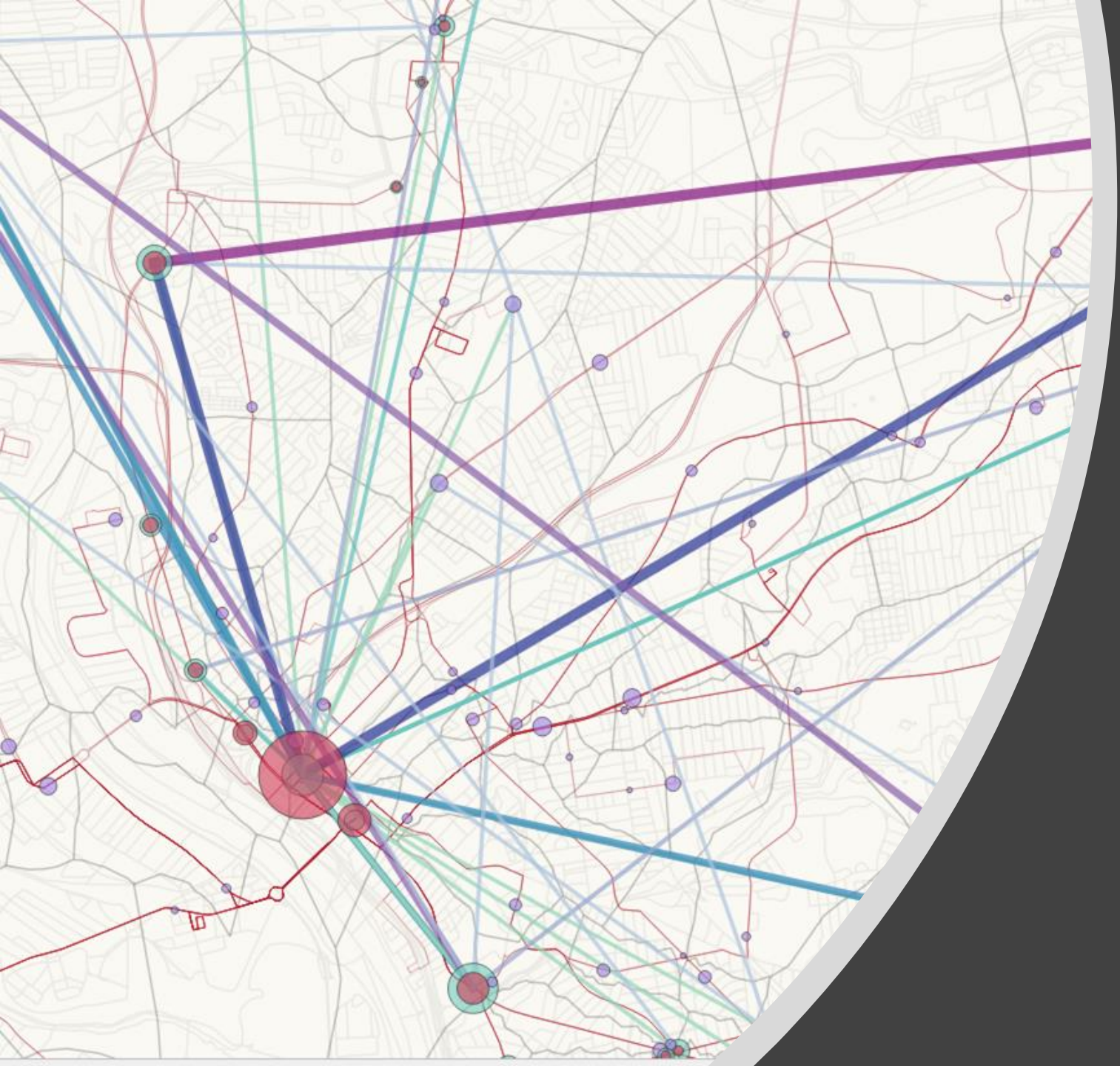
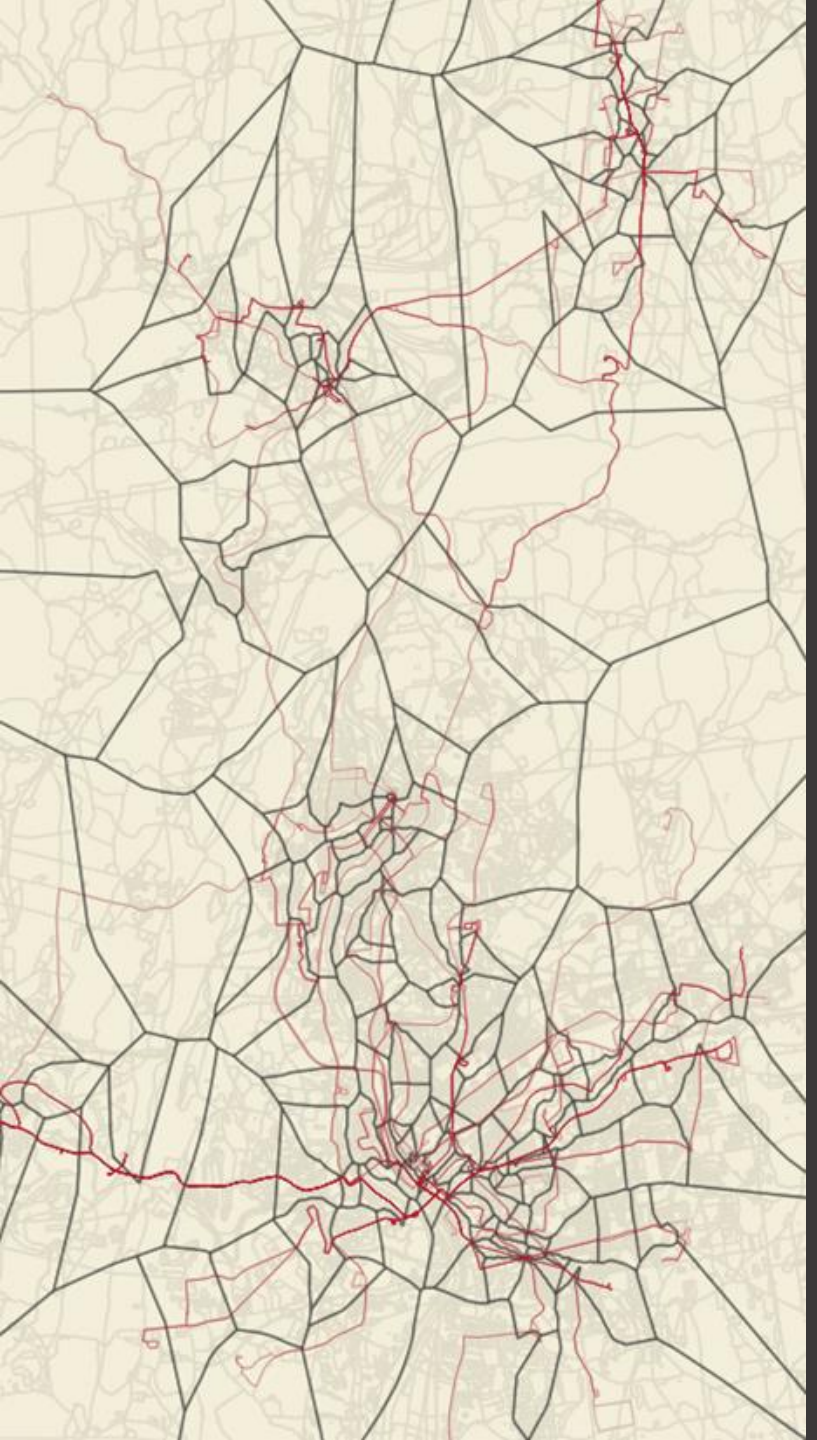


G1 Route Connections

Bytemark Data Analysis

PVPC & PVTA

The following presentation was made as an overview of my analysis, independently created, surrounding a proposal to split one of the Pioneer Valley Transit Authority (PVTA)’s largest routes into two routes. The data used is from the mobile pass app, the only account-linked Origin-Destination data available to PVTA. The app launched in July, 2020, and provided GPS cellular location and timestamp of each ticket activation. This methodology for using this type of data was newly developed for this analysis by myself with help from my colleague Peter Kuusisto, a transit planner.

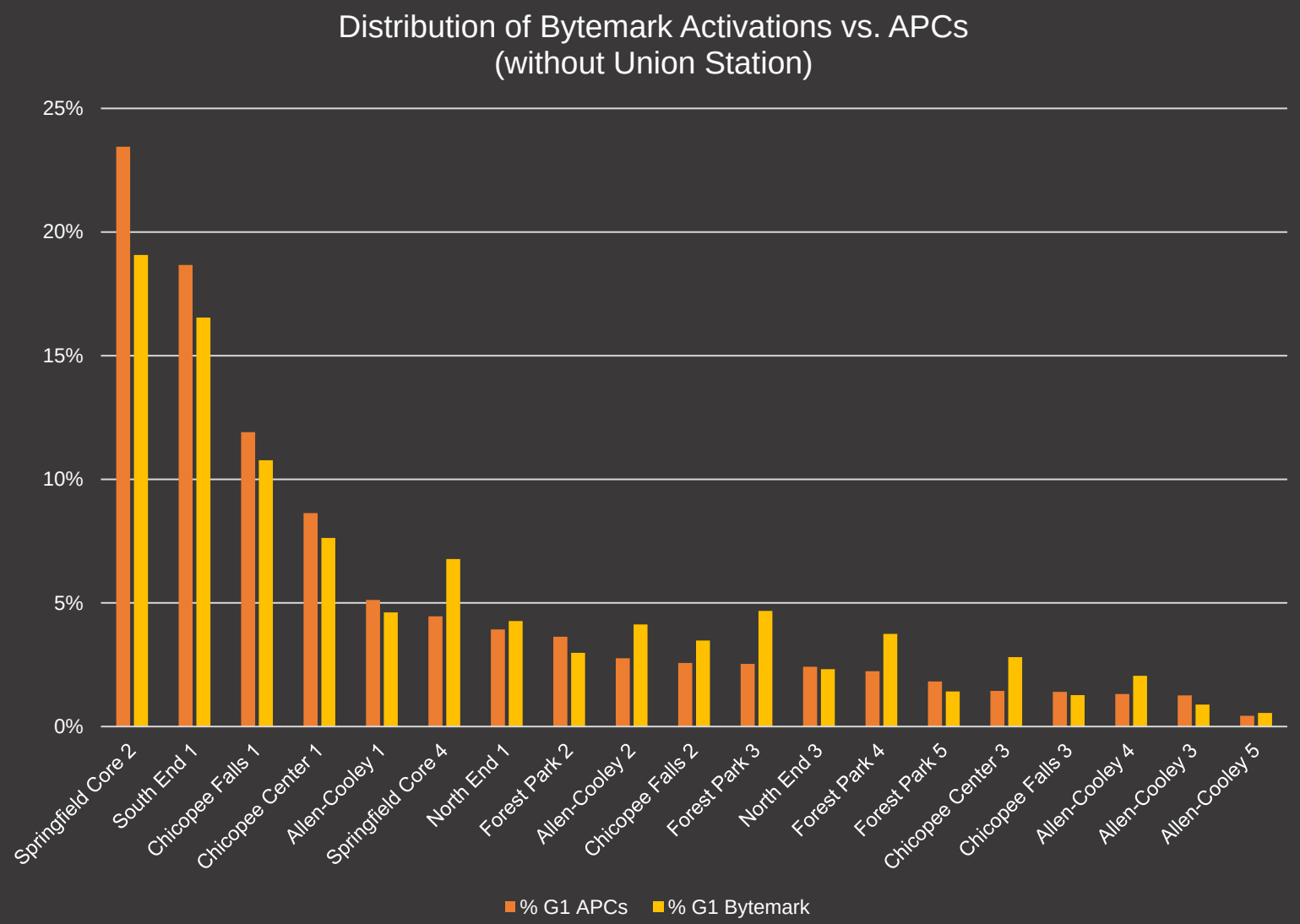


Methodology

- The PVTA Service Region was divided into Stop Corridor Areas based on groupings of bus stops that service different Routes. These areas are shown with a grey outline. Routes are shown in red.
- Bytemark activations were filtered to identify boards, and then categorized to a Stop Corridor based on their Longitude and Latitude. Beginning with 215K activations between 8/1/20 and 4/1/20, 184K were categorized to a Corridor.
- Based on the order that the activations were made by an individual, we can link activations into *Trip Segments* (two consecutive activations – 92,243 found) and *Connections* (two consecutive trip segments, i.e. three consecutive activations – 38,690 found).
- Trip segments are then matched to routes – if a trip segment begins and ends in two corridors serviced by the same route, then it is matched to that route. 71% of trip segments (65,587) were matched to at least one route.
- Connections with at least one segment along the G1 are sub-setted from the full data for this analysis.

Evaluating the Data Sample

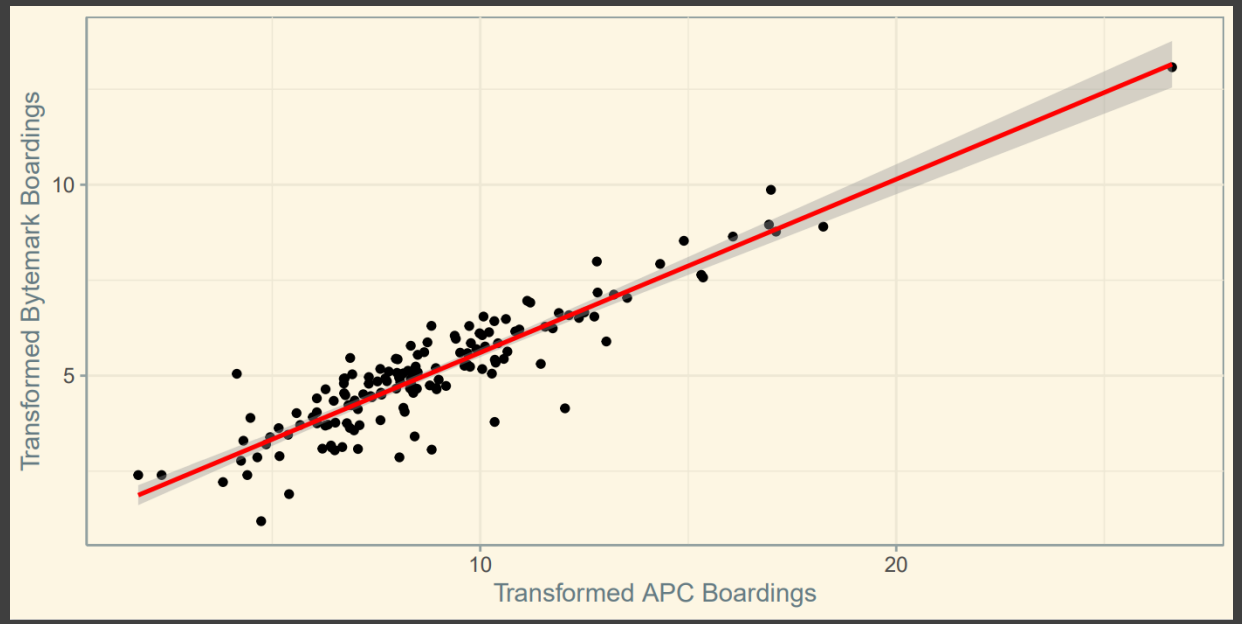
- The starting sample size of 92,243 trip segments equates to 3.7% of the 2.47M rides recorded by APCs in the same time period on fare-paying routes.
- The Bytemark data in this time period are collected from 3,612 unique users, and consists of 92,243 rides. For comparison, the 2019 customer survey collected responses from 1,529 rides.

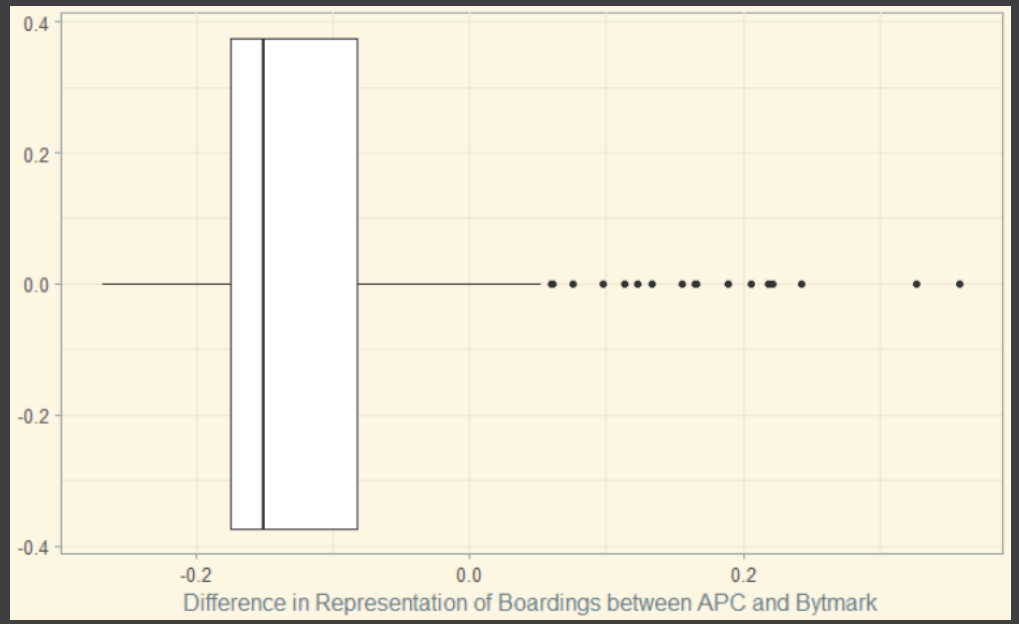


Above, the percent of Boardings in each corridor for APC and Bytemark Data are compared.

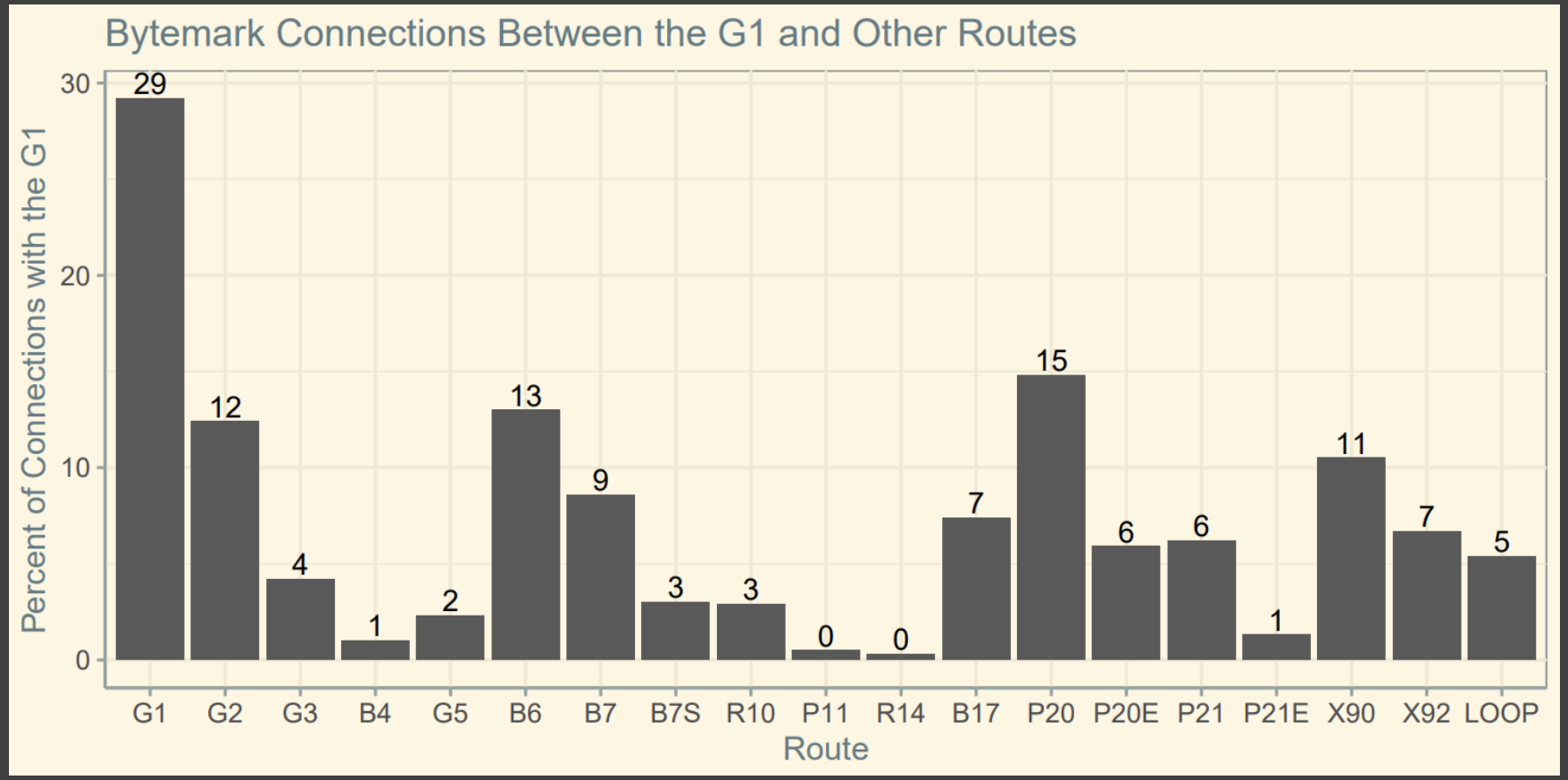
Evaluating the Data Sample cont.

- Statistical Analysis of the data for fare-paying corridors show that Bytemark Boardings are a significant predictor of APC Boardings (ß = 1.83, p-value = 0.0), as shown in the graph on the left.
- The difference in boardings between stops in the data is normally distributed, with a few outliers, as shown in the graph on the right.





G1 Connections Between Routes

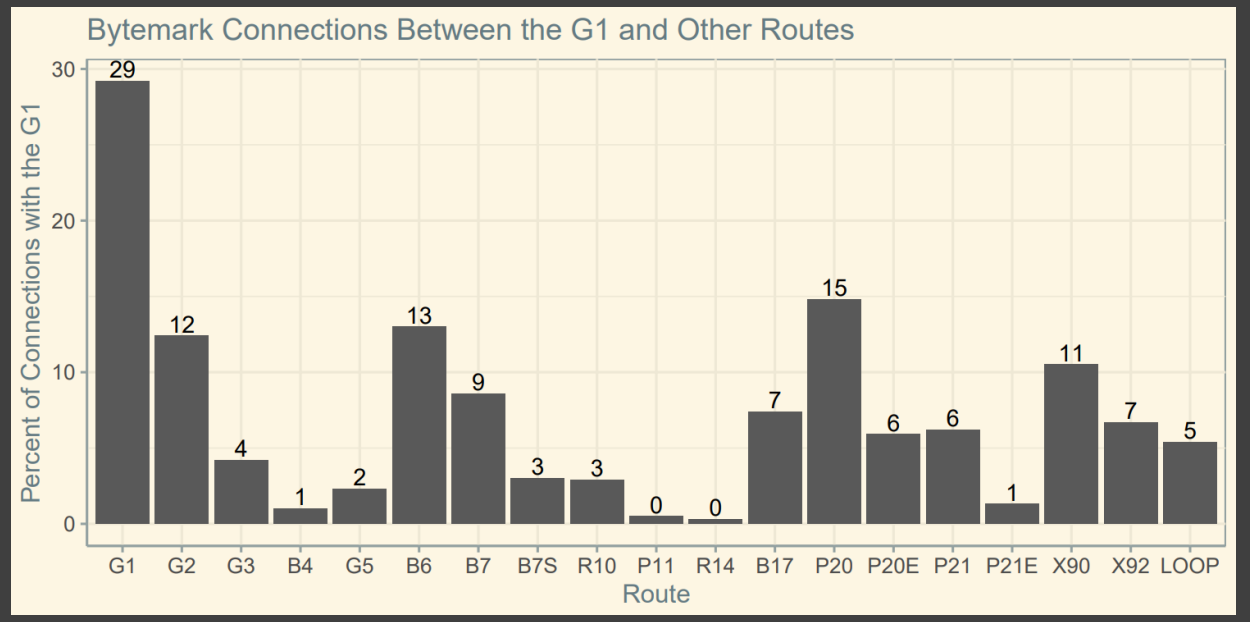


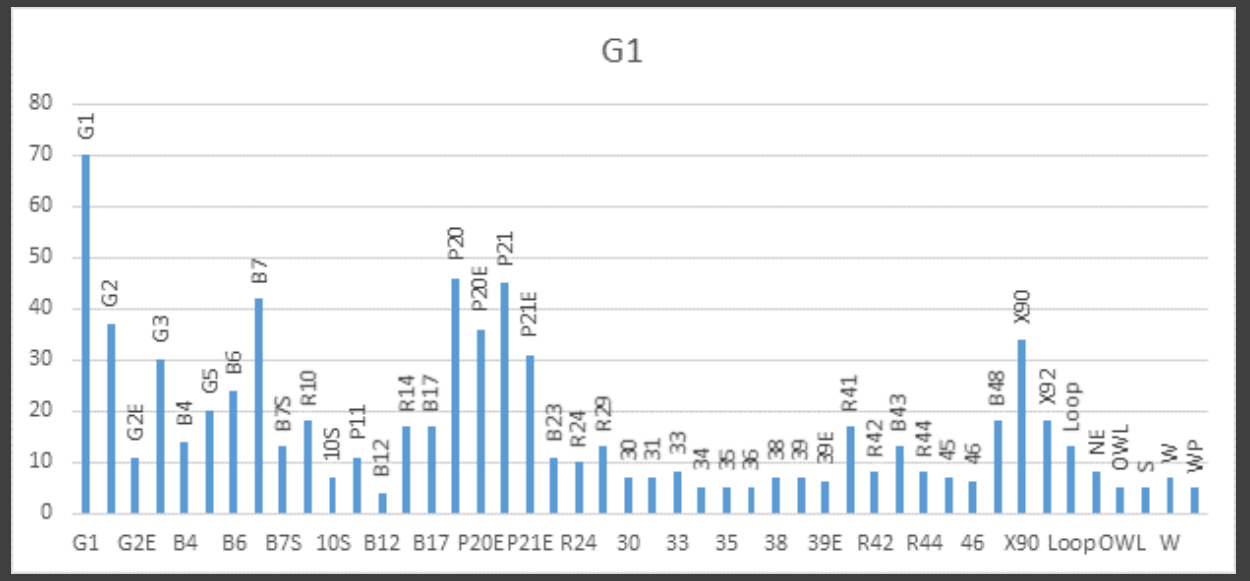
- 29% of Connections remain along the G1 route (mostly round trips).
- 15% transferred between the G1 and the P20.

G1 Bytemark Connections

Mobile Data Compared to Survey

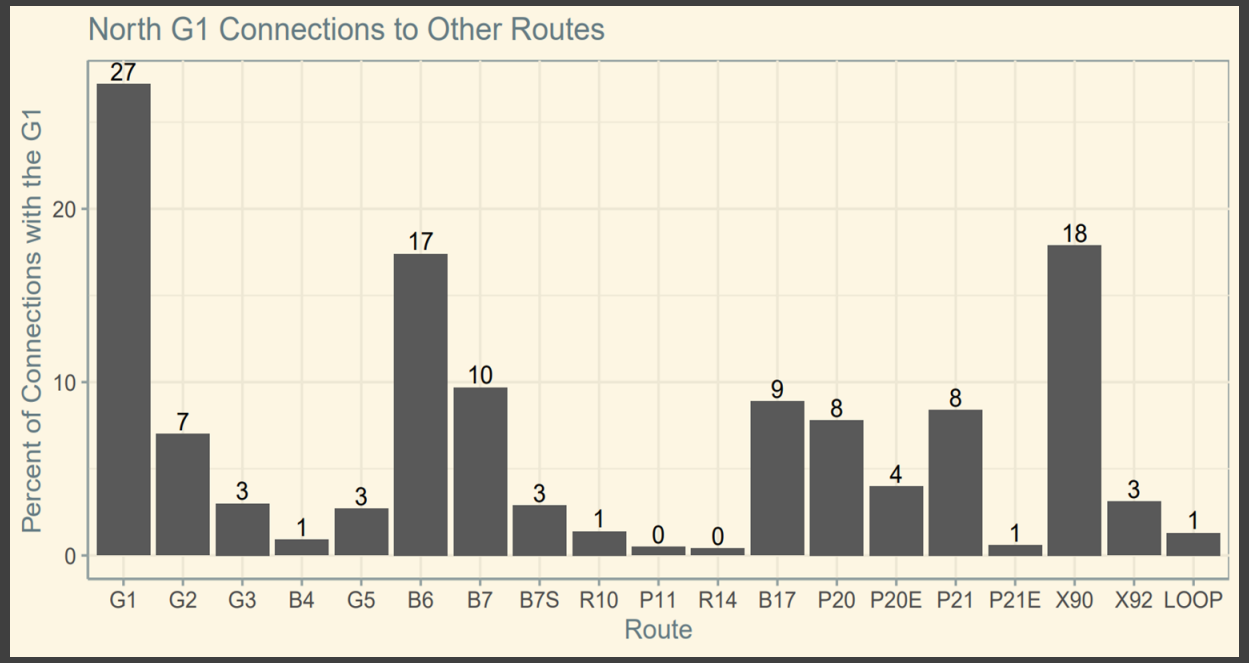
- G1 riders most often connect to the P20, B6, G2, X90, and B7 as shown on the top graph.
- Bytemark analysis results generally align with survey responses to the question of what routes riders utilized, shown in bottom graph.
- Note: Bytemark data provides much more detailed information about travel patterns than the survey result, which explains some of the differences.

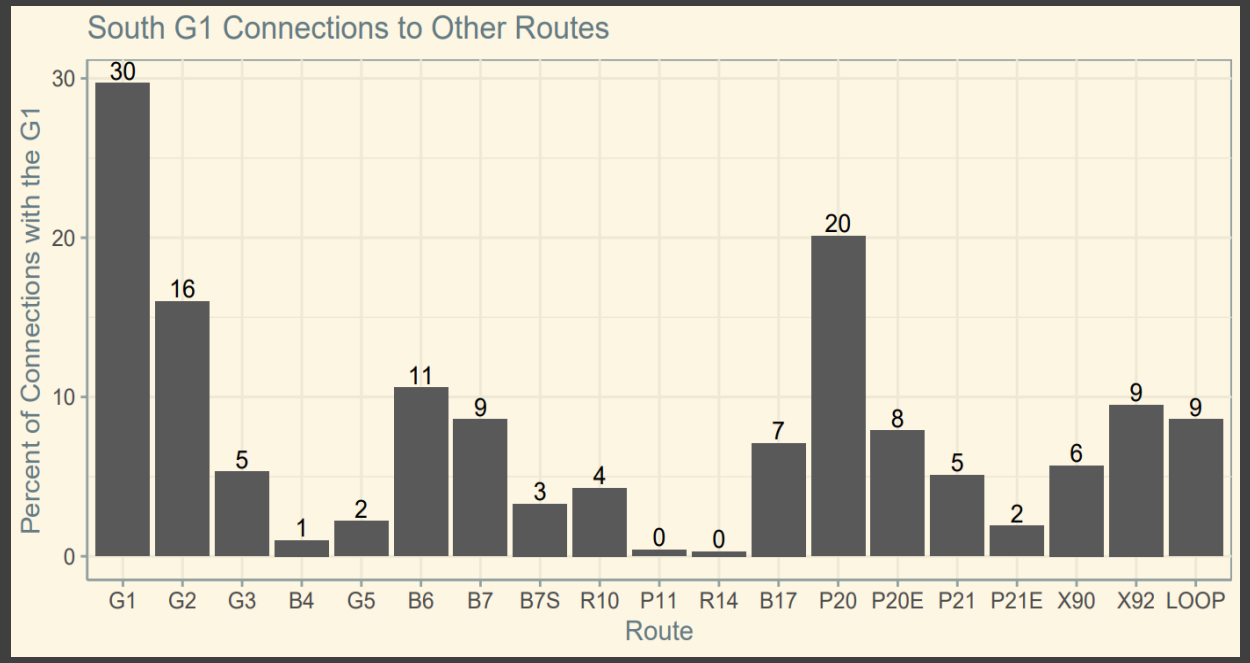




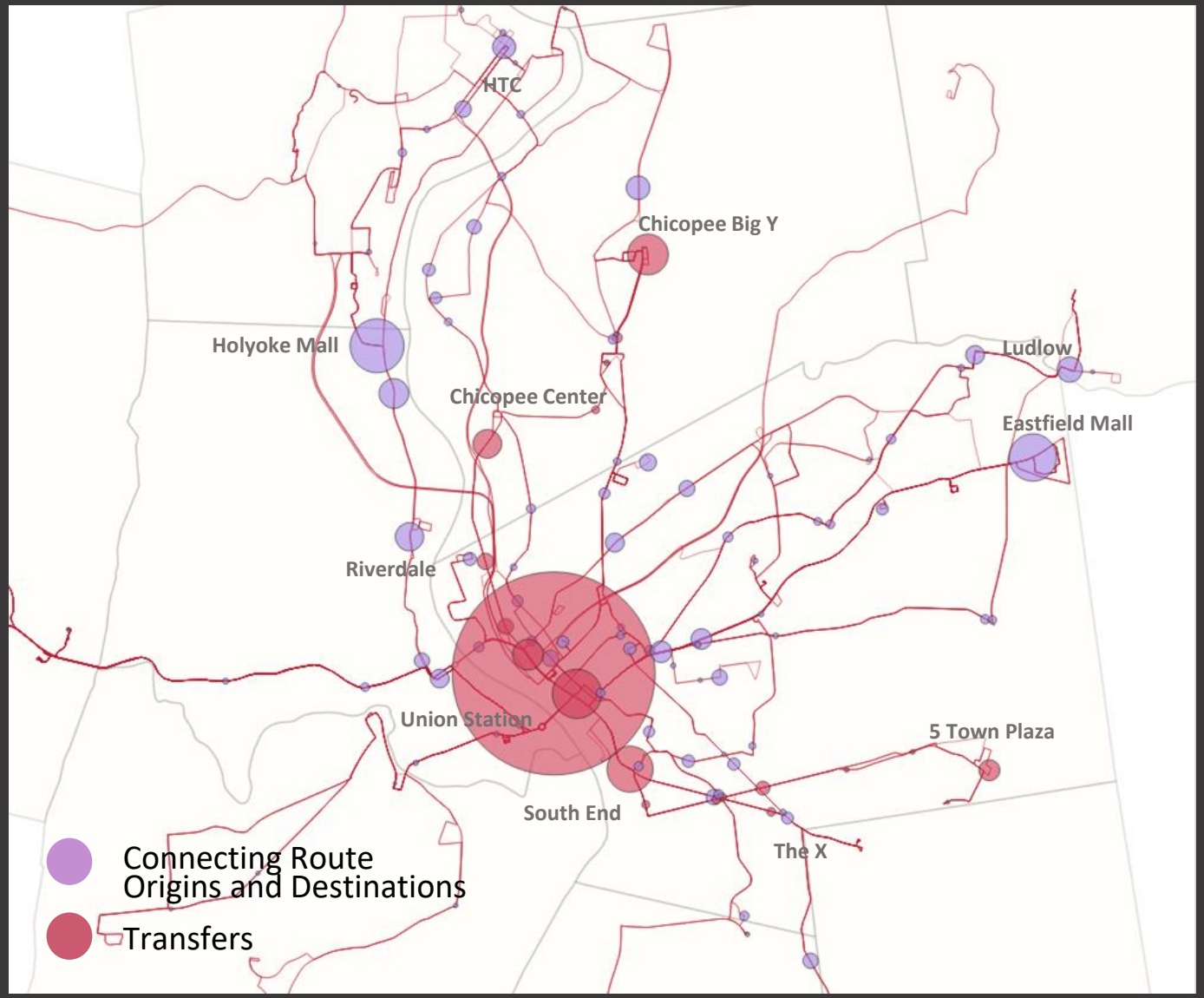
Northern and Southern Transfers

- 40% of Connections only included a North G1 trip, 43% included a South G1 Trip, and 6% included a North-South G1 Trip.
- Below, the transfers for the G1N and G1S are shown. Both have similar round trip rates, but there are some major differences in connecting routes.
  - The G1N connects mainly to the B6 and B7 heading to Ludlow and Eastfield mall, and to the X90 heading to North Chicopee.
  - The G1S Connects mainly to the G2 heading to various destinations, the and the P20/P20E to Riverdale and Holyoke Mall. The G1S also has noteworthy B6 and B7 usage.





G1 Transfers and Off-Route Connected Locations



- Red dots show Transfer locations for connections with the G1.
- Purple dots show locations from which people are connecting to the G1.
- Union Station is the main transfer location. We also see transfers at other locations in the Springfield Core, South End, Chicopee Center, and Chicopee Big Y.
- Holyoke Mall and Eastfield Mall show up as major origins and destinations on routes that connect to the G1.

Mapping G1 Connections

- These lines connect the origins and destinations of G1 connections. Purple lines connect them directly, and blue/green lines connect them via their transfer locations.

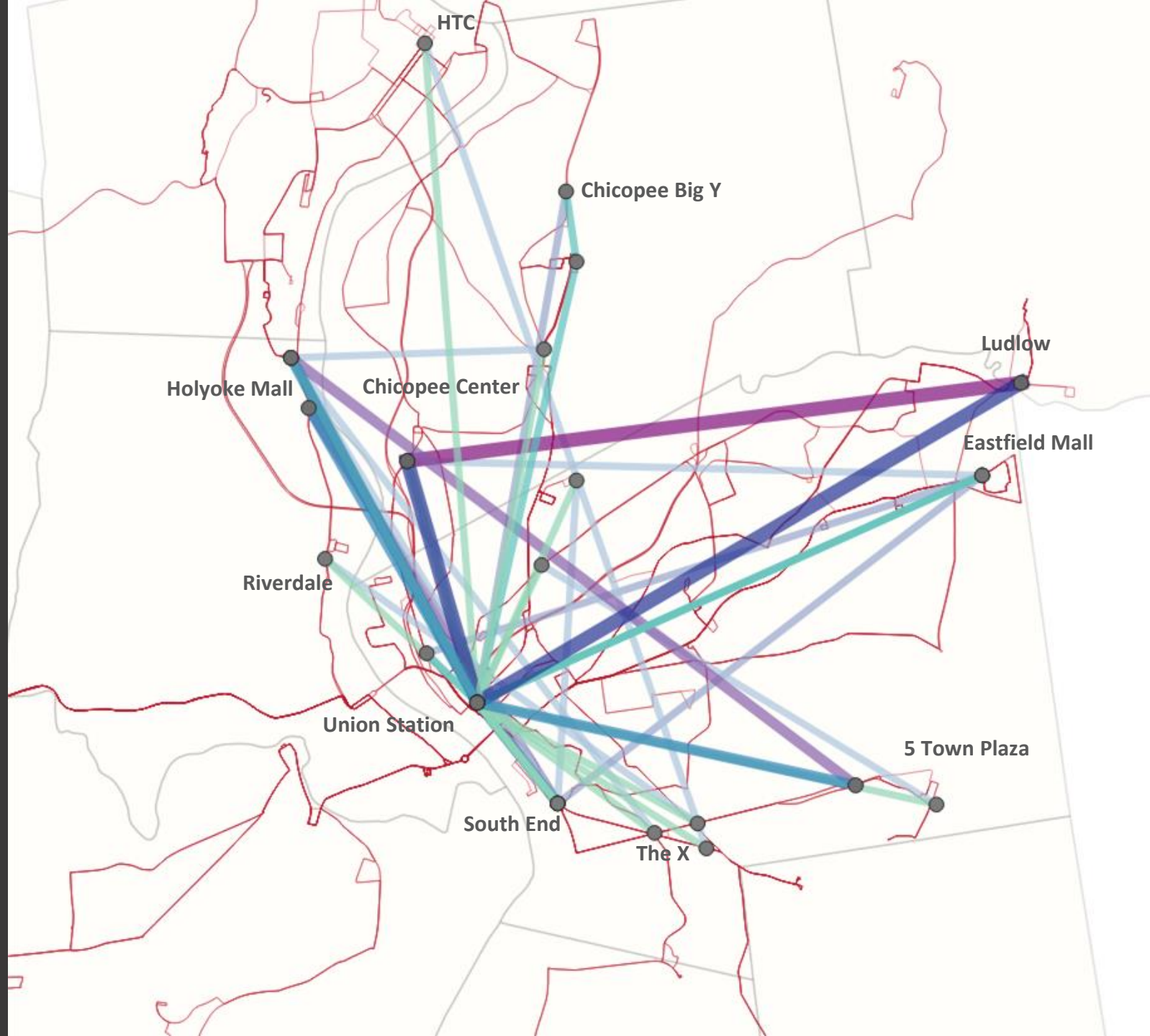
Connections shown Directly

Connections mapped via Transfers

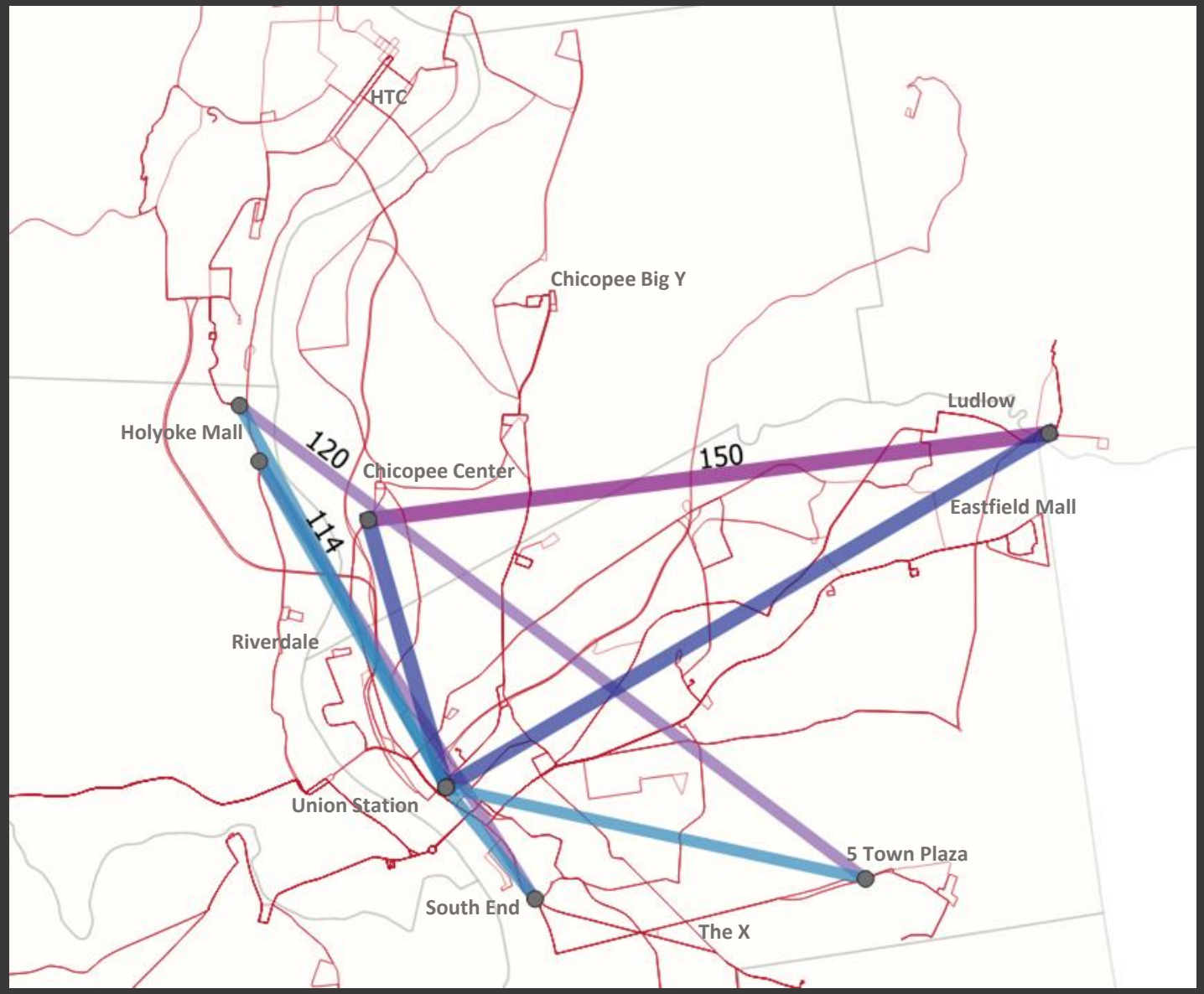
0 occurrences

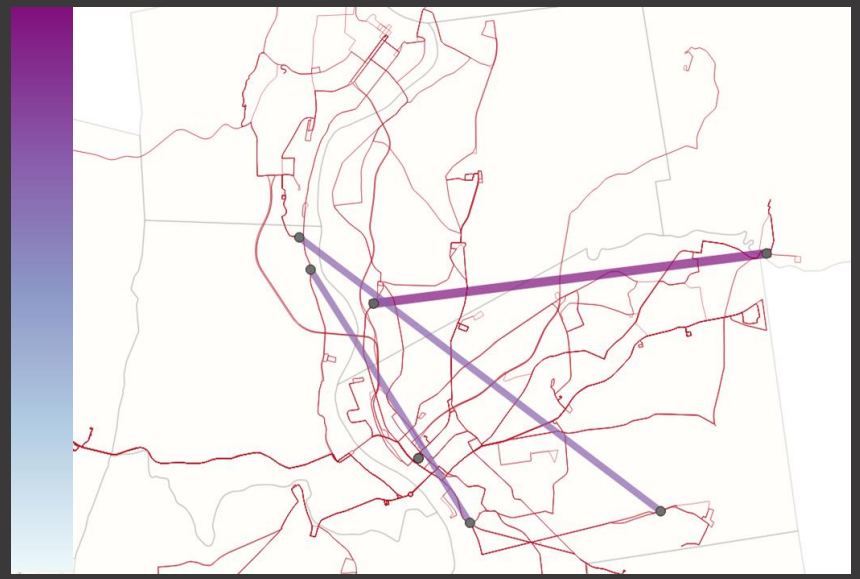
150 occurrences

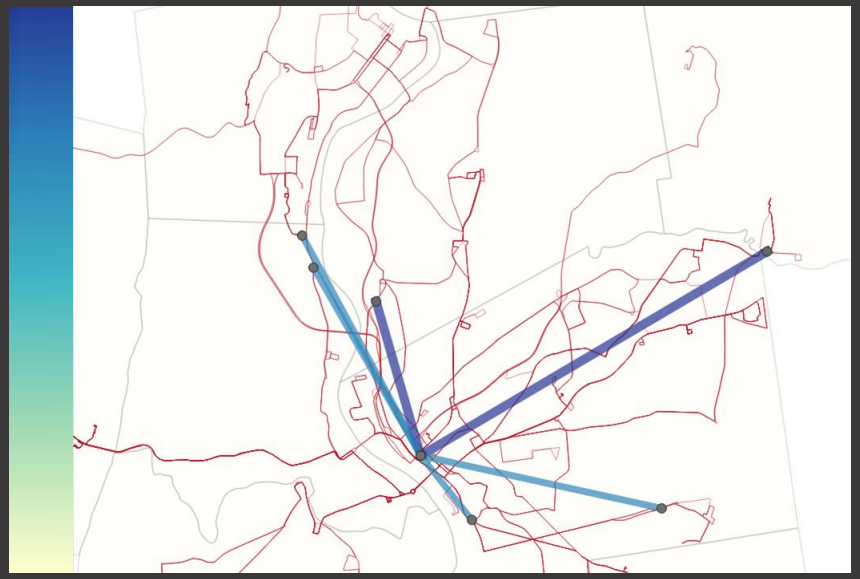
- Line thickness and color indicates the number of times each connection was made.
- These visualizations show the specific paths that people take to get to their destinations



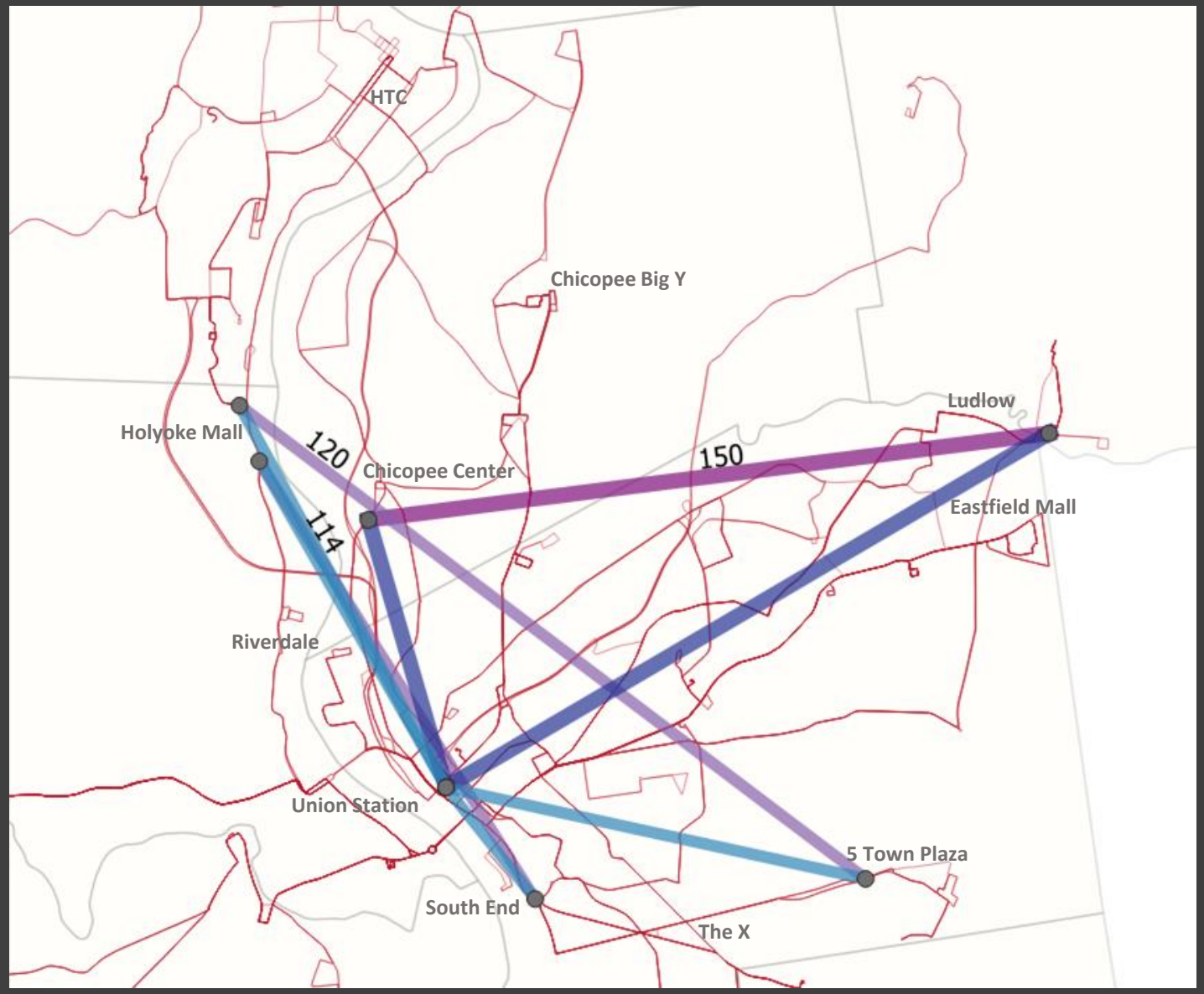
Most Common G1 Connections





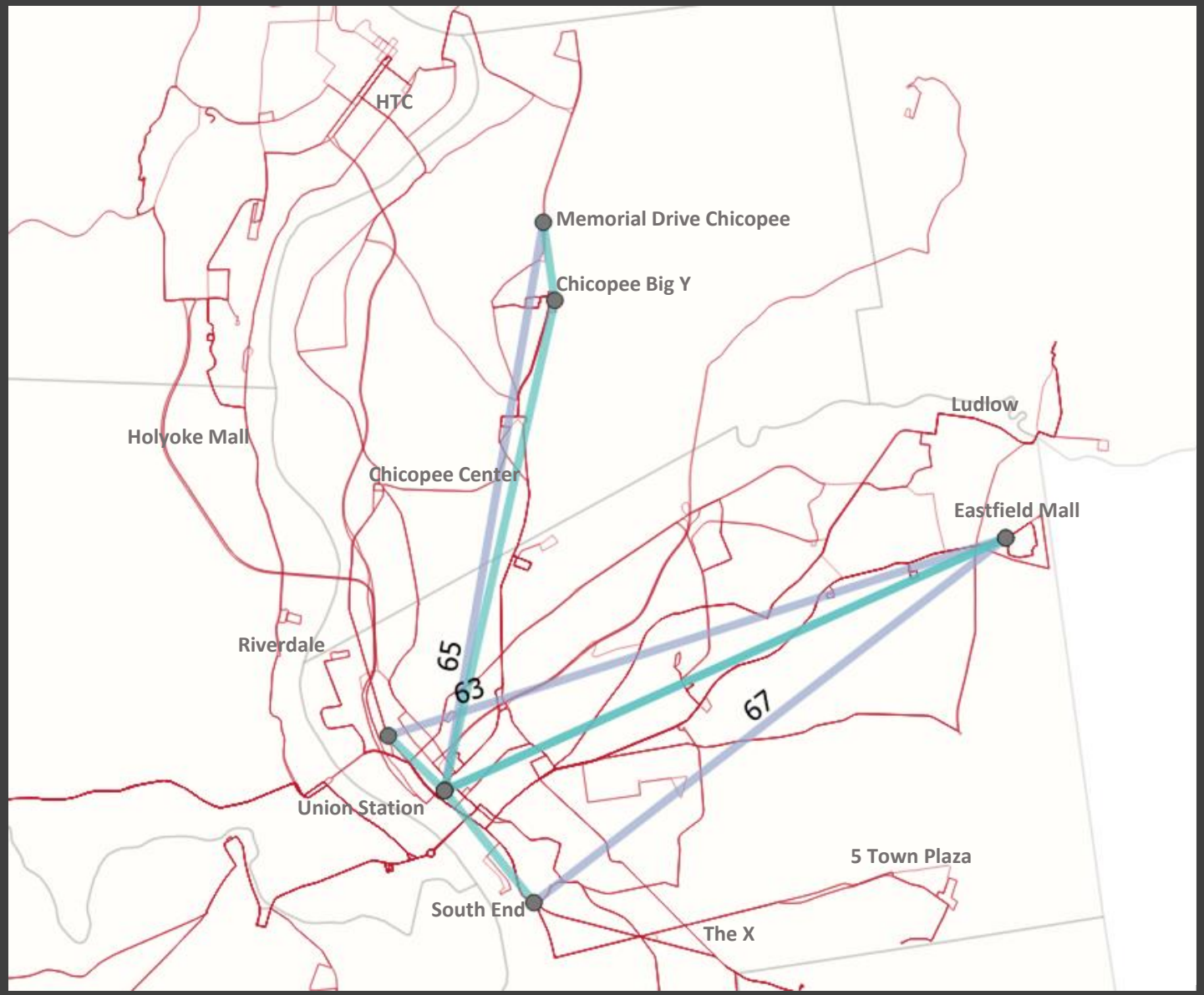


Most Common G1 Connections



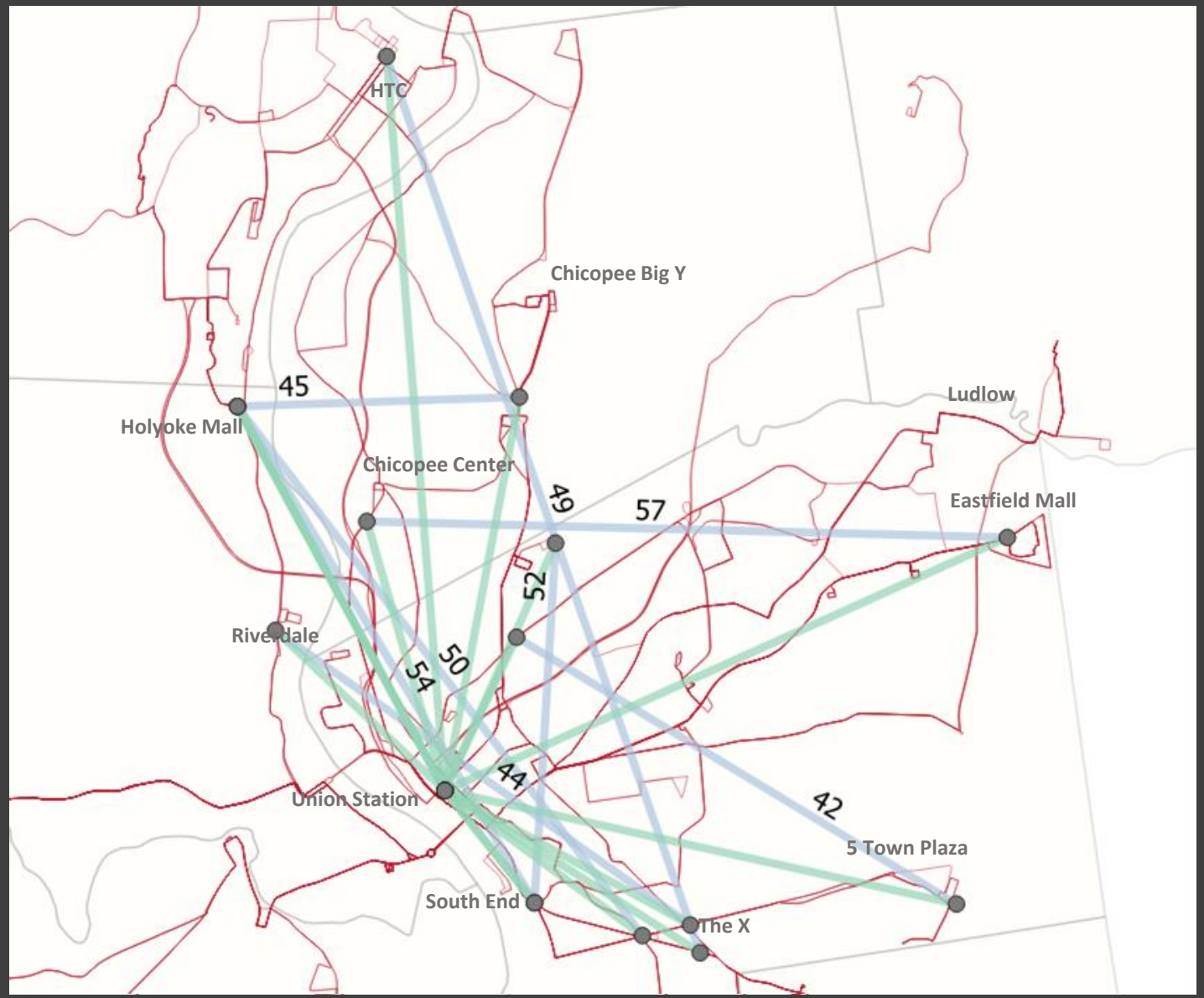
- The most common connection on the G1 was between Chicopee Center to Ludlow via the B6.
- 120 people travelled between Holyoke Mall and 5 Town Plaza via the P20 or P20E.
- 114 people travelled between Holyoke Mall and South End via the P20 or P20E.
- All most common transfers were at Union Stations.

Second Tier G1 Connections



- Again most transfers are at Union Station, but we do see 65 trips transferring from North Chicopee at the Chicopee Big Y from the X90 to the G1, and continuing on to Union Station. Many of these trips are made for the purpose of transferring again at Union Station to another destination.
- Eastfield Mall is the destination of two common paths that transfer to the B7 from the G1 at union station.

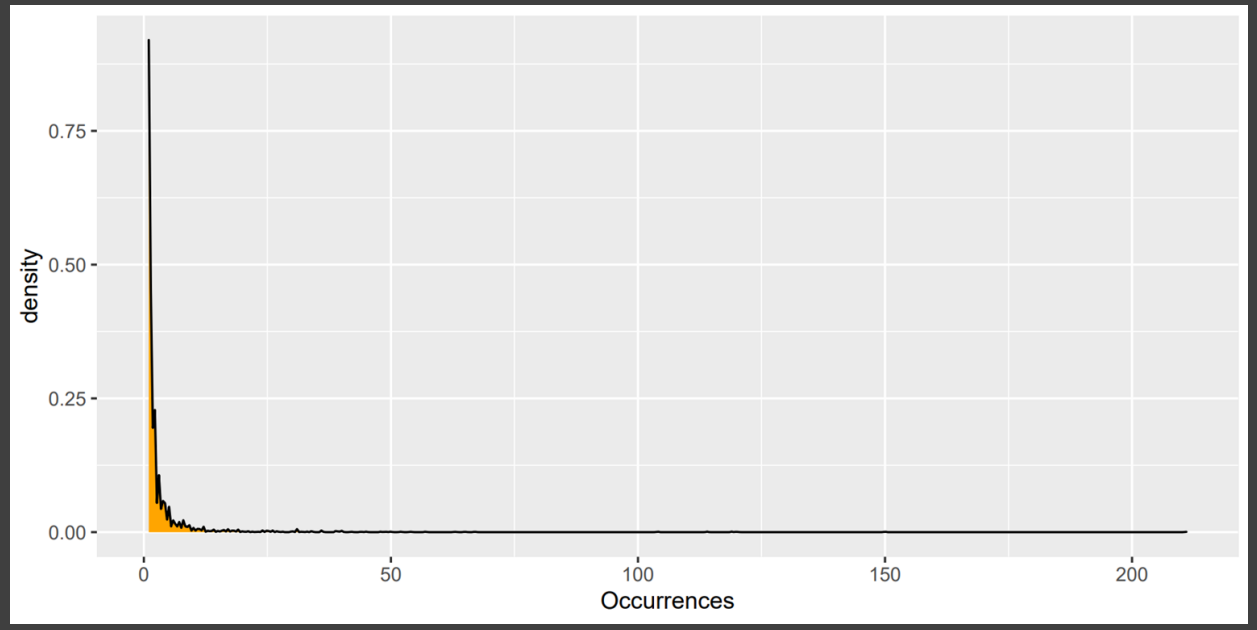
Next Tier G1 Connections

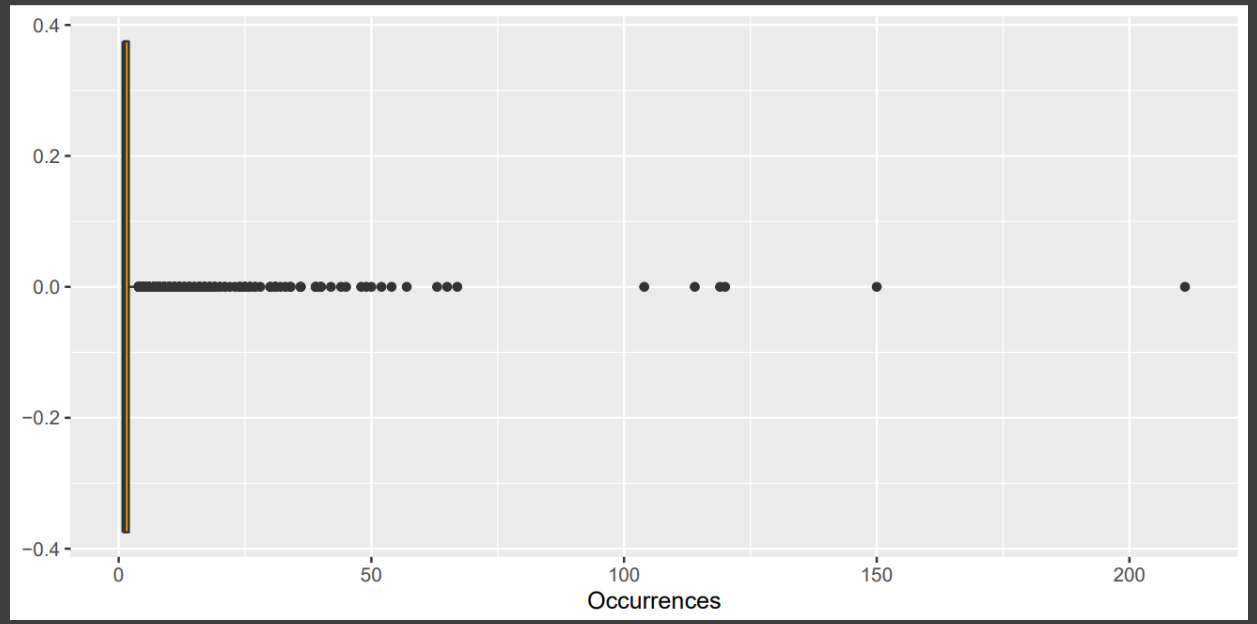


- Here we see multiple East-West Cross-Town trips, including Chicopee Center-Eastfield Mall.
- There are also multiple connections between the P20 and the southern G1.

Outliers in the Data

- All the connections highlighted in this presentation are outliers in the data, meaning that they were made by Bytemark users far more often than the average connection. This means that these connections are in high demand compared to other connections.





Takeaways for G1 N-S Split Proposal

- 5.5% of all connections on the G1 include a North-South Trip.
- 71% of Riders use the G1 to transfer to another route while 29% stay on the G1.
  - Of the connections that transfer to other routes, 55% transfer at union station, and 4.7% include a north-south trip on the G1 in order to reach the transfer location.
  - Of the connections that stay on the G1 (round trips), 7.1% include a north-south trip.
- At Union Station, G1 Transfers with the P20/P20E, B6, B7, and G2/G2E are the most important when considering changes to the G1 schedule.
  - The P20/P20E is being used more often to connect to the G1S.
  - The B6 and B7 are being used more often to connect to the G1N.
- There is demand for service to Union station from North Chicopee, which is currently being filled via a transfer to the G1 from the X9 0at Chicopee Big Y.