



Transit System Analysis in Buffalo, NY

Shravani Hariprasad



Introduction

- Analyzing the transit system in Buffalo, NY using the Smart Location database to provide insights for future transit projects.
- **DataSource:** US Smart Location Database
(<https://www.transportation.gov/grants/dot-navigator/general-dataset-and-mapping-tools>)
- **Tools used:** ArcGIS Online ([Smart Location Database \(arcgis.com\)](https://arcgis.com)) Web Application

How does transit system serve
residents without a car?

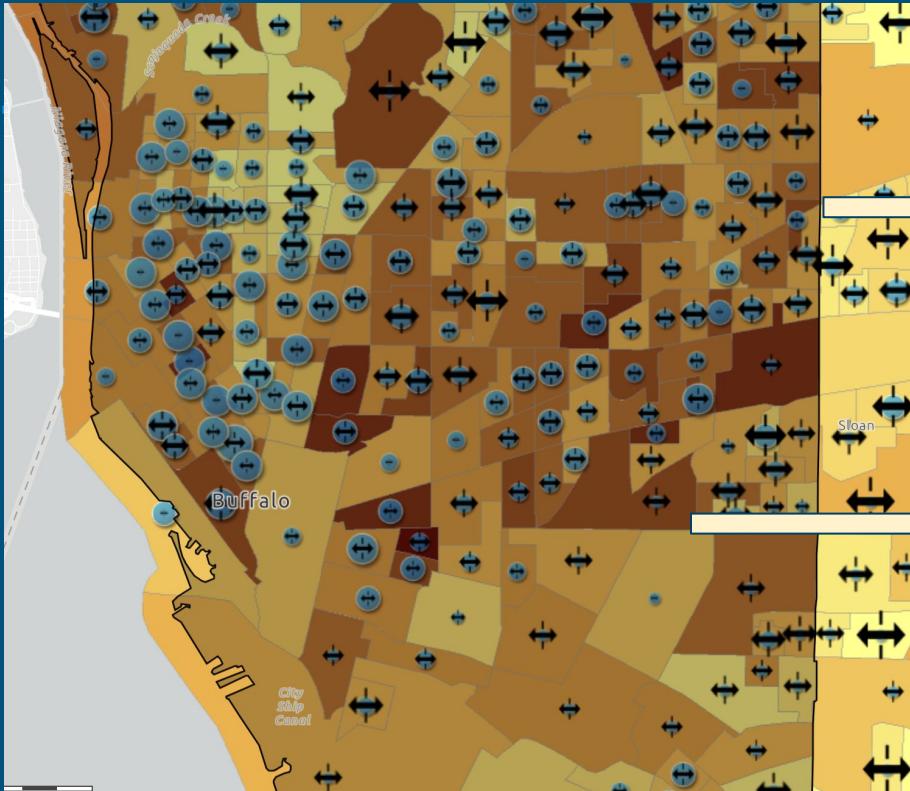
Demographics and Transit System

Map Contents:

Region of Interest: Bounding box delineating the City of Buffalo.

Smart Location Database Layers:

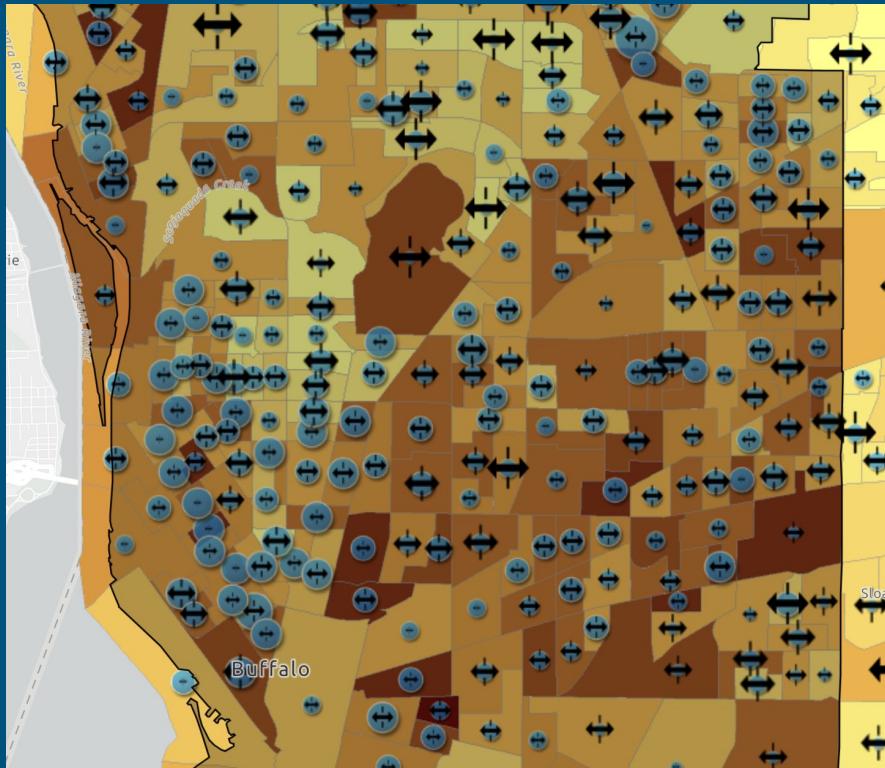
- 1. Distance to Transit (meters):** Indicates the proximity of residential areas (CBGs) to transit stops. Smaller distance symbol represent closer distances and vice versa.
- 2. Transit Service Frequency per sq mile:** Depicts the density of transit service coverage within the region. (Blue Pointers)
- 3. Percentage of Zero-Car Households:** Highlights areas with a higher concentration of households without cars, indicating potential reliance on public transit.



Added the layer - 'City of Buffalo by [cctoelln_suny_buffalo](#)' to display Bounding box for Buffalo City, NY

From the US Location Database layer, the following features were added.

1. Distance to transit (meters)
2. Transit Service Frequency per Sq mile
3. Percentage of zero-car households



Zero car households as a percentage of all households

Percent of zero-car households in CBG, 2018

- 0 - 5%
- 5 - 10%
- 10 - 15%
- 15 - 20%
- 20 - 30%
- 30 - 40%
- 40 - 50%
- 50 - 60%
- 60 - 75%
- 75 - 100%

SmartLocationDatabase

Distance to transit (meters)

Distance from the population-weighted centroid to nearest transit stop (meters)

- ← > 772 - 1,207
- ← > 565 - 772
- ← > 437 - 565
- ← > 324 - 437
- ← > 214 - 324
- ← > 0 - 214
- ← 0 - 0

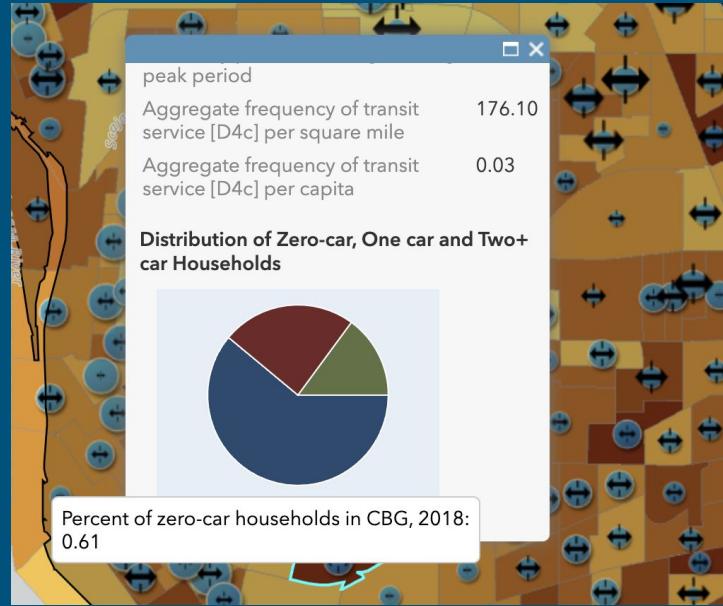
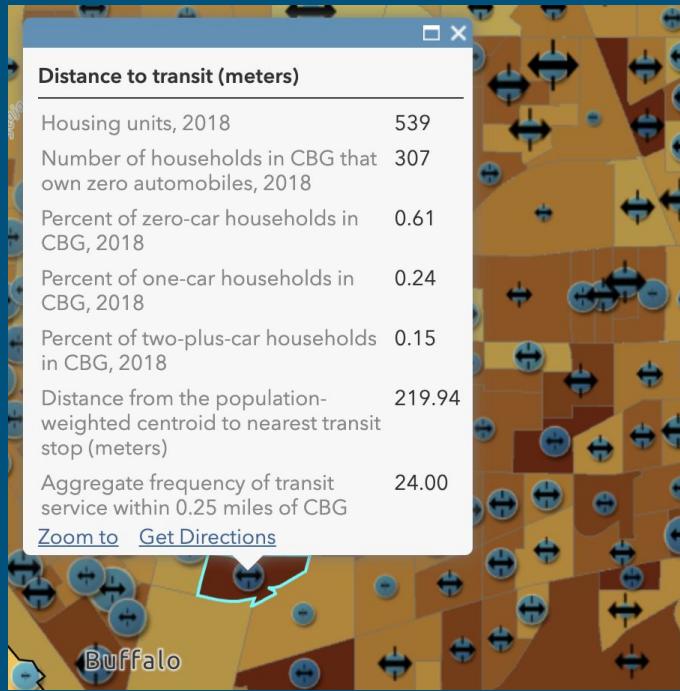
Transit service frequency

Aggregate frequency of transit service [D4c] per square mile

- > 700 - 1,500
- > 500 - 700
- > 200 - 500
- > 100 - 200
- > 50 - 100
- > 0 - 50
- 0 - 0

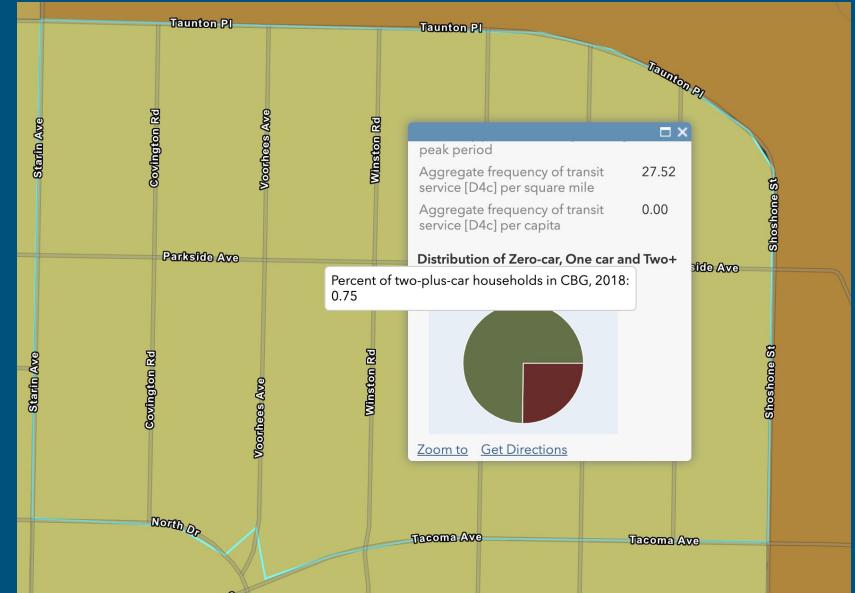
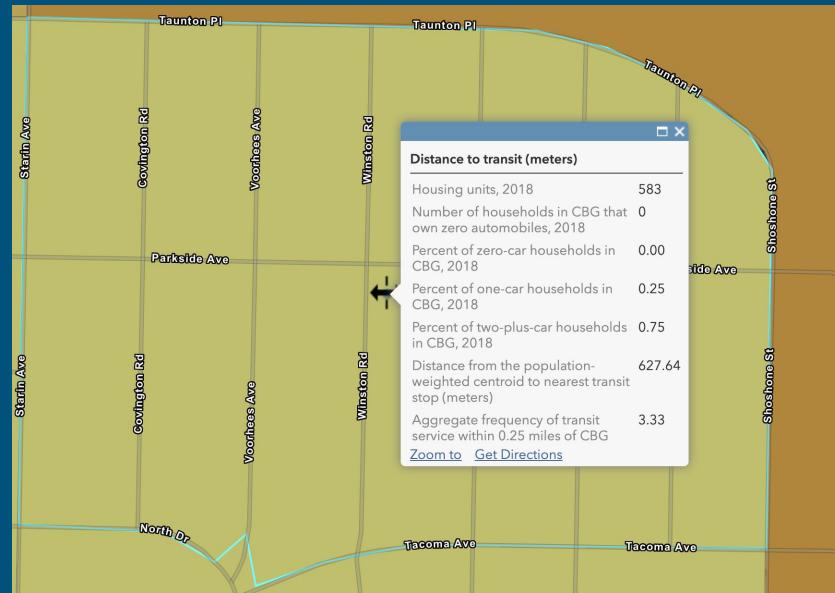
Insights

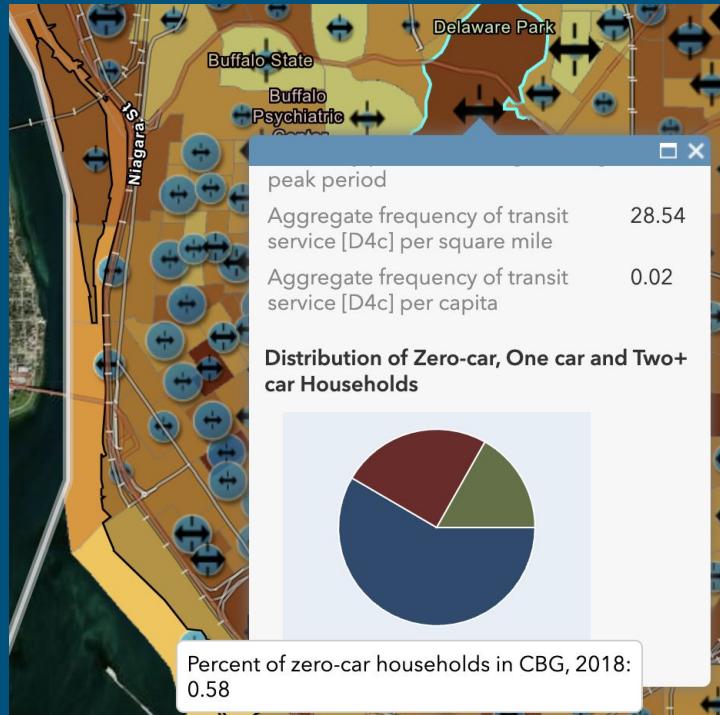
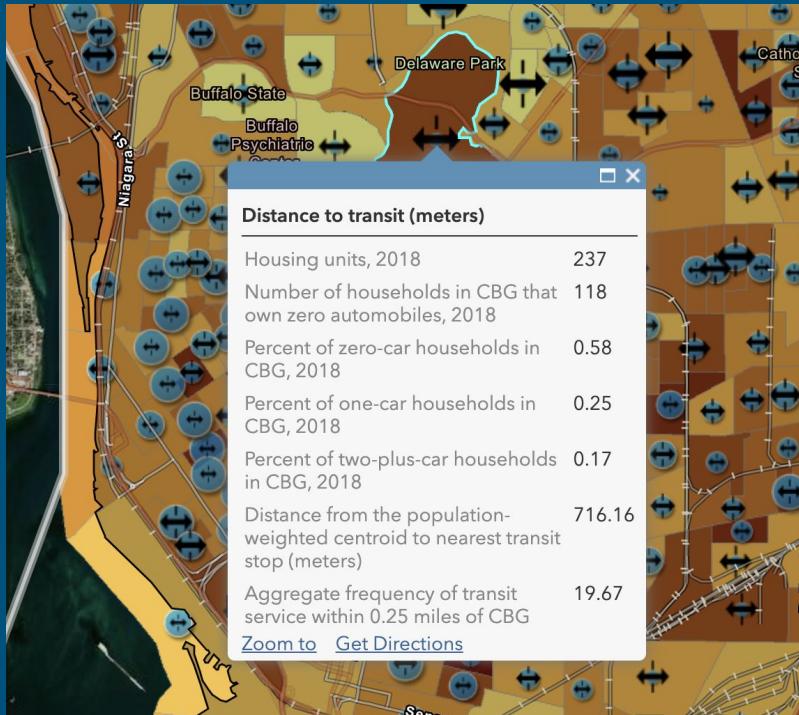
- The analysis shows if the Buffalo transit system serves residents without cars more effectively in areas with closer proximity to transit stops and higher service frequency.
- Areas with a higher percentage of zero-car households may require additional attention to ensure adequate transit service provision and accessibility.
- For each CBG the pop-up was configured to include relevant attributes specific to this map visualization, providing detailed insights. Additionally, a pie chart is displayed at the end of the pop-up, breaking down households based on car ownership for enhanced understanding.
- It is observed that the transit system demonstrates robust connectivity in most urban areas, but there is a need for additional stops in suburban areas. These suburbs experience lower service frequency and longer distances to existing stops, highlighting opportunities for improvement in transit accessibility.
- Below are some examples that help us understand the map better.
- ArcGIS Map link: <https://arcg.is/OvnaC0>



- There are numerous instances demonstrating a well-structured transit system, particularly evident in areas with a higher percentage of zero-car households. In such cases, transit service frequency is notably higher, with stops conveniently located at reasonable distances, facilitating easier access for residents residing on various streets within the vicinity.

- In the below example, the area encompassing Winston Rd, Carmel Rd, etc., suggests the presence of lower percentages of zero-car households and significant distances to transit stops. Additionally, there appears to be a higher number of people owning two or more cars, which may indicate that the residents are upper-class families or well-settled individuals.





- However, in some instances, such as areas near Delaware Park and Canisius College, marked in red indicating a higher percentage of zero-car households, around 58% of the 235 housing units experience longer distances to transit stops, approximately 716.16 meters (nearly half a mile), with a relatively lower transit service frequency per square mile at around 28.54.

01

Insight into Correlations

Through visualization, we analyze correlations between attributes, gaining insights into underlying patterns.

02

Analysis of Socio-economic Factors

We delve into socio-economic factors, particularly comparing the percentage of households based on car ownership.

03

Identification of Transit Needs

Despite higher percentages of zero-car households in some areas, transit service frequencies and distances to stops remain low, highlighting the necessity for transit improvements.

04

Observation of Car Ownership Patterns

Data suggests a higher percentage of zero-car households within the city boundary compared to suburbs, possibly indicating preferences for suburban living among wealthier residents and greater reliance on cars for transportation.

04

Recognition of Exceptions

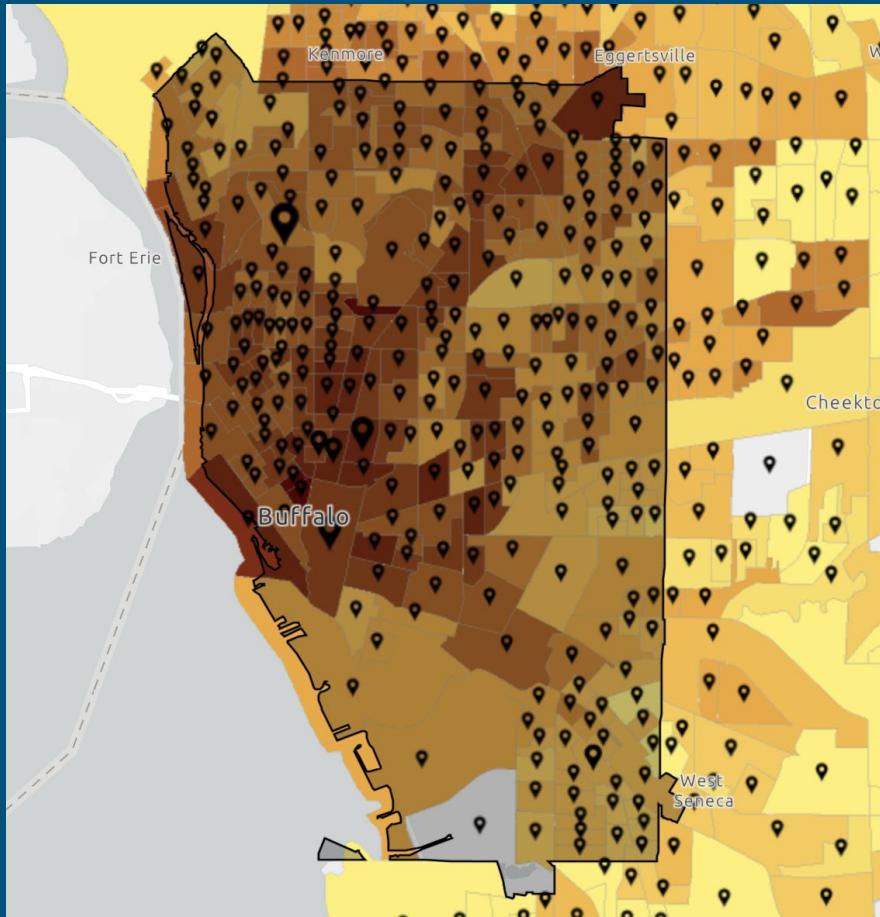
Despite prevailing car ownership patterns, there are exceptions where transit improvements are crucial, emphasizing the complexities of transportation decision-making.

**How well does the transit system
connect residents to job centers?**

Access to Job Centers

Map Contents:

- **Base Map: Accessibility Index - Transit to Jobs**
 - Color range from yellow to red, with values ranging from 0 to 1.
 - Higher values indicate greater accessibility to job centers via transit.
- **Data Layer: Jobs per Acre**
 - Symbols depict job centers, with the size of the symbol representing the number of jobs in the area.
 - Clicking on a job center reveals details about the types of jobs present.



Legend

City of Buffalo



SmartLocationDatabase

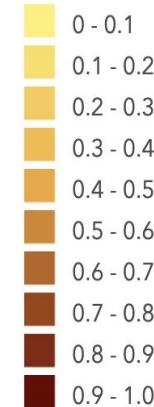
Jobs per acre

Gross employment density (jobs/acre) on unprotected land

- > 200 - 11,028
- > 150 - 200
- > 100 - 150
- > 70 - 100
- > 40 - 70
- > 0 - 40
- * 0 - 0

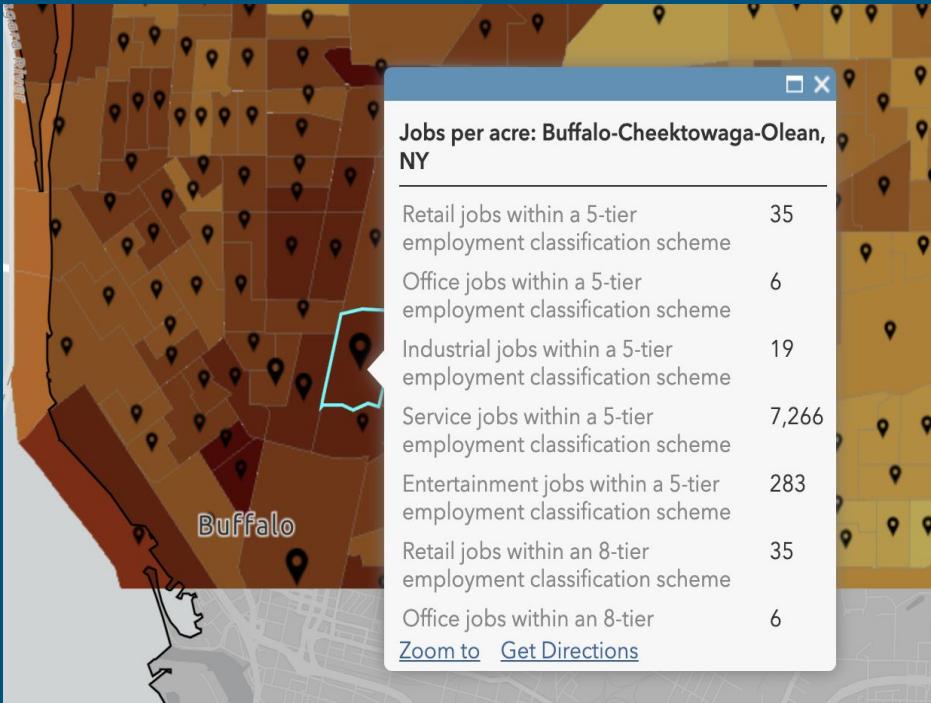
Accessibility index - Transit to jobs

Regional Centrality Index - Transit: CBG [D5dr] score relative to max CBSA [D5dr] score



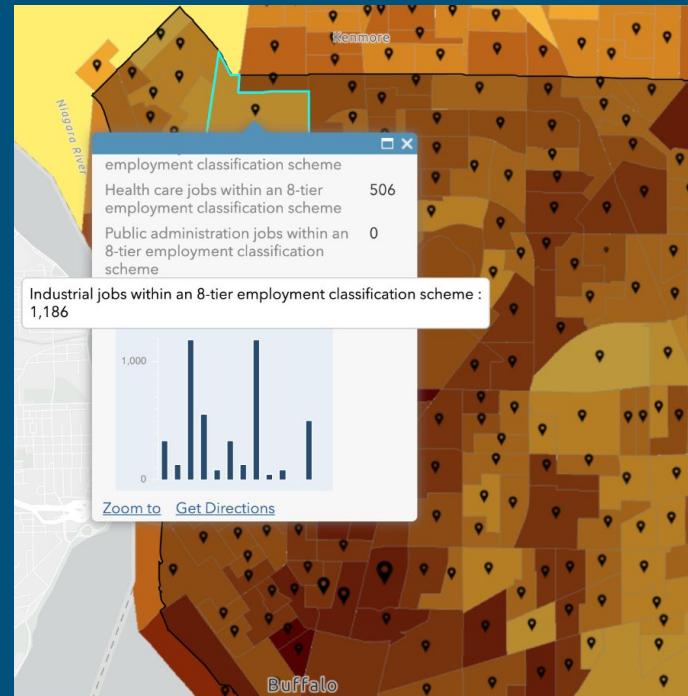
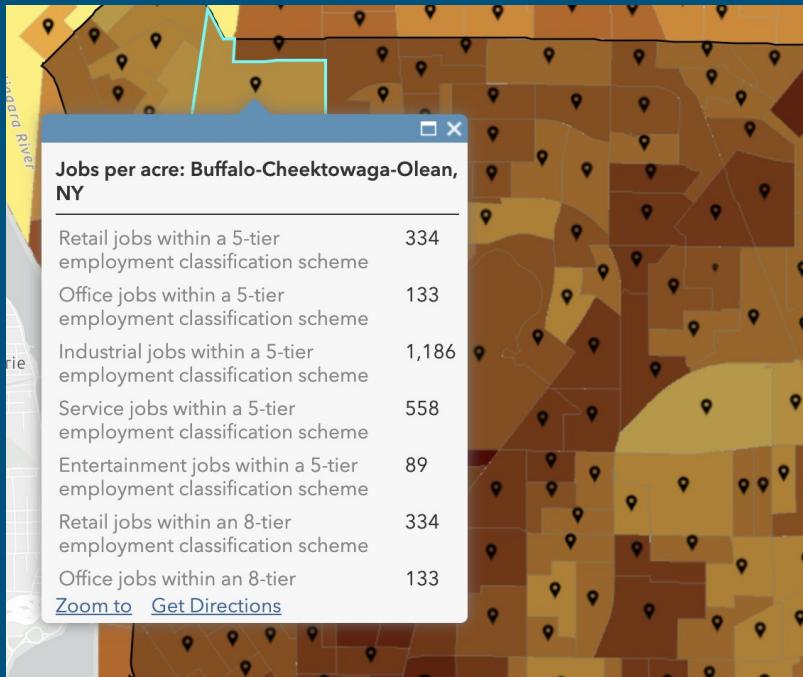
Insights

- The map highlights areas with high accessibility to job centers through the transit system, as indicated by the red shading.
- Job centers with a larger number of jobs per acre are represented by larger symbols, emphasizing their significance as employment hubs.
- ArcGIS Online map link: <https://arcg.is/i8beS>



- The example provided illustrates a correlation between higher accessibility to job centers via transit and the concentration of jobs in a specific area. This suggests that residents in these areas can easily commute to their workplaces using the transit system. Additionally, incorporating attributes such as transit service frequency could further enhance the analysis by providing insights into the frequency and reliability of transit services serving these job centers.

- The example below depicts the area near Rebecca Park, where there is relatively lower accessibility to job centers despite the presence of a significant number of jobs.



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How does transit compete with driving?

Transit and Driving Comparison

1. Accessibility Index Comparison

- Description: Compares accessibility index for transit and driving to job centers.
- Attributes:
 1. Accessibility Index - Transit to Jobs,
 2. Accessibility Index - Auto to Jobs

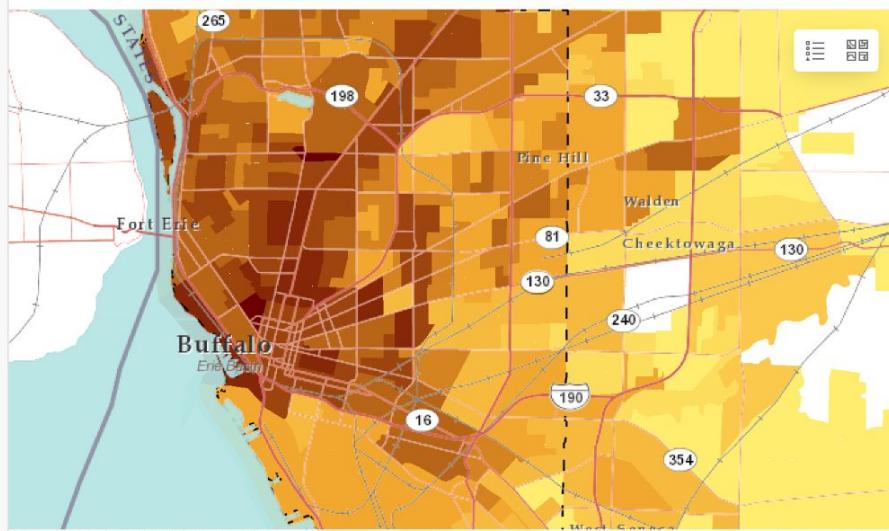


Transit Analysis (Driving vs Transit) (copy)



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Accessibility index - Transit to Jobs



Sources: Esri, USGS, NOAA | EPA Office of Community Revitalization and EPA National Geospatial Sup... Powered by Esri

The embedded Accessibility Index - Transit to Jobs layer on the map illustrates the level of accessibility to job centers via transit. Dark red regions signify areas with easy access to job centers, while light yellow regions indicate greater difficulty in accessing transit for commuting to workplaces.

Accessibility index - Auto to Jobs



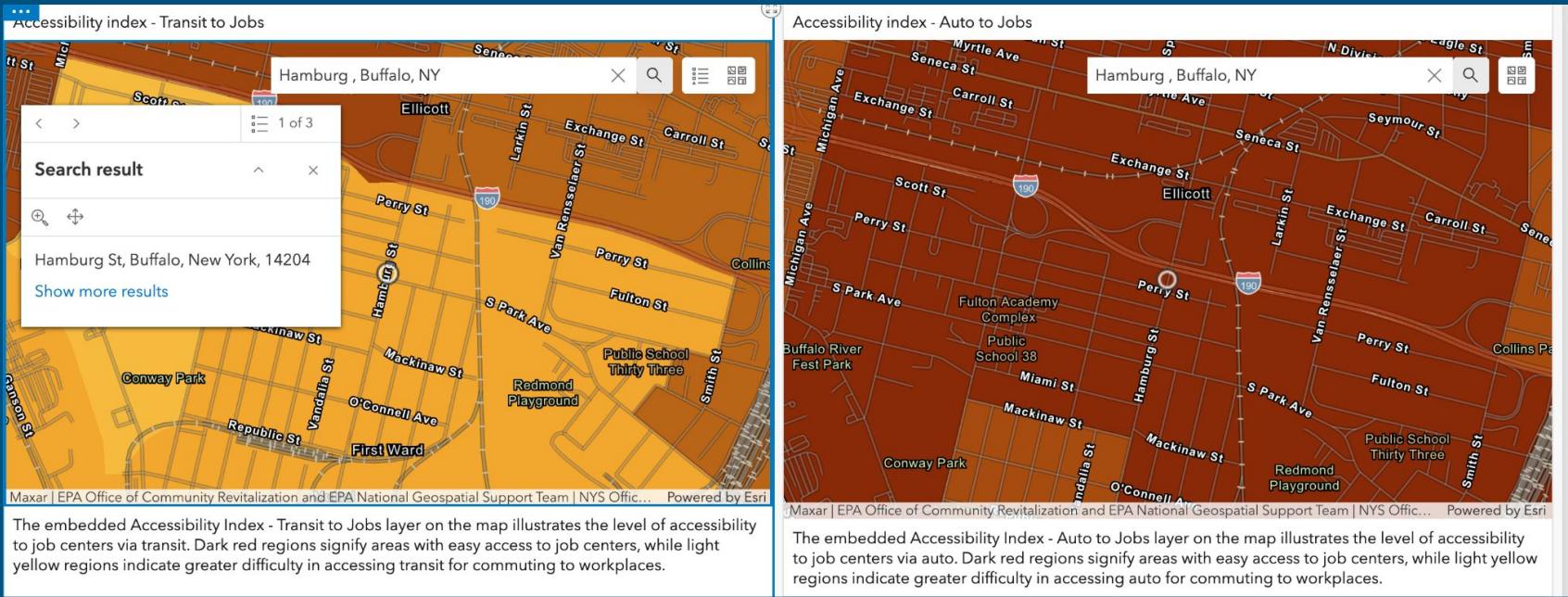
Sources: Esri, USGS, NOAA | EPA Office of Community Revitalization and EPA National Geospatial Sup... Powered by Esri

The embedded Accessibility Index - Auto to Jobs layer on the map illustrates the level of accessibility to job centers via auto. Dark red regions signify areas with easy access to job centers, while light yellow regions indicate greater difficulty in accessing auto for commuting to workplaces.

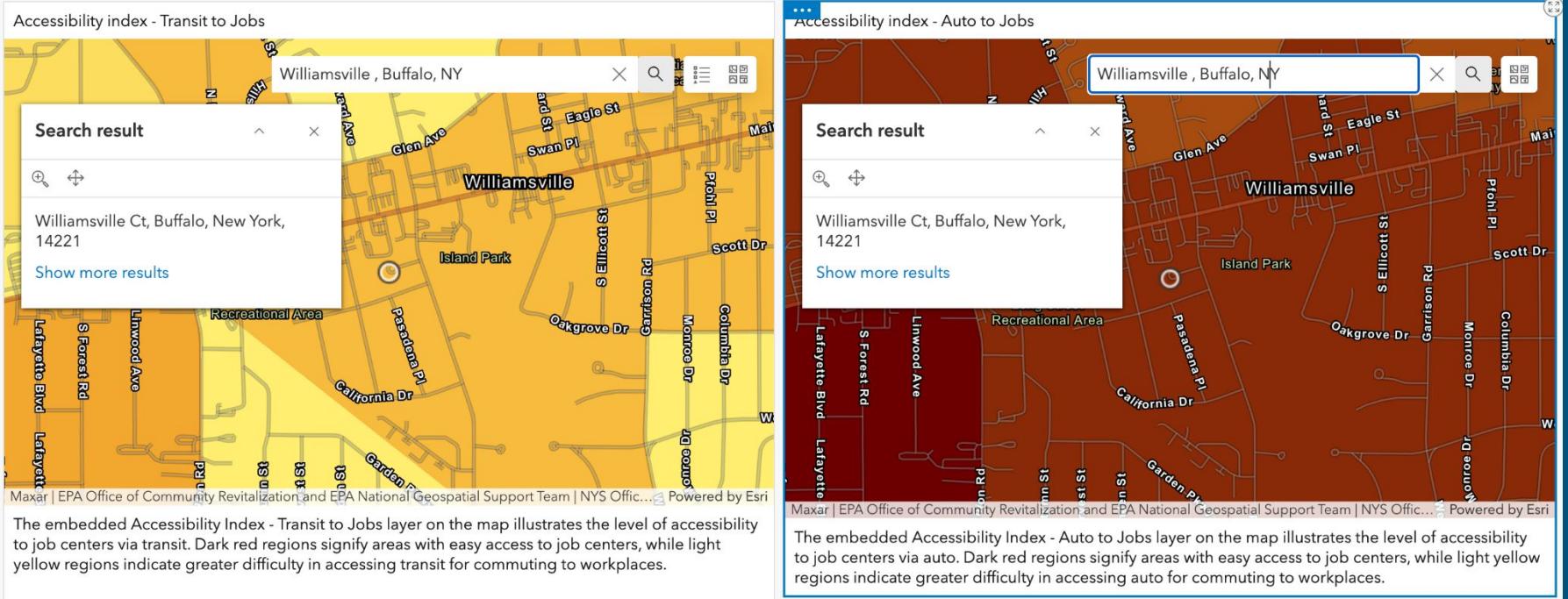
Accessibility Index - Transit to Jobs	Accessibility Index - Auto to Jobs
Darker shades in central regions like Lafayette Ave. indicate high accessibility to job centers.	Dark red shades across most areas indicate high accessibility to jobs by car throughout Buffalo.
Transit system serves as a viable option for residents in main cities where job concentration is higher.	Driving remains a convenient option for residents in suburban areas or those working in less accessible job centers.
Areas with well-developed and interconnected transit networks demonstrate easier access to employment opportunities.	Auto accessibility remains consistently high regardless of job location due to the flexibility of car travel.

Comparative Insights:

- Transit accessibility may vary based on location, with higher accessibility in urban areas and lower accessibility in suburbs.
- Auto accessibility remains consistently high across different areas due to the flexibility of car travel.
- Understanding the trade-offs between transit and driving based on location and job distribution is crucial for transportation planning.



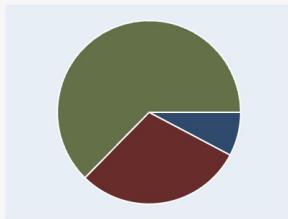
In suburban areas such as Hamburg and Williamsville, where transit infrastructure may be less extensive, lighter yellow regions on the transit accessibility map signify lower accessibility to job centers. However, the auto accessibility map depicts dark red shades across most areas, indicating high accessibility to jobs by car throughout Buffalo. This suggests that driving is a convenient option for residents in suburban areas or those working in job centers located away from the main cities.



Distance to transit (meters)

Housing units, 2018	243
Number of households in CBG that own zero automobiles, 2018	18
Percent of zero-car households in CBG, 2018	0.08
Percent of one-car households in CBG, 2018	0.30
Percent of two-plus-car households in CBG, 2018	0.63
Distance from the population-weighted centroid to nearest transit stop (meters)	642.40
Aggregate frequency of transit service within 0.25 miles of CBG boundary per hour during evening peak period	3.33
Aggregate frequency of transit service [D4c] per square mile	19.01
Aggregate frequency of transit service [D4c] per capita	0.01

Distribution of Zero-car, One car and Two+ car Households

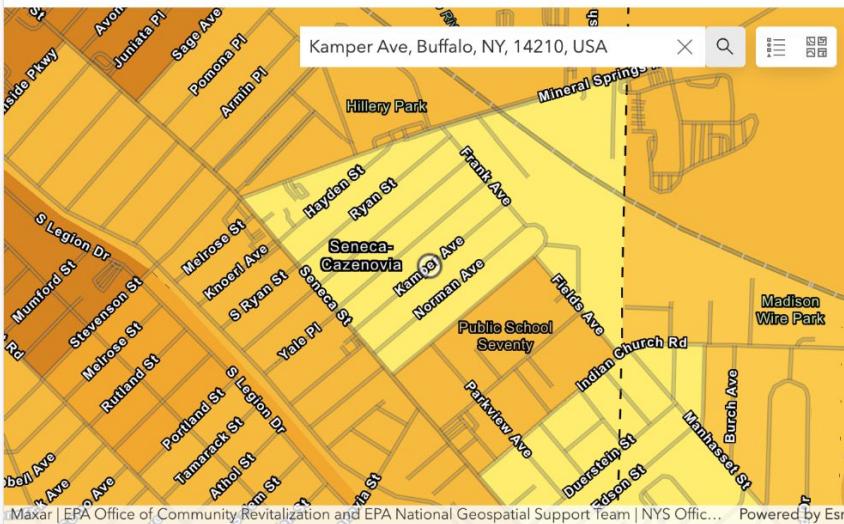


Assuming the details presented in the first map, which compares zero-car households with distance to transit and transit service frequency, reveal that in suburbs like Williamsville, car usage is higher while transit accessibility is lower. This observation allows us to infer the socio-economic factors based on car ownership influencing the area.



The pop-up info of
Williamsville area from map 1

Accessibility index - Transit to Jobs



The embedded Accessibility Index - Transit to Jobs layer on the map illustrates the level of accessibility to job centers via transit. Dark red regions signify areas with easy access to job centers, while light yellow regions indicate greater difficulty in accessing transit for commuting to workplaces.

Accessibility index - Auto to Jobs

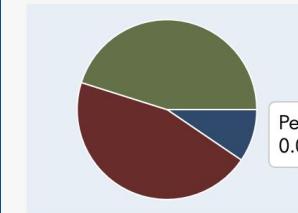


The embedded Accessibility Index - Auto to Jobs layer on the map illustrates the level of accessibility to job centers via auto. Dark red regions signify areas with easy access to job centers, while light yellow regions indicate greater difficulty in accessing auto for commuting to workplaces.

In some instances within the boundaries of Buffalo city limits, there are areas with limited access to transit, leading to a higher reliance on automobiles. Notable examples include locations such as Kamper Ave and Frank Ave.

Distance to transit (meters)

Housing units, 2018	889
Number of households in CBG that own zero automobiles, 2018	82
Percent of zero-car households in CBG, 2018	0.09
Percent of one-car households in CBG, 2018	0.45
Percent of two-plus-car households in CBG, 2018	0.45
Distance from the population-weighted centroid to nearest transit stop (meters)	445.25
Aggregate frequency of transit service within 0.25 miles of CBG boundary per hour during evening peak period	2.67
Aggregate frequency of transit service [D4c] per square mile	13.82
Aggregate frequency of transit service [D4c] per capita	0.00

Distribution of Zero-car, One car and Two+ car Households

Percent of zero-car households in CBG, 2018:
0.09



The pop-up info of Kamper Ave
near Seneca Street from map 1

2. Job Distribution Comparison

- Description: Compares distribution of jobs accessible by transit and driving within 45 min.
- Attributes:
 1. Jobs within a 45 min. transit ride (weighted),
 2. Jobs within a 45 min. drive (weighted)



Comparative Analysis: Jobs Accessible Within 45-Minute Travel Time, Weighted by Time-Decay (Network Travel ...)



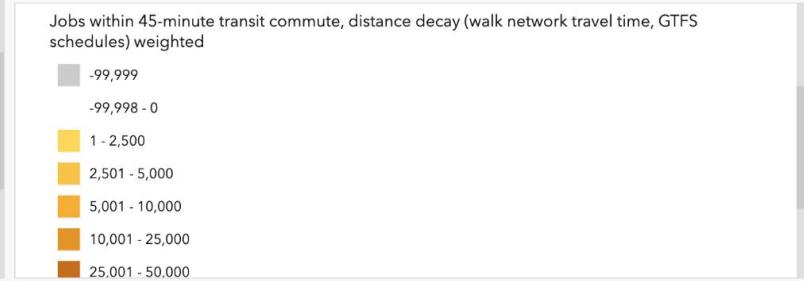
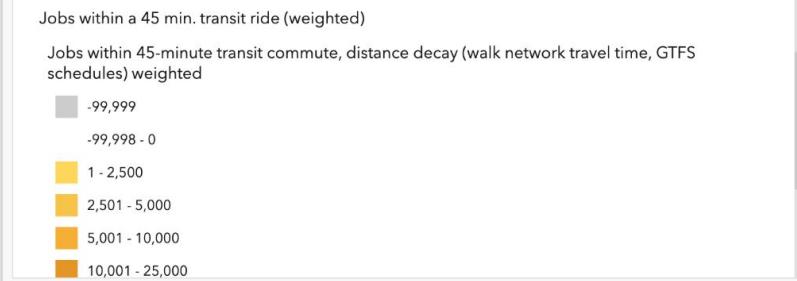
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This map illustrates the accessibility of job centers through transit within a 45-minute travel time. Darker regions indicate higher accessibility, where residents can easily reach job centers within the specified time frame. Conversely, lighter yellow regions signify areas with lower accessibility, where transit options may be limited or require longer travel times to access job opportunities.



This map depicts the accessibility of job centers by automobile within a 45-minute travel time, weighted by time-decay (network travel time). Darker regions indicate higher accessibility, where residents can conveniently commute to job centers within the specified time frame. In contrast, lighter yellow regions signify areas with lower accessibility, suggesting longer travel times or potential congestion that may impede access to job opportunities by car.



Insights:

- The dashboard screenshot above illustrates that the transit system offers greater reliability for commuting to job centers within a 45-minute travel time, as indicated by the dark shaded regions.
- Conversely, using automobiles to travel to job centers within the same time frame is less feasible, as denoted by the light yellow shaded portions.

Combined Comparative analysis:

- While transit may offer advantages in urban areas, driving remains competitive, particularly in suburban areas with limited transit infrastructure.
- Understanding the trade-offs between transit and driving based on location, job distribution, and socio-economic factors is crucial for effective transportation planning in Buffalo.
- The second dashboard indicates that using transit appears to be a more feasible option for commuting to jobs within a 45-minute travel time compared to driving.
- This suggests that with a well-established transit system in Buffalo, commuting via public transportation would be advantageous and could potentially surpass the number of commuters using private vehicles, regardless of individuals' financial status.
- Some of the possible reasons explaining why transit seems to be more accessible than driving to jobs within a 45-minute travel time are discussed in the following slide.

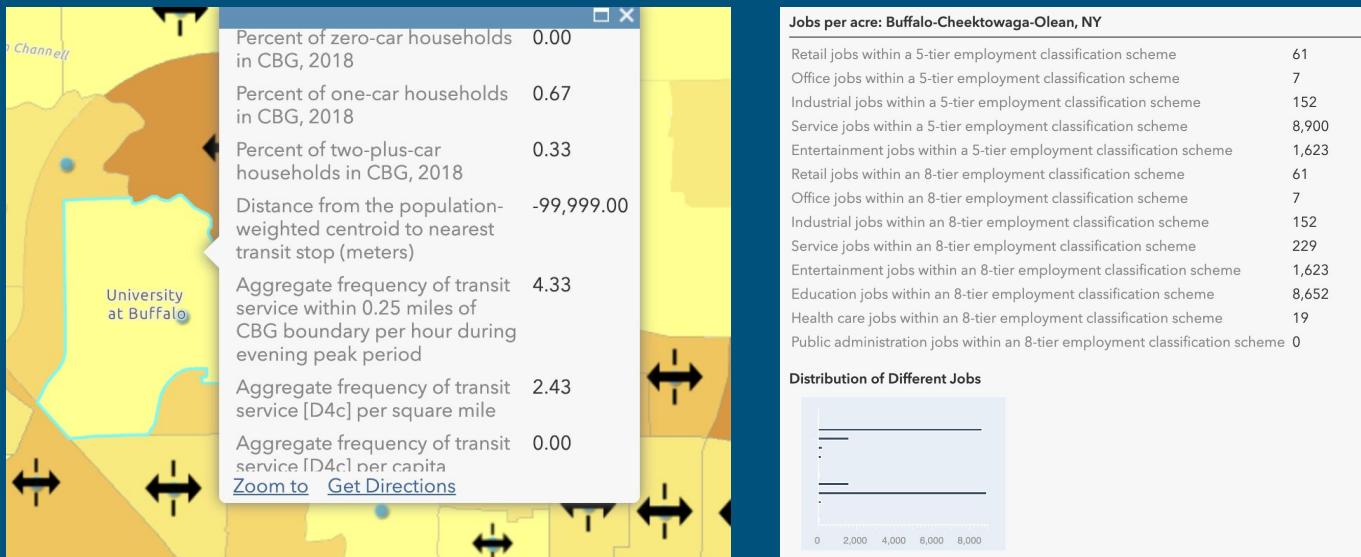
Possible Reasons:

- **Transit routes** may be optimized to serve major job centers within the city, leading to more **efficient travel times**.
- Congestion and **traffic congestion** in urban areas may slow down automobile travel, particularly during peak commuting hours.
- **Limited parking availability** near job centers may discourage automobile use for commuting.
- **Transit infrastructure** and services may be more extensive and **accessible** within the city, providing better coverage and options for commuters.
- **Environmental factors**, such as efforts to reduce carbon emissions or **promote sustainable transportation**, may incentivize the use of public transit over automobiles for commuting.

Recommendation for Transit Service Expansion

1. University of Buffalo Suburbs:

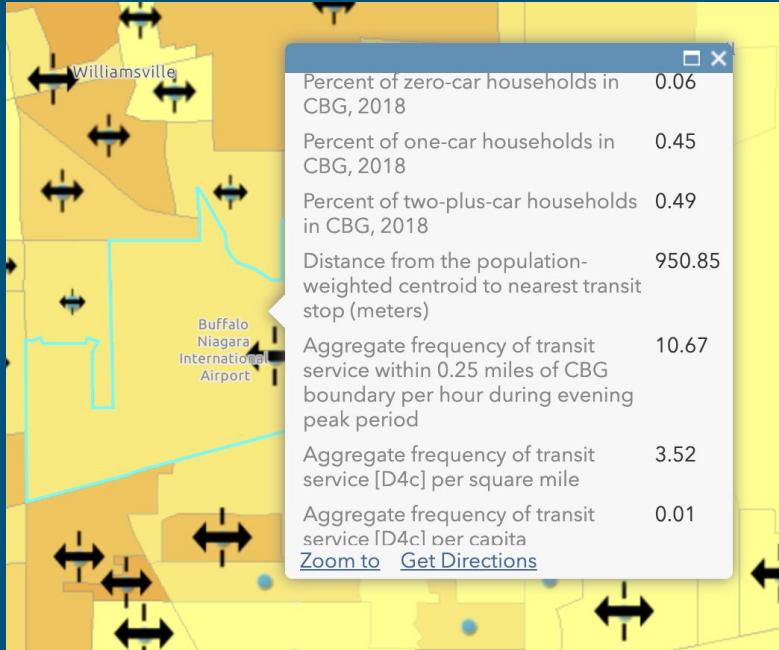
- Despite limited transit accessibility, University of Buffalo's suburban areas could benefit from transit connectivity, especially for students commuting to the main city.
- With approximately 8000 jobs in the education and service sectors, transit expansion could facilitate easier access to employment opportunities for residents and students alike.



Note: This discrepancy could also be due to lack of accurate data at this place.

2. Buffalo Niagara International Airport:

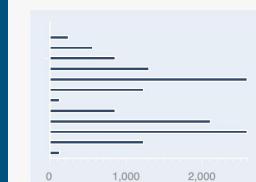
- Enhancing transit connectivity to Buffalo Niagara International Airport would provide a convenient transportation option for individuals without cars, improving accessibility to the airport for travelers and airport employees alike.

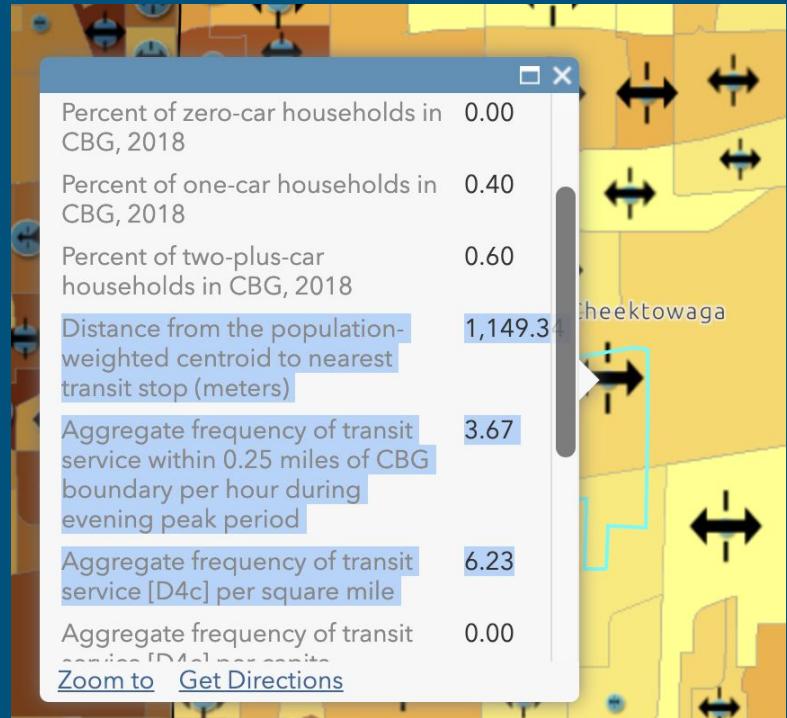
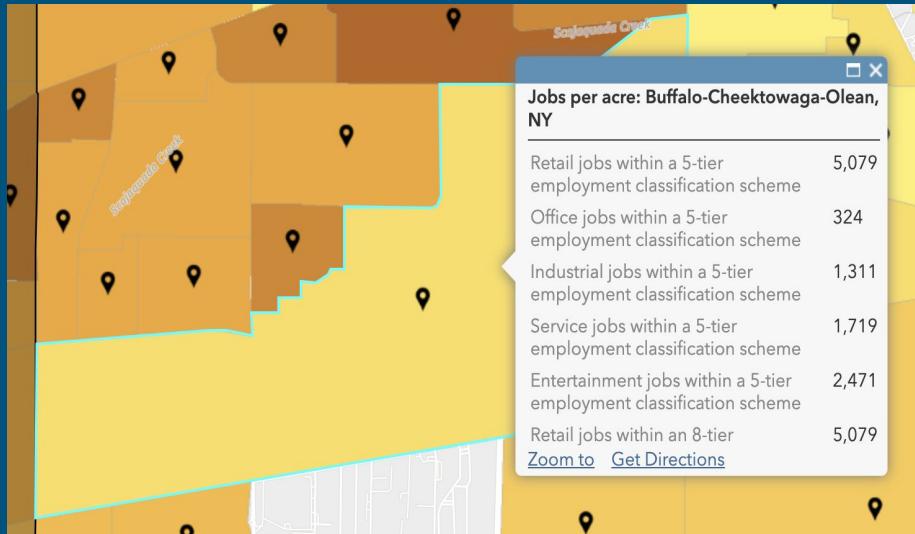


Jobs per acre: Buffalo-Cheektowaga-Olean, NY

Retail jobs within a 5-tier employment classification scheme	123
Office jobs within a 5-tier employment classification scheme	1,228
Industrial jobs within a 5-tier employment classification scheme	2,595
Service jobs within a 5-tier employment classification scheme	2,108
Entertainment jobs within a 5-tier employment classification scheme	855
Retail jobs within an 8-tier employment classification scheme	123
Office jobs within an 8-tier employment classification scheme	1,228
Industrial jobs within an 8-tier employment classification scheme	2,595
Service jobs within an 8-tier employment classification scheme	1,300
Entertainment jobs within an 8-tier employment classification scheme	855
Education jobs within an 8-tier employment classification scheme	563
Health care jobs within an 8-tier employment classification scheme	245
Public administration jobs within an 8-tier employment classification scheme	0

Distribution of Different Jobs





3. Suburbs near Cheektowaga:

- The suburbs near Cheektowaga currently lack proper transit connectivity, presenting an opportunity for service expansion.
- Establishing new transit stops in and around the locality would enable residents to commute without hassle, especially considering the reasonably high number of jobs in this area.

Other General Recommendations

- Prioritize areas with high job concentrations and limited transit accessibility for service expansion.
- Enhance transit service frequency and coverage in neighborhoods with long travel distances to existing transit stops.
- Target residential areas with diverse demographics and high percentages of zero-car households to improve transit accessibility.
- Strengthen connections between transit hubs and key transfer points to streamline travel and improve regional connectivity along with transit service frequency.

Conclusion

- The detailed analysis provides recommendations to prioritize areas with high job concentrations, limited transit accessibility, and diverse demographic profiles to address mobility challenges and promote equitable transportation options.
- Continued data-driven analysis and collaboration with local stakeholders will be essential for implementing these recommendations effectively and ensuring positive outcomes for residents and commuters.
- Despite my limited knowledge of the Buffalo area, the recommendations I've provided rely on data analysis. They aim to improve transit accessibility and connectivity throughout the region.



Thank You

- *Shravani Hariprasad*