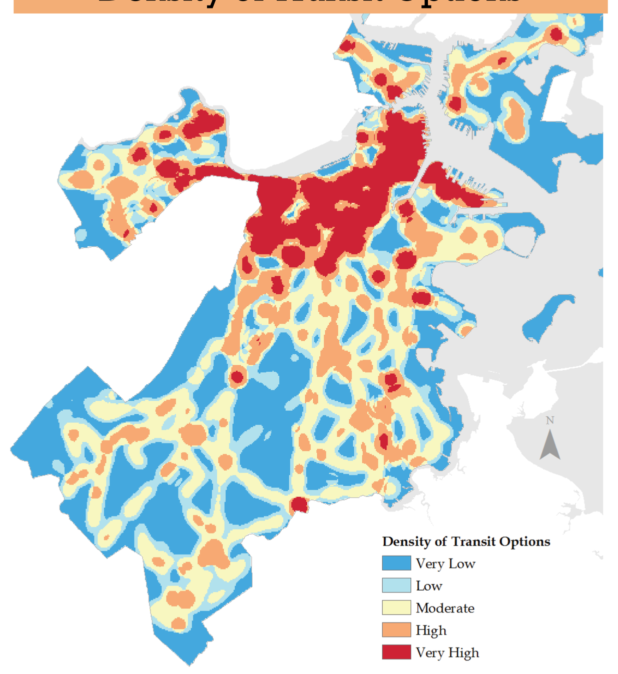
Bike Rack Availability



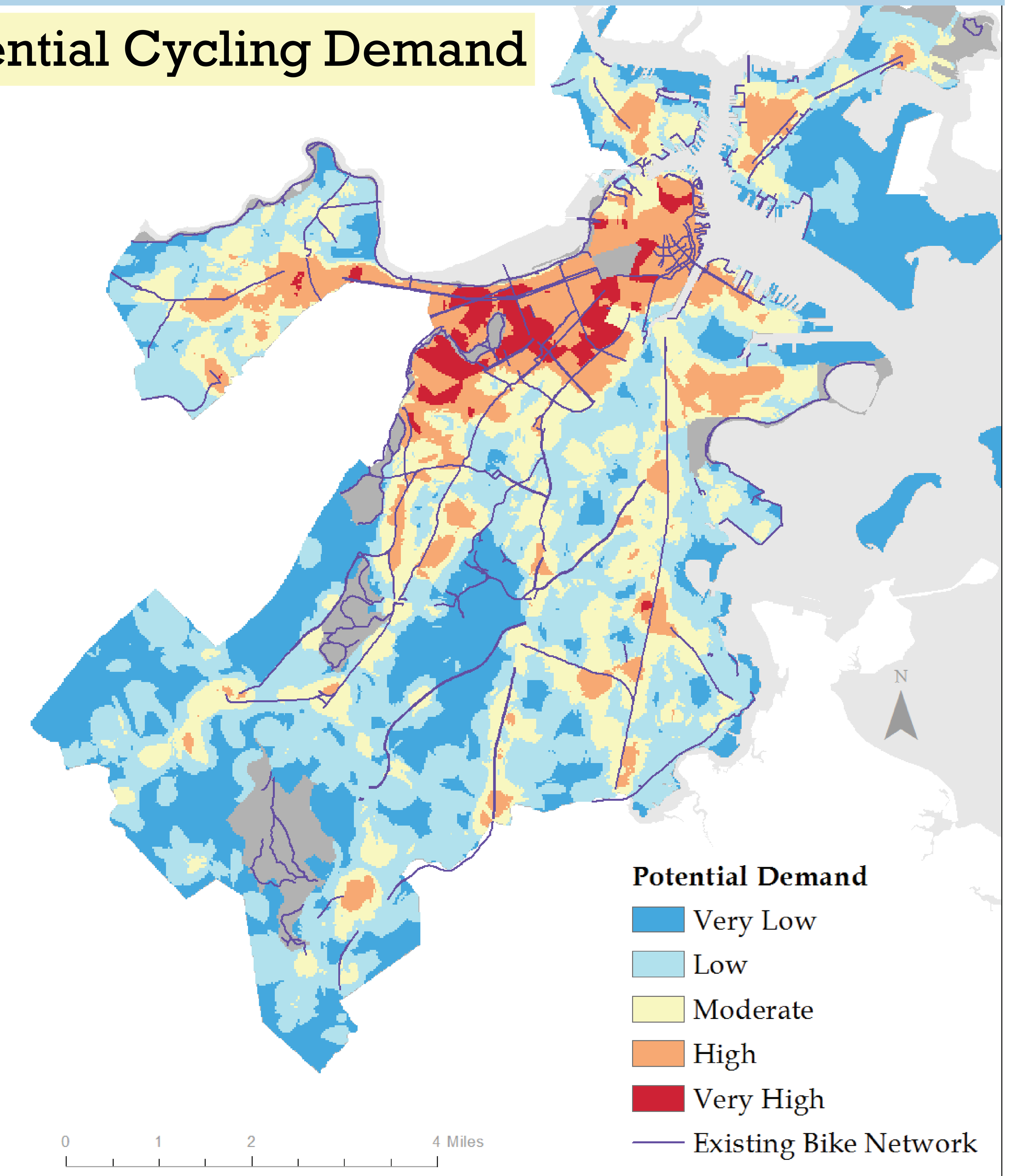
Density of Bus Stops



Density of Transit Options



Potential Cycling Demand



For each category, I converted all of the data layers into raster grids and reclassified each individual layer using a scale of 1-5, where 1 was very low density and 5 was very high density. I then combined the individual layers together to make composite maps of trip attractors, trip generators, and transit accessibility. My final step was to weight each of the composite maps to represent its importance in driving cycling demand. The trip attractor map received a weight of 50%, the trip generator map received 30%, and the transit accessibility map received 20%. The final result is a map where the current bicycle network is combined with an overall cycling demand map.

Conclusions

Overall, the existing cycling network seems to be fairly well-matched with my model of potential demand for bicycling infrastructure. There are bicycle facilities within a close proximity to many "very high" demand areas – for example, near downtown Boston. However, you can also see places where the bike network does not connect in areas where demand is high. One notable example is in Dorchester, near the Fields' Corner MBTA station. South Boston is also an area with potentially high cyclist demand, but this area has very little cycling infrastructure.

This analysis is a helpful tool that can assist bicycle planners and policymakers with efforts to visualize the growth of urban bicycle networks. If bike lanes and other types of bicycle infrastructure are well-matched to residents' demands for cycling facilities, cities like Boston will likely see an increase in bicycle rideshare.