

City Clustering Methodology proposed by APTA

Introduction

Given current trends in transit ridership in America, multiple efforts have been made by transit agencies, industry associations, and academia, to understand and develop strategies to tackle the negative trends in transit ridership nationwide. The following document was prepared American Public Transportation Association to support these efforts as an independent methodology proposal to cluster American cities according to multiple characteristics related with transit. Its goal is to supplement ongoing research data to encourage the design of better tailored and more actionable strategies for ridership improvement.

Data used

- CBSA Weighted Density in 2010¹(residents per square mile): Calculated as the population-weighted average density of each census tract in a CBSA. This metric has the advantage of discarding undeveloped or unpopulated census tracts and assigning a higher weight to census tracts with higher populations. It can be considered as the average perceived density in a CBSA.
- CBSA Ridership per Capita in 2017²: defined as the sum of unlinked passenger trips in all UZAs in a CBSA divided by the population in those UZAs.
- CBSA Total Operating Expenses in 2017³: defined as the total operating expenses reported by all transit agencies in the UZAs operating within a CBSA.
- CBSA Operating Expenses per Capita: calculated as a CBSA Total Operating Expenses divided by the UZA population in the CBSA.

Notes on the data used:

- CBSA Weighted Density is calculated using Census data and thus it is not possible to calculate it for 2017. Even though it is only available in 2010 it was assumed that there were order of magnitude changes for this measure and thus was considered valid for the analysis.
- CBSA Weighted Density approximates UZA Weighted Density, as UZAs account for the greatest weight in the density in a CBSA.
- UZA population reported by NTD is from 2010 and is not updated on a yearly basis, therefore the analysis does not account for possible changes in population since 2010.

Reconciliation of data

Given that the US Census Bureau reports weighted density at CBSA level and the NTD reports transit data at UZA level, it was necessary to reconcile both datasets for the analysis intended. A UZA was associated to a CBSA defined in 2017 if its centroid was inside the area of the CBSA. Also, CBSA definition

¹ Source: <https://www2.census.gov/programs-surveys/decennial/tables/time-series/c2010sr-01/cbsa-report-chapter-3-data.xlsx>

² Source: National Transit Database, <https://www.transit.dot.gov/ntd/data-product/2017-annual-database-uzas>

³ Ibid.

from 2017 was reconciled with the 2010 definition using the same centroid technique. CBSAs defined in 2017 were defined as the unit of measure for this analysis.

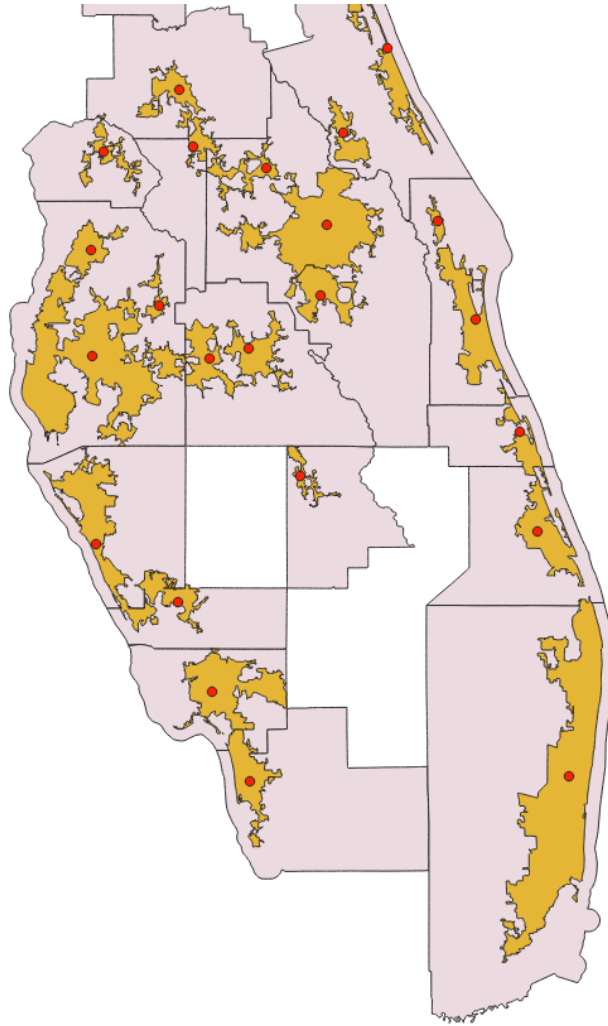


Figure 1. Geographical reconciliation of UZA and CBSA data

Clustering methodology

The set of CBSAs was split into three groups using the sum of Total Operational Expenses of the UZAs in each CBSA in 2017:

1. High Operational Expenses: Above 300M each, accounting for about 79% of operating expenses reported nationwide.
2. Mid Operational Expenses: Between 30M and 300M, accounting for about 16.5% of operating expenses reported nationwide
3. Low Operational Expenses: Below 30M, accounting for the remaining 4.5% of operating expenses reported nationwide.

Each group was then split into quadrants defined by levels of competitiveness and influence of external factors⁴. These variables were approximated using the following criteria:

- **External Factors:** Population weighted residential density was used as an approximation to the influence of external factors that favor transit ridership within a CBSA. The higher the weighted density, the more favorable are the conditions to support transit.
- **Competitiveness:** Ridership per capita was used as an approximation to indicate how competitive is transit compared with other modes within a CBSA. This might include cost competitiveness, time competitiveness, or other factors that can potentially be addressed by transit agencies. The higher the ridership per capita, the higher competitiveness against other transportation modes.

	External Factors	
Competitiveness	Less Favorable External Factors, Stronger Competitiveness:	More Favorable External Factors, Stronger Competitiveness:
	Less Favorable External Factors, Weaker Competitiveness:	More Favorable External Factors, Weaker Competitiveness:

Thresholds were defined for each operating expenses group using the average weighted density and average ridership per capita of the CBSAs within the group. The following are the thresholds defined for each group:

- High Operational Expenses Group: (New Your City and Los Angeles were removed from this calculation given their outlier nature):
 - Average Weighted Density: 6,107 residents per square mile
 - Average Ridership per Capita: 49.31 trips a year
- Mid Operational Expenses Group:
 - Average Weighted Density: 3,482 residents per square mile
 - Average Ridership per Capita: 16.88 trips a year
- Low Operational Expenses Group:
 - Average Weighted Density: 1,837 residents per square mile
 - Average Ridership per Capita: 7.62 trips a year

⁴ Source: <https://www.apta.com/wp-content/uploads/Resources/resources/reportsandpublications/Documents/APTA-Understanding-Recent-Ridership-Changes.pdf>