



Travel Times By Mode of Transit: Bike-Sharing vs MBTA “T”

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Introduction

Background

- Access to transit affects how people interact with their cities
- Bikesharing as substitute vs complement for other forms of public transit? (Kong et al 2020)
- Interested in whether bikeshare is a time-efficient choice in the Cambridge context

Research Questions

- RQ1: In Cambridge, MA in summer 2023, for what percent of start/stop Blue Bikes station pairs was bikeshare faster (slower) than the T (within Cambridge)? How much faster (slower) was bikeshare?
 - H1: Bikeshare was faster
- RQ2: What was the relationship between initial walking time to a T station and the difference in travel times across modes?
 - H2: As initial walking distance to a T station increases, bikeshare was relatively faster

Visualizations

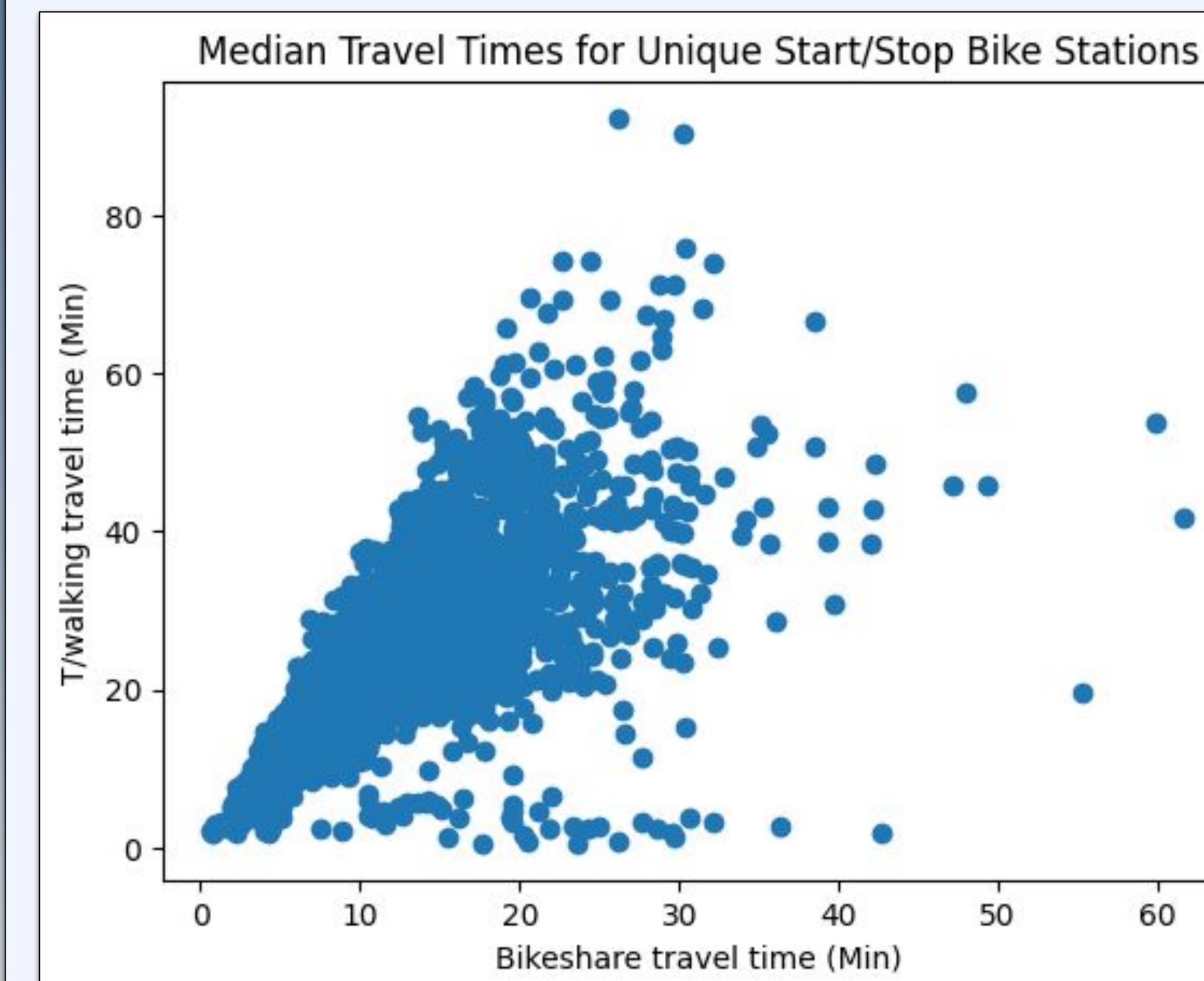


Figure 2. Median Travel Times for Unique Start/Stop Bike Stations.

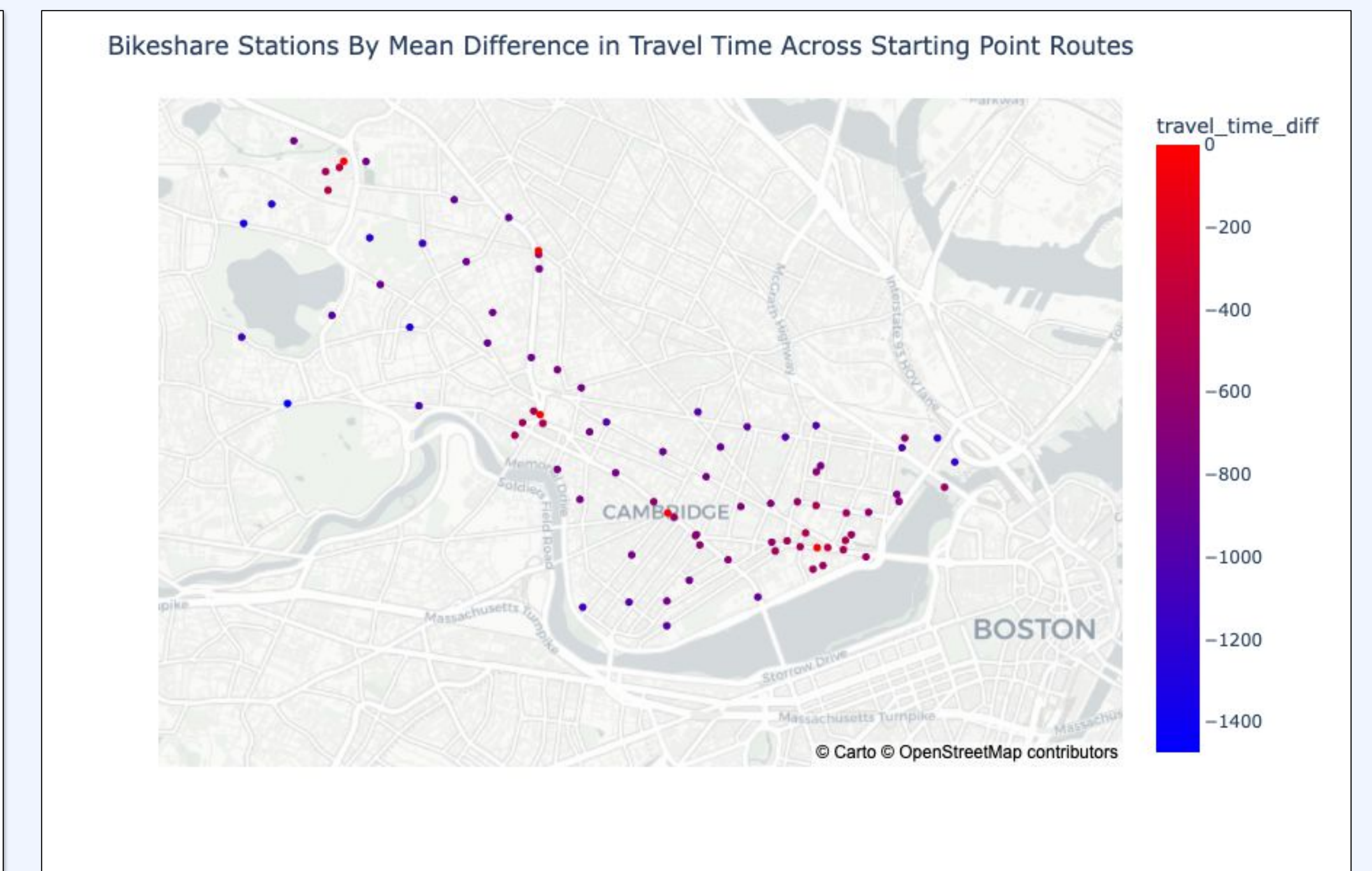


Figure 3. Map of Bikeshare Stations By Mean Difference in Travel Time Across Starting Point Routes. Includes T stations themselves.

Data & Methods

Primary data sources

- All Blue Bike trips (summer 2023)
 - Attributes: Start/end stations (ID, name, coordinates), start/end times
- MBTA “T” trips
 - Attributes: Start/end stations (ID), service date, start/end times, travel times

Secondary data sources

- Blue Bike stations
 - Use: Identify Blue Bike stations in Cambridge
- T stations
 - Use: Match T trips station IDs to T trips station names
- T trips January 2024
 - Use: Match T trips station names to T station start/stop coordinates

Data manipulation

- For each bikeshare trip, calculated the length of the corresponding “T” trip and walking trip → took minimum
 - Used T data from the exact day and time when the bike ride took place
 - T trip time includes time waiting for the next T
 - Used Google Maps API to get all walk times
 - Assumed walk time from bike station to T station and vice versa are the same
- For each start/end bikeshare station pair (with > 10 rides), calculated difference in median trip times for bikeshare vs T/walking

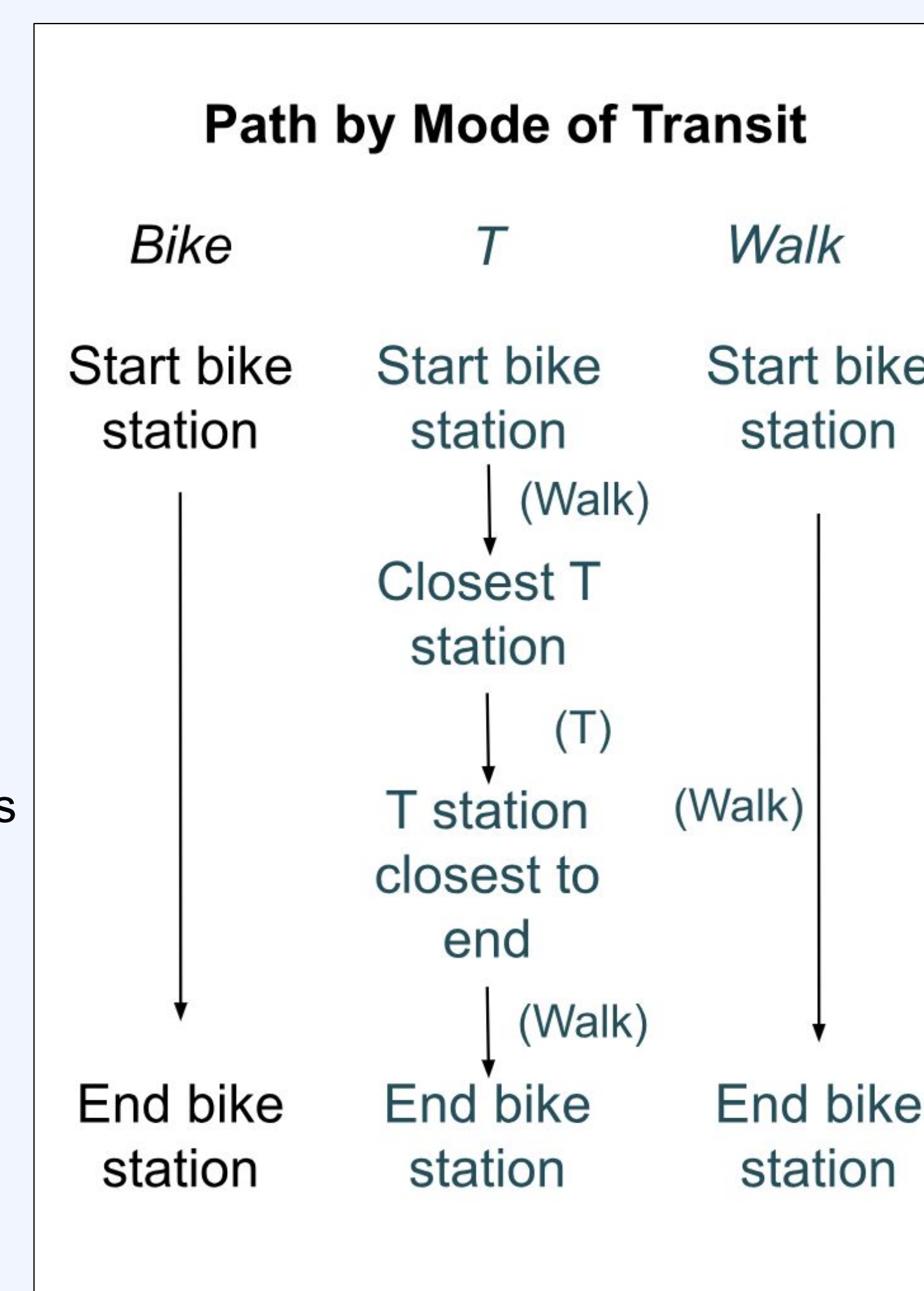


Figure 1. Path by Mode of Transit.

Results

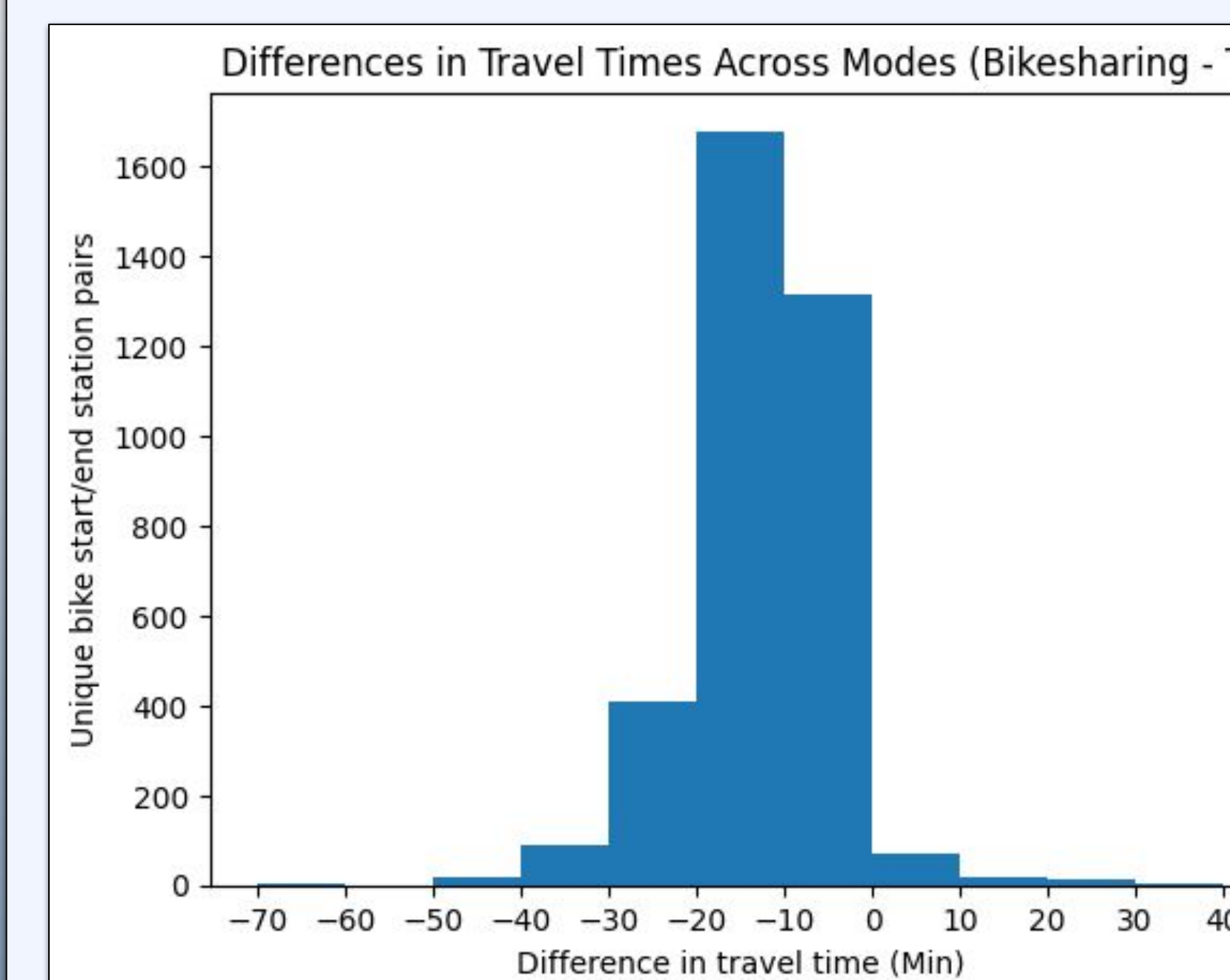


Figure 4. Differences in Travel Times Across Modes (Bikesharing-T).

- **Bikeshare is faster for 97.098% of start/end stop combinations**
- On average, **bikeshare is 12.506 minutes faster**
- Travel time differences
 - Min: -66.12
 - 25th: -16.85
 - Median: -12.00
 - 75th: -7.43
 - Max: 40.88

Model

$$\text{DiffInTravelTimes} = -8.24 - 0.38 * (\text{FirstWalkTime})$$

- Coefficient and intercept are significant
- Assumption issues: Independence



Figure 5. Differences in Travel Times By Walking Time from Start to Closest T. Allows linearity assumption.

Discussion & Conclusion

- → Provides evidence that bikesharing can be a time-efficient mode of transit
- Limitation: Here, people are 1) starting at bikeshare stations and 2) do not have to wait for bikes, but they do have to wait for the T
- Limitation: Did not allow people to get on or off at Davis Square, which is in Somerville
- Limitation: Did not consider spatial relations
- Future work: Add in bus routes
- Future work: Allow T stations outside of Cambridge