Locating Transit Deserts and Identifying New Stop Locations in the Tri-Met District

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GIS II | March 20, 2017

Background

Public transit has several benefits for cities. It reduces congestion and pollution and increases equity, among others. Past studies show that access to public transit is a significant factor in determining average rate of employment (Sanchez, 1999). Low-income communities in turn are more "transit dependent", meaning they have no or limited access to cars (Jiao & Dillivan, 2013). Portland's public transit is served by Tri-Met, and allows people to travel across the entire region on buses the MAX Light Rail, or WES commuter rail. However, there are areas that are difficult to access via public transit, called "transit deserts". (Jiao & Dillivan, 2013). People who live and/or work in transit deserts must rely on cars for transportation, which is difficult for those on fixed incomes or are unable to drive. Increasing access to transit in identified transit deserts is often associated with increased social welfare, economic gains, as well as reduced congestion and pollution.

Problem Statement

Despite the vast amount of area Tri-Met serves within the Portland Metro region, there are still several transit deserts (defined as being farther than a 1/4 mile walk from a transit stop) in the region. The purpose of this project is to identify where these transit deserts are within the Tri-Met District, and how best to serve the people that live and work in the deserts. Our study area is the Tri-Met district, which serves most of the Portland Metro Area, except for Clark County, WA and Wilsonville, OR, which are both served by different transit agencies.

Methods

The ArcGIS Network Analysit tool, "Service Area Analysis" was used to identify the location of transit deserts in the Tri-Met district. Each bus or rail stop was identified as a facility, and 1/4 mile buffers were created around each. The result displayed how many places one can walk to or from each stop in 1/4 mile using the street network. Because walking is the primary means of traveling to and from a station, the network is simple. When walking, people are not hindered by one way streets or turn restrictions, so it is not necessary to build a complex network.

A location-allocation analysis was performed after the service area analysis in order to identify suitable locations for new transit stops, using affordable housing units as the location. People in affordable housing use transit at a higher rate, so locating stops near them will lead to greater outcomes. Road junctions were identified as facilities in this scenario. The output of this anlaysis showed the optimal sites for new transit stops based on the density of affordable housing units.

Data Needs

- Tri-Met Bus, MAX, and WES stations
- Tri-Met service area boundary
- Affordable housing unit locations
- Census Tract size and populations
- Surface streets in Portland Metro Area

Results

The results of the service area analysis, shown in *Map 1* reveal three pieces of information: (1) there is a significantly lower concentration of transit stops in the western portion of the Tri-Met district, particularly in Beaverton and Hillsboro; (2) there is one corridor stretching from inner Southeast Portland out to Gresham between Powell Blvd. and Stark St. devoid of transit; and (3) virtually all edges of the transit district are underserved.

The results from the population density analysis show that the tracts with the highest density are located in Downtown and the east side of Portland. Some tracts on the west side are also high, particularly the areas between Hillsboro and Beaverton along Beaverton-Hillsday Hwy.

The results of the location-allocation analysis are displayed in *Map 3*. A pattern emerges that shows the need for more transit in east Portland, but the most need is in Beaverton and Hillsboro on the west side. In Beaverton, there is a considerable number of affordable housing units located in transit deserts. This presents the best opportunity and most potential for transit expansion in the Tri-Met District.

Discussion & Future Research Needs

The results show that there is a general need for additional transit on both the west and east sides of the Portland Metro Area. However, a more technical analysis is needed in order to assess the actual viability of adding more bus or rail service. Other factors that impact transit ridership, like income and race/ethnicity, should be examined.

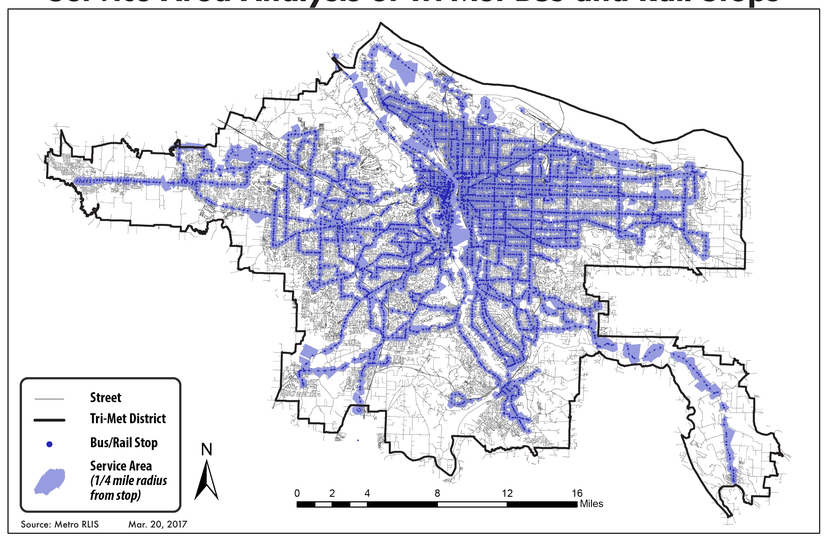
Additionally, it needs to be determined whether to add additional stops to existing routes, or to develop entirely new routes. Adding stops to existing routes is likely cheaper to implement, but slows down the existing bus and lengthening commute times. Conversely, developing a new route will be costlier, but save riders time.

Network analyst can continue to be utilized for further analysis. The vehicle routing problem tool can be used to determine the most efficient route when adding new stops to an existing route or developing a new route. Accounting for historical and live traffic data will also further increase the precision and efficiency of new route building.

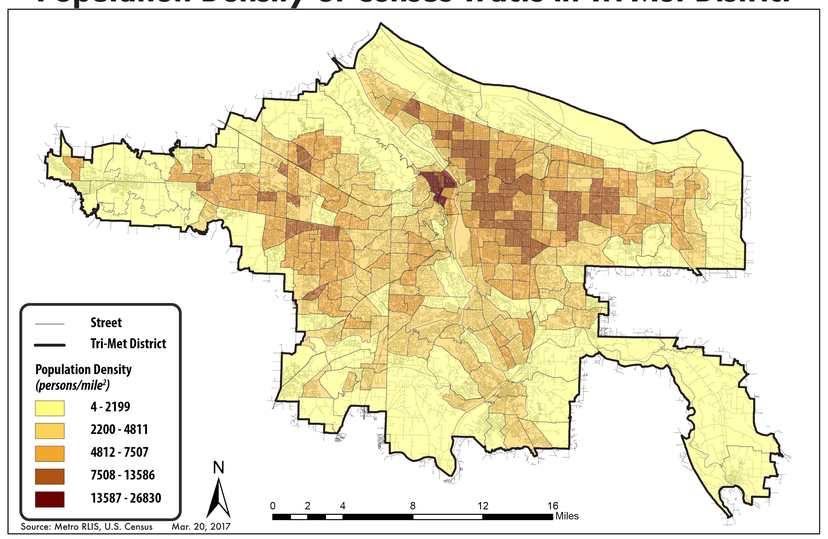
References

- Sanchez T W. The connection between public transit and employment: the cases of Portland and Atlanta[J]. Journal of the American Planning Association, 1999, 65(3): 284-296.
- Jiao J, Dillivan M. Transit deserts: The gap between demand and supply[J]. Journal of Public Transportation, 2013, 16(3): 2.

Service Area Analysis of Tri-Met Bus and Rail Stops



Population Density of Census Tracts in Tri-Met District



Location-Allocation Analysis of New Stop Sites