Can biking save students time?

A comparison of transit and biking travel times in Boston

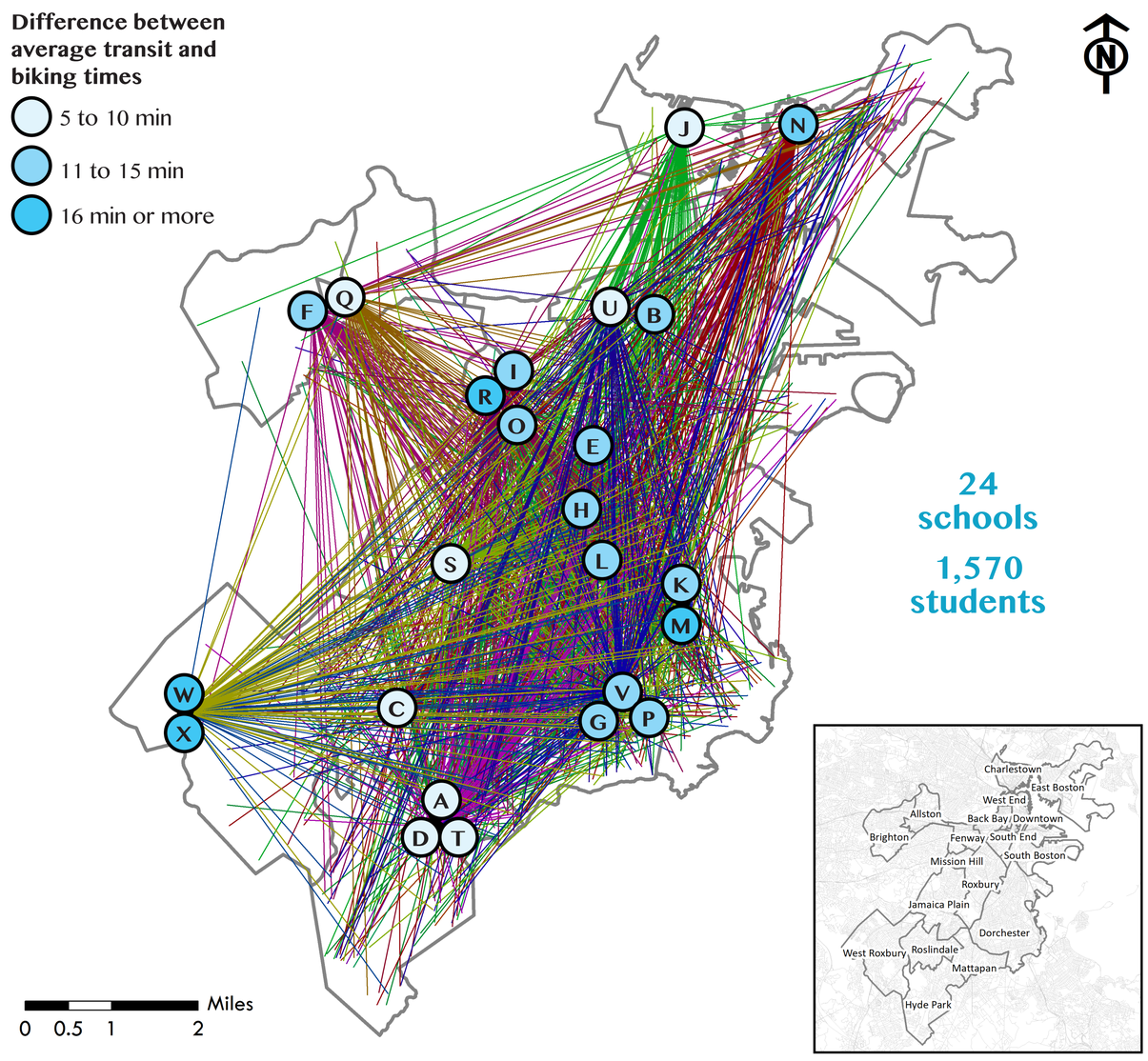
Introduction

A recent report on Boston youth transportation challenges[1] revealed that students in Boston deal with significant transit reliability and frequency issues along with long commutes. Students reported being late to school, job interviews and health appointments. Academic consequences included tardiness to school, not being able to turn in homework on time, and being put at risk of having to attend summer school or not graduating. Being detained at school also resulted in being late to work, after school activities, or getting home to take care of younger siblings in order to relieve parents needing to go to work. Biking is a reliable transportation alternative, however, another finding of the report was that youth have misconceptions about the length of time it takes to bike around the city. Some felt biking would take too long or would not be feasible. This project demonstrates the potential time savings for students through comparing travel times for public transit with biking for Boston students between home and school.

Methodology

A list of simulated student home addresses were obtained through the BPS transportation challenge in 2017. Students were randomly assigned to a BPS high school using a random number generator. Address data was converted using Geocodio. Origin-destination (OD) cost matrix and service area analyses were performed using a network. The network was built using the Massachusetts roads dataset and MBTA general transit feed specification (GTFS) data. OD cost matrix analyses were performed for each high school and its students to find transit travel times. Bike travel time was approximated using the network length between the ODs (based on 268 meters/min or 10 miles/hr). SQL was used to combine OD cost matrices from each high school and calculate data by neighborhood.

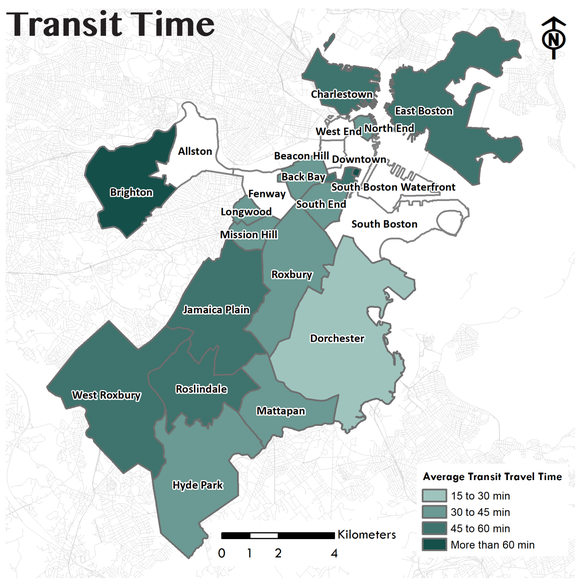
Student travel times: Home to school

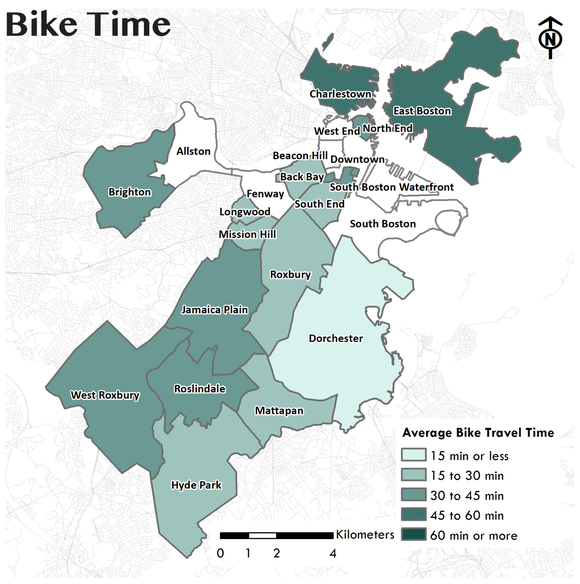


Cost matrix

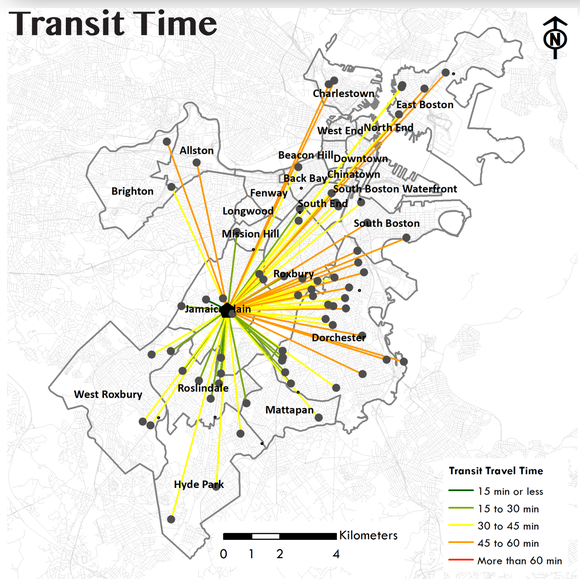
Map Letter	High school name	# of students	Avg transit time	Avg bike time	Difference between avg transit and biking times
A	Another Course to College	68	36	29	7
B	Boston Adult Technical Academy	52	44	32	12
C	Boston Collaborative High School	64	40	30	10
D	Boston Community Leadership Academy	59	36	28	8
E	Boston Day and Evening Academy	56	35	20	15
F	Boston Green Academy	74	60	49	11
G	Boston International Newcomers Academy	80	36	21	15
H	Boston Latin Academy	66	35	20	15
I	Boston Latin School	52	46	34	12
J	Charlestown High School	69	59	49	10
K	Community Academy of Science & Health	74	36	21	15
L	Henry Dearborn STEM Academy	74	30	15	15
M	Dorchester Academy	75	37	20	17
N	East Boston High School	69	62	50	12
O	Fenway High School	63	35	24	11
P	Dr. William W. Henderson K-12 Inclusion School	56	39	25	14
Q	Horace Mann School for the Deaf and Hard of Hearing	66	54	46	8
R	Edward M. Kennedy Academy for Health Careers	65	49	32	17
S	Margarita Muniz Academy	68	34	24	10
T	New Mission High School	66	37	29	8
U	Snowden International School at Copley	72	42	33	9
V	TechBoston Academy	67	42	28	15
W	Urban Science Academy	57	61	42	19
X	West Roxbury Academy	58	64	45	19
	AVERAGE ACROSS SCHOOLS	65	44	31	13

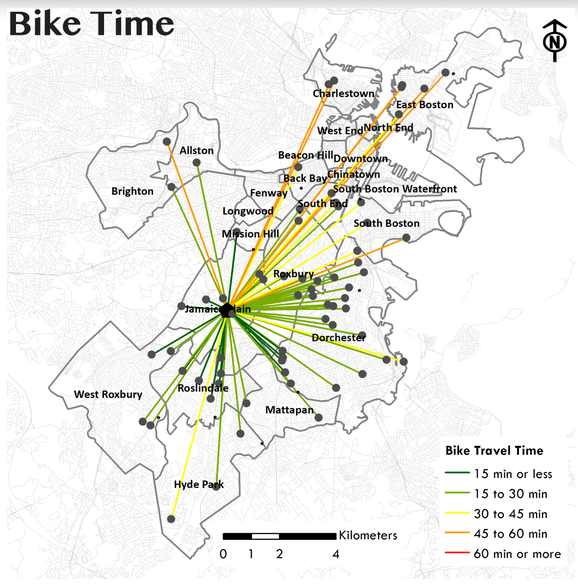
Neighborhood Travel Times



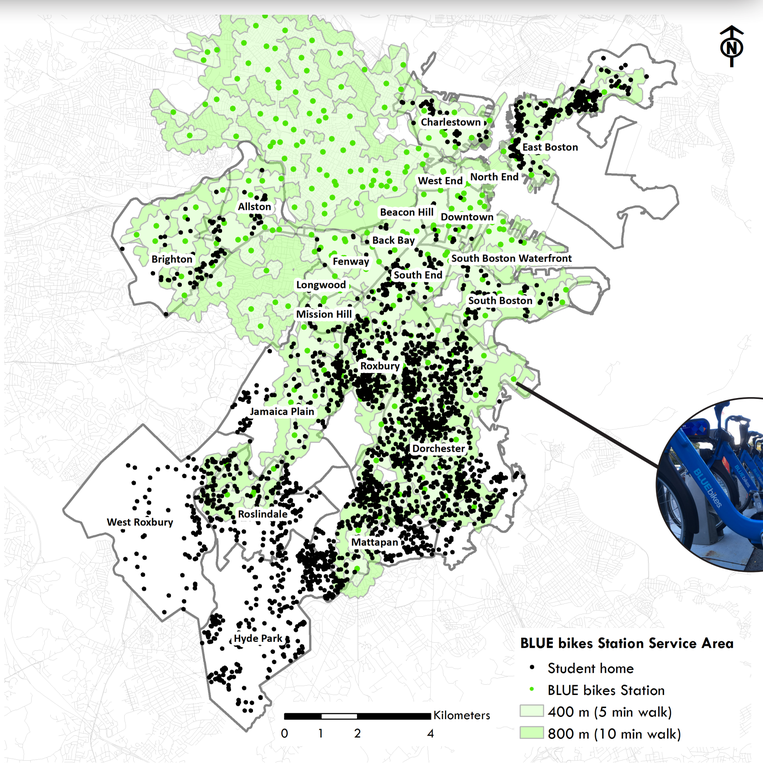


A close look: Margarita Muñiz Academy (S)





More bikeshare stations?



For the most part, students living in Hyde Park and West Roxbury do not have Bluebikes stations yet. There are parts of Roslindale, Jamaica Plain, Mattapan, Dorchester, Brighton and East Boston with students who are not within an 800 meter walkshed of any current station. Lastly, while some neighborhoods are covered by an 800 meter (10 min) walkshed, more stations could be placed in order to provide all students across Boston with a more convenient 400 meter (5 min) walkshed.

3,105 students
1,324 in 400 m walkshed
960 in 400 to 800 m walkshed
821 not in 800 m walkshed

List of stations was obtained through Bluebikes GBFS data (upcoming stations are included). Lat/Long data was converted using Geocodio. Numbers were calculated using a spatial join with service area polygons.

Conclusion

The travel cost comparisons between using public transit or biking in Boston demonstrate that there is potential for high school students to reduce their travel to school time through biking. The simulated dataset shows that there is the potential for travel cost savings at every high school. Nearly all neighborhoods showed a reduction in average travel time across students with biking compared with public transit. Additionally, the case study of Margarita Muñiz Academy demonstrates that many student trips that take between 30-45 minutes with public transit can be shortened to 15-30 minutes with biking. Because of this time savings and because biking is a relatively reliable travel mode, the City of Boston should provide students with more opportunities to learn how to bike and practice safely biking in the city, as well as more affordable biking options, such as a student bikeshare rate. The city should also increase accessibility to bikeshare stations.

Limitations

The BPS dataset contained over 22,000 simulated addresses for grades K-6. Grade 6, the closest to high school, was selected to limit the dataset. Some ODs were not possible to route given the road and transit network connectivity. Out of 37 high schools, 24 were connected to the network. A portion of students at each high school also lived in locations where it was not possible to map their routes. Due to these two routing limitations, a total of 1,570 out of 3,105 students were routed. However, there was an average of 65 students per school from a wide range of neighborhoods and locations. The biking times were approximated based on length, but there are many other considerations (e.g., type of road or bike facility, crossable locations) that could be taken into account to calculate bike time.

Reference

[1]Ko, Lily T. Boston Youth Transportation Project. Office of Michelle Wu, Boston City Councilor At-Large, December 2018, http://michelleforboston.com/wp-content/uploads/2018/12/BYPT-Report_final.pdf

Map Information

Sources: MassGIS, MBTA, Boston Public Schools, Bluebikes
Projection: NAD_1983_StatePlane_Massachusetts_Mainland_FIPS_2001 (Meters)
Geographic Coordinate System: GCS_North_American_1983

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