

Two-seat-ride

Analysis for SEPTA Services and its Possible Applications

Final
Report

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Abstract

Two-seat rides are commonly seen in any transit system that is large enough to involve transfer stations. The two-seat rides or transfers are an important index for evaluating transit services. Two-seat rides extend the transit services to more people in larger geographies with more opportunities. But that is achieved at the cost of increased travel time, service expansion cost, etc.

Taking Philadelphia and SEPTA as a case study, a way to quantify the impacts of two-seat rides compared to one-seat rides was first developed. It looked at population and jobs added and catchment area increased to learn about the potential of two-seat rides in general. Then, using employment, travel time, and service operating data, we tried to measure the efficiency of the transit system. Lastly, we applied the measurement on some real transit service expansion projects to look at how it measures their efficiency and feasibility.

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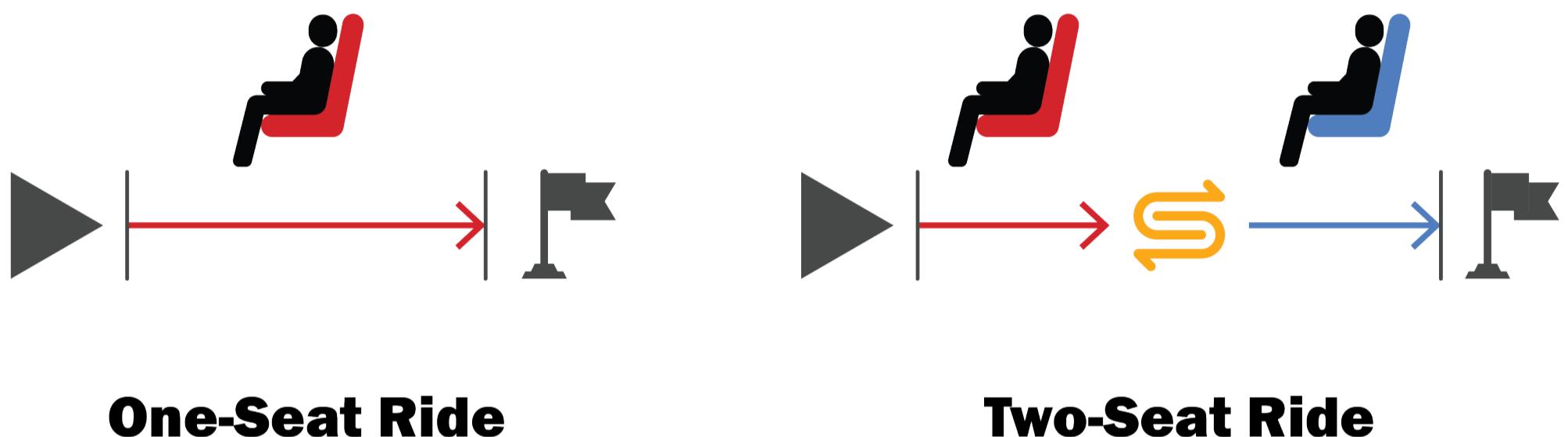
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1. Background

As is indicated by the name, a two-seat-ride is a ride that includes two transit routes and one transfer, as compared to a one-seat-ride, which includes one transit route and no transfer. When a transit trip switches from a one-seat-ride to a two-seat-ride, with one additional transfer and increased travel time, the reach of transit service will be increased as well. This raises questions such as how “good” the additional transfer is, how “effective” the two-seat-ride is, whether or not the extra transfer is worth it.



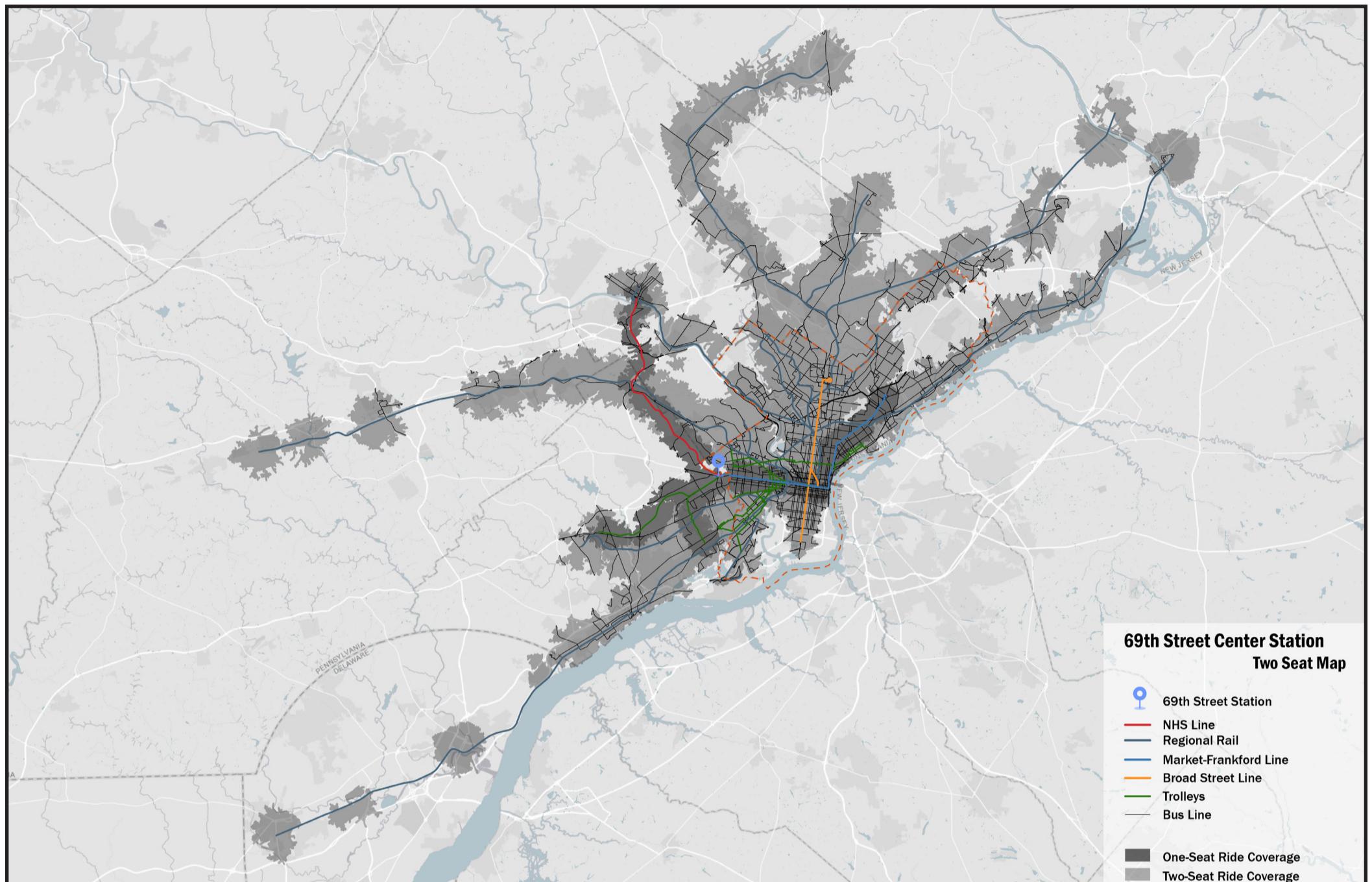
2. Purpose

In this research, starting from some specific stations in Philadelphia, I want to explore the potential of a two-seat-ride by comparing the differences between a one-seat-ride and a two-seat-ride from these stations. It could range from coverage area increased, stations included to population and jobs added.

The purpose here is that based on the comparison results, I could develop evaluation metrics that measure/quantify the efficiency of transit trips and then further generalize the two-seat-analysis into a framework for assessing the feasibility for service expansion plans.

3. Methodology

3.1 Exploring the potential of two-seat-rides

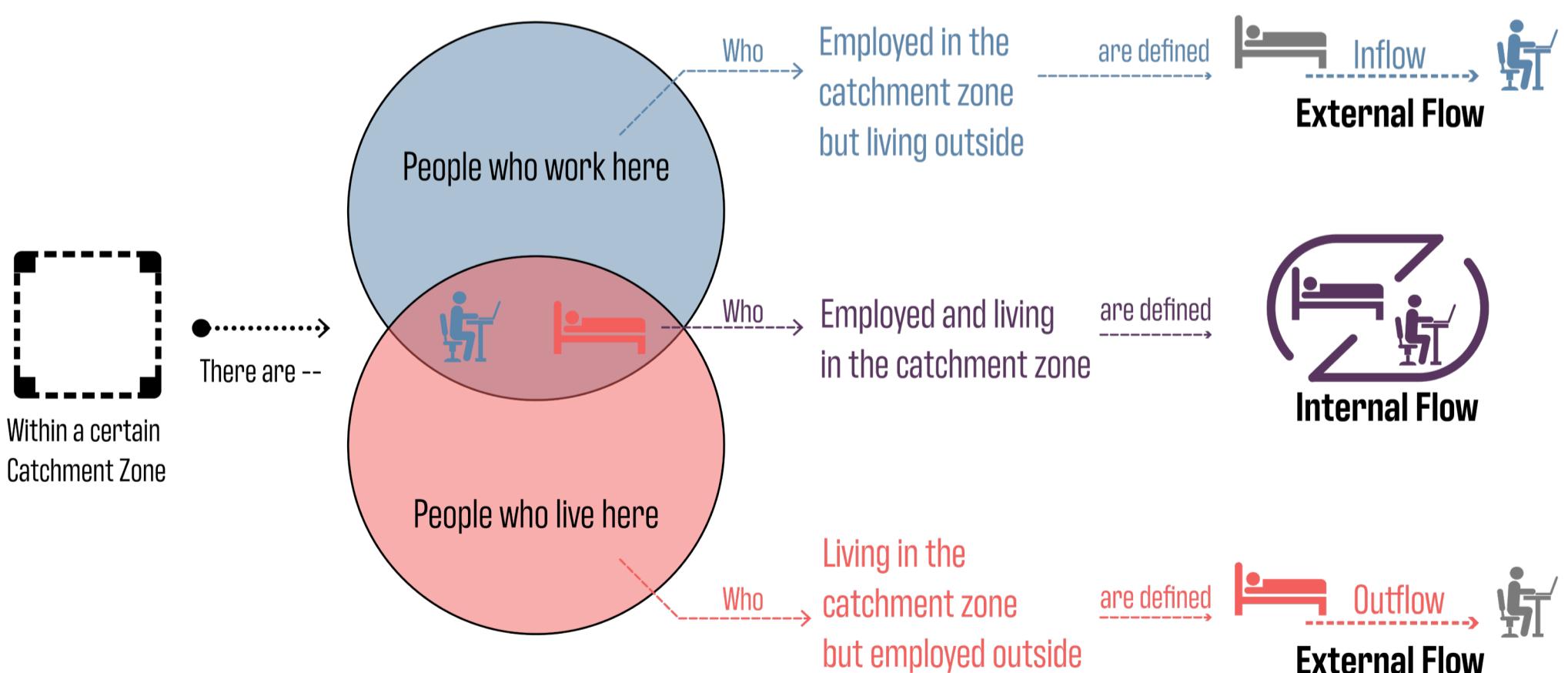


1. Firstly, I collected SEPTA service data including transit routes and station data. Then I selected the 69th Street Station as the origin station to perform the two-seat-ride analysis.
2. Then I selected the one-seat-ride and two-seat-ride routes starting from the 69th Street Station. Using Network Analyst in ArcGIS Pro, I created the service area for these one-seat-rides and two-seat rides.
3. Using the service area shape as boundary, I collected related demographic data such as population and employment data. I aggregated these data on a census tract level .
4. I used the one-seat and two-seat boundary to clip, join, and interpolate the census-tract-level demographic data so that I will have the one-seat and two-seat service area features with demographic information in it.

3.2 Measurement of two-seat-ride efficiency

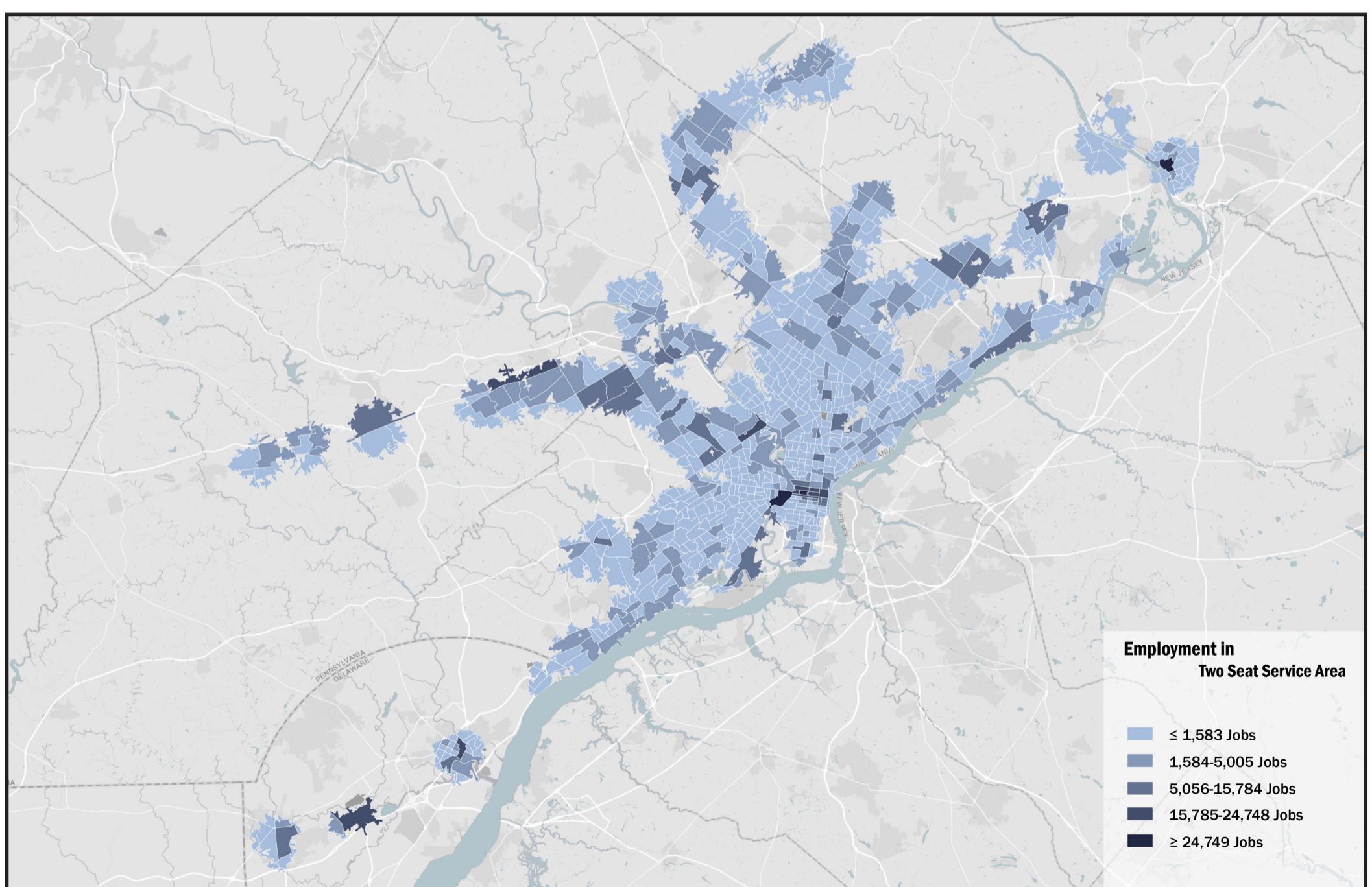
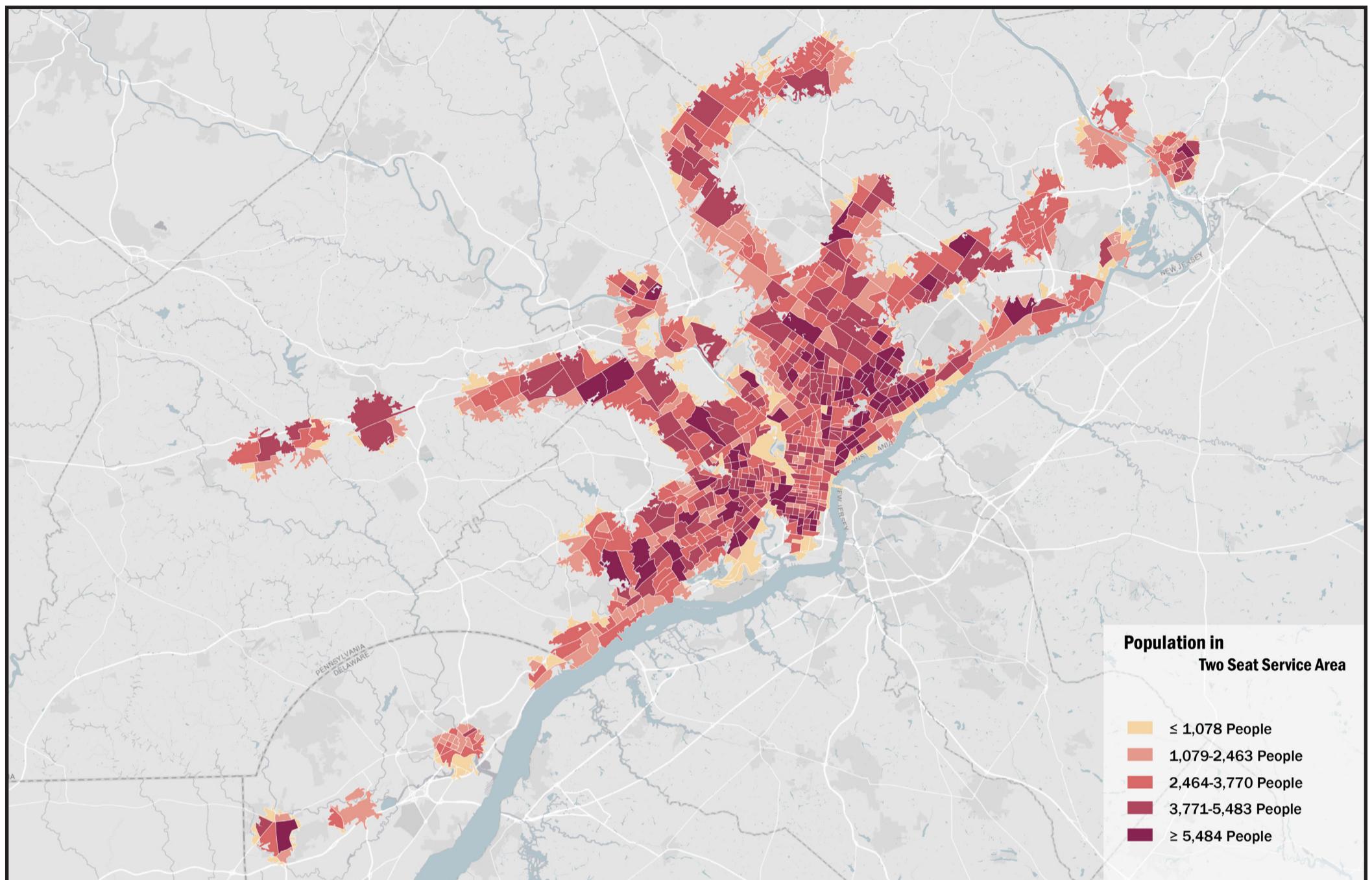
1. Up until now, we are able to assemble a set of shapes that contain certain demographic and economic information about different one-seat and two-seat rides. Then, we just need to visualize them on a map to demonstrate the differences between a one-seat-ride and a two-seat-ride.
2. However, the percent change and the visualization comparison only gave us a basic understanding of the changes between one-seat-ride and two-seat-ride. How do we know that change is “good enough”? How do we measure the “effectiveness/utility” of that change?
3. Therefore, I have come up with a measurement called the “internal / external flow”. I defined all commutings completed within a certain service area the internal flow, and all commutings completed outside of a certain service area the external flow.
4. I used the ratio between these two numbers to measure the efficiency of transfers since this ratio gives you a sense of how well a transit system can serve its commuters, and the better a transfer station, the better it should be able to help “internalize” some of the commutings.

Internal & External Flows



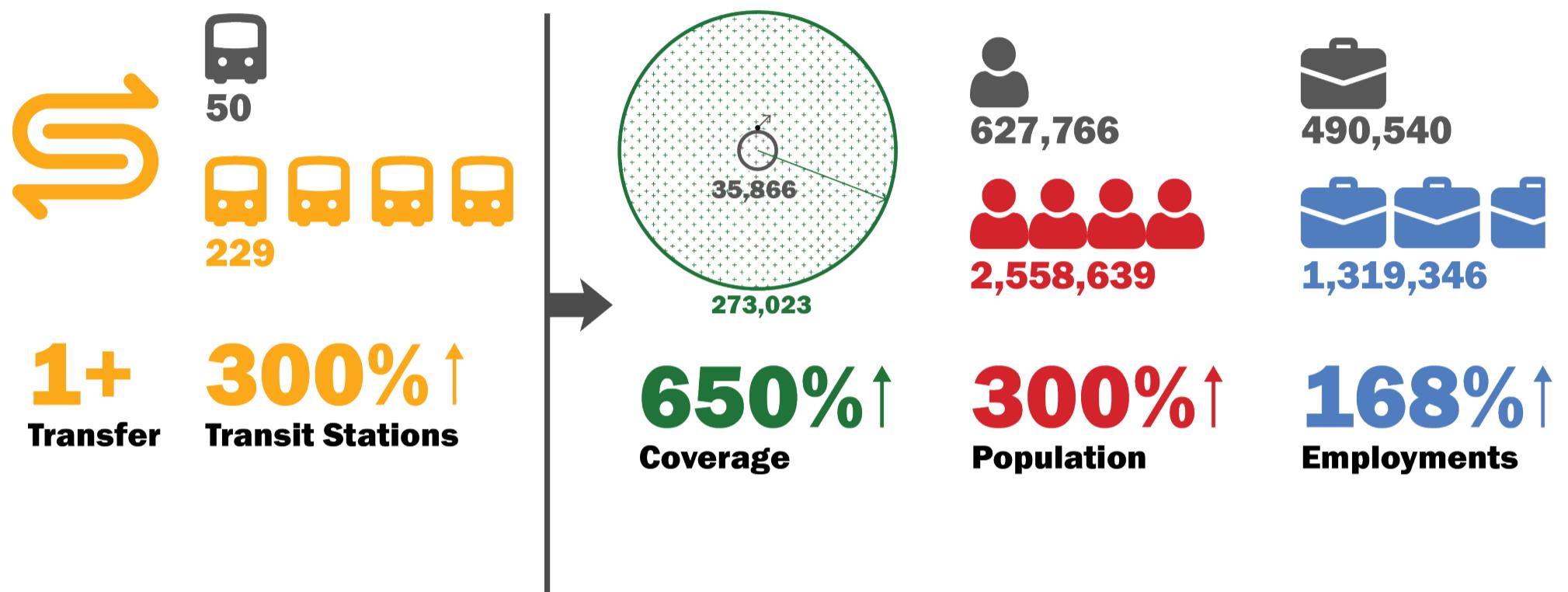
4. Findings

4.1 Differences Between One-Seat-Ride and Two-Seat-Ride

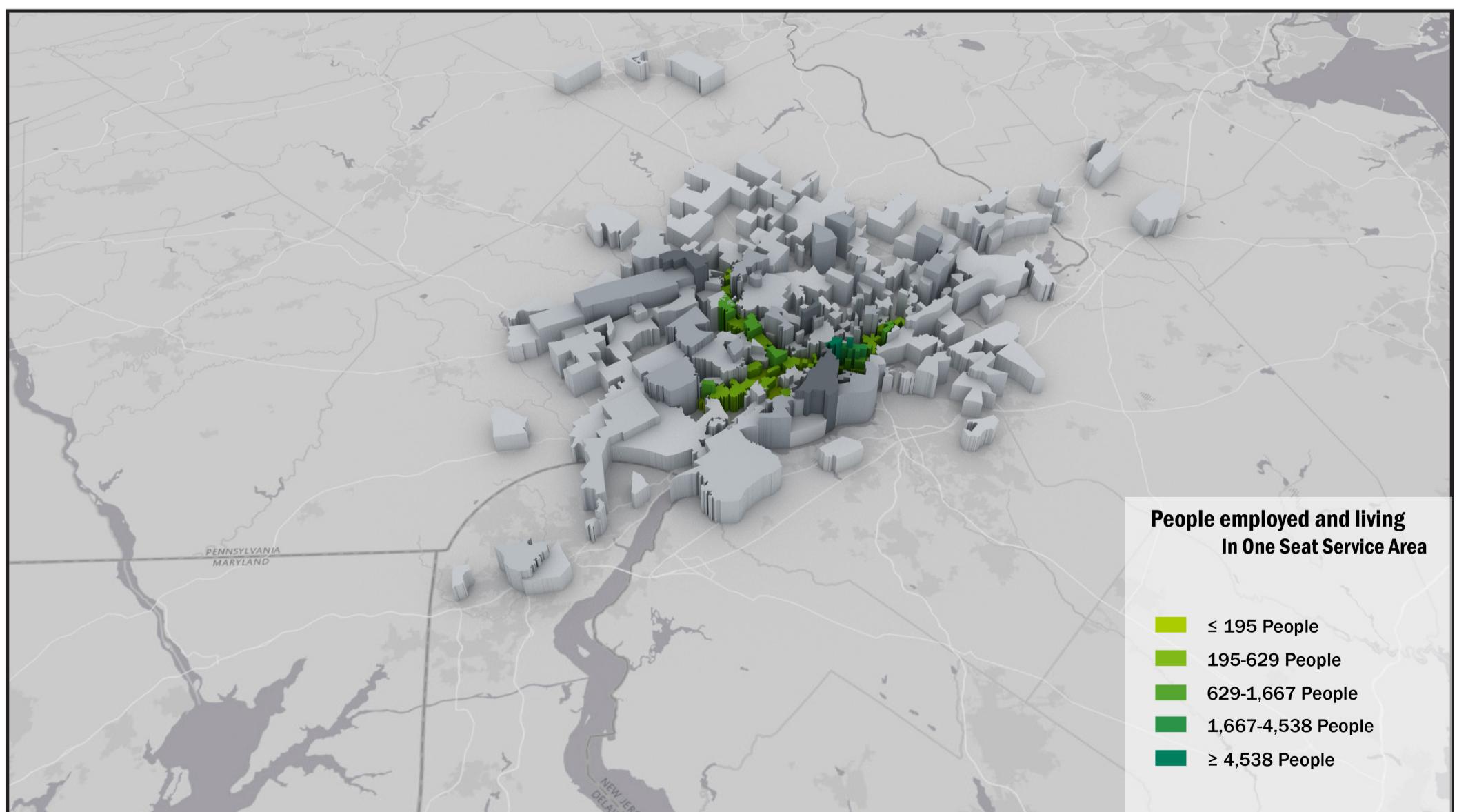


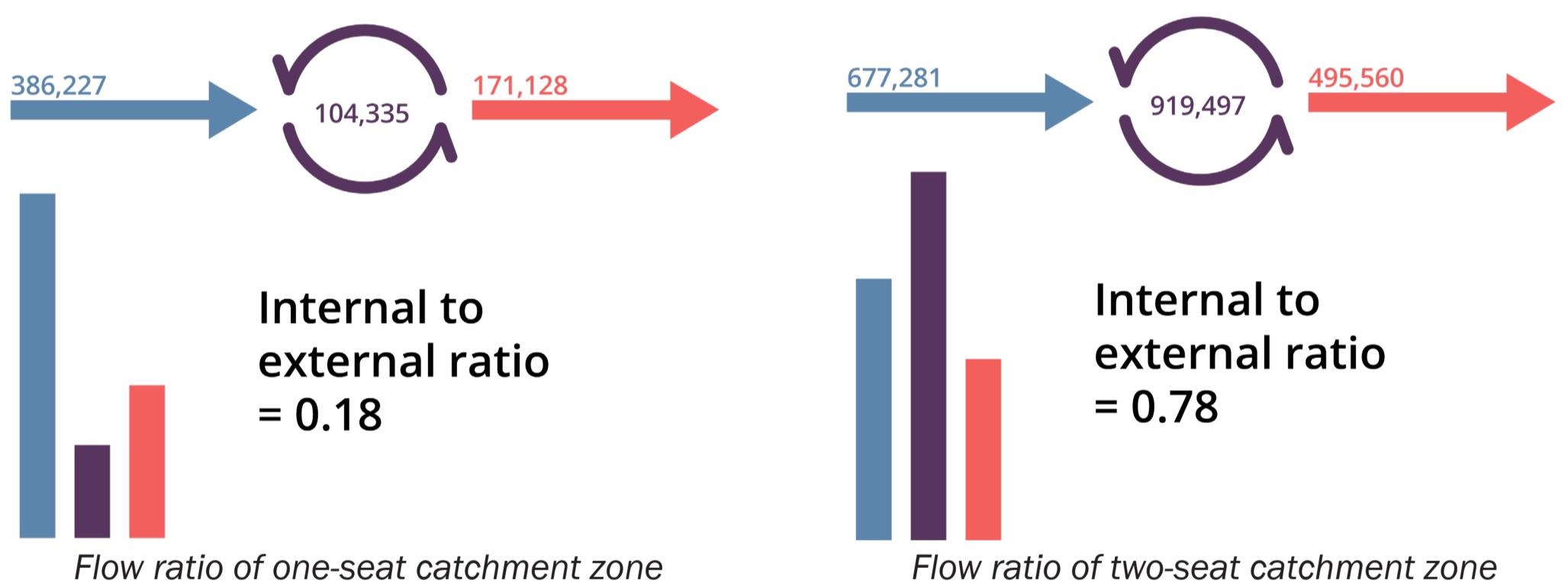
Originating from 69th Street Station, from a one-seat-ride to a two-seat-ride, with a single transfer, the transit stations connected increased by 300% from 50 stations in one-seat-ride to 229 stations in two-seat-ride. The catchment zone coverage increased by over 600% from one-seat to two-seat, the reach of SEPTA has greatly expanded

Also, population and employment generally increased by 200-300%, the potential of a two-seat-ride within the SEPTA system is great.



4.2 Efficiency of Two-Seat-Ride





5. Conclusion

From a one-seat-ride to a two-seat-ride originating from 69th Street Station, the service area coverage expanded by 600% with a single transfer, population and employment within the service area also increased by about 200%. The potential of two-seat-rides in SEPTA is great.

The “flow ratio (# of internal flow / # of external flow)” could be a good measurement for evaluating the efficiency / effectiveness of transfers or two-seat-rides. It delineates the benefits (increasing internal flows) and tradeoffs (increasing external flows) of adding transfers within a transit system.

6. References

[SEPTA routes and stations data](#)

(The location, operating details such as schedules, ridership, and frequency information)

[Philadelphia census data at tract level](#)

(Certain demographic information about the service catchment area different one-seat or two-seat-ride covers)

[Philadelphia employment data](#)

(Certain economic profile about the service catchment area different one-seat or two-seat-ride covers)

[SEPTA service schedule](#)

(Schedule information for all of SEPTA's transit services in preparation for possible travel time increase/decrease calculation)

[SEPTA yearly financial statement](#)

(financial statement and operating budget and possible expansion plans and feasibility evaluation)