# A Spatial Analysis of Transit Deserts and Infrastructure Gaps in Oklahoma City

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## ABSTRACT

Transportation equity is crucial for equal access to essential services and opportunities, but disparities in urban transit systems often affect transit-dependent populations. This study examines transit deserts in Oklahoma City, where the demand for public transit exceeds the available supply, affecting residents who lack access to personal vehicles. Despite rapid growth, the city's public transit infrastructure has not kept pace, leading to significant service gaps. The transit-dependent population in Oklahoma City constitutes 13.24% of the total population, with significant transit deserts in suburban and less densely populated areas. This uneven distribution highlights a disparity in transit resource allocation, with higher-demand urban centers receiving more comprehensive services compared to underserved peripheral areas. The research provides actionable insights for policymakers and urban planners to address transit inequities and foster a more inclusive and equitable transportation system in Oklahoma City.

## BACKGROUND

Over the past century, urban areas in the United States have faced numerous social and ecological challenges, with car-oriented development being one of the most significant. The prevalence of automobiles has profoundly influenced urban landscapes, raising concerns about environmental sustainability and social equity (Banister, 2008; Cavoli, 2021). Historically car-centric development in most of the American cities has led to increased automobile dependence and longer trip distances, posing significant challenges to equitable transportation access—a key factor in enhancing urban livability and economic opportunity. Oklahoma City's rapid urban growth, evident in new housing and commercial developments, predominantly along major transportation corridors such as the north-south freeway and the Kirkpatrick Turnpike loop, exacerbates this issue. The city's sprawling urban layout and rapid development heighten the necessity for effective public transit to ensure all residents, particularly transit-dependent ones, can efficiently access city services, employment, and educational opportunities. Despite public transportation's critical role in promoting urban equity and sustainability, service provision gaps often fail to meet residents' needs equitably (City of OKC, 2020a, 2020c).

Despite the extensive urbanization, the underserved and transit-dependent population faces significant challenges. Approximately 15% population living in poverty which is greater than the national average 12.5%, are particularly affected by the inadequate transit facilities (US Census Bureau, 2022). The absence of comprehensive studies on Oklahoma City's transit system underscores the urgency of identifying transit gaps.

## OBJECTIVE

- Analyze disparities between transit supply and demand at the block group level using geo-spatial data and statistical methods.
- Identify strengths and weaknesses in Oklahoma City's current transit infrastructure.
- Highlight underserved areas and key demographic groups affected by transit deficiencies.
- Pinpoint regions in need of public transportation improvements.

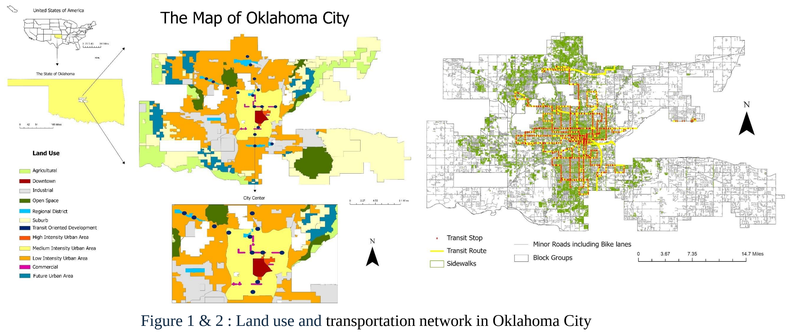


Figure 1 & 2 : Land use and transportation network in Oklahoma City

## METHODOLOGY

Table 1 The variables of the study

| Category | Variable | Data Source |
|---|---|---|
| **Transit Demand** | Population | US Census Bureau |
| | Vehicle Available | US Census Bureau |
| | Group Quarter Population | US Census Bureau |
| | Non-institutionalized population living in group quarters | US Census Bureau |
| | Means of transportation (Carpooling) | US Census Bureau |
| **Transit Supply** | Number of transits stops within each block group | Bureau of Transportation Statistics, General Transit Feed Specification (GTFS) |
| | Number of transit routes within each block group | Bureau of Transportation Statistics, General Transit Feed Specification (GTFS) |
| | Total length of sidewalks (mi) within each block group | City of Oklahoma Open Data Portal |
| | Total length of bike routes (mi) within each block group | City of Oklahoma Open Data Portal |
| | Total length of low-speed limit (Speed Limit less than 40 mile/hour) roads (mi) within each block group | OpenStreetMap |
| | Intersection density within each block group | OpenStreetMap |
| | Frequency of transit service (Based on weekday service) | Embark General Transit Feed Specification (GTFS) |

### Transit Demand

**Calculation of Transit-dependent population**

**Household drivers** = (population age 16 and over) – (persons living in group quarters)

**Transit-dependent household population** = (household drivers) – (vehicles available) * national level carpooling ratio

**TDP** = (transit-dependent household population) + (population ages 12–15) + (non-institutionalized population living in group quarters) (According to U.S DOT)

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**Geospatial Data Integration**
TDP was spatially joined with block group shapefiles to map the metrics

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**Density Calculation**
For each block group, the TDP was divided by the area (in square meters) to calculate density

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**Standardization**
Z score of TDP density in block groups

### Transit supply

**Transit Supply Metrics**
We used the seven comprehensive metrics from Jiao (2017

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**Geospatial Data Integration**
Each variable was spatially joined with block group shapefiles to map the metrics

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**Density Calculation**
For each block group, the value of each metric was divided by the area (in square meters) to calculate density.

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**Standardization**
The values for all metrics were standardized using a z-score to normalize data.

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**Aggregation of Z score**
The overall transit supply for each block group was determined by aggregating the z-scores of all metrics.

**Transit Gap** = Supply (Z score) – Demand (Z score)

## RESULTS




Figure 3 The distribution of transit dependent population in Oklahoma City




Figure 4 The distribution of low- and moderate-income population with underserved racial concentration in Oklahoma City

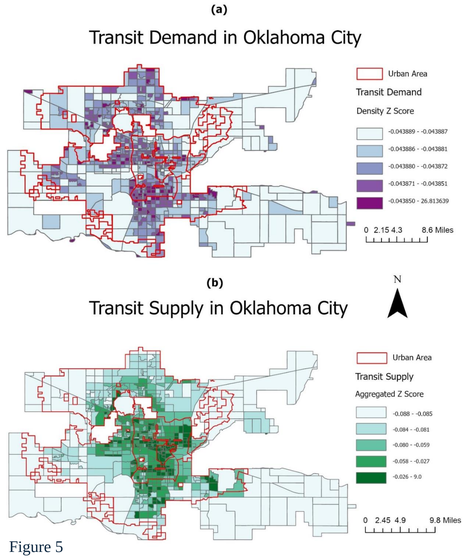


Figure 5

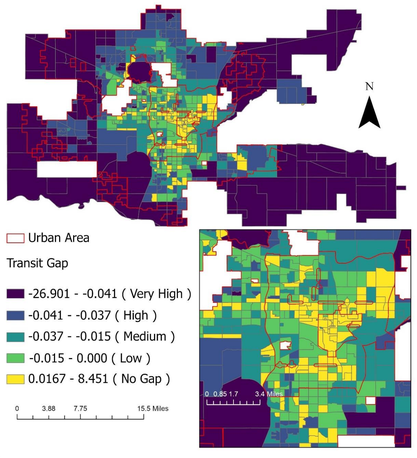


Figure 6 Transit desert analysis in Oklahoma City

## DISCUSSION

- Approximately **13.24%** of Oklahoma City's population (91,988 individuals) rely on public transportation, distributed across both central urban areas and suburban regions.
- Transit demand is concentrated in urban areas, with block groups in the city core showing the highest needs due to higher population density and lower car ownership.
- Block groups with high percentages of **LMI populations (76%–100%)** are primarily located in dense urban areas, where transit demand is also highest.
- Block groups with higher percentages of racially/ethnically underserved populations **(over 70% non-white)** show a strong overlap with high transit demand and transit gaps.
- The city's transit infrastructure, including **1,237 transit stops and 51 routes**, is heavily concentrated in the downtown and central areas, leaving outlying regions with minimal services.
- Out of 725 block groups, **516 (85%)** exhibit transit gaps, with the highest gaps found in suburban areas and among racially and economically disadvantaged populations.
- Significant transit deserts were identified, particularly **in suburban and peripheral areas,** despite high transit service density in the central business district (CBD).

## RECOMMENDATIONS

- **Targeted Transit Investments**: Allocate resources to improve transit services in underserved areas, particularly in suburban and low-income regions.
- **Multi-Modal Integration**: Enhance connectivity through the integration of various transportation modes such as buses, streetcars, bikes, and walkable infrastructure.
- **Community Engagement**: Involve local communities in transit planning to ensure the needs of transit-dependent populations are met.
- **Policy Adjustments**: Redirect funding and subsidies from wealthier areas to prioritize transit-reliant, low-income neighborhoods.
- **Infrastructure Enhancements**: Expand pedestrian and bike-friendly infrastructure to improve walkability and sustainable mobility options.
- **Data-Driven Planning**: Continue using geo-spatial data and statistical analysis to monitor transit gaps and adapt services to meet evolving urban needs.

**References**

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