CS506 Bus Performance Team D

Early Insights Presentation

James Xiao, Xavier Thomas, Haoxiang Huo, Risvhen Pravin, Ketan Saichandran

Problem Statement

Public transportation plays a crucial role in the quality of life for residents in Massachusetts and the Greater Boston area. However, how sure can we be that the quality of service is equal for all reachable areas? With such a substantial impact on resident day-to-day life, it is necessary to quantify how “fair” Boston’s public transportation is, and which areas perceive better/worse quality of service.

Workflow

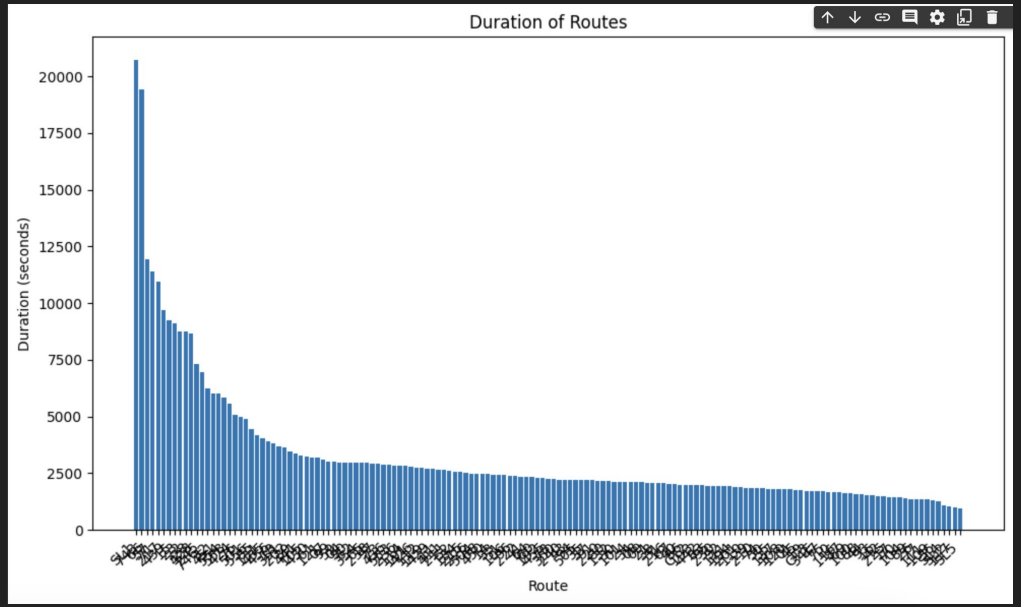
We have collected data from MBTA-massdot.opendata and are mainly using these 5 datasets:

1. PATI Bus Stops
2. MBTA Bus Arrival Departure Times:
3. Bus Reliability
4. Bus Ridership by Time Period, Season, Route Line, and Stop
5. Wheelchair/Accessibility

In our weekly scrum meetings, we examine what progress we have made so far, which blockers remain unresolved, and what goals we have for the next weekly sprint.

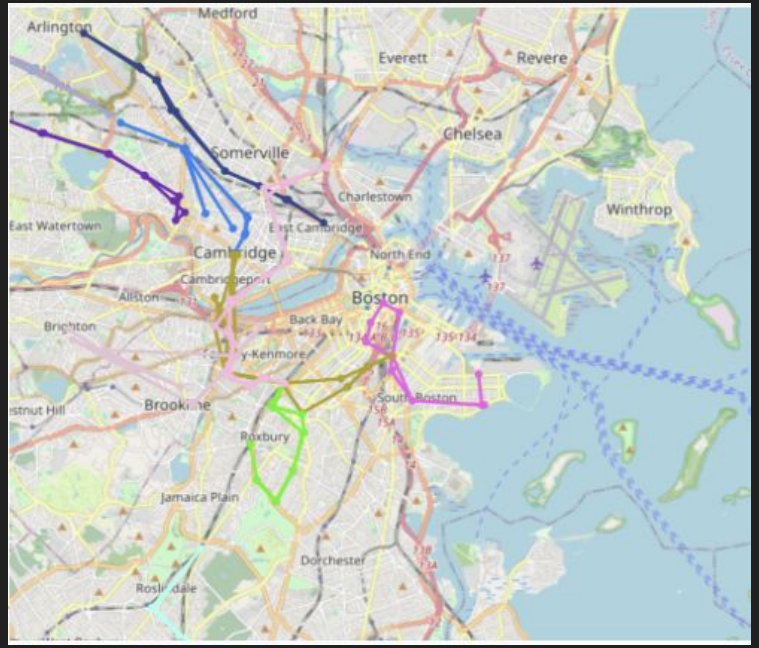
Everyone in the team is encouraged to look through the datasets for meaningful correlations with bus performance.

Early Results - End to End Travel Times



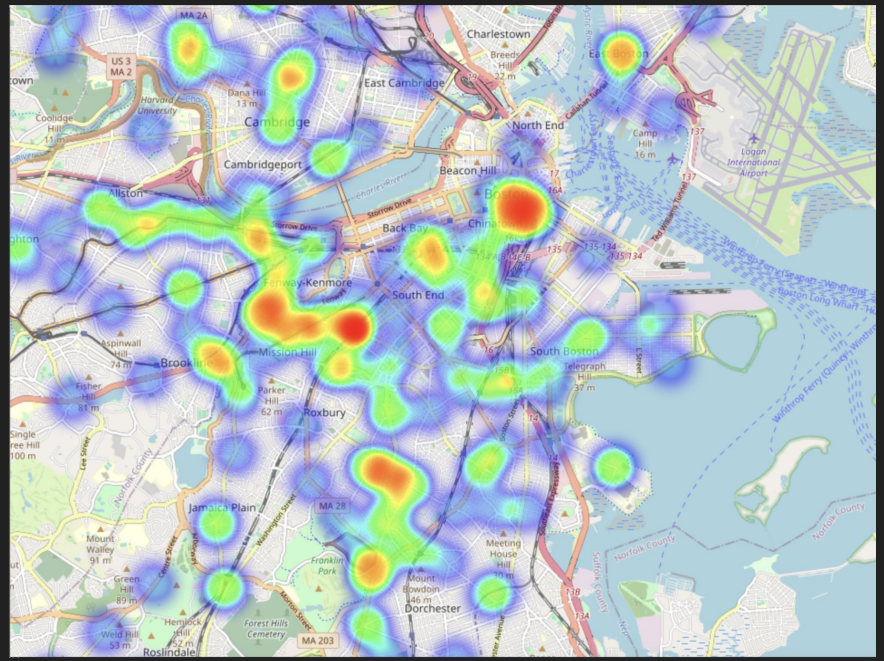
We notice that a majority of the lines have end to end travel times of < 5000 seconds

Early Results - Late Lines



This plot maps the top 10 latest lines.

Early Results - Late Stop Heatmap

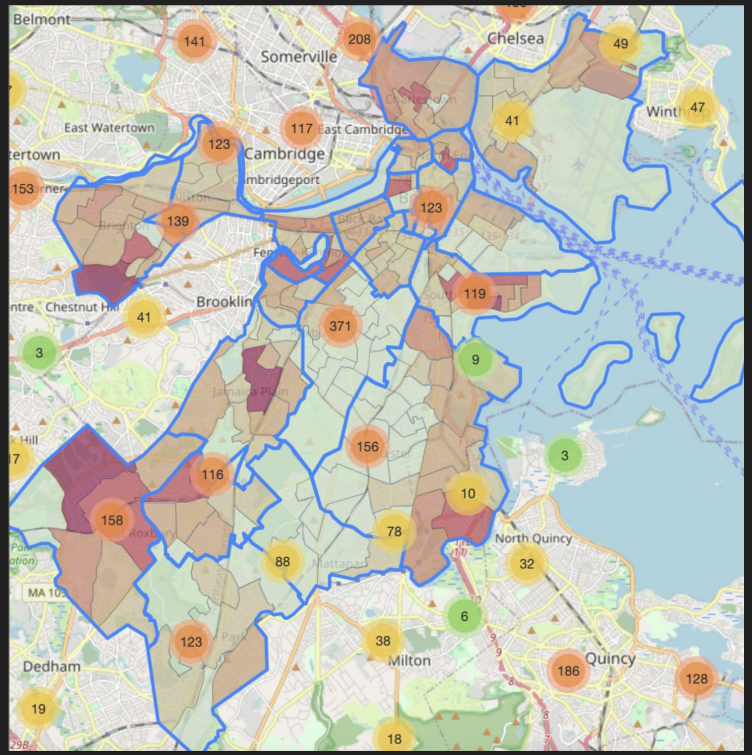


A heat map of late bus stops in Boston provides a visual representation of spatial and temporal patterns of delays, revealing clusters of high-delay areas, potential correlations with traffic congestion and infrastructure issues, and insights into route-specific challenges.

Early Results - White Population

For dense areas, they are served by on average of 133 bus stops.

Roxbury: There are 60,705 residents in Roxbury, with a median age of 34. Of this, 46.64% are males and 53.36% are females. US-born citizens make up 63.05% of the resident pool in Roxbury, while non-US-born citizens account for 22.89%. $66,756 average income. 55% some college degree. 9.5% elderly. Other than car, most people bus and no one bikes/walks.
Jamaica Plain: There are 41,112 residents in Jamaica Plain, with a median age of 35.1. Of this, 46.46% are males and 53.54% are females. US-born citizens make up 74.48% of the resident pool in Jamaica Plain, while non-US-born citizens account for 16.21%. Additionally, 9.31% of the population is represented by non-citizens. 106,153 median income. 75% college degree. 10.8% elderly. Most travel by car, or walk or bus or bike.
Chestnut Hill: There are 2,195 residents in Chestnut Hill, with a median age of 31. Of this, 46.65% are males and 53.35% are females. US-born citizens make up 74.81% of the resident pool in Chestnut Hill, while non-US-born citizens account for 13.03%. Additionally, 12.16% of the population is represented by non-citizens. $222,413 average income. 90% some college degree. Most travel by car or walk.
North Quincy: There are 8,486 residents in North Quincy, with a median age of 40. Of this, 51.04% are males and 48.96% are females. US-born citizens make up 62.86% of the resident pool in North Quincy, while non-US-born citizens account for 21.89%. Additionally, 15.25% of the population is represented by non-citizens. Average income: $112,866. Everyone car, no one bus. 15% elderly.
South End: There are 25,101 residents in South End Boston, with a median age of 33.7. Of this, 49.02% are males and 50.98% are females. US-born citizens make up 68.03% of the resident pool in South End Boston, while non-US-born citizens account for 21.34%. Additionally, 10.63% of the population is represented by non-citizens. Average income $141,172. More people walk, then people drive, then people bus. 19% elderly.

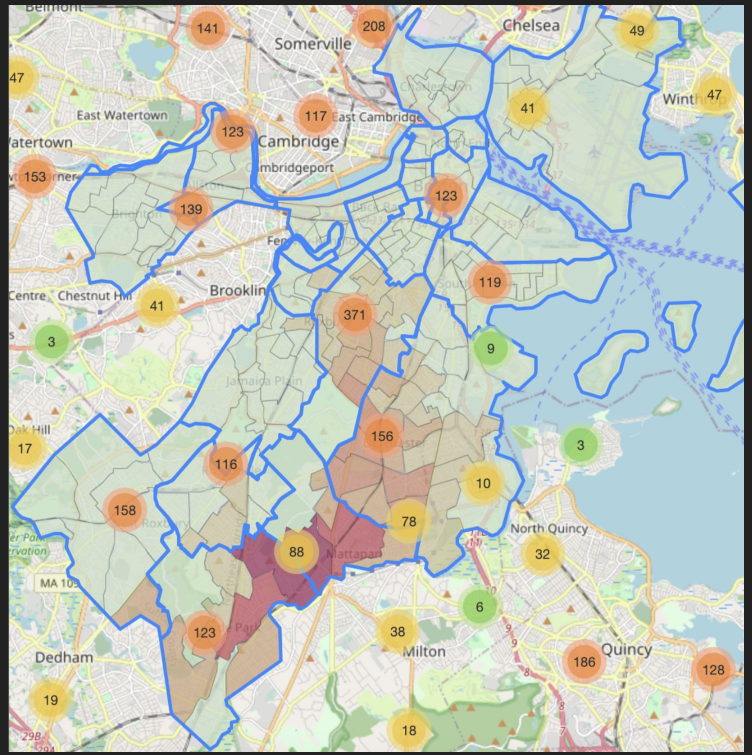


Early Results - Black Population

For dense areas, they are served by on average of 83 bus stops.

Hyde Park: There are 38,402 residents in Hyde Park, with a median age of 37. Of this, 47.6% are males and 52.4% are females. US-born citizens make up 63.33% of the resident pool in Hyde Park, while non-US-born citizens account for 25.44%. Additionally, 11.24% of the population is represented by non-citizens. Average household income: 93,746. 60% some college degree. Some people take bus but most people car.

Mattapan: There are 35,997 residents in Mattapan, with a median age of 36. Of this, 46.33% are males and 53.68% are females. US-born citizens make up 64.87% of the resident pool in Mattapan, while non-US-born citizens account for 22.28%. Additionally, 12.85% of the population is represented by non-citizens. Average household income: $81,033. 56% some college degree. Most people car, then bus.

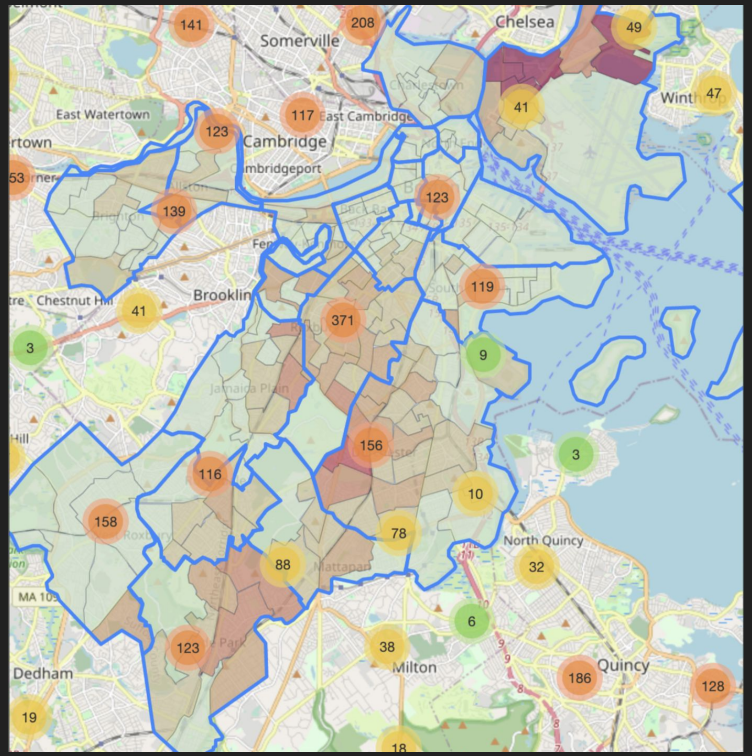


Early Results - Hispanic Population

For dense areas, they are served by on average of 45 bus stops.

Dorchester: There are 85,854 residents in Dorchester, with a median age of 35.1. Of this, 47.05% are males and 52.95% are females. US-born citizens make up 63.98% of the resident pool in Dorchester, while non-US-born citizens account for 22.85%. Additionally, 13.18% of the population is represented by non-citizens. 54% college degree. Average household income: $93,069. Most people car and then bus.

East Boston: There are 45,501 residents in East Boston, with a median age of 33.8. Of this, 51.97% are males and 48.03% are females. US-born citizens make up 51.5% of the resident pool in East Boston, while non-US-born citizens account for 15.83%. Additionally, 32.67% of the population is represented by non-citizens. Average household income: 98,782. 52% some college degree. Most people car then bus.

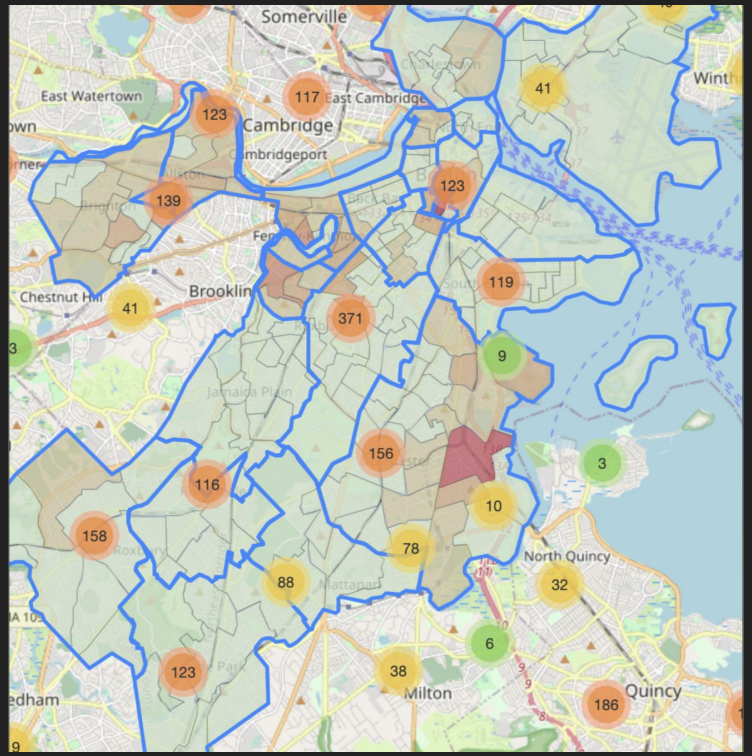


Early Results - Asian Population

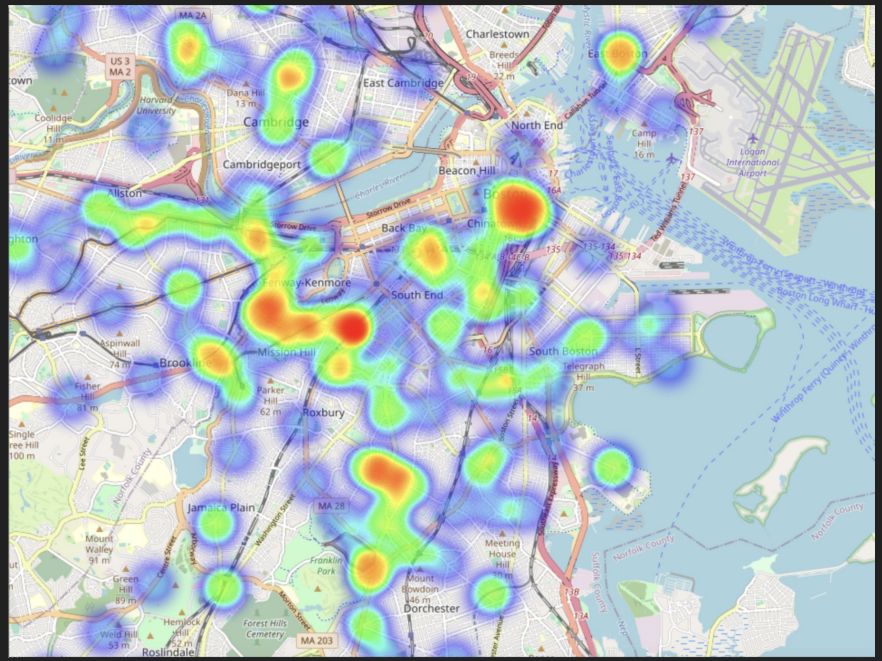
For dense areas, they are served by on average of 66 bus stops.

Chinatown: 6,546 population. 50% some college degree. Average income: 50,652

Dorchester: stated earlier



Early Results - Late Stop Heat Map



To reiterate:
East Boston
Chinatown
Mission Hill/Northeastern
Commonwealth Avenue
Roxbury
Cambridge

Reflection

Challenge:

- Lack of information in ridership csv.
- Inability to utilize car crash csv.

Limitations:

- Incompleteness and inconsistency in datasets.
- Assume the data is accurately reported and synchronized.

Next Steps:

- Further examine intense areas in the lateness heatmap.

Extension Pitch: Exploring the Intersection of Disability Access and Bus Ridership

In our endeavor to delve deeper into the factors influencing bus ridership and accessibility, we propose an extension project that focuses specifically on the correlation between disability access features on buses and ridership patterns. By examining the relationship between these variables, we aim to not only enhance our understanding of inclusivity in public transportation but also contribute insights that can inform policy decisions and service improvements.

Rationale

This extension is crucial for uncovering the nuanced interplay between disability access features on buses, ridership patterns, and socioeconomic factors. It seeks to reveal how income levels, employment rates, and education within specific neighborhoods correlate with the utilization of disability-accessible public transportation. It is important for promoting equity in public transit and understanding the social dynamics influencing accessibility usage. The extension aligns with the original dataset on bus performance by deepening the understanding of the factors influencing ridership, particularly within the context of disability access.

Questions for Analysis

Socioeconomic Disparities in Ridership:

How do socioeconomic factors such as income and education levels impact the utilization of buses with disability access features?

Identification of Accessibility Deserts in Low-Income Areas:

Are there regions with a high prevalence of disabilities but lower accessibility usage due to socioeconomic factors?

Correlation Between Employment Hubs and Disability Access Usage:

Does the presence of employment hubs in certain areas correspond to higher usage of disability-accessible buses, possibly indicating a need for accessible commuting options?

Datasets and Sources

Bus Performance Data:
The original dataset on bus performance, including ridership metrics and information on disability-accessible buses.

Census Data:
Socioeconomic indicators such as income, education levels, and employment rates at a granular level, mapped to census tracts corresponding to bus stops.

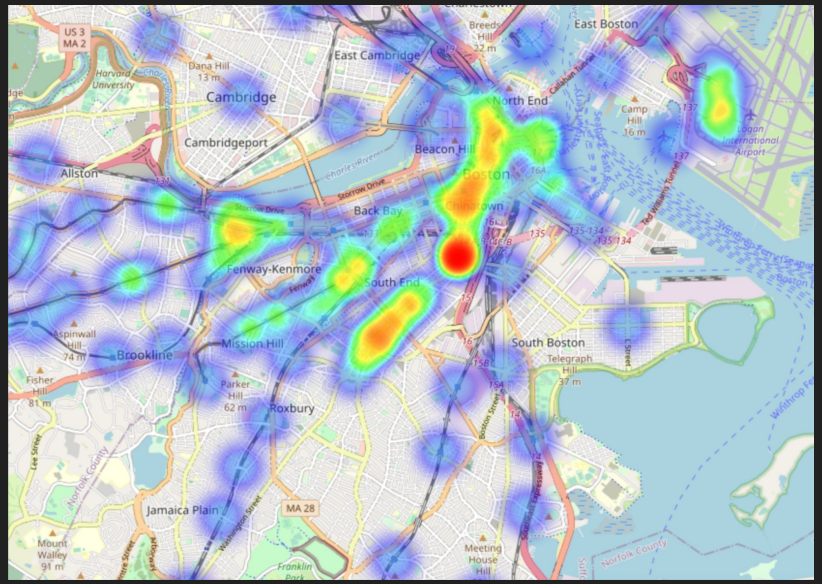
Disability Demographics:
Data on the prevalence of disabilities at the census tract level, providing insights into the distribution of potential users of disability-accessible features.

Data Visualization

Heatmap of Disability-Accessible Bus Utilization:
A heatmap overlaying disability-accessible bus utilization on socioeconomic indicators, highlighting areas with high usage and potential disparities.

Scatter Plots of Ridership vs. Socioeconomic Factors:
Scatter plots showing the correlation between ridership levels on disability-accessible buses and socioeconomic factors like income and education.

Bar Charts Comparing Accessibility Usage Across Employment Hubs:
Bar charts comparing the percentage of disability-accessible bus ridership in areas with significant employment centers.



Heatmap of Disability-Accessible BUs Utilization

Additional Information

Understanding the socioeconomic dimensions of disability access and ridership is crucial for designing targeted interventions and ensuring that public transportation serves all community members equitably. This extension recognizes the importance of socioeconomic factors in shaping transit choices and aims to contribute insights that foster a more inclusive and accessible public transportation system.