

Cincinnati Strategic Transit Study

July 2020



Uber

FEHR & PEERS



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TRANSIT AUTHORITY OF NORTHERN KENTUCKY

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Cincinnati Strategic Transit Study

Prepared for:
Cincinnati Mobility Lab

July 2020

SF18-0990

Prepared by:
FEHR  **PEERS**

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Preface – This Study & COVID-19

This study supports and buttresses the vision of the transit authorities in the Cincinnati region and prescribes how demand-responsive services can better complement fixed route services to improve mobility and access to opportunities in the region. We completed the plan prior to the onset of COVID-19 in the and the rest of the nation; however, the findings and recommendations remain pertinent and timely.

COVID-19's effects on the Cincinnati region have drastically altered the transit landscape, increasing health risks, decimating ridership, and reducing funding drastically. Local transit agencies acted quickly in temporarily reducing and re-orienting bus operations to prioritize serving essential workers. They also took other measures to minimize physical contact, including installing plexiglass barriers in the operator cab and requiring personal protective equipment (PPE) for drivers. Throughout the crisis, bus operators and other agency workers have courageously performed a critical public service, underscoring the value of transit to the region.

In the span of a couple months, many of transit's major funding sources have declined substantially: fare revenue, taxes, tolls, among others. Emergency funding from the federal government can only partially plug these gaps. Additionally, ridership has plunged due to "Shelter in Place" orders. Even as these orders are lifted, customers are more cautious about using transit. These changes demand a re-evaluation of service provision, rallying around a critical core of fixed route service while considering newer mobility options in cases where they may better meet constituent needs. This means weighing the different needs of the variety of riders to best allocate resources within new, reduced means and safety constraints.

From our point of view, the pandemic has served to accelerate the underlying drivers of the study: a steady decline in transit ridership over 50 years, evolving regional needs and emerging travel options, a desire for better connectivity to jobs, and a desire to lower motor vehicle impacts on congestion and air quality. This plan was developed to respond to those drivers, providing insights on demand-responsive transit to round out and reinforce the Reinventing Metro plan and TANK's System Redesign. Those two plans are essential -- we know that the crisis will pass, and hope that demand will return quickly as travel patterns bend back towards the pre-COVID baseline. However, there is great uncertainty as to whether COVID-related changes that are a challenge to transit agencies, such as working from home, or the wariness of close contact with other people, will be durable. Public transportation, however, can thrive in this new post-COVID era by focusing on evergreen needs: being responsive to people's underlying need for comfortable, convenient, strong and stable service, seamless inter-operability across systems and modes, and adaptation to changing travel patterns. Our recommendations address these three areas and we as partners in the Cincinnati Mobility Lab, we look forward to working together to implement them.



Given how much COVID-19 has impacted transportation and uncertainties about the near and medium term future, there is an elevated urgency to re-evaluate service. This plan contains proposals for new service concepts and bundling of modes. We wish to re-iterate that community outreach, especially to underserved populations, should not be shortcut in a quest for quick action. Other cities have recently provided templates for nimble and meaningful outreach that can generate buy-in (such as Oakland's Open Streets).

Critically, the voters' approval of Hamilton County's transportation levy (Issue 7) is a timely re-commitment to transit, even in this new era of uncertainty. This report can guide planners and decisionmakers in channeling this momentum into taking concrete steps to boost transit's service to the region and its people, reversing the long-term decline in ridership, and supporting the region's economic and social needs for decades to come.

Acknowledgments

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1. Executive Summary

1.1 The Problem Statement

This study is designed to better understand how demand-responsive transportation services (i.e., ride-hailing and flexible transit) currently fit into the Cincinnati transportation system and their potential role to complement fixed route transit services.

1.2 Study Objective

We offer recommendations for ways on-demand transportation services can operate complementary to fixed route transit to help meet the region's transportation system priorities, providing clear strategies to better serve transit riders and other travelers, integrate various modes of transit to address service gaps in ways that are equitable and non-discriminatory, and lower vehicular impacts on congestion, air quality and other economic, social and environmental outcomes.

1.3 Backdrop

While the Cincinnati region's population and economic output has grown over the past decade, the region is experiencing a decline in overall transit ridership at an average rate of three percent per year between 2012 and 2018. The decline is set against a backdrop of a 2 percent overall increase in both population and employment between 2010 and 2015 and statewide increases in per capita vehicle miles traveled (VMT) between 2014 and 2017. Public funding for transit in Cincinnati is small compared with spending on automobile transportation. Of the money contained within the 2040 regional Transportation Improvement Plan (TIP), 24.9 percent is assigned for transit operation funding and capital expenditure. Supplying productive transit service in many parts of the region is very challenging and therefore most travel is done by private automobile. An overview of mobility today is characterized in the diagram below, which represents a generic U.S. city. The nine points on the map (with detail at left) describe aspects of contemporary transit networks and characteristics of private driving, many of which negatively affect transit productivity.

Mobility Today

IN US CITIES

Fixed Route Transit



1 High frequency backbone transit delivers high accessibility and quality of service



2 Buses get stuck in the same bottlenecks as cars during busy periods



3 Central transit hub with non-timed transfers is required for crosstown trips



4 Overly circuitous routing for some fixed route services reduces effectiveness



5 Infrequent fixed-route services in lower density areas draw little ridership



6 Express service connects park-and-rides to unique destinations and major job centers

Private Driving



7 Extensive freeway and arterial network outcompetes fixed route transit for suburb-to-suburb trips



8 Public spending on road building and parking encourages heavy car use



9 Requiring car travel for most trips saddles users with high transportation costs

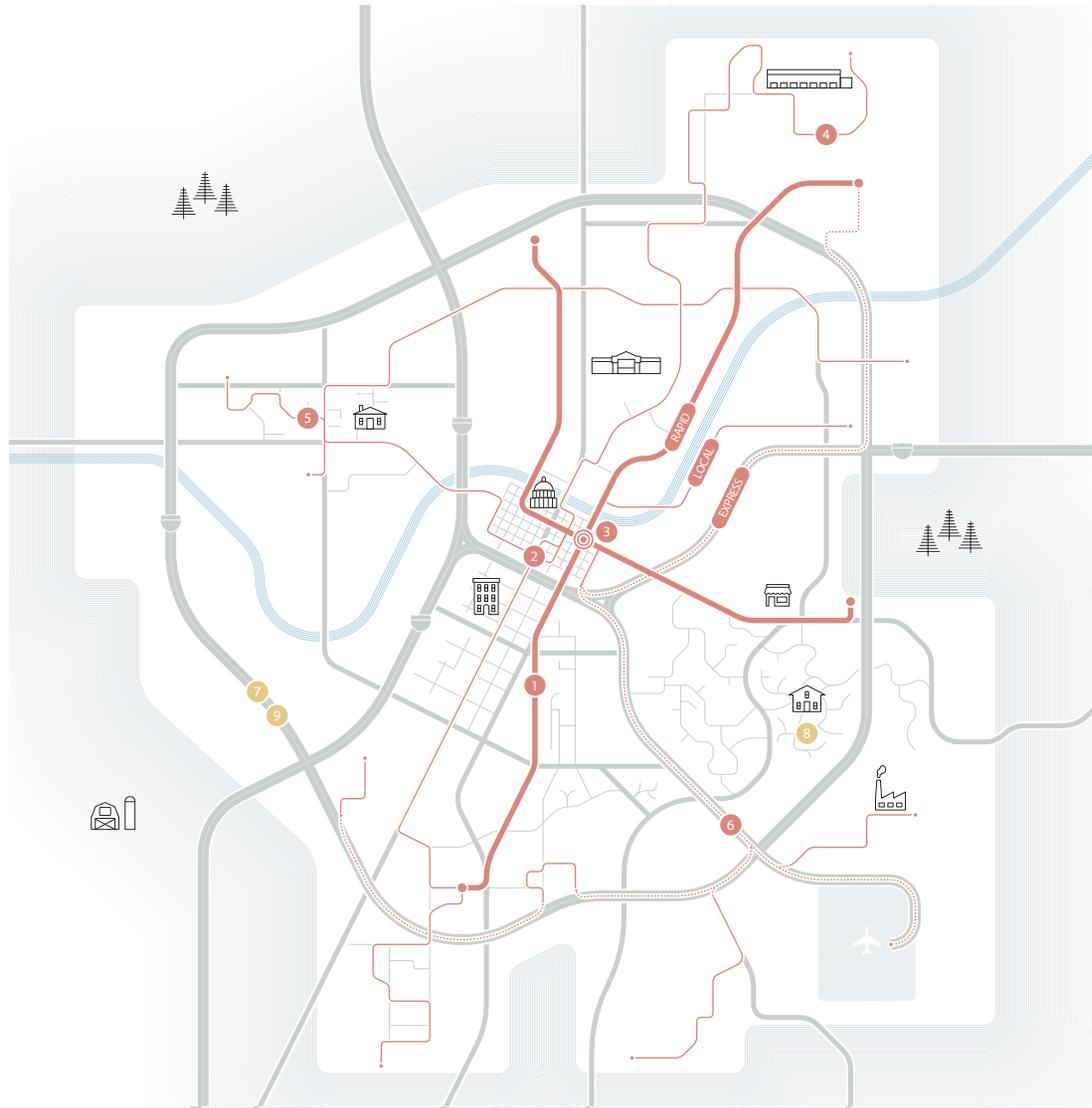


Figure 1 – Mobility Today in US Cities

1.4 Cincinnati Insights

Uber travel is growing rapidly at the same time that transit is enduring a fifty-year decline in ridership. Across the region, Uber now has about one-third the daily trips as SORTA and TANK. However, their respective markets are hugely different with little overlap. Those who ride the bus are typically those with lower incomes, typically do it frequently and during the daytime, often for work trips or other essential trips (school, shopping, medical, etc.) because they cannot afford to own a car. Uber is used typically by those with higher incomes, on an occasional basis typically on evenings and weekends, and predominantly for social/recreation trips for which it makes sense to leave their car at home. People who ride the bus generally do not also use Uber, and vice versa. Uber is likely a secondary factor in transit ridership decline, as ridership has been falling steadily for over fifty years, and only 13 percent of Cincinnati Uber riders state that they used to take bus for their trip prior to Uber being available.

1.5 Recommendations

The three key recommendations below seek to shape the deployment and use of on-demand services to achieve public policy goals, achieved by allocating fixed route and on-demand transit and ride-hail services as appropriate, depending on subarea trip density and socioeconomic markets, environments, and travel behaviors. These policy goals include stemming losses in transit ridership while balancing spending, user cost, trip quality, and trip availability. The recommended improvements to transit would result in mode shift from auto to transit and thus meet the objectives of lower vehicular impacts on congestion, air quality and other economic, social and environmental outcomes. More detailed information about the recommendations can be found in the Recommendations section of the report.

1.5.1 Targeted Funding of On-Demand Service

In areas of high-quality fixed route transit, on-demand service can complement by rounding out the bundle of travel options that can allow a household to function either car-light or car-free, specifically by serving trips mis-aligned with the bus network. In areas without any transit or lacking frequent fixed route transit, on-demand service could meet the mobility needs of underserved populations, possibly replacing low-performing coverage service. Challenges associated with integrating ride-hail services into the transit network include long term uncertainty of ride-hail costs, and that trip demand in these environments may not be conducive to pooling without sacrificing response times or through significant subsidy. Therefore, the success of this path is not inevitable. While some pilots have set fare levels and serve areas with demand densities that indicate promise, a sustainable successful model has yet to be proven.



We recommend that public funds be spent on flexible transit in corridors or areas where demand is either slightly too dispersed or too sporadic for productive fixed route transit or where demand is misaligned with the overall orientation of transit services in terms of the direction (e.g., suburb-to-suburb) or timing (e.g., late evenings). In each case above, public spending would allow on-demand service to become an affordable part of a bloc of public transportation offerings that provides the requisite mobility for households to fulfil their needs without choosing car ownership.

We recommend that funding at first be invested in the form of pilots to test the relationship between net ridership generation and net spending in the Cincinnati market. The Recommendations section contains specific service designs to test based on our understanding of travel markets in Cincinnati.

1.5.2 Seamless Payment and User Interface

We recommend that transit users be incentivized to get subscriptions (i.e., transit passes) so that they have the easy option of taking transit at no marginal cost. This pass should integrate with other sustainable modes, such as bike share and scooter share, and could include the option for a set amount of on-demand transit travel.

We recommend that mobility options be bundled together in a way that covers each different type of trip, to make it possible to conduct daily life without needing a private automobile. Mobility-as-a-service (MaaS) represents this concept, typically in the form of a centralized smartphone app. We recommend that agencies look to collaborate with and support MaaS providers and coordinators through actively linking to these platforms and data sharing. The degree to which services meet and respond to the public need can be increased if all parties (public and private) maintain a positive and collaborative relationship, which specifically could include sharing information on traveler feedback and stakeholder concerns, and working together to evolve data-processing tools and data standards.

1.5.3 Transit Best Practices

The foundation of any MaaS system, and indeed any credible plan to reduce VMT and boost ridership, is a strengthened backbone transit network. While improving mobility for many, on-demand services alone will not reverse ridership declines in an efficient manner. Investing in quality fixed route service and accompanying infrastructure is needed. Thus, we recommend that agencies and municipalities implement thoughtful service restructuring, adopt transit-supportive policies, enable supportive land use decisions, and invest in key transit-supportive physical, technology, and data infrastructure. We also recommend that agencies establish on-going data and resource-sharing agreements.

The diagram below summarizes our recommendations, which combine dynamic and fixed services with the goals of reducing redundancies, ensuring that each provider is more cost effective in the markets they are focused on, and prioritizing underserved communities. Most importantly, we present four recommendations to strengthen existing backbone service (shown as thick red lines): namely increasing service, improving infrastructure, reinforcing the central hub, and optimizing routes. Shown in blue are three recommendations to promote on-demand services in outlying areas. Typical service patterns are indicated schematically

As part of this section, we recommend that stakeholders implement policies to assist in the shaping of land use development to support transit and other high-occupancy and sustainable modes. Specifically, we recommend that stakeholders execute and follow through on the OKI *Strategic Regional Policy Plan* of 2005 and the *Elements of an Effective Local Comprehensive Plan* of 2016 to encourage transit-supportive land use, and establish pricing of VMT to account for full cost including externalities.

Recommendation Summary

	Recommendation
Short-Term	<ul style="list-style-type: none"> • Pilot subsidized on-demand services in key areas. • Integrate transit into mobility apps. • Cross-agency fare policy and payment integration.
Medium-Term	<ul style="list-style-type: none"> • Evaluate pilots and integration, and implement more permanent service plans where it makes sense. • Establish on-going data and resource sharing agreements. • Prepare a transit ridership growth plan
Long-Term	<ul style="list-style-type: none"> • Implement transit service restructuring, and a ridership growth action plan, adopt transit-supportive policies, and invest in transit-supportive infrastructure. • Continue to monitor programs and use the learnings to inform overall transit strategy.

INTRODUCING

A Vision for Mobility

Fixed Route Transit

-  **1** Backbone network is redesigned with increased rapid service that better aligns to travel markets
-  **2** Bus-supportive infrastructure speeds buses through bottlenecks and across downtown
-  **3** Central hub is reinforced with seamless transfers, coordinated on schedule and fare
-  **4** Routes are straightened and stop spacing is optimized to improve quality of service

On-Demand Service

-  **5** Pooled rideal is deployed in lower density areas to reduce subsidy per trip and serve more people
-  **6** Flexible transit and rideal are deployed to increase access to express service
-  **7** Publicly-funded pooled rideal or flexible transit are deployed to improve convenience of suburb-to-suburb travel

Private Driving

-  **8** Mobility alternatives to car ownership are bundled together; auto travel and parking are priced to reflect true cost

Equitable Investments

-  **9** Focus investment on priorities of underserved and vulnerable communities

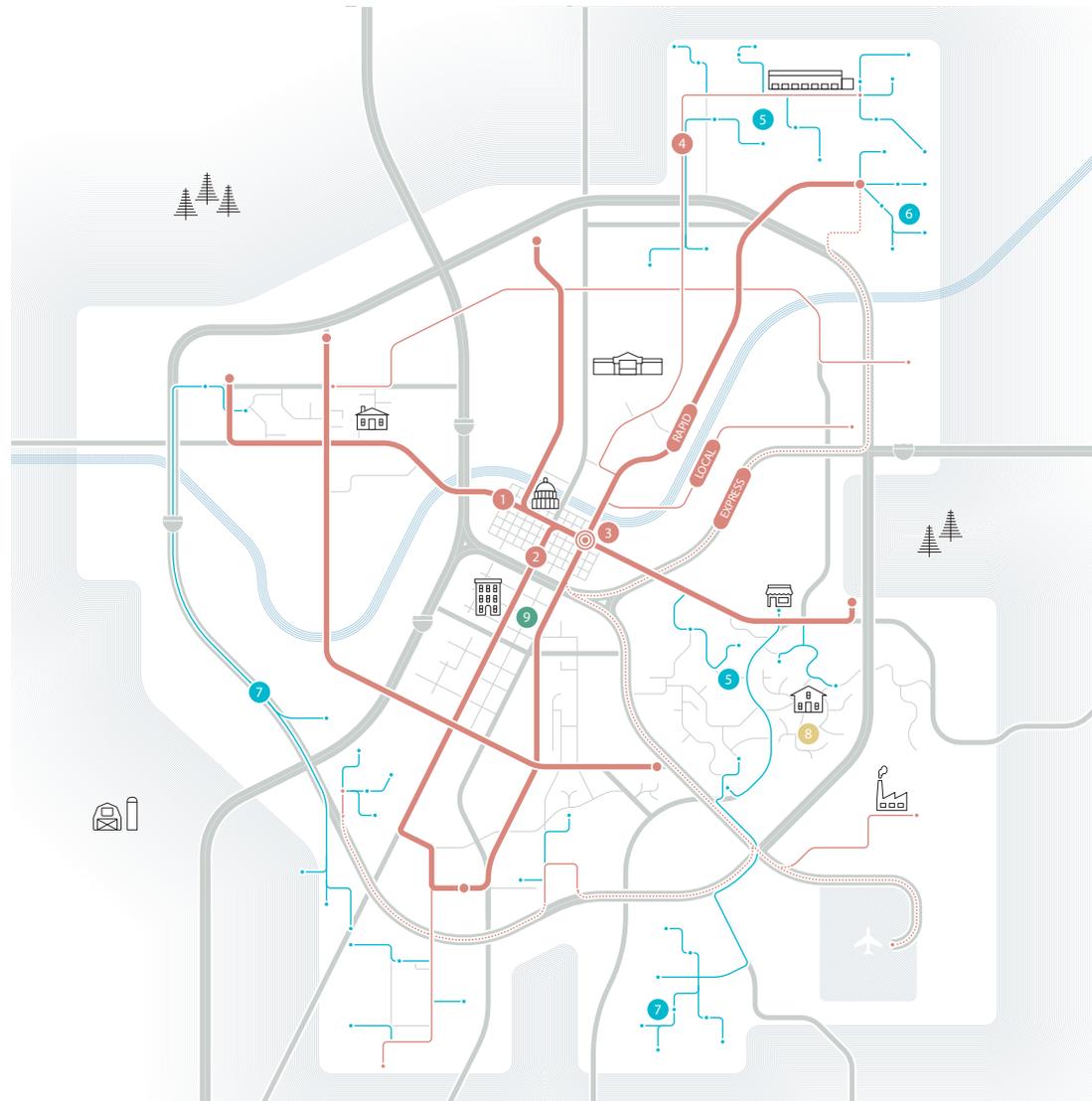


Figure 2 – A Vision for Mobility

2. Introduction

2.1 Cincinnati Mobility Lab

This study is one component of a broader partnership between Uber and the Cincinnati region, called “Cincinnati Mobility Lab,” created to ensure that the benefits of new transportation options are widely shared. This study has been prepared for and in collaboration with SORTA, TANK, and Uber. Ohio–Kentucky–Indiana Regional Council of Governments (OKI) and the Cincinnati USA Regional Chamber served in an advisory capacity.

Against a backdrop of declining ridership, public transit agencies in Cincinnati are eager to explore engagement opportunities with the private sector to provide service if it results in positive outcomes. However, this comes during a time when a “majority of transit execs are still nervous about Uber and Lyft.”

“27% of transit execs listed Transportation Network Companies (TNCs) like Uber and Lyft as a major concern for public transit in their cities. Many execs went one step further, with 24% of respondents considering TNCs an existential threat to transit.”¹

This is a time of upheaval in the public transportation sector. Agencies willing to take risks are best suited to learn from pilots and adapt to the new environment to meet the needs of their customers. It is in this spirit the Cincinnati Mobility Lab was formed; to forge a partnership between public and private sectors to proactively steer future transportation outcomes in a positive direction.

¹ Swiftly. (2019, January 15). *Swiftly's 2019 Transit Executive Survey*. Retrieved from <https://blog.goswift.ly/swiftlys-2019-transit-executive-survey-5e142ce7b719>



US | Jan 30, 2018

A new way of partnering with cities

— Written by Andrew Salzberg, Head of Transportation Research and Policy



Figure 3 - Uber Blog Post Announcing the Mobility Lab Partnership²

In addition to this study, the multi-year Lab commitment includes the following elements:

- **Expanded Uber Presence:** A renewed commitment to a local presence in the Cincinnati Region including a dedicated Uber partnership manager for this project.
- **Data Sharing:** Bringing Uber's data sharing platform (Uber Movement) to the Cincinnati Region including coordination with regional agencies.
- **Curb Study:** Fehr & Peers and Uber jointly developed a curb study that provides recommendations for strategies the City of Cincinnati can deploy to increase the productivity of curb space.³

² Uber. (2018, January 30). *A new way of partnering with cities*. Blog post. Retrieved: <https://www.uber.com/newsroom/cities-as-partners/>

³ Fehr & Peers. (2019, February 25). *Cincinnati Curb Study* (Tech.). Retrieved https://issuu.com/fehrandpeers/docs/cincinnati_curbstudy_2019-01

- **Employers & Commuting:** Announcing the creation of an employer forum with the Cincinnati USA Regional Chamber to help shape the future of commuting.
- **Cincinnati Mobility Summit:** Uber, along with Harvard professor Stephen Goldsmith, organized a forum to discuss how cities can manage transportation mobility, digest complex data sets, and embrace new forms of technology in a way that removes traditional barriers to transportation.

Primary goals of the Cincinnati Mobility Lab are to improve regional mobility, improve transportation system performance, and reduce environmental impacts. As stated by OKI, Uber, SORTA, TANK and other local stakeholders, the partnership seeks to:

- develop a strategic plan that optimizes the region's transportation system priorities and investment
- improve accessibility and save taxpayer dollars, with innovative strategies for better serving transit riders
- integrate various modes of transit to address gaps in service, improve ease of use, get people to jobs and better connect the entire region

To facilitate a deeper analysis of the relationship between Uber and public transportation activity in the Cincinnati region, Uber provided aggregated origin-destination (OD) travel and cost data at the transportation analysis zone (TAZ) level, as well as results from a rider survey developed specifically for this study. When paired with data provided by transit agencies, this allowed us to evaluate the potential for future on-demand transit services in Cincinnati.

2.2 Problem Statement and Study Goal

2.2.1 Problem Statement

This study is designed to better understand how on-demand transportation services (i.e., ride-hailing) currently fit into the transportation system and their potential role to complement fixed route transit services. It focuses on three key regional problems that are concerns of the regional stakeholders, and potential opportunities for on-demand services to contribute to meaningful solutions:

1. The steady decline in transit ridership during a period of economic expansion, which has resulted in drops in productivity on many routes.
2. A mismatch of public transportation options to regional transportation needs – for most people the automobile outcompetes more sustainable ways of travel due to the status quo in auto-



centric government spending and planning, and has an outsized impact on social costs and the environment.

3. A lack of clear understanding of how on-demand ride-hailing (e.g., Uber) and on-demand transit fit into the transportation system and their potential role to complement fixed route public transportation, as well as what transit itself can do to improve the match between the services it offers and evolving public expectations.

2.2.2 Study Goal

Declines in transit ridership and productivity are problematic because of transit's unique ability to provide accessibility to all people in a manner that can scale with smaller externalities than private cars (such as increased congestion or pollution). All stakeholders agree these are disconcerting trends and each desire to effect mode shift away from the private automobile to transit.

We offer recommendations for ways on-demand transportation services can contribute to optimizing the region's transportation system priorities and investments, providing innovative strategies for better serving transit riders, and integrating various modes of transit to address gaps in service in ways that are equitable and non-discriminatory, lower vehicular impacts on congestion, air quality and other economic, social and environmental outcomes.

More specifically, the Mobility Lab's strategic planning process strives to improve the integration of transit, Uber services, and other on-demand type services within the region in a manner that:

- recognizes, responds to and reinforces revealed traveler preferences and the strengths of the respective modes,
- enhances the performance of transit investments to benefit the public and the transit agencies,
- is equitable and non-discriminatory,
- produces lower vehicular impacts on congestion, air quality and other economic, social and environmental outcomes by providing residents with opportunities to minimize the number of cars they need to own, the number of miles they need to drive, and the amount of congestion they need to endure,
- best balances user cost, trip quality, and trip availability within current limits on public spending.

2.3 Local Background

The Cincinnati metro area has a population of a little over two million and spans eight counties across three states: Ohio, Kentucky, and Indiana. It is the 29th largest metro area in the United States.⁴ The City of Cincinnati, located within Hamilton County, has a population of around 300,000 and contains the region's central business district, on the north bank of the Ohio River.

Initially fueled by steamboat traffic, and then railroad activity, the City of Cincinnati grew rapidly outward along and away from the river during the 19th century. This was later fueled by a horse-drawn streetcar system, which was converted to electric in the latter part of the 19th century. The boom in automobile travel in the middle of the 20th century was enabled by construction of highways (itself only possible with demolition of many tracts and neighborhoods), and led to the replacement of the streetcar system with bus service and substantial outward growth in the suburban fashion centered on automobile travel. The average residential density of the region is trending downward and this trend is expected to continue as new low density developments are added to the periphery. In 2005, the highest percentage of households was found in the two-to-four dwelling units per acre category. However, the regional metropolitan planning organization, OKI, projects that in 2040 the highest percentage will be in the one-to-two dwelling units per acre category due to outward low density growth.⁵

Figure 4 – Cincinnati Skyline



Image credit: 5chw4r7z⁶

⁴ Table of United States Metropolitan Statistical Areas. (2018, January 20). Retrieved from https://en.wikipedia.org/wiki/Table_of_United_States_Metropolitan_Statistical_Areas

⁵ OKI. (2016, June). *2040 Regional Transportation Plan: Chapter 3, Demographics (Rep.)*. Retrieved https://www.oki.org/departments/transportation/pdf/2040plan/finalchapters/ch3_demographics.pdf

⁶ Photo retrieved from <https://flic.kr/p/fkwXry>



The region is served by Cincinnati/Northern Kentucky International Airport (code: CVG) which is located around 12 miles southwest of downtown Cincinnati in Hebron, Kentucky. The airport is a major hub for passenger travel and is also the fourth largest and fastest-growing airport in the United States for cargo and mail,⁷ being the largest global hub for both Amazon Air and DHL Aviation. In terms of cargo alone, the airport is now ranked third, behind Memphis and Louisville.⁸

Across the region, 84 percent of workers drove alone to work while ten percent carpooled, three percent used transit, and three percent walked or bicycled.⁹

While Cincinnati is served by a cross-country Amtrak route (three times a week), and a 3.6-mile modern streetcar route was opened in downtown in 2016, transit is otherwise wholly provided by bus service. Public transit service in the region consists of local and express buses operated by Southern Ohio Regional Transit Agency (SORTA) under the “Metro” brand, and Transit Agency of Northern Kentucky (TANK). Bus service in Cincinnati is a mix of commuter-focused express buses and local buses. There are 21 Metro express routes, 25 Metro local routes, 14 TANK express routes, and 12 TANK local routes. Almost all local buses have a headway of 30 minutes or shorter on weekdays. Most local buses have a ridership goal, although some have a coverage goal. The bus network is largely radial, serving trips to and from downtown Cincinnati. This means transit is typically not a feasible option for travel between outlying suburban areas. All except one TANK express route have a productivity (also known as service effectiveness) of greater than 8 passengers per revenue hour and most have a productivity of between 12 and 32 passengers per revenue hour. Metro has an average productivity of 19.4 passengers per revenue hour, roughly comparable with rates for similar-sized cities (18.4 for Nashville, 16.6 for Indianapolis, 17.2 for Columbus, and 33.2 for Pittsburgh).¹⁰ Ten Metro routes and one TANK route require a subsidy of >\$10 per passenger.

Butler County Regional Transit Authority (BCRTA) and Clermont Transportation Connection (CTC) serve neighboring Butler and Clermont counties, respectively. These agencies provide fixed-route bus transportation, and CTC operates express bus routes directly to downtown Cincinnati. While these agencies play an important part in connectivity at the edges of the region, to ensure adequate focus, SORTA and TANK are the only transit agencies considered and evaluated as part of this study.

⁷ Bureau of Transportation Statistics. (May 2017). Cincinnati, OH: Cincinnati/ Northern Kentucky International (CVG). Retrieved May 11, 2018 from

http://www.transtats.bts.gov/airports.asp?pn=1&Airport=CVG&Airport_Name=Cincinnati

⁸ Sixel. *2018 Air Cargo Rankings*. (2018). <https://www.sixelconsulting.com/pages/2018-air-cargo-rankings>. Retrieved December 31, 2019

⁹ OKI. (2016, June). *2040 Regional Transportation Plan: Chapter 3, Demographics (Rep.)*. Retrieved https://www.oki.org/departments/transportation/pdf/2040plan/finalchapters/ch3_demographics.pdf

¹⁰ National Transit Database (2017). *Annual Agency Profiles*.



*The auto-oriented nature of the Cincinnati region embodies the traditional mobility paradigm typical to mid-size regions across North America. Please refer to **Supplement A** for additional context on the forces that have shaped the Cincinnati region over the past few decades.*

Uber and Lyft have been operating in Cincinnati since March 2014. These companies are referred to by many different names, chief among them “ride-hailing companies” or “Transportation Network Companies” (TNCs).¹¹ The latter is used in this report. TNCs are generally enabled by three technologies: the smartphone, wireless data, and GPS, plus the availability of a contractor work force willing to work flexible schedules. The combination of these technologies allows for vehicles to be tracked in real-time, and this information can then be used to more efficiently match drivers and riders. Smartphone apps advise people of generally how long it will take for a vehicle to arrive, when they will arrive at their destination, and the cost of the service, allowing to them to decide if they want to travel by TNC. While transit agencies have taken advantage of these technologies to provide better real-time information to customers, TNCs are offering a seamless on-demand transportation experience centered around the smartphone experience. In short, TNCs offer door-to-door service with lower travel time, often lower wait time, higher reliability, but at a higher out-of-pocket cost to the user. According to Pew, 60 percent of TNC users nationally who also use transit find TNCs more reliable than taxis or public transit.¹² Some recent national studies indicate that TNCs in the same markets as transit are siphoning off some ridership, while other studies have shown the opposite effect of growing transit ridership,¹³ and many studies recognize that transit declines have multiple causes and the degree to which TNCs are having an effect is not agreed upon by researchers.^{14,15} Ultimately, the promise of TNCs is, in concert with other more sustainable transportation modes, to provide a viable alternative to car ownership and daily driving. We subject this promise to scrutiny as part of the study.

2.4 Study Contents

The remainder of the study is structured with the following two sections:

¹¹ Shared Use Mobility Center. (2016). *Shared Mobility and the Transformation of Public Transit*. Transit Cooperative Research Program (TCRP), 188 doi: 10.17226/23578

¹² Smith, A. (2016, May 19). *The New Digital Economy: Shared, Collaborative and On Demand* (Tech.). Retrieved <https://www.pewinternet.org/2016/05/19/the-new-digital-economy/>

¹³ Hall, J. D. & Palsson, C. & Price, J. (2018). *Is Uber a substitute or complement for public transit?*. Journal of Urban Economics, Elsevier, vol. 108(C), pages 36-50 <https://doi.org/10.1016/j.jue.2018.09.003>

¹⁴ Transit Center. (2019). *Who’s on Board 2019*. Retrieved <http://transitcenter.org/publications/whos-on-board-2019/#executive-summary>.

¹⁵ Manville, M.; Taylor, B.D. and Blumenberg, E, (2018, January). *Falling Transit Ridership: California and Southern California*. UCLA Institute of Transportation Studies.



Chapter 3: Cincinnati Trends. Following an overview of transportation services in Cincinnati we present findings from analysis of data provided by SORTA, TANK, Uber, and OKI from the Cincinnati region, which spans travel patterns, user demographics, trip costs, and a reveal of mode shifts to Uber.

Chapter 4: A Strategic Transit Study for Mobility in Cincinnati. This section includes key considerations and recommendations.

2.4.1 Typology of Services

A framework for integrating TNCs with transit envisions an array of services across a diverse urban area that integrates public and privately provided services at several tiers of service type, described below and shown in **Figure 5**:

- **Backbone Services:** High-capacity, high-frequency and fast transit network that focuses on serving major origin-destination pairs, including many of TANK and SORTA ridership-oriented routes (i.e., designed to maximize ridership) and the most productive of their coverage-oriented services (i.e., designed to maximize geographic coverage).
- **Crowdsourced Services:** Nimble, small- to medium-sized vehicle (~5-20 seats), with either minor on-demand deviations from a fixed route serving moderate origin-destination pairs, a fixed route alignment that changes over the span of a few days based on “crowdsourced” user requests, or fully dynamic routes within a service area that adjust in real time based on traffic and demand. We term the latter of these as “microtransit,” defined by the U.S. Department of Transportation as “a privately owned and operated shared transportation system that can offer fixed routes and schedules, as well as flexible routes and on-demand scheduling. The vehicles generally include vans and buses.”¹⁶
- **On-Demand Ride-hail Services:** Fully demand-responsive solo or pooled ride options for relatively low-volume origin-destination pairs, following flexible routes and guaranteed travel times, while attempting to pool several traveler groups. Pooling may result in some walking distance for the user at the origin and destination to minimize overall travel time across all passengers.

¹⁶ Eno Center for Transportation. (January 8, 2018). *Uprouted: Exploring Microtransit In The United States*. Retrieved: <https://www.enotrans.org/etl-material/uprouted-exploring-microtransit-united-states/>

MOBILITY TYPOLOGIES

What Modes Work Best Where?

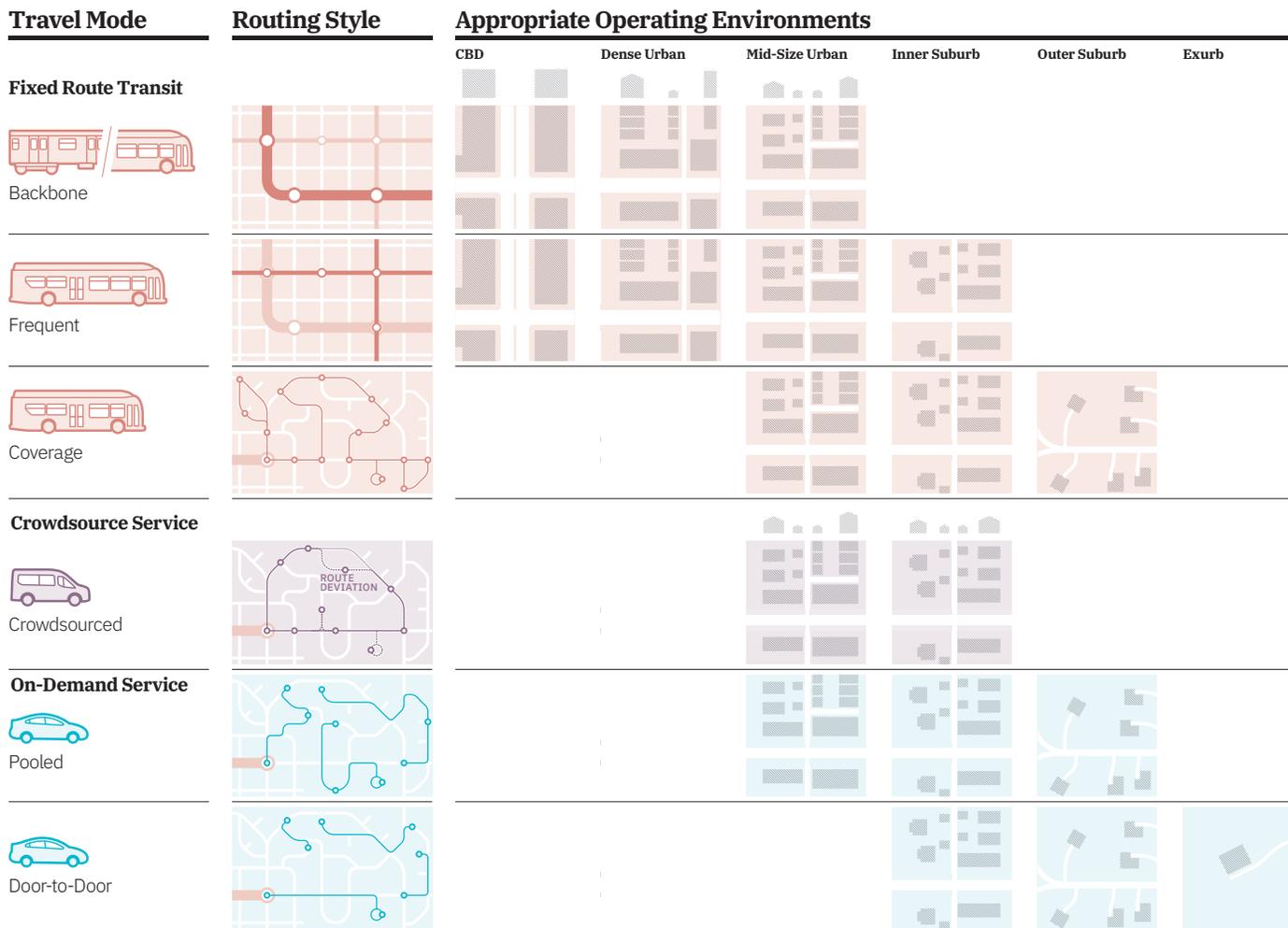


Figure 5 - Tiers of Integrated Transit and TNC Services



Service areas are seldom exclusively suited to a single mode, and overlapping presence of several types are appropriate for many contexts as illustrated in the above Figure 5.

Establishing an effective array of overlapping services able to reduce traffic and car ownership provides the opportunity to accommodate growth in less car-centric forms, strengthening the regional economy, protecting the environment, and enhancing local communities. The study's recommendations on improved mobility options will rest on a strong foundation of existing transit services and mode options that serve as alternatives to the automobile.



*Transit agencies across the country have undertaken numerous pilots to learn about the effect of subsidized flexible transit and ride-hail services. Please refer to **Supplement B** for further reading on key learnings from these experiments.*

3. Cincinnati Trends

The past decade has seen the Cincinnati region approach a tipping point where municipalities have sought to increase non-automobile travel options to promote livability, health, and mobility for those unable or unwilling to drive. The region is making some progress in providing feasible options for short trips, through various walk, bicycle, streetcar, and micromobility developments. The success of these measures (such as the Cincinnati Bell Connector, bicycle infrastructure, and complete streets projects) has been mixed.

In this chapter we present current services available to Cincinnatians, highlighting the mobility options available to drivers, and the extent of current transit and TNC service. We then present a set of findings from an analysis of Cincinnati-specific data. We will show that bus ridership has been steadily declining over the past few years, that bus speeds are often not competitive with the auto, and that trip patterns for auto, transit, and Uber each differ substantially from each other; i.e., each mode serves very different markets. Finally, we present information to characterize users of transit and Uber, and how they differ substantially, before presenting findings on what this all means to the future of transit in Cincinnati.



*Please refer to **Supplement C** for an unabridged version of the findings contained within this chapter, including data and maps showing bus and Uber speeds and on-time performance that do not appear in this section.*

3.1 Current Service

This subsection provides an overview of the extent of driving, transit, and TNC offerings in the Cincinnati region.

3.1.1 Auto and Carpool

Cincinnati residents typically use a private automobile for everyday trips. Most households have vehicle access with about 79 percent of households owning at least one vehicle; approximately 1.3 vehicles are owned per household in the city.¹⁷

Most parking throughout the region is free and abundant. In the few areas with on-street parking meters, rates vary by location, with higher rates at downtown meters (maximum \$2.75 per hour) and lower rates in neighborhood locations. Residents and visitors have many parking options downtown with over 30,000

¹⁷ U.S. Census (2017). *American Community Survey 5-Year*. Retrieved <https://factfinder.census.gov>



parking spaces. Typical daily rates for garages are around \$8 per day in downtown Cincinnati, with some locations¹ as high as \$12.

Private automobile trip reduction services offered by employers and agencies include OKI's RideShare which facilitates carpool and vanpool formation. OKI reports that 8 percent of workers commute in carpools.¹⁸

3.1.2 Transit and Paratransit

There are two main transit agencies in the Cincinnati Metro Area: SORTA and TANK. SORTA operates 46 fixed route Metro bus lines. Metro operates north of the Ohio River, within the City of Cincinnati and its Ohio suburbs. Twenty-five of the routes are local and 21 are express that operate only during commute periods. The bus network is almost entirely radial, focused around downtown Cincinnati. The high frequency lines (seven of which operate at 15-minute headways or better) all converge to downtown. The three Crosstown routes operate at 60-minute frequencies.

TANK operates mainly south of the river in the Northern Kentucky suburbs of Cincinnati. TANK operates 26 fixed route bus lines, and a demand-responsive paratransit service called Regional Area Mobility Program (RAMP). Many of the bus routes cross the river and stop in Downtown Cincinnati. TANK's routes include 10 local, 15 express, and the Southbank Shuttle that connects areas along the south bank with downtown Cincinnati.

In addition, the City of Cincinnati owns the Cincinnati Bell Connector downtown streetcar, which is operated under contract by Transdev. The streetcar operates on a 3.6-mile loop with 18 stations, including downtown, the stadium area, and the mixed use Over-the-Rhine district. All transit routes are shown below in **Figure 6**.

¹⁸ OKI. (n.d.). *Other Travel Mode Alternatives*. Retrieved: <https://2040.oki.org/other-travel-modes/>

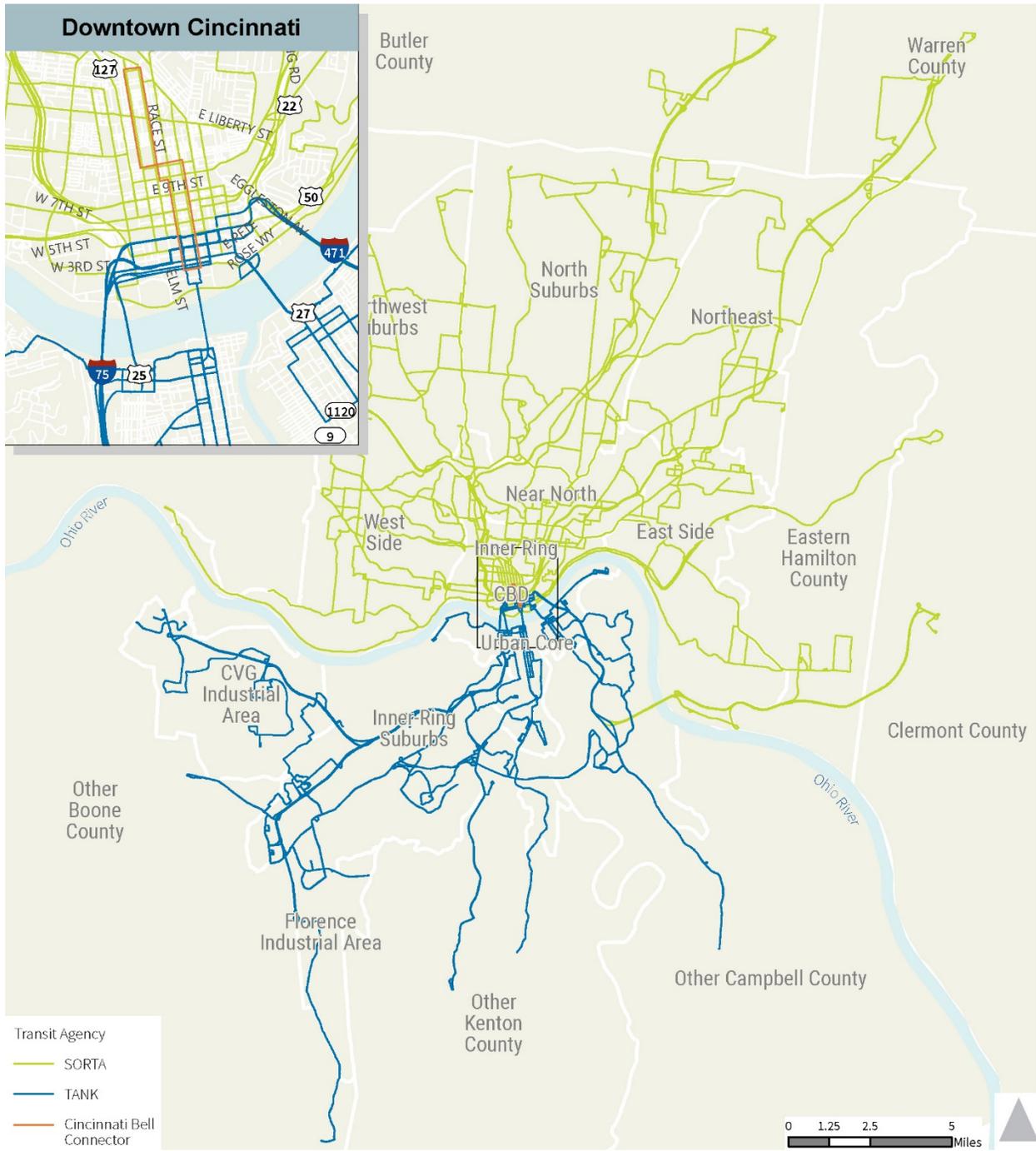


Figure 6 - Transit Routes in the Cincinnati Region

Source: Data provided by Metro and TANK, mapped by Fehr & Peers.

Metro offers a shared-ride bus paratransit service for those that cannot take passenger bus transit, called Access. The service area and hours of operation are equivalent to the regular Metro service, limited to areas within three quarters of a mile of regular, non-express, service. Across Boone, Campbell, Hamilton, and



Kenton counties, around 64 percent of people live within three quarters of a mile of fixed route non-express service. The cost of the service is \$3.50 within Zone 1 and \$4.50 in Zone 2.¹⁹ Government spending per passenger trip is about \$35.²⁰ Total annual paratransit ridership has increased steadily from 198,000 in 2014 to 231,000 in 2018; despite this growth, overall ridership has declined during the same period. TANK has developed The Regional Area Mobility Program (RAMP), a door-to-door paratransit service. Like the Metro paratransit service, it serves areas within three quarters of a mile of fixed TANK routes. Those needing service outside these boundaries can call ahead to schedule a pick-up or drop-off.

Neighboring Clermont County Connection (CTC) operates two express bus routes into downtown Cincinnati. The New Richmond Express (2X) operates twice daily, and the Amelia Express (4X) operates eight trips daily, mostly in the morning commute hours.

3.1.3 Taxis

Per conversations with the local stakeholder team, Cincinnati does not have a robust taxi presence citywide, and service is largely concentrated at the airport and event centers. Taxis serve many of Cincinnati's central neighborhoods, especially for shopping (grocery) and medical appointment trip purposes. Taxis are also in abundance during peak arrival/departure times at Downtown's Greyhound Bus Terminal. Taxi travel is permitted at the city level.

3.1.4 Uber & Lyft

Uber is ubiquitous throughout the Cincinnati metro area, with no geographic or temporal boundaries around where the drivers are allowed to operate. Service availability is, however, dependent upon driver participation. Uber offers four passenger car service types in the Cincinnati metro area: UberX, UberXL, Uber Comfort, Uber Black. The remaining service types, UberPool, Uber Express Pool, Uber Select, Uber Assist, and Uber WAV, are not currently offered. The service types are defined as follows:

- **Available in Cincinnati**
 - **UberX** is the entry-level cost option, with vehicles that seat four passengers such as regular sedans.
 - **UberXL** is the entry-level cost option, but with larger vehicles that seat six passengers, such as minivans and some SUVs. UberXL costs more than UberX.

¹⁹ Go Metro. (n.d.). Access Program. Retrieved from <http://www.go-metro.com/accessibility/access-program>

²⁰ U.S. Federal Transit Administration (2018). National Transit Database - SORTA Annual Agency Profile. Retrieved from: https://www.transit.dot.gov/sites/fta.dot.gov/files/transit_agency_profile_doc/2018/50012.pdf

- **Uber Comfort** is a mid-range cost option, with more spacious, newer vehicles, drivers that meet a minimum rating, and ability for riders to specify certain preferences such as a quiet ride.
- **Uber Black** is the luxury option, with insured livery vehicles that are commercially registered, typically a black SUV or luxury sedan. This is the most expensive Uber service.
- **Not Available in Cincinnati**
 - **UberPool** is an offering where the ride may be shared with one or more other Uber users, selected by an Uber algorithm, who are heading in a similar direction.
 - **Uber Express Pool** is similar to Pool but there may be a walk to the pick-up spot and from the drop-off point to the final destination.
 - **Uber Select** is a mid-priced option, with high-end vehicles that seat up to four passengers.
 - **Uber Assist** is an option with drivers who are specifically trained to assist riders with vehicles and can accommodate folding wheelchairs, walkers, and scooters.
 - **Uber WAV** is an option that has drivers who are certified by a third party in driving and assisting people with disabilities. Vehicles can accommodate wheelchairs or motorized scooters. It is currently testing in a small number of cities.

Lyft is the only other TNC service currently operating in Cincinnati. While no local information exists about split of service, Uber claims to have over 65 percent of the bookings in the U.S. and Canada; it is likely that Lyft has a majority of the remainder.²¹

3.2 Transit Data

This section provides an overview of Metro and TANK's predominantly downward ridership trends over the past five years. As shown in the Overview to **Supplement D**, this is a longstanding trend that has continued for over 50 years, well before the introduction of TNCs to the region. This section also contains a presentation of Metro speed data and on-time performance data.

3.2.1 Metro Ridership

Weekday ridership has declined by 19 percent since 2014 despite the amount of weekday service Metro providing remaining fairly constant (decreasing only 1.3 percent over the past five years), as shown in

²¹ Uber (2019). *Form S-1 (Registration Statement Under The Securities Act Of 1933.)* Page 3. Retrieved: https://www.sec.gov/Archives/edgar/data/1543151/000119312519103850/d647752ds1.htm#toc647752_4

Figure 7. Productivity is also shown, which is ridership per service hour. The declines are more pronounced on weekends where the ridership decline is 23 percent despite service hours holding steady. Service hours fluctuate from month to month due to the number of days per month and the proportion of these which are weekdays, where service levels are higher.

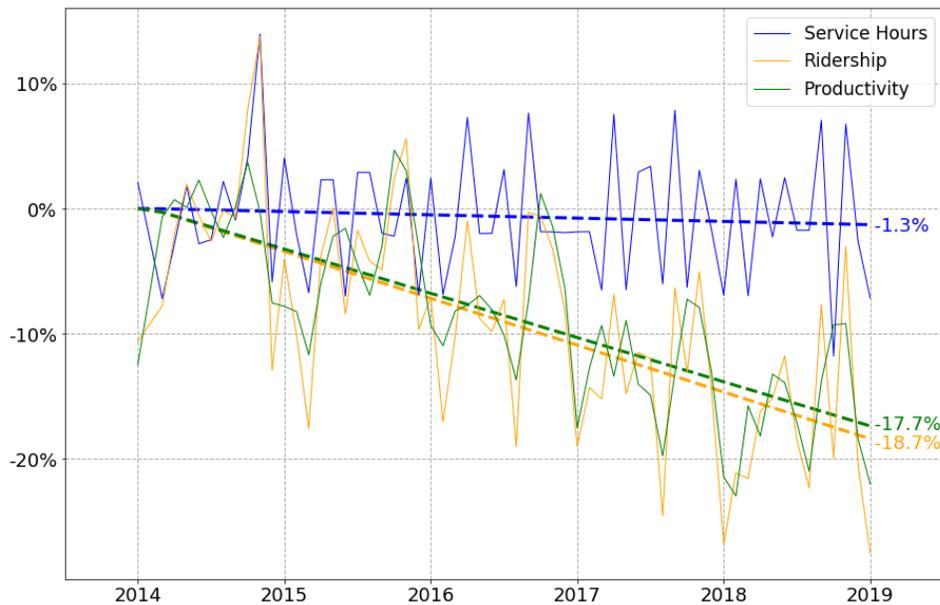


Figure 7 - Weekday SORTA Ridership, Service Hours, and Productivity (2014-2018)

Ridership for “local” and “express” services have both declined substantially (18.3 and 23.9 percent, respectively). Over the past five years Metro has kept “local” service levels at roughly the same level but has reduced “express” service by 10 percent.

SORTA ridership has steadily decreased for nearly 90 percent of its routes. The five routes with the largest decline in percentage terms over this period are routes 1, 50, 72, 52, and 28, where the declines are between 41 and 68 percent. There is no obvious pattern to these routes, although only route 50 serves the west side. The respective declines are presented below in **Table 1**. The five routes with the largest absolute declines are, in descending order, the 17, 4, 43, 11, and 78 routes, with declines ranging from 9,000 to 25,000 (equivalent to between 18 and 29 percent reductions). Although the percentage decline of these routes is less than for the previous five, and we are not identifying them as generally under-performing, the loss in terms of actual ridership coming from some of the most productive services is more significant in terms of declining user base and fare revenue. Each of these five routes terminates in Downtown Cincinnati; they are each radial in nature and comparatively long distance, and each originates either north or east of downtown.

Only five bus routes exhibiting constant or modestly increasing ridership over the 2014-2018 period: routes 41, 29, 90, 38, and 68. These routes are spread across the service area without any clear pattern.

Table 1: SORTA Routes with Greatest Percentage Decrease and Greatest Ridership Change (2014-2018)

Lines with Greatest Percentage Decrease			Lines with Greatest Ridership Change		
Route	Percent Decrease Over 5 Years	Monthly Ridership Change Over 5 Years	Route	Monthly Ridership Change Over 5 Years	Percent Decrease Over 5 Years
1	-68%	-5,120	17	-24,830	-25%
50	-59%	-3,410	4	-22,190	-29%
72	-52%	-1,250	43	-21,500	-18%
52	-43%	-1,680	11	-15,190	-26%
28	-41%	-2,220	78	-9,580	-18%

3.2.1.1 Route 90 – a Modest Increase

Bus route 90 has shown modest increases in ridership over the same period, attracting monthly riders¹ at a faster rate than any other route. Route 90 is the only *Metro*Plus* bus line which is “geared toward providing limited stop service on [a] major important corridor with specifically ‘branded’ vehicles;” stops are limited to 2-3 per mile.²² Route 90 operates only during the weekdays and service hours have increased 2 percent since 2014. Launched in August 2013, *Metro*Plus* experienced substantial increases in ridership until 2015, where it has trended slightly upward since; ridership remains approximately four percent above 2014 levels. Route 90 has the 11th highest average ridership across all SORTA routes.

3.2.2 TANK Ridership

TANK provided data for 2014-2018, absent data for 2017 (due to a major service realignment that year). TANK increased overall service hours by 4.6 percent between 2014 and 2018, as shown in **Figure 8** while ridership decreased by 19.4 percent over the same period.

²²SORTA (2016). SORTA Service Evaluation, Development, and Management Study Final Report. Retrieved: <https://reinventingmetro.com/uploads/pdfs/Aecom%20Final%20Report%20With%20Executive%20Summary.pdf>

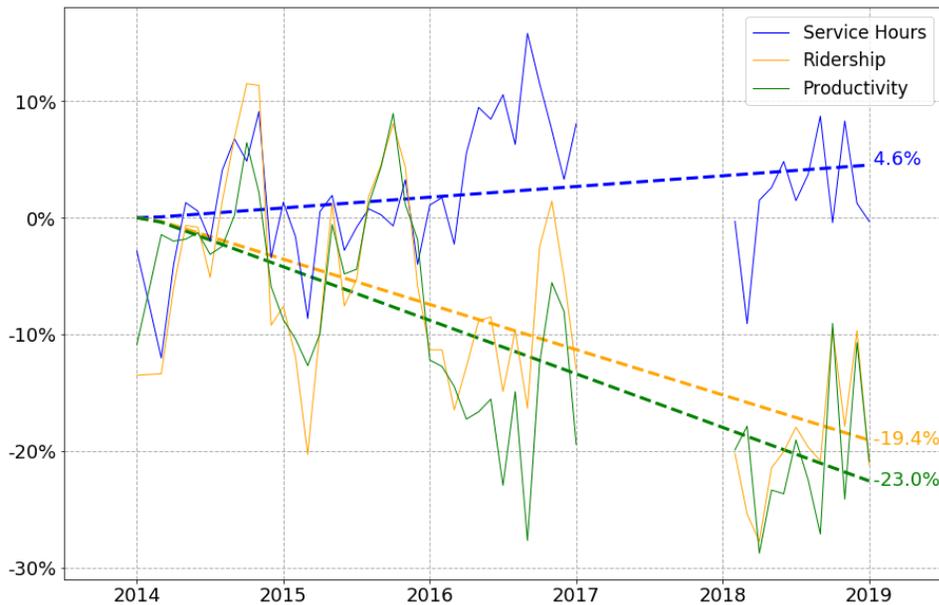


Figure 8 - TANK Ridership, Service Hours, and Productivity (2014-2018)

The sharpest decrease in productivity has occurred on the express routes, where service levels have increased by over 33 percent but have been accompanied by ridership declines of 11.8 percent. Local routes have suffered a 23 percent decline in ridership accompanying a 6.6 percent decline in service hours.



Please refer to **Supplement D** for a deep-dive into the factors that have led to transit ridership decline, and an assessment of the contribution of TNCs. We conclude that TNCs are one of many contributors to ridership decline in U.S. cities, and themselves a small proportion (less than a quarter).

3.3 Trip Pattern Data

Between 2014 and 2018, Uber use in the Cincinnati region has grown from zero to 10,000 trips per day while Metro and TANK have seen decreases totaling 8,000 (when removing transfers), as shown below in **Figure 9**. By comparison, on a typical weekday in 2017 there were around 4.5 million private auto person trips in the region.²³

²³ U.S. Federal Highway Administration. (2017). *National Household Travel Survey*.

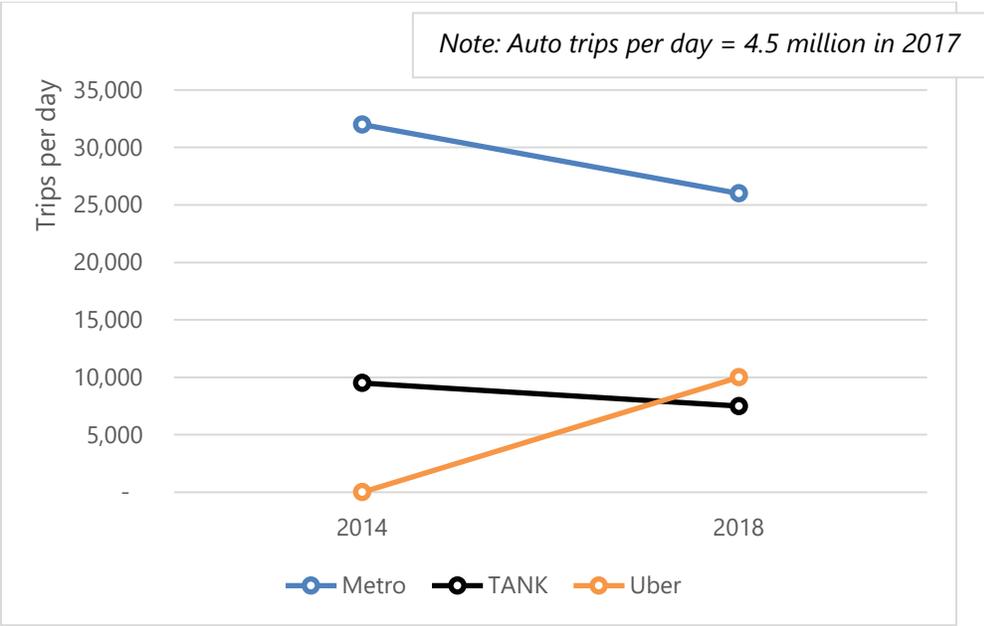


Figure 9 - Daily Trips for Metro, TANK, and Uber

A survey of over 1,000 Uber riders completed as part of this study finds that 13 percent of riders state that they used transit for their particular trip prior to TNCs being available to them (see Section 3.4.8 for more detail). Therefore, of the 10,000 daily trips that Uber gained, 1,300 of them may have switched from transit according to these results. While this would constitute around 15 percent of the 8,200 daily passenger trips that transit lost in this period, the total percentage would be higher if Lyft were also included. No data on Lyft usage was available.

3.3.1 Travel Flows

The following are a series of travel flow maps (also known as desire line maps) for auto, transit, and Uber travel. They depict where people are going using each of these modes and also drill down to identify geographic areas where transit and Uber are holding their ground and where they may be underperforming. Whereas auto travel is spread across the region in rough proportion to activity density, transit and Uber travel each enjoy very location-specific concentrations, which are highlighted below.

For each of the figures, the weight of each desire line corresponds to the demand for travel by a particular mode between that origin-destination pairing. The spatial level of analysis is the subregion, defined in collaboration with stakeholders. The subregions delineate major employment areas, high activity areas, and other urbanized areas in the region.

Key takeaways from this subsection are presented in Section 3.3.1.6.



3.3.1.1 Auto

Figure 10 below shows travel flows for bidirectional daily auto travel within the region's core. The source for automobile flow data is regional travel demand model outputs, specifically the 2015 OKI model. Overall, auto travel is well-dispersed throughout the region, both in the center, inner, and outer rings. The figure shows that auto travel is greatest within and between the northern suburbs, west side, near north, and east side. Auto trips appear to be more intra-zonal rather than inter-zonal, showing that people tend to drive to destinations within their subregion. There is also a lot of travel within the Kentucky inner-ring suburbs, and between that area and the Kentucky urban core. Comparatively few auto trips cross the river. The greatest flow is 97,000 trips between the Kentucky Inner Ring Suburbs and the Kentucky Urban Core. The biggest intra-subregion flow is 291,000 daily trips within the North Suburbs.

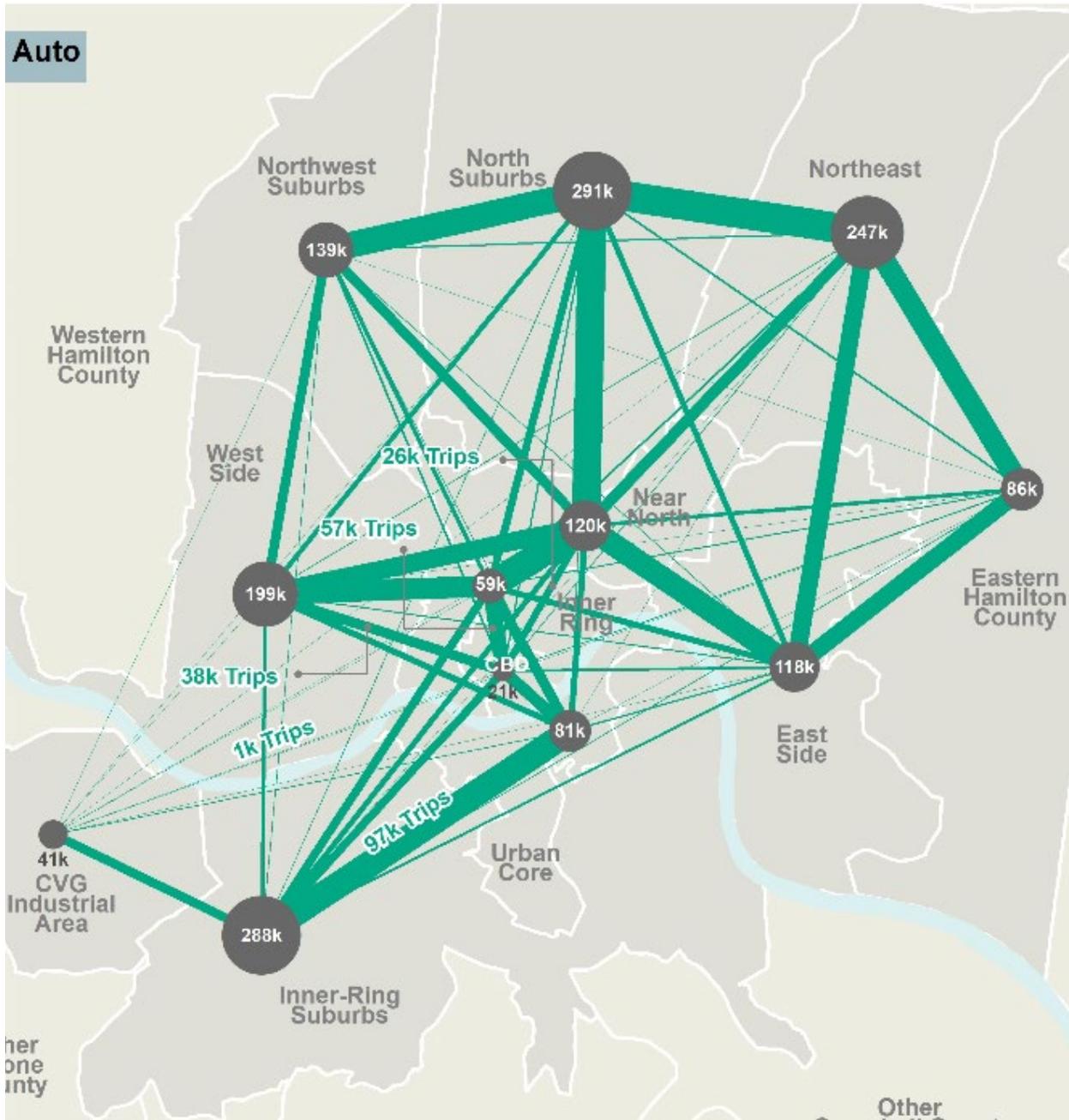


Figure 10 - Desire Lines for Daily Subregional Auto Person Trips



Auto travel to/from the CBD is comparatively small. The CBD is one of five major job clusters, and although the largest and the densest, the others are nearly as large:²⁴

1. Central Business District Hub, 50,862 jobs
2. Uptown Hub, 43,764 jobs
3. CVG Hub, 38,545 jobs
4. Blue Ash Hub, 31,632 jobs
5. North Tri-County Hub, 30,905 jobs

3.3.1.2 Transit

Figure 11 shows transit travel flows. The source is travel demand model outputs scaled by boarding data collected by each transit agency. This figure is at a different scale as transit trips are much smaller in quantity than auto overall. It's clear there are four main corridors for transit, and each is focused on the CBD. These corridors are trips to/from the CBD and the West Side, Inner Ring, Near North, and Kentucky Urban Core (i.e., Covington north of I-275). The biggest flow is 5,000 trips between the Cincinnati Inner Ring and CBD (a lot smaller than 97,000, the largest for auto). The biggest intra-subregion flow is 4,800 trips within the CBD (a lot smaller than 291,000, the largest for auto). The Near North and North Suburbs are well represented while the East Side is not. This matches our expectations as these areas are comparatively high in transit service. Trips to/from other subregions are relatively sparse.

²⁴ Job Hubs Cincy Region "Mapping Our Region's Job Hubs" web application. <https://jobhubs.oki.org/map/index.html>
Accessed December 31, 2019

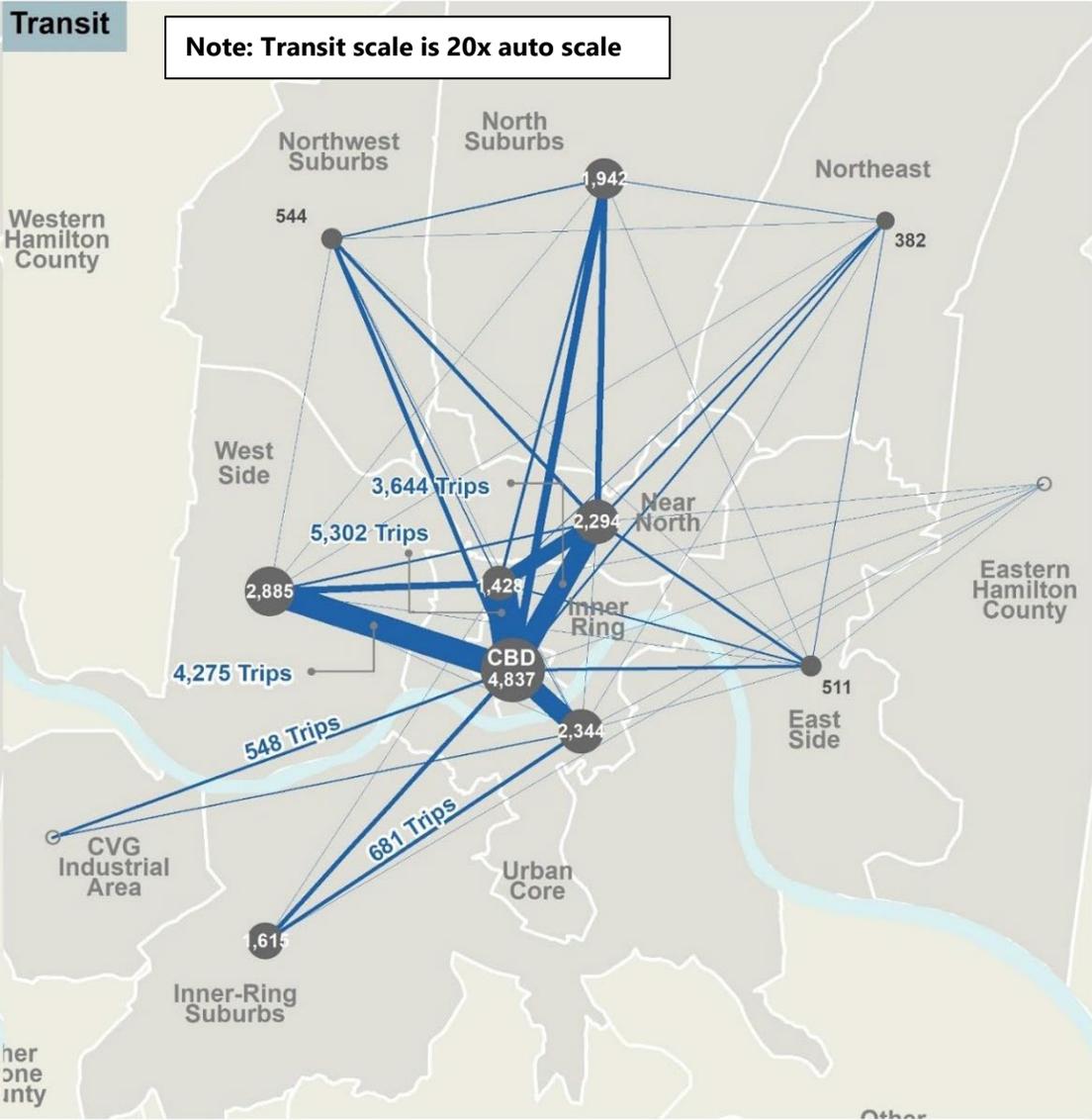


Figure 11 - Desire Lines for Daily Subregional Transit Person Trips

3.3.1.3 Uber

Figure 12 shows Uber travel flows, shown as daily person trips (where a ratio of 1.5 was used to convert trips to person trips, where “person” refers to passengers and not the driver). Schaller has assumed 1.5 passengers per trip (similar to typical auto trip averages)²⁵ while Henao et al. have found 1.4 passengers per trip.²⁶ Again, this is at another different scale as Uber travel is outweighed by transit travel. A few major

²⁵ Schaller Consulting. (2018, July 25). *The New Automobility: Lyft, Uber and the Future of American Cities* (Tech.). Retrieved <http://www.schallerconsult.com/rideservices/automobility.pdf>

²⁶ Henao, A. & Marshall, W.E. (2018). *The Impact of Ride Hailing on Vehicle Miles Traveled*. Retrieved from: <https://doi.org/10.1007/s11116-018-9923-2>

corridors do emerge, but travel is more dispersed across the region than transit, although less dispersed than auto. The largest flows are between the CBD and Inner Ring, Near North, East Side, and CVG Airport area. The largest is 720 trips between the CBD and the Inner Ring, and the largest intra-regional flow is the 588 within the CBD. There is a lot of travel between the East Side and the CBD, with little travel to/from the West Side. Uber also has a relatively high number of cross-town trips.

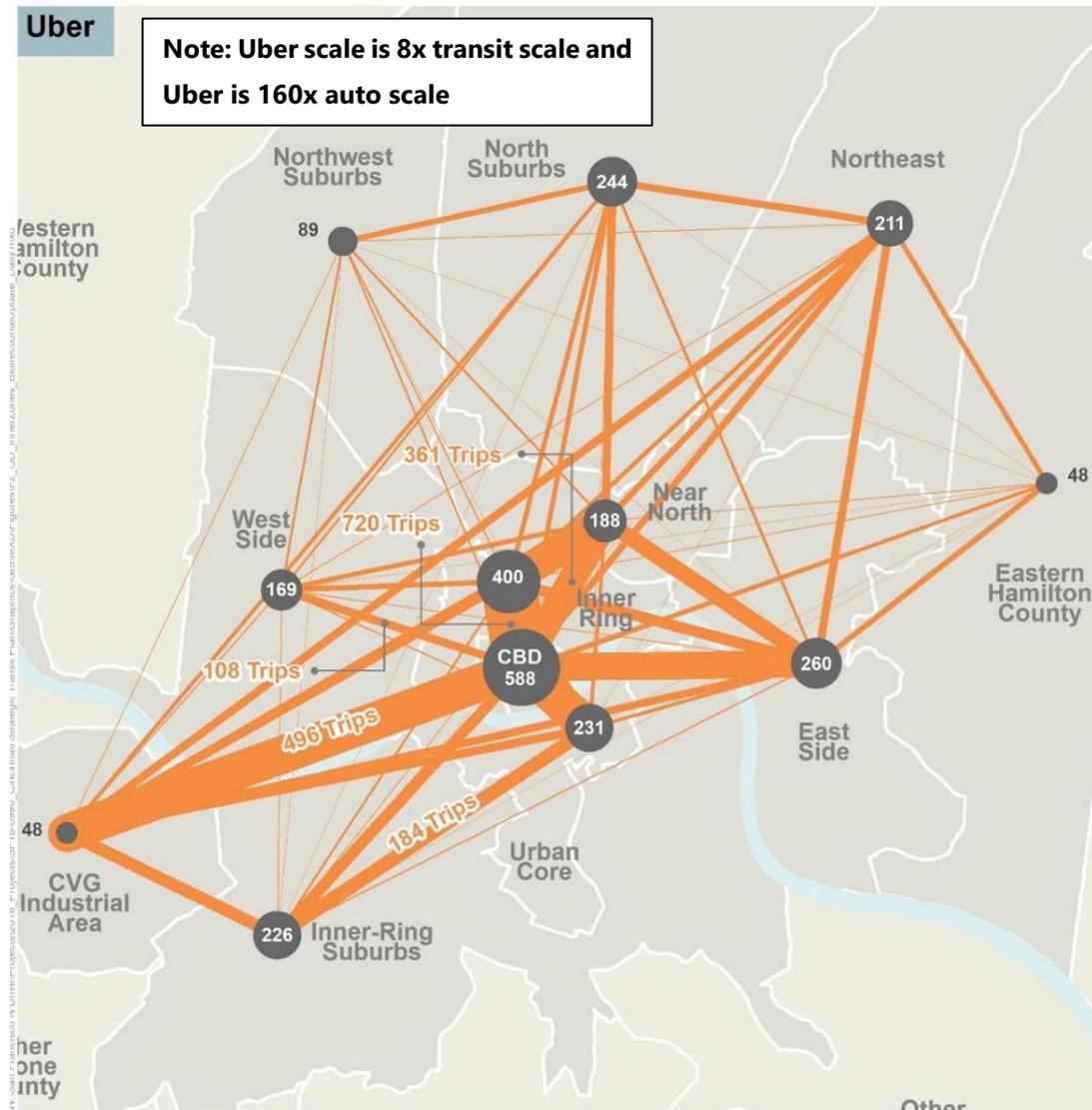


Figure 12 - Desire Lines for Daily Subregional Uber Person Trips

3.3.1.4 OD Pairs where Transit Captures an Undersized Part of the Market

The next figure (**Figure 13**) shows the links where transit service is currently provided but is failing to capture a large share of a comparatively large travel market. In other words, the figure reveals areas with the highest growth potential for transit (although tapping this potential may require more than just service improvements, i.e. densification of the underlying land use or improved accessibility to destinations). The thickest lines on the figure show the “large travel markets” (defined as more than the 75th percentile of bi-directional daily person trips across all subregion pairs, equating to >21,000 person trips per day). The orange coloration shows where transit is both present and capturing a “small share” (defined as less than the 25th percentile of transit share percentages across all subregion pairs, equating to <0.11 percent mode share). Therefore, the thick orange lines are areas with highest growth potential for transit.

There are five such OD pairs, three of which cross the river and are near the downtown area but do not start or end in the CBD. This may be representative of how many of the transit routes that do cross the river either start or end in the CBD, such that trips that cross the river but bypass the CBD require transfers for passengers between buses. It suggests that either more seamless connectivity within the CBD (e.g., at Government Square transit hub) or more direct routing between these areas could lead to transit better serving demand.

Additionally, thick dark gray lines show where transit has a comparatively large share of a comparatively large overall travel market. Thick light gray lines show where transit is not present in a comparatively large overall travel market.

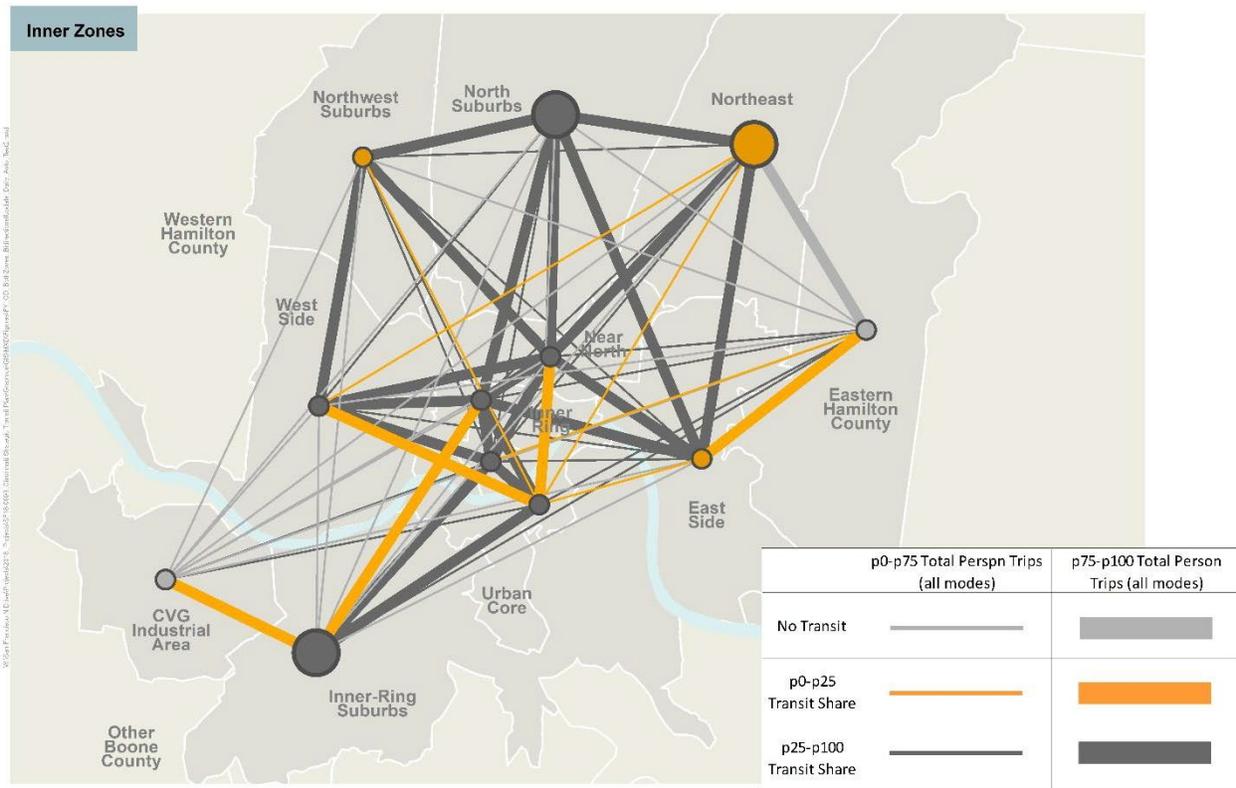


Figure 13 - Transit Share and Overall Daily Person Trip Comparison in Inner Core

3.3.1.5 Travel and the Block/Neighborhood Level

In support of the desire line effort above, and in order to assist the public agencies in deciding where to commit their limited resources, we developed an interactive web map to show OD travel at the TAZ level.

3.3.1.6 Travel Flow Takeaways

The overall scale of auto travel in the region is orders of magnitude higher than transit and Uber. But whereas auto travel is spread across the region in rough proportion to activity density, transit and Uber travel each enjoy very location-specific concentrations, particularly transit. Understanding these concentrations is critically important because due to transit's ability to scale mainline service cheaply, shifting travel from auto to transit would be most cost-effectively achieved by doubling down on investment in areas of existing strength rather than spreading resources evenly across the region in parts where transit is not getting much traction.

Auto travel correlates well with the multi-polar nature of the regional job market and is characterized by lots of travel within and between suburbs. This reflects the few limitations placed on auto travel in the

region. Conversely, transit travel is largely concentrated and mainly self-contained within each of the following subregions: CBD, West Side, Near North, and Covington. Each are areas comparatively well-served by transit and with high population densities or denser job centers. Travel between the CBD and the three other areas is also fairly high; transit captures around 10 percent of the overall market for some of these corridors. Uber travel is well-dispersed, but with concentrations centered around the east side (a high income neighborhood), CVG airport (convenient access without needing to pay long-stay parking), and crosstown travel (Uber offers flexibility here). As such, transit out-draws Uber in areas where bus service is comparatively good, but Uber is closer to parity or has higher ridership in outlying areas, trips to/from the airport, and for travel to/from the higher income east side.

The areas with perhaps the steepest growth potential for transit, i.e., where transit currently serves a very small part of a very large overall market, are cross-river trips that pass through downtown but don't start or end there. More seamless connectivity within the CBD (e.g., at Government Square transit hub) or more direct routing between these areas could lead to transit better serving demand.

3.3.2 Time of Day

Ridership data shows us that transit ridership heavily outweighs Uber during the weekday daytime. For example, transit trips outnumber Uber 6:1 in the weekday PM peak period. However, the gap narrows during evening and weekends to 2:1 for weekday evenings and 1.25:1 on the weekend. These statistics again assume an average of 1.5 passengers per trip for Uber.

There is a consensus among researchers that ride hailing is more commonly used for recreational trips than for everyday commuting. Ride-hailing use peaks between 10 PM and 4 AM, with weekday commute-hour trips only making up 20 percent to 27 percent of total TNC trip volume for the week.²⁷

Trips per hour by mode are shown below in **Figure 14** and trips per time of day are presented in **Figure 15**.

²⁷ Feigon, S., & Murphy, C. (2018). *Broadening Understanding of the Interplay Between Public Transit, Shared Mobility, and Personal Automobiles*. 11–11. doi: 10.17226/24996

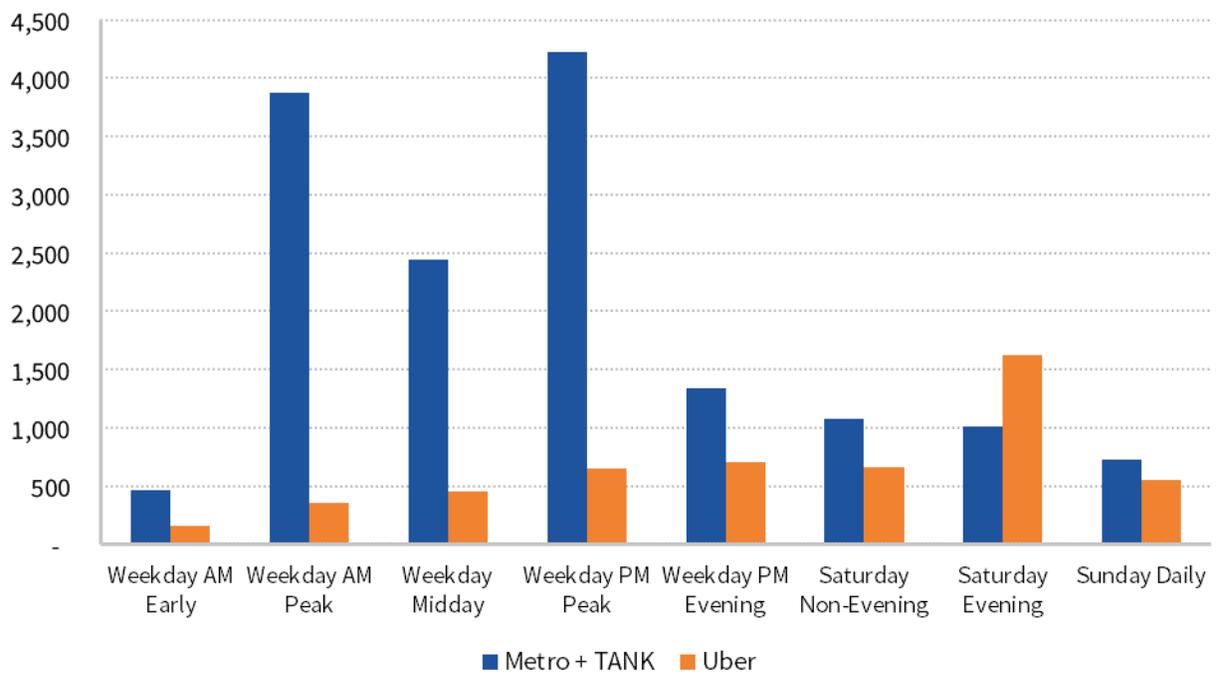


Figure 14 - Passenger Trips per Hour for Uber and Transit during Different Times of Week

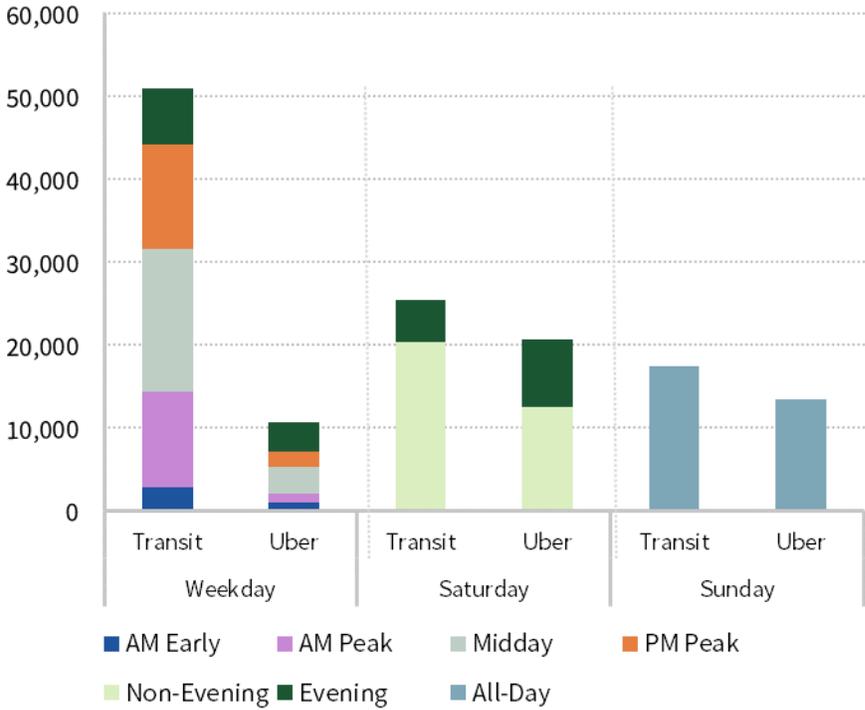


Figure 15 - Passenger Trips per Day for Uber and Transit

Weekday evening Uber trips are far less geographically spread out than weekday PM period, and these evening trips are focused on trips between the downtown, near north, and Oakley/Hyde Park. Weekday evening transit trips appear to be about as well-dispersed and scaled as weekday PM period trips, with the exception of outlying areas served exclusively by express buses which do not run during the evenings. These trends correspond with the national literature.

3.3.3 Service Type

Three service offerings were available during the 2017 calendar year, the timeframe for the dataset. UberX accounts for the vast majority of trips on Uber, especially on weekdays. UberXL is about twice as popular on the evening and weekend than weekday daytime. Uber Black is a very small proportion (averaging only around 80 trips per day). The small proportion of Uber Black usage may indicate that most Uber riders are cost-sensitive; alternately, it may reflect a lack of vehicle type ownership within the driver pool.

3.3.4 Trip Distances

Uber trips are about the same length on average as transit trips. Uber has an average trip distance of 6.93 miles, which corresponds closely with the average trip distance across many metro areas nationwide, which is 6.1 miles according to Schaller.²⁸

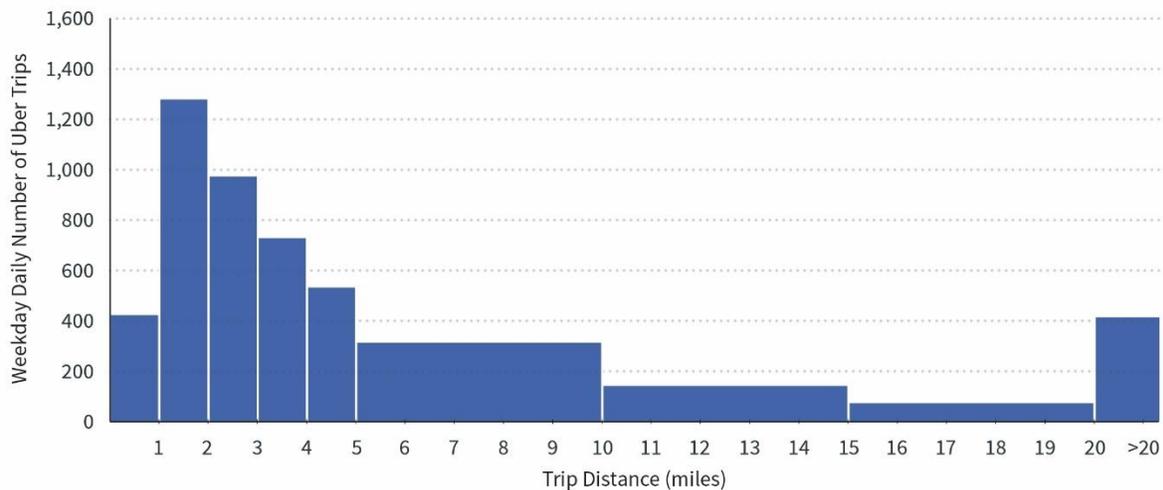


Figure 16 - Distribution of Uber Trip Distances in Miles (mean = 6.93 miles)

According to the National Transit Database, the average unlinked passenger trip length (i.e. each leg of a transfer is treated separately) is 5.64 and 6.67 miles for Metro and TANK, respectively.

3.4 Survey Data

Both SORTA and TANK collect information on who their riders are and what’s behind their choices to ride transit through periodic rider surveys. In this section, we cross-reference this data against results from an Uber rider survey that was conducted specifically for this study. Thus, we are able to understand key differences between who rides Uber and transit, and the extent to which these populations overlap, or people have switched from one to the other.

We developed and deployed the Uber rider survey in summer 2019, crafted to understand OD travel patterns, trip purposes, and traveler characteristics of those who recently took an Uber trip in the Cincinnati region. The rider survey was deployed in June 2019 over a period of ten weeks via email to all people who had taken an Uber trip over the previous 48 hours. The return rate was 1.5 percent (1,026 out of 67,891).

²⁸ Schaller Consulting. (2018, July 25). *The New Automobility: Lyft, Uber and the Future of American Cities* (Tech). Retrieved <http://www.schallerconsult.com/rideservices/automobility.pdf> [page 13]



Please refer to **Supplement E** for a copy of the Uber rider survey instrument.

Specific to Cincinnati, our key takeaways are as follows:

- Local bus services have a higher share of non-white riders, a higher share of low-income riders, have a higher proportion of child and senior riders, and higher share of non-work trips than express buses.
- Express buses serve a whiter, wealthier population than local buses, and primarily serve trips to/from work.
- Uber riders are typically younger than transit riders, have higher incomes (at levels similar to express bus riders), although they have a racial diversity similar to the region as a whole.
- Transit is used more frequently by individuals than Uber, which has a different role of filling in gaps or serving special trip purposes.
- A plurality of transit trips is work trips, whereas a plurality of Uber trips are social/recreation trips.

3.4.1 Gender

Across bus and Uber, the gender split is roughly even, except for TANK where the reason for such a high deviation from 50/50 is not known. A 58/42 female/male split for TANK may be due to a small survey sample size of 900.

3.4.2 Age

Overall, the median TNC rider age is lower than that for transit. However, the average age may increase in future with the aging of the smartphone-native generations.

3.4.3 Income

As of 2017, the median household income in the Cincinnati region was \$61,653.²⁹ This is around \$1,000 higher than the national median. Metro and regular TANK services have a higher proportion of low income

²⁹ Census ACS. (2018). *Cincinnati–Middletown Ohio Household Income*. Retrieved from <https://www.deptofnumbers.com/income/ohio/cincinnati/>

riders; whereas Uber and TANK Express services have a lower proportion of low income riders (as shown in **Figure 17**).^{30,31,32}

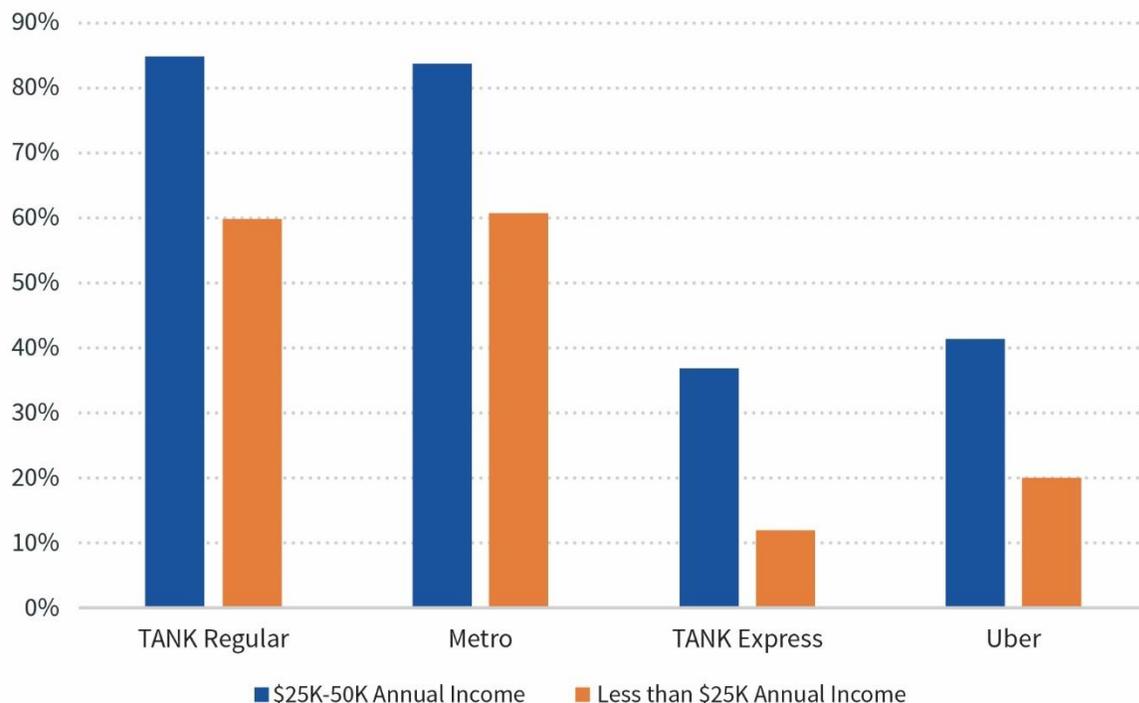


Figure 17 - Proportion of Riders with Annual Household Income <\$50k

3.4.4 Race and Ethnicity

The City of Cincinnati is 49 percent non-Hispanic white, with 3 percent Hispanic (excluding black and Asian Hispanics), 43 percent black, 2 percent Asian, 3 percent mixed, and half a percent other. It is more diverse than the metro area which is 80 percent non-Hispanic white, with 3 percent Hispanic (excluding black and Asian Hispanics), 12 percent black, 2 percent Asian, 2 percent mixed, and 0.3 percent other.³³

Overall, Uber and TANK express have the lowest proportion of non-white ridership (28 and 22 percent respectively), TANK local has 32 percent non-white, and Metro has by far the highest proportion of non-white riders (71 percent). These statistics largely reflect the communities where service is oriented; much of Metro’s service is oriented to minority neighborhoods in the west and north sides of Cincinnati, TANK’s

³⁰ TANK 2014 rider survey

³¹ Metro 2018 rider survey

³² Civis Analytics. (2018). *Uber: Cincinnati Rider Comparative Analysis*.

³³ Statistics Atlas. (n.d.). *Race and Ethnicity in the Cincinnati Area (Metro Area)*. Retrieved from <https://statisticalatlas.com/metro-area/Ohio/Cincinnati/Race-and-Ethnicity>

express service is focused on the predominantly white suburbs of northern Kentucky, while Uber serves the region as a whole, which is overwhelmingly white.^{34,35,36}

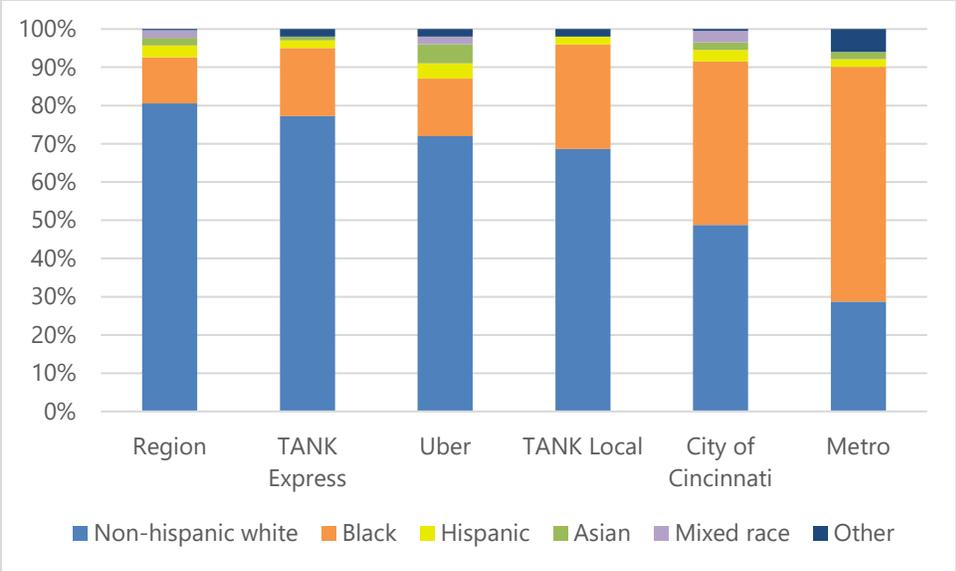


Figure 18 - Racial Distribution of Transit and Uber Riders, Arranged in Descending Order of Non-Hispanic White

On a given weekday, 47 percent of transit and 42 percent of Uber trips originate from areas considered minority environmental justice communities, while 39 percent of transit and 31 percent Uber trips stem from areas considered poverty environmental justice communities.

3.4.5 Car Ownership

Most Uber riders (80 percent) either own or lease a car in their household. Of the 20 percent in zero-car households, three-quarters have an annual household income below \$45k, compared with 36 percent of all Uber riders. This reveals that zero car ownership is uncommon among Uber riders, and a function of having low household income, rather than a lifestyle choice. Only one-tenth of those Uber riders who do not own or lease a car in their household have incomes above \$65k.

Of the 80 percent of Uber riders who do own or lease a car, around half did use one of their cars on the same day as the Uber ride, and about half did not. People taking Uber rides from 6 AM to 4 PM on the weekday are over three times more likely to not be using their private car for other trips that day, whereas

³⁴ Fehr & Peers and Uber. (2019). *Survey of Cincinnati Uber Riders in June-August*.

³⁵ Metro 2018 rider survey

³⁶ TANK 2014 rider survey



people taking Uber rides from 4 PM to 12 AM on the weekday are 1.35 times more likely to have used their private car for other trips that day. On the weekend, the likelihood of the two are around the same.

3.4.6 Frequency of Use

In Cincinnati, TNC riders use TNCs much less frequently than transit riders use transit. Seventy-six percent of Uber riders in Cincinnati use it for 0-3 trips per month. This is a higher proportion than the 60 percent of Uber riders nationally in this category.³⁷ Only two percent of Cincinnati Uber riders say they use it more than 12 times per month (compared with 10 percent nationally).³⁸ In contrast, 47 percent of Metro users say they ride Metro every day and 90 percent of TANK riders say they ride at least three times a week. Forty-two percent of local riders say they ride 6-7 times per week, compared with only 10 percent of express riders, implying that local riders rely on the service for a broader variety of trip purposes.

Ultimately, transit riders are more frequent while TNC users are more infrequent in their usage of the respective service. Transit serves as a fundamental way of getting around for a higher share of people, while TNC serves a role of filling in gaps for most of its users.

3.4.7 Trip Purpose

According to the Uber rider survey, 57 percent of trips had a purpose of social/recreation, 17 percent were to/from work (plus 6 percent for work-related business), 9 percent were for family/personal errands, 3 percent shopping, 3 percent medical, 0.6 percent place of worship, and 0.3 percent for school/university, with 4 percent other. This correlates to Schaller's findings, where using NHTS data from 2016 he found that work trips constitute around 20 percent of TNC trips, which is similar to the rate for personal auto use. Social and recreational trips and home-based non-work trips are other popular purposes.³⁹

Trip purpose varies substantially by household income, as shown below in **Figure 19**. Lower income and/or minority persons use Uber more for trips to and from work and less for social/recreational purposes, while higher income and/or white persons use Uber primarily for recreational trips. Of those <\$45k annual household income that used Uber to/from work, 60 percent do not own a car, and the most commonly-cited reasons for shifting to Uber included ease of use and shorter travel time.

³⁷ Civis Analytics. (2018). *Uber: Cincinnati Rider Comparative Analysis*.

³⁸ *Ibid.*

³⁹ Schaller Consulting. (2018, July 25). *The New Automobility: Lyft, Uber and the Future of American Cities* (Tech). Retrieved <http://www.schallerconsult.com/rideservices/automobility.pdf> [page 13]

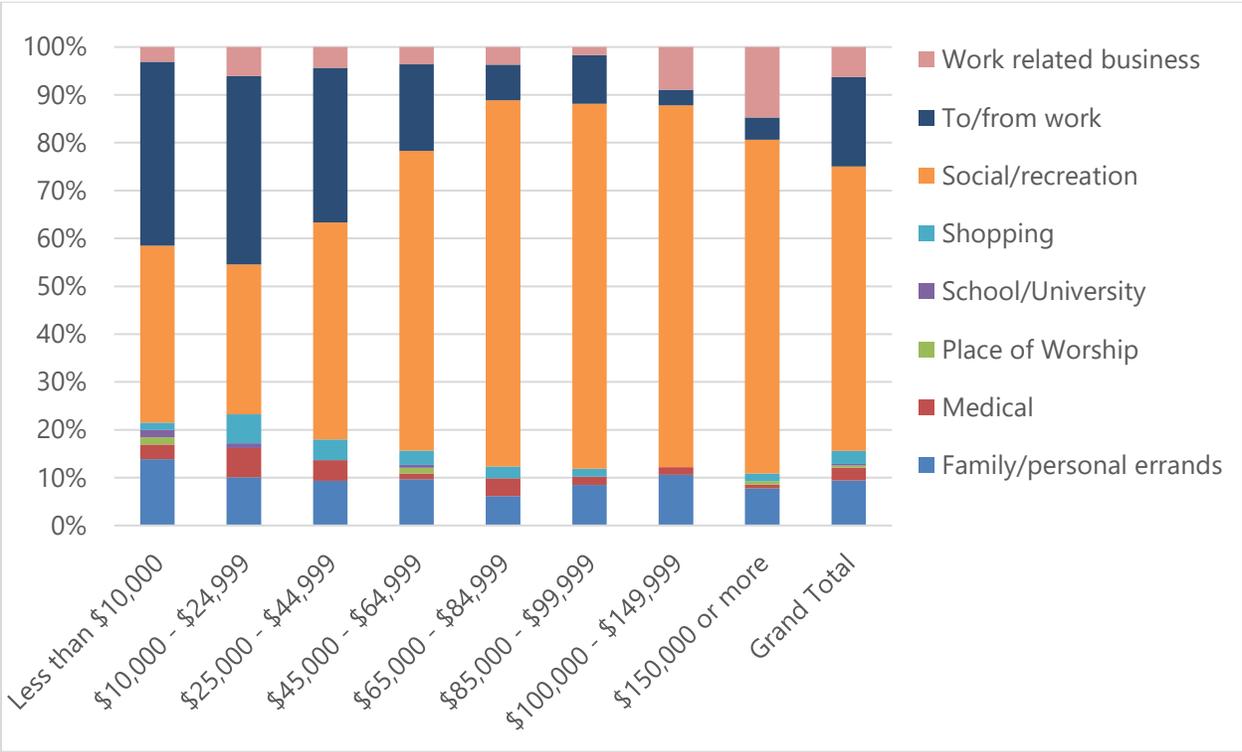


Figure 19 - Uber Trip Purpose by Household Income Category

Of trips to/from work taken by those with household incomes of <\$45k (14 percent of overall trips), 15 percent are happening on weekends. The rest are weekday trips: 24 percent are happening between 6 and 9 AM, 28 percent are happening between 9 AM and 4 PM, 21 percent are happening between 4 PM and 7 PM, and 12 percent are happening between 7 PM and 12 AM. Therefore, 55 percent of these work trips are happening outside of “traditional” commute hours, where transit is far less prevalent.

Of trips to/from work taken by those with household incomes of <\$45k, 33 percent are mode shifts from transit, 22 percent from bike/walk, 18 percent from auto, 14 percent from taxi, and 10 percent are new trips, with 3 percent other. Of the transit donor category, 90 percent of this shift to TNC is from weekday trips; for auto 80 percent are weekend trips.

TANK did not provide information on trip purpose, but Metro rider survey results show that work trips are 48 percent of trips, followed by school at 11 percent, shopping and 10 percent, and medical at 8 percent.⁴⁰ Thus, work trips are more common for transit than TNC and auto.

⁴⁰ Metro rider survey. (2018).

3.4.8 Mode Shift

As part of the Uber rider survey, we asked people to think back to before they had Uber or a similar app-based service and state how they took their particular trip then. According to the Uber rider survey, 34 percent of trips are mode shifts from auto, 26 percent are from taxi, 17 percent are new trips not previously taken by any other mode, 13 percent are from bus, 8 percent are from walk, 2 percent are from friend drove them, 1 percent are from bike, and the remaining <1 percent are other modes.⁴¹ In instances where respondents listed multiple “donor” modes, each was given equal fractional weighting summing to one for that individual. The donor mode is more likely to be transit, bike, and walk for those of lower incomes, and is more likely to be auto and taxi for those of higher incomes, as shown in **Figure 20**. For car and taxi as donor modes, the most common trip purpose is overwhelmingly social/recreation (71 percent and 62 percent, respectively). For bus as donor mode, the trip purposes are much more spread with to/from work being the highest at 40 percent, and social/recreation the next highest at 23 percent.

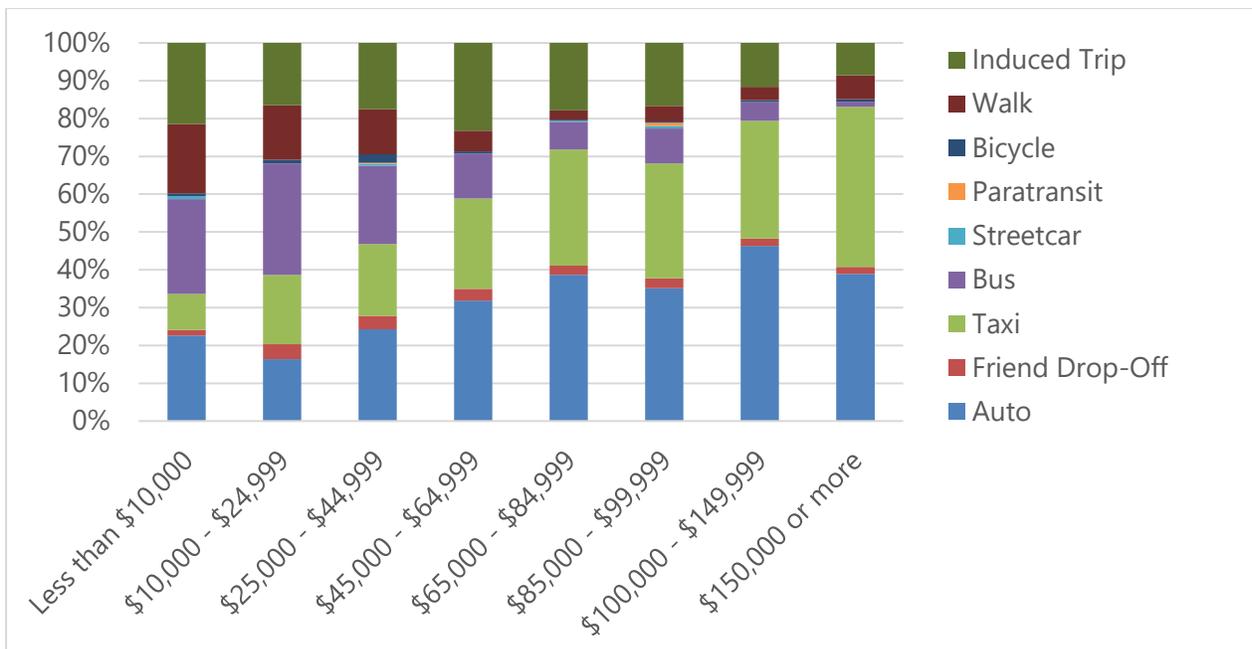


Figure 20 - Mode Shift to Uber by Household Income Category

⁴¹ Sum of rounded numbers is greater than 100 percent. Sample size 914 respondents.

3.4.9 Multimodal Trips

According to the Uber rider survey, 8 percent of Uber trips were taken as part of a round-trip or tour where another of the legs was transit. Despite the small number, this suggests some compatibility between the two modes in providing travelers flexible options for getting both to and from destinations depending on respective relative service levels for each trip leg.

3.4.10 Why are People Shifting to Uber?

As part of the Uber rider survey, we asked why people shifted to Uber from another mode. Respondents could select more than one reason. Results in this subsection are filtered for where the mode is selected as the sole donor mode. For the three greater donor modes, the factors cited by at least 10 percent of respondents, in descending order are:

- **Auto:** easier, safer,⁴² more cost-effective
- **Taxi:** easier, more cost-effective, safer, lower wait time
- **Bus:** lower travel time, easier, lower wait time

A breakdown of each response for these three modes is given in **Figure 21**.

The data is showing that low income/minority people are shifting trips to Uber from transit because, by-and-large, ride-hail services provide a more reliable transportation option without the need to own a car or drive. Travel time and wait time are a much bigger factor for people shifting from transit.

⁴² The most common write-in explanation given for respondents who selected "safer" than the auto was that Uber gave them the option to attend a social event to drink alcohol, suggesting that it decreases the incidence and safety risks involved with operating a vehicle under the influence.

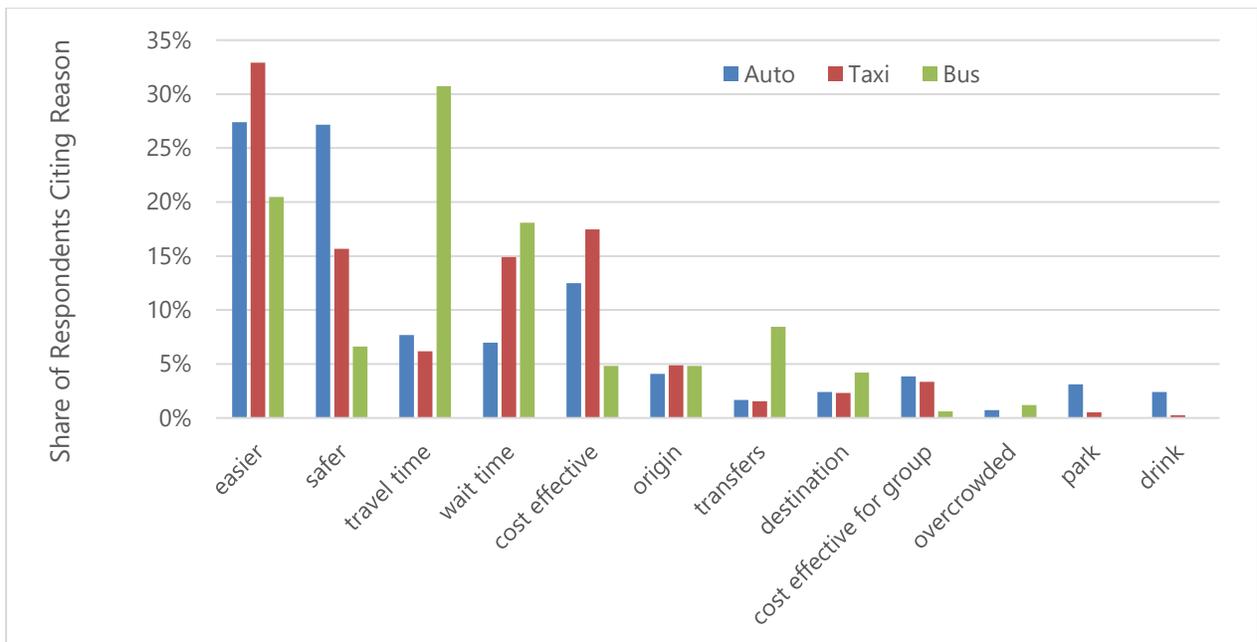


Figure 21 - Reasons Cited for Shifts from Auto, Taxi, and Bus to Uber in Cincinnati

3.5 Trip Cost Data

This section reveals the comparative cost to the user and the agency of driving a personal vehicle, taking transit, and taking Uber. For this question, local context is essential. We examine the average cost of personal vehicle ownership and of driving. This is followed by an overview of the fare system for Cincinnati transit before presenting an analysis of route productivity and subsidies for transit routes. We compare the cost to provide a trip for Uber and for transit. Finally, we describe the ways the upfront and marginal costs of each mode influence individual mode choice. Our key takeaways are as follows:

- The upfront costs of personal vehicle ownership are high, but once a vehicle has been purchased, the marginal cost to take each trip is relatively low.
- The fare system in Cincinnati is quite complex, there is limited regional fare integration, and payment using cash is widespread.
- As of 2016, Metro had the best farebox recovery ratio (30 percent) of peer cities.
- Average transit subsidy per passenger is \$5–6 and Metro express routes underperform on this metric compared with other bus routes.
- Bus service in Cincinnati has a lower cost per person trip to the user than Uber.

3.5.1 Fare Structures

Metro has a zone-based fare system, where fares range from \$1.75 per trip within Zone 1 (which is the City of Cincinnati) steadily ascending with zone numbering to \$4.25 per trip to/from Zone 5 (Warren County). Each transfer costs 50 cents. TANK does not have a zone-based fare system. Instead, fares are \$1.50 for local routes, \$2.00 for express routes, and \$1.00 for the Southbank shuttle. Each transfer costs 25 cents. Passes are available for each agency.

3.5.2 Transit Agency Productivity & Subsidies

In 2016, Metro's overall farebox recovery ratio was around 30 percent, near the top of a basket of 15 peer cities (ranging from Austin at 11 percent to SORTA at 30 percent).⁴³ TANK's ratio is 20 percent.

Metro and TANK both provided data by route on productivity, revenue, and subsidies. Of the 72 routes studied, 11 had a subsidy per passenger of greater than \$10 while only two routes had a subsidy per passenger of greater than \$15. Of those 11 routes, seven are Metro Express, one is TANK Express, and one is Metro Local. Twenty routes had a subsidy of less than \$5 of which 12 are Metro Local, four are TANK Express, three are TANK Local, and one is Metro Express. **Figure 22** shows a comparison of passengers per revenue hour and subsidy per passenger. Around 13 passengers per revenue hour are required to keep subsidy per passenger below \$10 and, similarly, around 0.8 passengers per revenue mile are required for the same.

Figure 23 shows a comparison of passengers per revenue mile and subsidy per passenger.

Figure 24 shows average subsidy by route type, demonstrating that local routes typically have a lower subsidy per passenger and also a lower spread of subsidy. Metro Express routes appear to be an outlier with a particularly high subsidy per passenger.

⁴³ Source: Mid-America Regional Council (MARC). (2018, September). *Peer Cities Transit Report Summary* (Rep.). 2016 data from the NTD. Retrieved http://www.marc.org/Transportation/Plans-Studies/pdfs/2018PeerCitiesTransitReport_summary.aspx

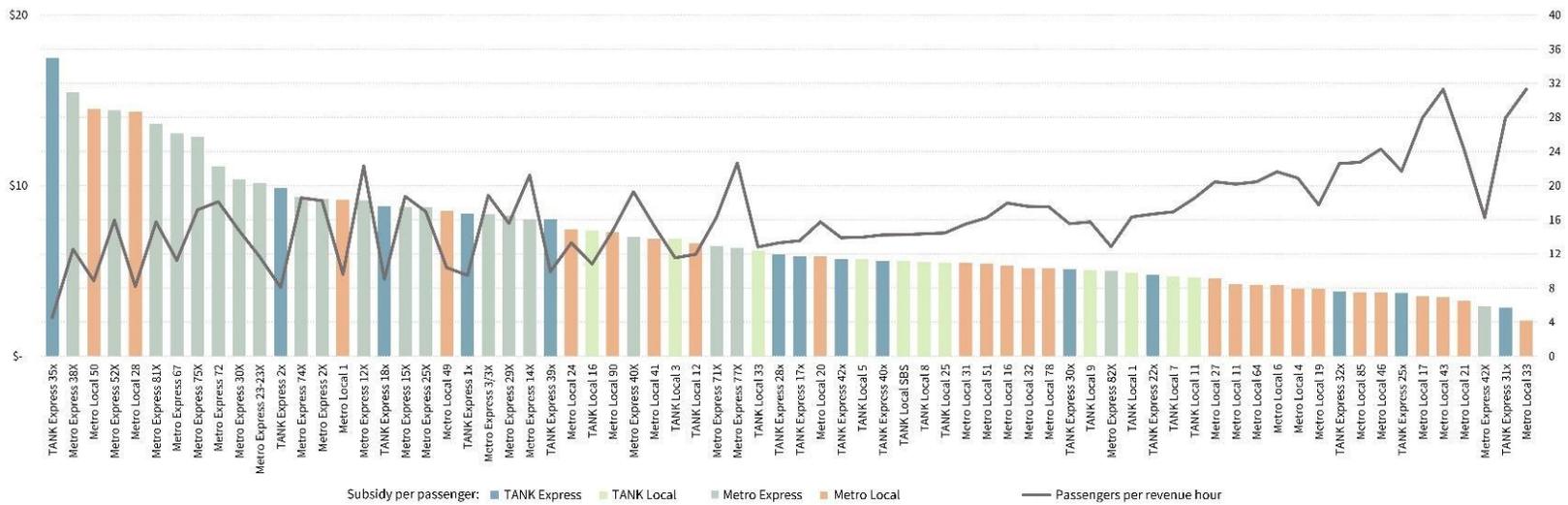


Figure 22 - Comparison of Passengers per Revenue Hour and Subsidy per Passenger

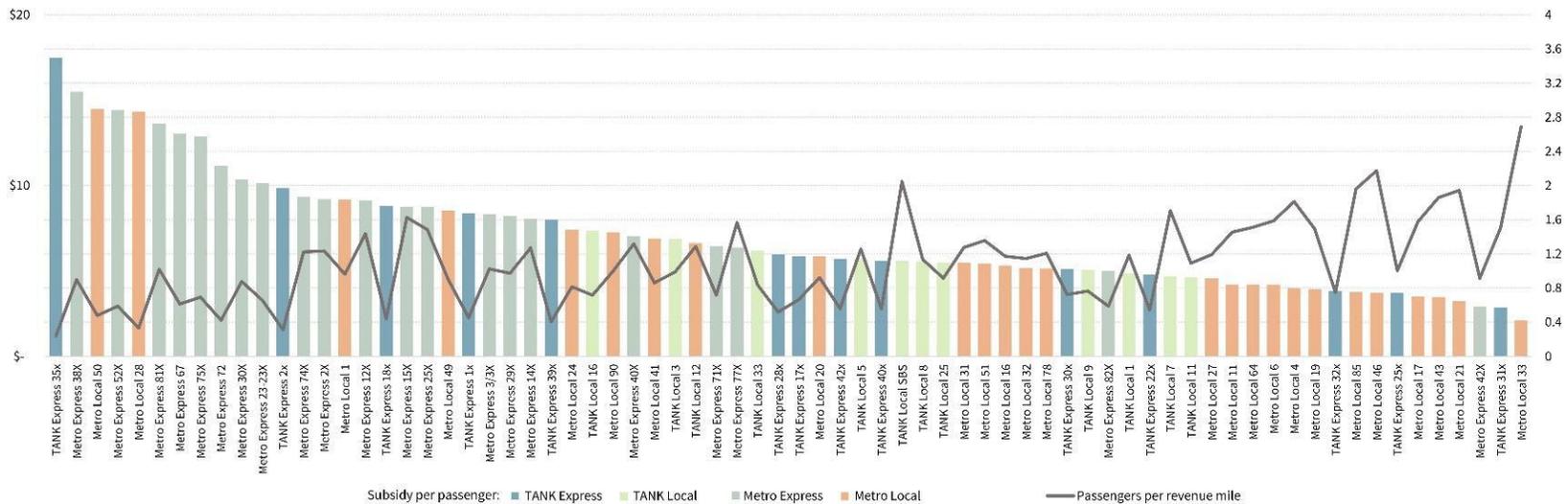


Figure 23 - Comparison of Passengers per Revenue Mile and Subsidy per Passenger

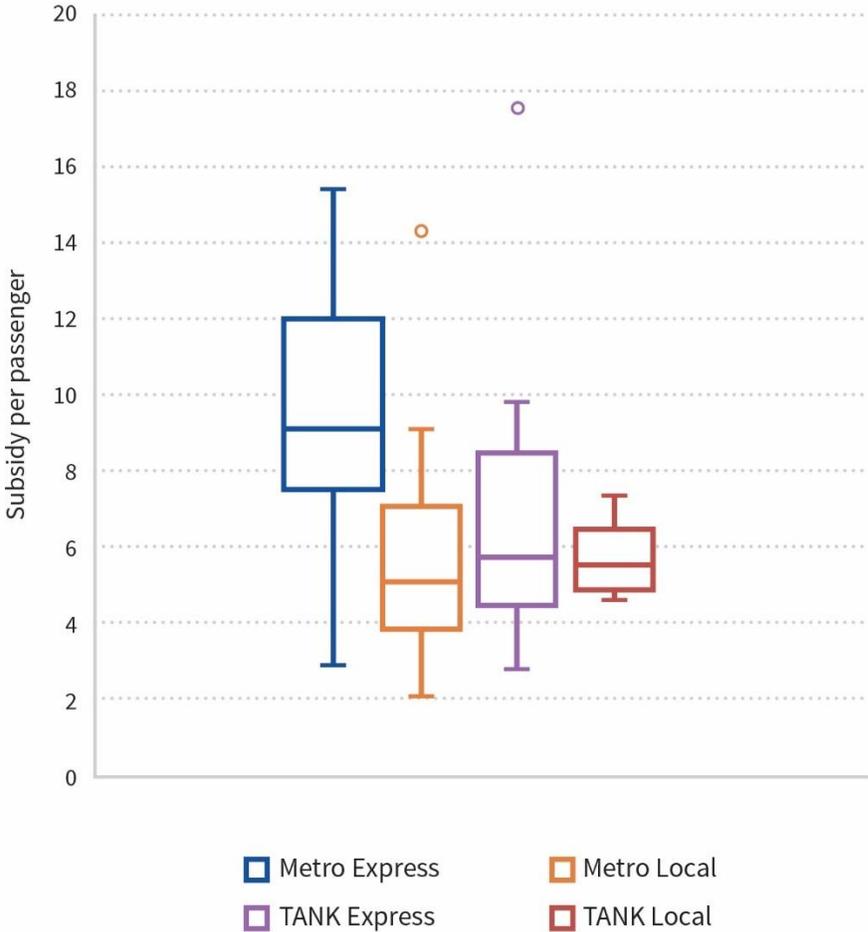


Figure 24 - Subsidy per Passenger by Route Type

The parts of the service that are least financially self-sustainable have the most financial upside to being served in a more cost-competitive manner.

3.5.3 Uber/Transit Cost Comparison

For the purposes of this study, we are assuming the fare paid by the user is the total cost of the trip to Uber (including driver payment). The Uber fare includes costs and profits consistent with Uber’s present business model, and we assume it will continue to do so for purposes of the study, although we acknowledge this may change in future. Therefore, the rider fare would also be a reasonable estimate of the cost to the transit agency of providing an Uber trip. This assumption allows us to compare the costs to a transit agency of providing each type of trip.



A comparison of the cost profiles for Uber and transit is provided below in **Figure 25**, where the sample is each individual trip taken over the course of a month. The Uber cost is the cost to the user and is assumed to represent Uber's gross cost of providing the service including its targeted return on its investment. This is the fully loaded cost for transit and does not include fare revenue. It demonstrates that most transit trips cost the agency between \$4 and \$6 with few above \$8. The typical cost for Uber is higher at \$6 to \$10 for most trips with very few less than \$6. Uber's higher typical cost could be explained by either longer trips, a lower cost-efficiency per mile service, or costs expended on zero-occupancy travel waiting for trips.

TNCs have much lower labor costs than transit. However costs could increase due to reclassification of employees, possible unionization, and city or state regulations requiring different wage levels or structures. In the long run, costs could also decrease substantially if labor is replaced with automation. For comparison sake, transit may also continue to experience rising labor costs, and could also see cost reductions due to automation.

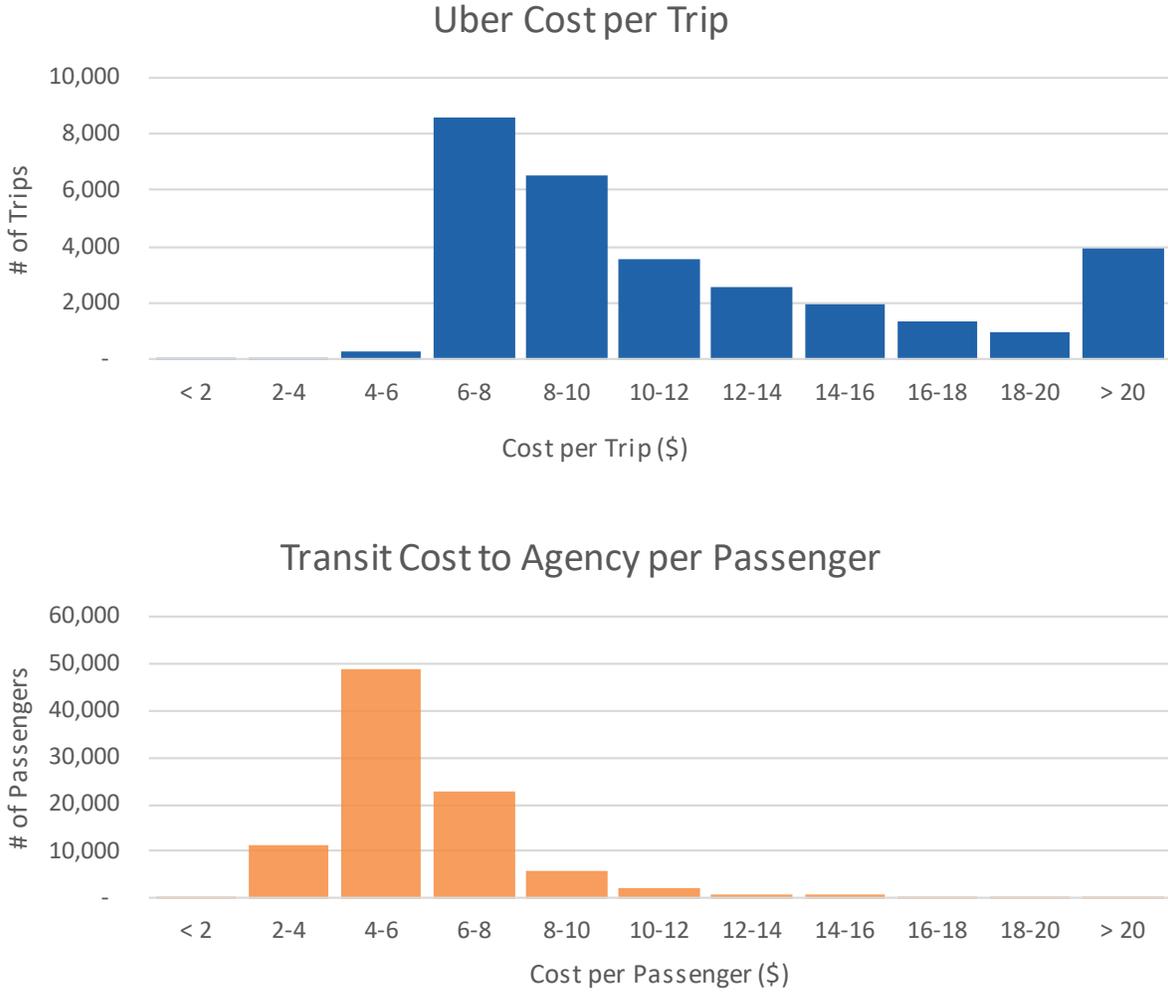


Figure 25 - Cost per Trip to Agency for Transit Trips and Cost per Trip to Passenger for Uber Trips

3.5.4 Impact of Trip Costs on Mode Choice

While the monetary cost is not the sole determinant of the mode one chooses to use to make a trip, it is an important factor in the decision-making process. The upfront and marginal costs of each mode can vary by an order of magnitude or more. Using a personal vehicle requires a high upfront cost; in comparison, the initial investment for carshare, transit, or Uber is low to minimal. The marginal cost of taking a transit trip is generally lower than for other modes. However, time – and the value of time – is another factor impacting decision-making. Despite the low cost of a bus fare in Cincinnati, where transit is infrequent or indirect, many individuals choose to drive or take a TNC instead. In particular, if it is inconvenient to make necessary



trips (commuting, shopping, school), by other modes, those with the means will generally purchase a personal vehicle.

An indicative summary of upfront and marginal trip costs for a three mile trip (the average length of a transit trip in the region) is shown in **Table 2** below, comparing auto to carshare, transit, and Uber. The value of time is not included in this assessment. Assuming four round-trips a day, the minimum total cost for car or Uber trips are about four times the cost of transit, and the maximum total trip costs are about three times the transit trip cost. However, because travelers rarely consider the “sunk” cost of owning their car in choosing their mode for an individual trip, transit is perceived to be more expensive than auto trips that don’t require parking, while Uber is cost competitive with auto for short or medium length trips that do involve parking. Limitations to this analysis do exist. Factors such as owning a car, have access to a vehicle at all times, or owning a smartphone all influence one’s perception of available transportation options. Additionally, some origin-destination pairs are not served by transit, either due to limited service during off-peak periods or a gap in the transit network. This analysis compares costs for trips in which a destination can be reached by any mode at any time.

A chart showing the range of marginal cost per trip is then shown in **Figure 26**. These charts make clear the low marginal cost of driving compared with transit (assuming parking costs are low, which they are in all but the downtown core), and the low marginal cost of transit compared with carshare and Uber.

Ultimately, to counter the car, a basket of non-automobile options to fit different needs would need to replace it. This is the concept behind Mobility-as-a-Service (MAAS). We recommend incentivizing transit users to get subscriptions (i.e., transit passes) so that they have the easy option of taking transit at no marginal cost.

Table 2: Upfront and Marginal Cost Comparison for a Typical 3 Mile Trip

	Car		Zipcar (Carshare)		Transit		Uber	
Upfront Monthly Costs	Insurance	\$92.00	Membership	\$7.00	Transit pass	\$70.00		
	Car Payment ¹	\$530.00						
	Registration, fees ¹	\$12.00						
	Maintenance ¹	\$99.00						
Fixed Total		\$733.00		\$7.00		\$70.00		
Marginal Costs ³	Gas ²	\$0.33	Rate min. (1 hr)	\$8.50	Fare min. ⁵	\$1.00	Fare min. ⁶	\$6.00
	Parking min. (4 hrs)	\$0.00	Rate max. (4 hrs)	\$34.00	Fare max.	\$4.25	Fare max.	\$15.00
	Parking max. (4 hrs) ⁴	\$11.00					Tip	\$1.00
Marginal Total min.		\$0.58		\$8.50		\$1.00		\$6.00
Marginal Total max.		\$11.33		\$34.00		\$4.25		\$16.00

Notes:

1. Monthly car payment, registration, fees, and maintenance based on national average
2. Gas cost calculated using a rate of \$2.75/gallon for 25 mpg vehicle.
3. Automobile depreciation is not included for the car option, although is typically negligible at around \$0.002 per mile
4. Parking maximum assumed hourly rate of \$2.75, the maximum meter rate in Downtown Cincinnati
5. Transit range includes TANK fare as low as \$1.00/trip up to \$4.25 for Metro trip into Zone 5. Fare is zero if transit pass is purchased.
6. Uber fare range for UberX 3 mile trip in Cincinnati.

Sources: CarInsurance.com for average Cincinnati auto insurance costs; Zipcar for carshare costs; Nerdwallet for average monthly car payments; CincyInsights for Downtown parking costs; Uber data provided to Fehr & Peers for Uber fare data; Hang et. al for depreciation costs.

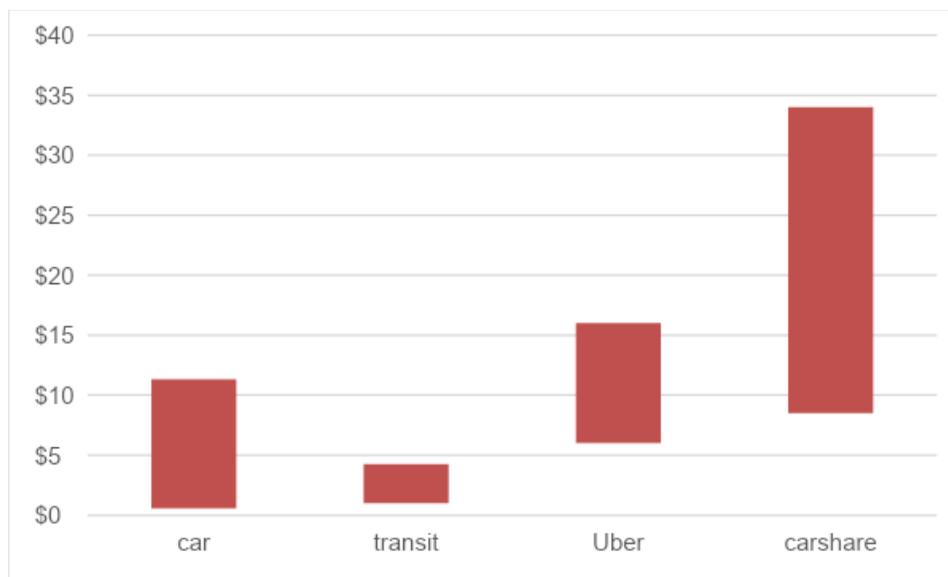


Figure 26 - Range of Marginal Costs for a Typical 3-Mile Trip



3.6 Discussion

3.6.1 Overview

Given the near-total dominance of car ownership and car travel in the Cincinnati region, the usage of transit and Uber is best scrutinized through the lens of car ownership. Car travel is long-established and firmly entrenched (four-fifths of households own a car), whereas transit ridership has declined (20-30 percent over the past five years) to 35,000 bus trips per day (not counting transfers). Uber use has risen over the same period to 10,000 trips per day. Despite these overlapping trends, it remains that car availability is the primary impediment to transit use. Having committed to the sunk cost of owning a car, its owner enjoys a very small marginal cost for each subsequent trip, rendering consideration of any other mode a non-starter, except in a select few edge cases, such as those where parking costs are high – at the airport or downtown – or to avoid driving under the influence. It follows that these edge cases are where other complementary modes, such as Uber, thrive.

3.6.2 What are we Seeing?

The respective markets of Uber and bus travel are hugely different with little overlap. Bus travel is largely radial along the corridors that extend from downtown. Much of it is either contained within low-income neighborhoods or is between a select few regional job centers and those neighborhoods; no surprise, given the network's orientation around these patterns. Much of it is during the daytime, with far less during evenings and weekends; again, no surprise given most service is laid on outside of evenings and weekends. Conversely, Uber travel is highly dispersed spatially and travel is largely focused within and between wealthier neighborhoods and select activity centers (such as the airport and university). The degree of scatter is less during the evening (Uber's busiest period) when travel is largely restricted to within and between downtown, near north, and Oakley/Hyde Park, and is predominantly serving social/recreational trips. At its current price point, most Uber trips are ill-suited to bus travel because they either occur during periods where transit service is poor (evenings and weekends) or non-existent (due to network limitations).

Those who ride the bus typically do it frequently, and often for work trips or other essential trips (school, shopping, medical, etc.) whereas Uber is typically an occasional use and often for non-essential trips (57 percent is social/recreation alone).

Uber trips are about the same on average as bus trips (around 6 miles each). Uber trip length distribution has a long tail (many trips >5 miles); however, the distribution of trips was not available for transit.

In sum, people who ride the bus generally do not also use Uber, and vice versa (although there is a small proportion that use both); substantial numbers within each income bracket use both TNCs and transit depending on the options available for that particular trip. Bus riders are generally low income, and Uber riders are generally high income, although there are a significant number of people who buck this trend on both ends. Because the desire and willingness to pay for convenience spaces across income brackets, anyone may be willing to travel by Uber given their value of time is high enough.

Eighty percent of Uber riders own a car, whereas only 43 percent of bus riders do (we suspect that for many this is largely not out of choice; it's because they cannot afford it). A phenomenon that is common in cities with significant investment in rail transit and adjacent high-density development is not manifest here: that of the Uber rider that is both high income and car-free by choice. That could change in Cincinnati but only with substantial investment in high quality transit, walkable neighborhoods, and transit-oriented compact development. For now, the bus is commonly the slow and inconvenient last resort for households that cannot afford car ownership or have fewer cars than adults, whereas based on survey responses, most Uber rides are taken by people with the option to drive. For many Uber trips, bus is not a feasible option while driving is feasible but not desirable for some reason (i.e., DUI when going out to drink alcohol, or long-stay parking cost when going to airport). For some people, Uber is a direct substitute for driving, whereas for others, the presence of Uber complements their use of driving for other trips. While each Uber trip may be more likely to replace a car trip than a bus trip, it does mean that for some Uber is complementing an auto-oriented lifestyle.

3.7 Conclusion

3.7.1 What is the Goal?

Every Mobility Lab stakeholder wishes to reverse the longstanding decline in bus ridership in the region. This decline can be attributed to many factors, of which the emergence of TNCs is only a minor one. At its current price point, Uber cannot capture substantial transit ridership, evidenced by only 13 percent of Uber riders stating that they used to take bus for their trip prior to Uber being available (Section 3.4.10).

3.7.2 Can Uber Reverse Ridership Loss?

While Uber is not one of the largest causes of ridership decline in Cincinnati, we ask: can Uber help to reverse, at least in part, the trend? To have a hope in doing so, deployment of on-demand ride-hail, boosted by government spending to reduce user cost, would need to successfully reduce car ownership and thus feed the virtuous cycle of transit. There is no doubt that a strengthened backbone transit network is required to efficiently serve the bulk of non-auto trips in this scenario, which means higher frequencies, more



streamlined routes, higher speeds enabled by infrastructure investments, and fare payment simplification. However, on-demand ride-hail can provide a supplement (or backup) by serving trips that transit cannot efficiently cater to (such as evening, weekend, out-of-direction), so long as investment in it does not undermine backbone transit. For some households, ride-hail (if priced differently) could be the convenient missing link that enables all travel needs to be met car-free, and if this bundle of options can be provided at lower overall cost to car ownership, it could result in shedding of one or more cars per household.

3.7.3 What about Replacing Fixed Route with Uber?

We do not recommend that any Backbone or Frequent fixed route services in Cincinnati be replaced with an on-demand option, but the coverage-oriented routes in suburban areas with the lowest productivity are candidates for being replaced by on-demand services.

The low cost at which ride-hailing can provide high-convenience chauffeured trips can transform mobility for car-free or car-lite households in areas without robust transit or bicycling networks. While the low densities of these areas dictate that even subsidized ride-hailing is unlikely to attract significant ridership, it could nonetheless provide a key public service. Transit agencies currently meet the public mission in these outlying areas by providing low-frequency and low-convenience coverage-oriented service. Those with access to a car do not use these services. Due to the non-existence (in these outlying areas) of an underlying density that justifies spending on quality fixed route transit, the money currently invested might instead be better spent on a ride-hail or flexible transit if its balance of cost and convenience is in the public interest.

Accordingly, the extent to which ride-hailing can meet the public interest depends on its cost-competitiveness. While the long-run cost of on-demand services is uncertain, one thing that appears certain is that pooling rides reduces unit trip costs. The absence of Uber Pool in Cincinnati indicates that Uber does not currently consider Cincinnati a profitable market for unsubsidized pooled service. It must also be stated that just as a higher demand density plays in Uber Pool's favor, it also plays in fixed route transit's favor, and above a certain density threshold, buses are cheaper to run than Uber Pool. Therefore, pooled ride-hailing only makes sense within a "Goldilocks" range where it is viable but not so successful as to be replaceable by fixed route transit. Many current pilots are seeking to locate this "Goldilocks" range, trying to understand the amount of subsidy necessary to induce enough trips to justify the existence of the service. Stakeholders/operators are finding that they must spend money to induce a critical mass of trips that can then save them money (through pooling).

Paradoxically, while on-demand service can cater to many more trip types than fixed route transit in lower density areas, those trip types (i.e., non-work, especially evening and weekend) are inherently more dispersed in a way that works against pooling. Therefore, the amount of government spending and/or operator incentives needed to bring down the user cost to a level that supports pooling might be untenable.

It is not clear whether providing on-demand ride-hailing at both a similar user cost and subsidy level of coverage bus service is realistically achievable. Many pilots for both pooled and non-pooled service have failed, whereas others (those typically with higher marketing budgets, steeper subsidies, and with high legibility to the user) have succeeded in achieving some or all stakeholder goals. Most have struggled to scale beyond a small area, and economies of scale do not seem to be accumulating for those that have. Therefore, small-scale experimentation through pilots is critical to incrementally learn more about its viability in the Cincinnati region.

To summarize, on-demand transit could replace low-performing coverage service or special needs private services to meet the needs of underserved populations; however, in these areas it may struggle to pool trips and therefore costs must be even more closely scrutinized. Such service should be designed to help round out the bundle of travel options that can allow a household to be car-light or car-free, feeding the virtuous cycle of transit investment. If successful, and should it result in cost savings over coverage transit, it can allow the transit agencies to divert funds currently devoted to operating unproductive coverage services toward enhancing backbone services for improvements in overall ridership.



4. A Strategy for Mobility in Cincinnati

The primary objective of the recommendations presented in this chapter is to arrest transit ridership declines by shifting travel away from the private automobile to transit and shared-ride services, in a cost-effective and equitable way. The study aims to boost accessibility between all neighborhoods while reducing cost per passenger trip. It has been primarily informed by lessons learned from across the country as well as travel trends in Cincinnati.

Below, we first present the recommendations, and follow this with an action plan that provides a roadmap for how to carry out each recommendation and under what timeframe.

4.1 Recommendations

The recommendations below fall into three main categories: 1) Targeted Funding of Pooled On-Demand Services to serve areas where transit cannot be productive to produce a net savings in transit costs in order divert savings to enhancing backbone services , 2) Seamless Payment and User Interface, and 3) Transit Best Practices.

4.1.1 Targeted Funding of On-Demand Services

We recommend that agencies publicly fund pooled TNC or flexible transit trips in corridors or areas where overall travel demand is either too dispersed or too sporadic for productive fixed route transit or where demand is misaligned with the overall orientation of transit services in terms of the direction (e.g., suburb-to-suburb) or timing (e.g., late evenings). The diagram in **Figure 1** depicts recommendations that combine dynamic and fixed services with the goals of reducing redundancies, ensuring that each provider is more cost effective in the markets they are focused on, and prioritizing underserved communities.

We recommend that opportunities and pilot studies be identified that subsidize pooled TNC or flexible transit trips in outlying areas to replace what are currently the least productive services. These could include coverage-oriented service areas where savings from the more cost-effective forms of local service could be reinvested in strengthening backbone transit service in adjacent areas. This allows for the experimentation among the lowest performing of the agency's offerings, which results in comparatively low levels of disruption.

We recommend that this service not be deployed on any of Cincinnati's many high demand corridors with backbone transit, and on-demand service would not be intended to replace ridership-oriented transit in those corridors. Instead, we recommend that service be structured to promote pooling to the maximum

extent possible to drive unit costs down, therefore promoting more usage and establishing a positive feedback loop in a setting where fixed route transit would likely be unable to establish one.

This strategy is untested at a large scale. Therefore, we recommend that agencies proceed cautiously, through pilot testing and incremental implementation with continuous reassessment of performance. Experimentation would take place at the fringes of the agency's offerings, which results in comparatively low levels of disruption. The following subsections contain objectives for the pilots, which types of concept are most appropriate, specific pilot designs, methods for controlling costs, and funding sources.

4.1.1.1 Define Pilot Objectives and Evaluation Framework

Objectives must be clearly defined prior to implementation of a pilot in order to assess whether it is a success or not. Stakeholders must define success through measures that can reasonably be obtained and agree to them in advance of designing a pilot to give clear direction to all involved.

The objectives in **Table 3** are based on our conversations with stakeholders and what we understand to be the gaps and opportunities in the region. They should serve as a starting point, to be refined by stakeholders in a process that involves the communities, with measurable metrics and defined measurement methods.

Table 3: Objectives, Metrics, and Methods of Measurement

Objective	Pilot Study Metric	Method of Measurement
Provide desirable alternatives to the automobile and enhanced service to non-auto users	Pilot participation is a high percentage of current transit users in the target market. New rides come primarily from auto users, not from those walking or cycling Public spending is justified in terms of reduced service costs and/or reduced impacts caused by automobile use	Before and after bus occupancy counts and rider survey. Return on investment, accounting for the economic and environmental benefits of reduced auto impacts
Provide more cost-effective transit and shared-ride services	Average public spending per person trip of less than the average transit subsidy in that geographic area. No increase in cost to traveler.	Statistics provided by transit agency.
Achieve high levels of customer satisfaction	Average door-to-door trip times (including wait times) are reduced, and cost does not increase. Rider satisfaction is greater than that of existing transit.	Before and after transit level of service monitoring and rider survey, combined with ride statistics provided by Uber.
Provide services available to all, including the unbanked and those without smartphones	Concierge service and free option for unbanked are available, and have regular use.	Usage statistics provided by public agencies or Uber. Also, socio-economic attributes of those who continue to use transit.
Benefit underserved communities (neighborhoods and subregions with the highest populations in the environmental justice categories described below) first	Early investments are targeted at underserved communities.	Rider survey and usage statistics provided by public agencies or Uber, compared against Census data.

4.1.1.1.1 Invest in Underserved Communities

Transportation equity focuses on traditionally underserved populations, including low-income, minority, and limited-English-proficiency populations, as well as seniors, children, and persons with disabilities. It is important for stakeholders to support all transportation users within their jurisdiction to make decisions that best serve their communities.

Integration of transit and TNC services provide an opportunity to improve accessibility and the quality of trips taken by people across the Cincinnati region. However, without appropriate consideration of differing needs of underserved communities, public subsidy of TNCs could serve to exacerbate inequities in transportation outcomes. Federal law (Title VI) requires the performance of an equity analysis prior to the

implementation of any major service change. The goal of the Cincinnati Strategic Transit Study is that each community receives the transportation resources they need to have access to the same opportunities.

OKI has categorized five environmental justice (EJ) populations: elderly, minority racial categories, people with disabilities, population below the poverty level, and zero car households. There are barriers to TNCs adequately serving these populations. For the elderly, there is a steep learning curve for the technology.⁴⁴ Many aren't familiar with smartphones and some don't have them.⁴⁵ For minority population, there exists the phenomenon of race-based cancellation of rides, although TNCs have been found to nearly eliminate the racial differences in service, especially when compared to taxi service.^{46,47} For people with disabilities, there is the difficulty of receiving a vehicle and/or driver able to meet their needs, whether wheelchair-accessible or other; UberWAV is only available in several major U.S. cities.⁴⁸ For people in poverty there are the higher fares compared with transit, which are often prohibitively expensive. People in poverty are also more likely to be unbanked, and there may be a lack of trust about giving credit information to corporations such as Uber.⁴⁹ Another vulnerable population, although not an environmental justice category designated by OKI, are children. Under-18s are not allowed to hail rides using Uber.

Objectives of the Cincinnati Strategic Transit Study are, therefore, to first avoid worsening outcomes for vulnerable populations, and work to improve them by:

1. Ensuring that proposed changes do not include any service cuts without replacement of equivalent or better quality of service for no increase in user cost
2. Re-investing any savings into transit services in environmental justice communities
3. Including ADA-accessible vehicles for people to book for trips in advance
4. Extensively marketing and outreach to alert riders and provide instructions

⁴⁴ Span, Paula. (August 16, 2019). *Older People Need Rides. Why Aren't They Using Uber and Lyft?* New York Times article. Retrieved from: <https://www.nytimes.com/2019/08/16/health/uber-lyft-elderly.html>

⁴⁵ *Ibid.*

⁴⁶ Ge, Y., Knittel, C. R., MacKenzie, D., Zoepf, S. (October 2016). *Racial and Gender Discrimination in Transportation Network Companies*. National Bureau of Economic Research (NBER) Working Paper No. 22776. Retrieved from: <https://www.nber.org/papers/w22776.pdf>

⁴⁷ Brown, A.E. (2018). *Ride-hail Revolution: Ride-hail Travel and Equity in Los Angeles*. UCLA Thesis Dissertation. Retrieved from: <https://www.its.ucla.edu/2018/06/27/ride-hail-revolution-groundbreaking-its-dissertation-examines-discrimination-and-travel-patterns-for-lyft-uber-and-taxis/>

⁴⁸ Ocampo, J. (March 25, 2019). *How to Find Wheelchair-Accessible Ubers*. Lifehacker article. Retrieved from: <https://lifehacker.com/how-to-find-wheelchair-accessible-ubers-1833540740>

⁴⁹ Sweeney, E. (2018, May 14). *71% of consumers worry about brands' handling of personal data, study finds*. Marketing Dive article. Retrieved from: <https://www.marketingdive.com/news/71-of-consumers-worry-about-brands-handling-of-personal-data-study-finds/523417/>

5. Engage the community in selection of pilot study areas and service change implementation help to ensure equitable outcomes
6. Evaluate program effects in a manner that distinguishes effects on disadvantaged population groups as well as the community as a whole

Program evaluation would specifically address effects based on disadvantaged stakeholder representation, distribution of funding, equitable distribution of accessibility, service quality, safety and environmental impacts and affordability, and effects on labor.



*Please refer to **Supplement F** for a more detailed guide for ensuring equitable outcomes.*

4.1.1.2 Plan and Implement Pilots

We have developed some specific service designs for consideration based on our understanding of travel markets in Cincinnati. The most promising concepts are the following:

- Service to suburban employment centers (e.g., near CVG airport)
- On-demand service in a low density service area (e.g., Colerain Township or North Avondale)
- Express route replacement with pooled ride-hailing service (e.g., replace TANK 35X)

Two additional concepts that have not been planned in detail, but which merit further consideration are:

- Special-needs service overlay
- Coordinated transit/TNC guaranteed-ride-home service



*Please refer to **Supplement G** for an evaluation of the full universe of service concepts that was initially considered and from which the final concepts were selected.*

We recommend that transit agencies review these concepts and designs, benchmark them against their local knowledge, then select and, if needed, modify desired concepts for pilot implementation, before monitoring their performance and deciding whether to continue, expand, or terminate.

4.1.1.2.1 Recommended Pilot Designs

We have developed a set of guidelines for selecting an appropriate location for a subregion concept pilot. Using these guidelines, we have defined a promising location for the “on-demand service in a low density service area” concept: the Colerain Township. This is presented below. We also present two other concepts: a CVG Airport Area service and an express bus replacement service.



*Please refer to **Supplement H** for the full set of guidelines developed for use of selecting the appropriate location for pilots.*

Colerain Township

The Colerain Township area is to the immediate northwest of the City of Cincinnati, around 11 miles from Downtown Cincinnati. It has an area of around 27 square miles, a population of 53,200, and employment of 20,700. The average household income is around \$59,000, which is a little less than the median for the region. Most of the housing is suburban, although some parts of the area are more exurban in setting. Many TAZs have average incomes in the range of \$24,000 and \$50,000. There is a substantial presence of minority, low income, and elderly population: seventeen of the TAZs are designated by OKI as minority, with four of those also low income, and three of those also elderly. Metro routes 17 (60-minute frequency), 19 (30-minute frequency), and 74X (12-minute frequency during peak period) run through the area along Colerain Avenue (SR 27). All three serve Downtown Cincinnati. However, large parts of the area are greater than a mile from any bus stop and therefore not within walking distance of transit. Key destinations and transit routes within this area are shown on **Figure 27**, and include Stone Creek Towne Center (shopping center), Northgate Mall, Colerain Hills shopping center, other strip malls, senior centers and assisted living facilities, churches, community centers, recreational areas, and a large recycling plant. These would each likely generate trips.

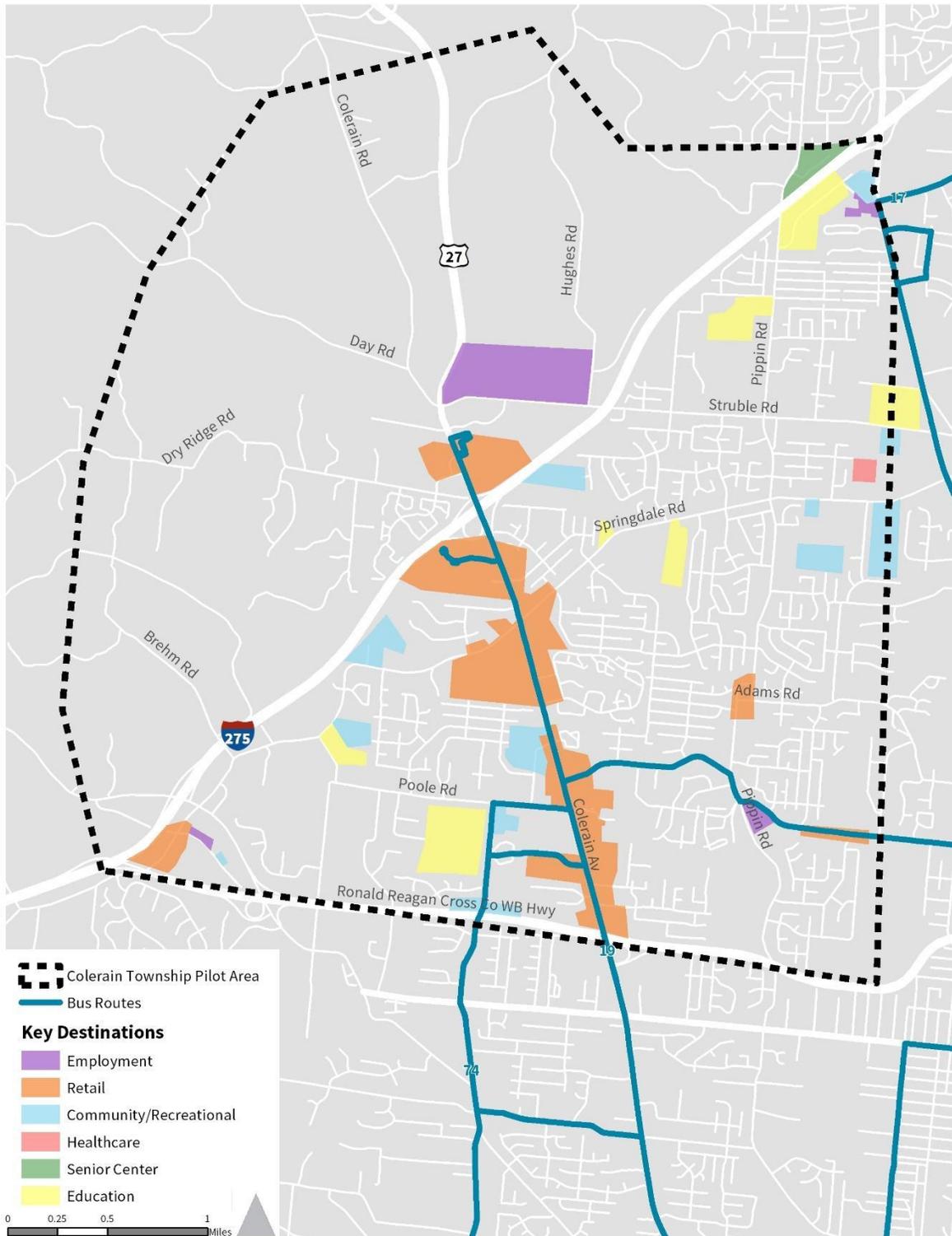


Figure 27 - Key Destinations and Transit Routes within Colerain Township Pilot Area

Environmental justice populations, average income distribution, and current travel demand by Uber and transit are shown in **Supplement H**.

Given a typical trip length within this area would be around 2-4 miles, and that an Uber trip of this length costs around \$6-\$13 (given a typical average of \$3 per mile for trips starting and ending in the pilot area), less a fare of \$1.75 (so as to be the same as transit), the typical public spending could be around \$4-\$11 per trip. While the three routes in the area (17, 19, and 74X) have average public spending per trip of \$3.50, \$3.94, and \$9.34, respectively, the public spending per trip at this furthestmost end of the route may be much higher as ridership is likely lower than the route as a whole. Pooling could also serve to reduce the public cost per trip, but given the residential densities, the potential for pooling trips is limited. Ultimately, public spending per trip could be comparable with low-productivity coverage bus routes in this area. The public spending comparison is particularly important to evaluate as part of a pilot program, as door-to-door service could induce longer passenger trips than the existing transit service typically carries. A detailed study of the per trip costs in this area prior to the pilot will set the baseline to evaluate against. Another thing to consider is that, if the on-demand service fully replaces the existing fixed routes (rather than serving as an overlay), those who presently board those routes in the area for trips outside the area will need to transfer from the on-demand to the out-of-area fixed routes at a designated end-line stop in order to complete their journey.

We recommend deploying a pilot in Colerain Township, to explore the extent to which spending/incentives are needed to encourage pooling in this trip density.

This proposal is similar to the high-level recommendation of a deviated-route circulator service in both Blue Ash and Springdale, as proposed by the Reinventing Metro plan. We support SORTA's plans to conduct more detailed study on the best on-demand service for these and any other areas in the medium term. We recommend that SORTA use the guidelines listed in "Selecting an Appropriate Location" in **Supplement H**.

CVG Airport Area

This design falls under the "service to suburban employment centers" concept, and is anchored off of the CVG Airport Area Businesses, which are quite dense but not enough to support high-frequency backbone transit service. Here, job types are more likely to not conform to regular shift patterns, making an on-demand service a better fit. There are almost 30,000 jobs in this area. A map of the area with key land uses and current transit service is shown below in **Figure 28**.

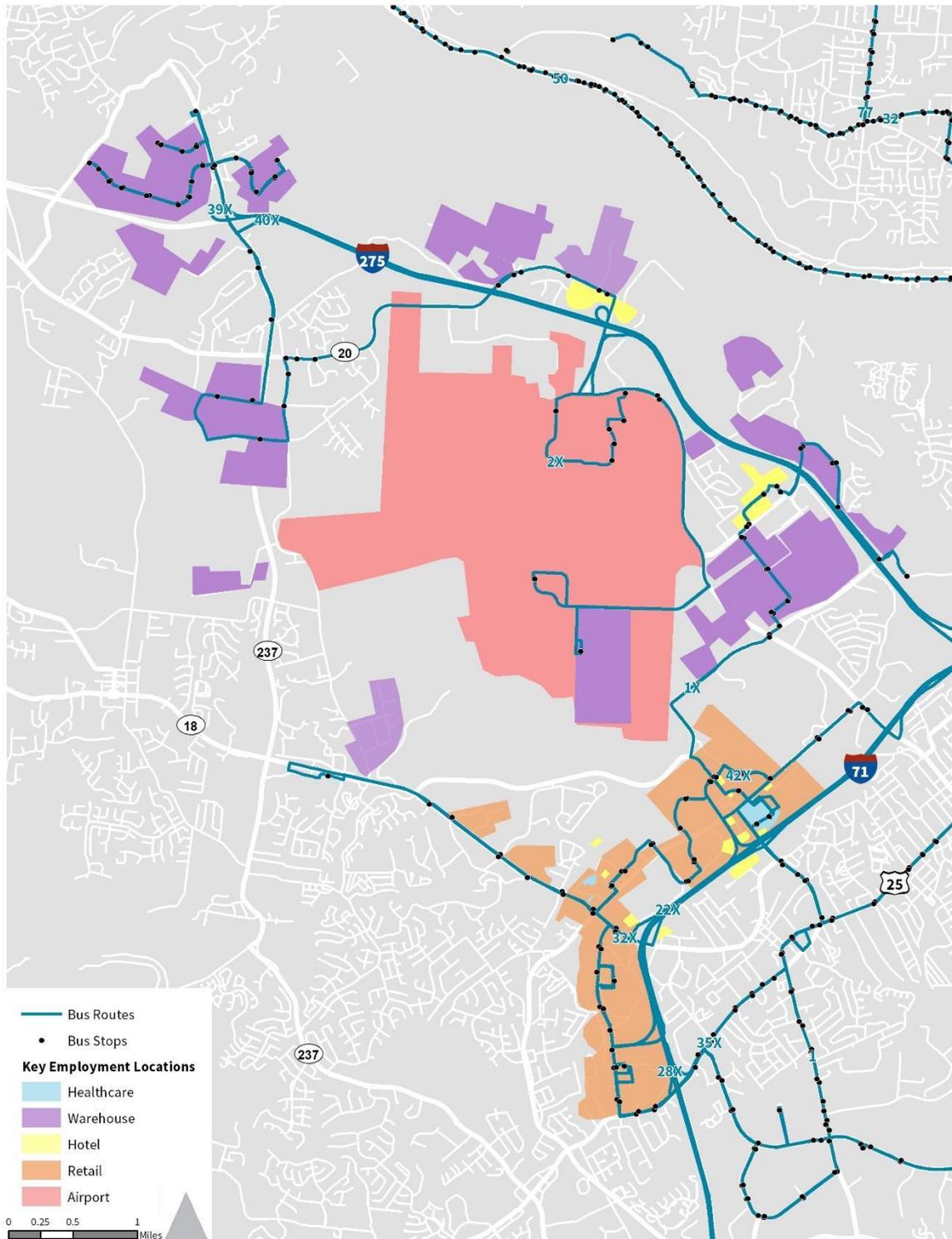


Figure 28 - Employment Locations and Bus Routes in the Vicinity of CVG Airport

Given the clustering of jobs in this area, we see potential for a pooled TNC service, such as UberPool. Employees in the warehouse, retail and service facilities with similar work schedules could use UberPool in different combinations to get to or from work. In general, the higher candidate pool, the more likely a match would be made and the lower the marginal cost per trip. We believe that the best concept would be for UberPool to serve the complete home-to-work trip, rather than simply serve a nearby centralized transit hub, or only serve a regional transit hub (i.e., Government Center). Because this service is highly focused on providing accessibility for work trips and thus providing a benefit to employers as well as to the public interest, there is an opportunity for both government and employers to contribute to the success of the program. Further consideration for this pilot design is presented in **Supplement H**.

Express Bus Replacement

This concept involves the replacement of a low-performing ridership-oriented route with subsidized pooled TNC service. Some of the express buses are amongst the lowest performing routes in the system, and a pilot could augment or replace such a route with a subsidized pooled ride-hailing option. Legibility of any pilot is essential and as such the geographic boundaries and/or nodes of this concept should be carefully drawn. The pilot could take the form of cordon a certain distance from the route or the stops of the current route. However, it may be difficult for people to instinctively understand which areas fall within or outside the pilot. An improvement in terms of legibility could be made through defining the pilot as a “route” operated by TNC or flexible transit vehicle with the same pick-up and drop-off points as the current route in addition to door-to-door service for origins and destinations that deviate substantially from these stop locations. A good candidate could be a low-performing express bus on the fringe of the region, such as the TANK 35X, which has a subsidy of \$17.39 per trip.

4.1.1.2.2 Roadmap for Implementing Pilots

Stakeholders of the Mobility Lab can move forward to initiate an on-demand pilot by taking the following steps:

Near Term

We recommend that stakeholders **define and agree to pilot goals and objectives**, such that success can be objectively benchmarked. We suggest using the set of objectives tabulated in Section 4.1.1.1 as a starting point. After this exercise, the stakeholders would **select a pilot concept**. A determination of how **ADA-compatible service** would be provided would also be made. Once a concept is selected, the stakeholder team would **establish an evaluation framework**. We suggest using the metrics and methods of measurement tabulated in Section 4.1.1.1 as a starting point and ensure that there is agreement between the service provider and the stakeholders on the data that will be shared via a data-sharing agreement. Evaluation metrics should capture the strengths and weaknesses of a potential pilot from an equity



perspective. Stakeholders would then **determine the funding sources** for the pilot and **produce a financial plan**. Stakeholders **select a service provider** using a process of their choice; multiple different providers may be necessary depending on the concepts selected, although the remainder of this section assumes a single provider is selected. All parties would then need to agree to terms related to how and when the agreement might be exited by either party. We recommend that the service provider and the transit agencies also deploy a joint communications and public relations program conveying how the service provider are putting their “best foot forward,” and, for Metro, setting goals and managing expectations. The communications would become more specific as medium term actions are completed and then as program performance is monitored.

Medium Term

In the medium term, we recommend that the stakeholder team **design and finalize a service area**. The CVG concept and express bus replacement concept show the most promise to meet the objectives as we have defined them. The Colerain Township pilot area is another option, and while we are skeptical that it could operate at lower subsidies than the existing bus service, it could be a worthwhile experiment if overlaid on top of current service at first. However, stakeholders should use local knowledge to select from choices presented in Supplement H, adapt them to their preferences, or use the set of rules listed in Supplement H to select a new area. We recommend that the team also **establish a fare structure** for the pilot. Knowing roughly where the pilot will be, the stakeholder community ought to **develop an outreach plan and begin engaging with communities and the most vulnerable users** to help with development of the plan, and later on to seek buy-in and feedback. We recommend that stakeholders **collect “before” data** on the evaluation metrics. This could include collecting data on levels of VMT, level of trip-making, trip patterns, and transit ridership. Because it can take longer than expected, we recommend that stakeholders **begin the contracting process** as early as possible.

Once the above steps are complete, stakeholders would **launch the pilot**. Once it is established, stakeholders would **collect data on evaluation metrics**. Over time, the stakeholders would iterate the pilot with the goal of improving outcomes.

Long Term

In the long term, we recommend that the agency implement a **comprehensive route restructuring** and service planning effort, considering the expansion of public/private partnerships to achieve well integrated multi-faceted mobility services. This could serve as a foundation for conceptual **long range strategic plan** for service reorganization throughout the region that takes advantage of multi-tiered and optimized line-haul, crowd-sourced and individual demand responsive services provided through collaboration between transit agencies and on-demand service providers. Such a plan would offer improved rider experience, reduced subsidies, an optimized mix of corridor-centric backbone, crowdsourced, and on-demand service,

and reduced regional vehicle miles traveled and associated impacts on congestion, household costs, public transportation expenditures, and the environment.

4.1.1.3 Other Considerations for Public-Private Partnerships

A fully private service might have lower costs and higher performance based on cost structure than a service operated by a public agency. Presently, TNCs have much lower labor costs than transit. However, costs could increase due to reclassification of employees, possible unionization, and city or state regulations requiring payment of living wages or minimum wage, as well as adjustments to business models as publicly traded companies. On the other hand, transit costs could also change, mainly dependent on the terms contained within labor agreements. When autonomous vehicles are available for widespread use on city streets—at least five years away and probably longer—the cost of private services that avail themselves of the technology, such as Uber, may become significantly lower. For transit agencies, although roughly 70 percent of costs are for labor, the savings resulting from scaling back services or autonomy would likely be less than 50 percent on average because of the expenses of non-driver, non-maintenance staff and due to labor agreements that prevent job loss.

Forging a public private partnership for such services will also need to address the challenges related to restrictions on federal transportation funding that do not allow allocation to private services such as Uber, and needs for standardization of contract terms including potential termination scenarios.

A role in the Cincinnati region's future might emerge if areas with suitable demand density and driving disincentives, like high parking costs at key destinations, can concentrate demand along certain corridors or transit first/last mile branches. If a pilot is cost-effective, this could allow re-deployment of some transit investments to improving backbone and other services and reduce solo vehicle miles traveled and needs to construct parking.

4.1.1.3.1 Methods for Controlling Costs

Two pilots in other regions (Monrovia and Innisfil) have seen high usage and are implementing measures to control costs. Monrovia has decided to raise fares to preserve operating dollars, and Innisfil has decided to place trip caps on users, rationing service. More details on these pilots can be found in Section 6.3 in Supplement B.

On-demand pilots run up against two prominent tensions:

- Finding a demand density lower than that for which fixed route transit would be productive but high enough to elicit enough demand density to support TNC and ideally a substantial proportion of pooled trips

- 
- Setting a low enough fare to encourage ridership, but not one that is so low that operating budgets are exceeded, all the while ensuring the fare is equitable.

Neither Monrovia or Innisfil have demonstrated that pooled trips can form the majority of overall trips and thus these agencies have resorted to raising fares and rationing trips to limit expenditures. Productivity has not exceeded around 2-4 passengers per hour, in most cases. Nonetheless, due to the range of unit costs reported, there remains promise that such service can replace poor-performing coverage service at a similar subsidy per trip. However, if popular it cannot scale cheaply, and agencies must face a choice of either increasing money spent on this type of coverage service (either through raising more funding or reallocating funding from fixed route service), limiting the amount of service offered through rationing, or raising the user cost to discourage usage, which could then lead to it not being affordable to low income people. Therefore, until an era where automation dramatically alters the cost calculus, the future for on-demand services is limited to tinkering around the edges of the transit system, i.e., reducing costs at the fringe.

4.1.1.3.2 Funding Sources for On Demand Pilots

Several funding avenues are available for on demand transit pilot programs. Typically, agencies in the U.S. have diverted funds from their general transportation operating budget. In some cases they have supplemented self-sourced funds by pursuing local, regional, or federal grant opportunities. Of 15 programs studied, eight were self-funded through the agency's operating budget and seven were combinations of grant-funding with budget funding. In general, grants allow for the development and implementation of pilot programs. As evidenced by all programs reviewed, those that move beyond the pilot phase are funded directly from the operating agency's general fund and we know of no agencies that have passed new tax measures to fund such programs.

General Operations Budget

Several agencies implemented pilot programs to replace existing paratransit service. The Pickup pilot in Austin, Texas diverted funding from Cap Metro's paratransit service to provide accessible on demand transit which Cap Metro made available to all users.⁵⁰ The MBTA also developed an on demand paratransit partnership with Uber, Lyft, and Curb and fully funded the program with state funds;⁵¹ this program provides subsidized rides in wheelchair accessible vehicles to those who qualify. Other agencies launched on demand pilot programs to improve their dial-a-ride service, often diverting funds from their general operating budget to foster the program. The City of Monrovia diverted funds from its existing dial-a-ride service to

⁵⁰ Cap Metro Operating & Capital Budget and 5 Year Capital Improvement Plan. Retrieved: https://capmetro.org/uploadedFiles/New2016/About_Capital_Metro/Financial_Transparency/Annual_Budgets/Fiscal-Year-2018-Approved-Budget.pdf

⁵¹ Email from Chris Pangilinan, Uber. Dated February 3, 2019.

launch GoMonrovia, a program that supplements the City’s dial-a-ride service with Lyft as the operator.⁵² AC Transit, the bus operator in Alameda County, California, implemented the AC Transit Flex pilot with its general funds. AC Transit general funds consists of national funding from the FTA; state funding through the Transportation Development Act, the State Transportation Assistance program, and Senate Bill 1 which increased vehicle licensing fees and gas taxes; regional funding from toll revenues; and local funding from property, parcel, and sales tax.⁵³ The West Sacramento On-Demand pilot was funded by about \$750,000 of its dollars provided by California’s Transportation Development Act,⁵⁴ funded by a statewide sales tax.

Grant Opportunities

Some pilot programs successfully obtained grants to implement their programs. The FTA’s 2016 Mobility On Demand Sandbox grant provided a \$1.2 million grant to DART to help launch on demand pilot programs such as DART GoLink. DART matched the FTA’s grant dollars by diverting funds from its dial-a-ride service.⁵⁵ GoDublin similarly matched a grant provided by the Alameda County Transportation Commission by reallocating a portion of its general operating budget, funded through the Measure B sales tax measure. Beyond the pilot period, the Livermore Amador Valley Transit Authority has continued GoDublin with funds from the agency’s general operating budget.⁵⁶ Marin Transit Connect, providing on demand service across San Rafael, California, was primarily funded by a \$700,000 FTA Section 5310 grant; additional funding for subsidies was provided from Marin Transit’s general fund which is sourced from Marin County vehicle registration fees and sales taxes.⁵⁷ Finally, in greater Sacramento, the SmART Ride on demand pilots in Citrus Heights, South Sacramento, and Franklin were funded by the Sacramento Regional Transportation general operating budget, although a \$12 million grant from the Sacramento Transportation Authority is helping to expand the service.⁵⁸

⁵² Chi, Oliver. “Case Study – City of Monrovia: Leveraging emerging ridesharing services to expand mobility options.”

Retrieved: <https://www.apta.com/wp-content/uploads/Resources/resources/mobility/Documents/GoMonrovia%20Case%20Study.pdf>

⁵³ AC Transit Budget. Retrieved: <http://www.actransit.org/about-us/facts-and-figures/budget/>

⁵⁴ City of West Sacramento January 17, 2018 Agenda Report. Retrieved:

<https://www.cityofwestsacramento.org/home/showdocument?id=8865>

⁵⁵ Farr, Brittney et al. “Mobility on Demand.” Retrieved: <https://www.apta.com/wp-content/uploads/Resources/members/memberprogramsandservices/Emerging-Leaders-Program/Documents/MOD%20FINAL-Group%205.pdf>

⁵⁶ Katayama, Devin (2016). “Pilot Programs to Help Dublin Commuters Pay for Uber, Lyft, Cabs.” Retrieved: <https://www.kqed.org/news/11055367/pilot-program-to-help-dublin-commuters-pay-for-uber-lyft-cabs>

⁵⁷ “Marin Transit Connect Evaluation Report” (2019). Retrieved:

https://marintransit.org/sites/default/files/projects/2019/Connect%20Evaluation%20DRAFT_FINAL.pdf

⁵⁸ Shannon, Chelsea (2020). “Goodbye, Uber Pool. Hello SacRT.” Retrieved:

<https://www.abc10.com/article/news/local/sacramento/sacramento-regional-transit-rides-on-demand/103-22e744d7-8815-4285-a335-d115858e397a>



Federal Formula Funding and Reporting

Until FTA further rules, there is uncertainty as to whether formula funding will be available for on-demand transit operations, and the extent to which usage data must be reported to the FTA. Curtis et al. note the following:

Currently, TNC trips provided through transit agency partnerships (that either subsidize or promote those trips) are not eligible to be counted and reported to the NTD because the FTA has not yet made a formal determination of whether those trips meet the statutory definition of public transportation. To be considered public transportation, among other requirements, neither the driver nor the passenger(s) may refuse additional passengers. (pp. 5-8, 5-9)

All transit agencies that are recipients or beneficiaries of either the 5307 Urban Formula or the 5311 Rural Formula federal funding programs must report all transit activities and services to the NTD ... Currently, the only TNC services that may meet the definition of public transportation are their shared ride products (e.g. UberPool and Lyft Line). However, until FTA undertakes a formal assessment of these shared ride services, transit agencies subsidizing or promoting TNC trips as part of a partnership should not report those trips to the NTD. (p. 5-9)

4.1.2 Seamless Payment and User Interface

We recommend that transit users be incentivized to get subscriptions (i.e., transit passes) so that they have the easy option of taking transit at no marginal cost. We recommend agencies work to ensure that the public can access transit and TNC fare payment and trip planning from within the same travel aggregator apps.

4.1.2.1 Establish Seamless Multi-Modality

We recommend that stakeholders seamlessly integrate customer access to alternative mode mobility services in the region through a joint public/private mobility as a service (MaaS) such as the Uber App to deliver the following service efficiencies and user benefits:

- Simplified trip planning, mode selection, and ticketing to easily provide travelers their preferred combination of cost, convenience, speed and flexibility, and to make travelers aware of transit access opportunities with Uber as a first mile/last mile option and as a guaranteed ride home option.
- Integration of transit schedules and access information into the Uber App or similar platform,
- User access to comprehensive and comparative transit information and the full range of Uber and other services, including pooled rides, scooters and bikes

- Cooperative and coordinated transit and TNC promotional and discount programs
- Assurance that special-needs travel is being serviced and that the public is being offered travel via the subsidized service partnership that is no greater than that of a transit trip

A primary objective of the study is to promote cost-effective and sustainable travel options that are competitive against solo driving. Given the expansive road network in Cincinnati, the automobile serves all manner of trips, short and long, for solo travel and group travel, across all weathers, at all times of day. Other modes such as walking, biking, transit, and TNC each have particular strengths in each of these categories. Thus, a combination of all are needed to offer a competitive alternative to driving for the different trips that compose a typical week. Mobility options can be bundled together in a way that covers each different type of trip, to make it possible to conduct daily life without needing a private automobile. Mobility-as-a-service (MaaS) represents this concept, typically in the form of a centralized smartphone app, and typically is underpinned by a strong backbone transit service that is capable of serving many trips in an efficient way. We recommend that agencies look to collaborate and support MaaS providers and coordinators and that this approach be supported by supporting investment in infrastructure and services that promote walking and bicycling, such as protected bike lanes and intersections, bike share programs e.g., Red Bike, car share programs, and improved sidewalks and pedestrian crossings. Some of these will also improve access to transit; a double benefit.

This approach would also be supported through pricing auto travel and parking to better reflect their true societal costs.

4.1.3 Transit Best Practices

The heart of the action plan is to reinforce the backbone transit network. We recommend that transit agencies and other regional stakeholders consider improvements to their fixed route service and other transportation and land use policy within the following six categories: transit ridership growth planning, service restructuring, policy, physical infrastructure, land use, and technology & data. Actions under each category are presented below:

4.1.3.1 Prepare a Transit Ridership Growth Plan

In conjunction with the SORTA *Reinventing Metro Plan* and the TANK *2020 System Redesign*, we recommend that stakeholders prepare a ridership growth plan in response to decades of sustained ridership decline that would:

- Conduct an in-depth assessment of transit ridership trends at the system, route and stop level data to assess changes in ridership based on location, geography, and temporal characteristics,

and cross reference with customer data to determine which rider groups are over-represented in the ridership change.

- Evaluate trip origin/destination patterns and line-to-line transfers and operator-to-operator transfers to understand key travel patterns their effect on service quality and ridership loss and how well bus routing aligns with actual travel patterns. This could include a focus on employer/transit agency relations to attract riders on routes that serve dense employment centers, and by providing bulk discount programs that give employees passes.
- Examine regional trends that could have affected the ability of transit to service travel needs, including changes in population and employment density, income levels, vehicle ownership, locational shifts in density of youth and elderly and non-ambulatory population groups.
- Assess user and non-user experience through focus groups, rider and non-rider surveys on perceptions of quality of service, comfort, customer service, information and technology and travel needs.
- Develop strategies to address any concerns about customer experience, safety and comfort, information and awareness, fares and payment structure, employee training and expectations, agency processes and coordination, marketing and promotion, delivery and quality of service.
- Formulate performance indicators and performance targets to measure success.

People



Customer Survey & Focus Groups

Market Segments



Non-Customer Survey & Focus Groups

Market Segments

Data



Multi-Year Trends Analysis

Ridership
Demographics
Travel



Travel Pattern Analysis

Big Data



Multi-Scale Data Analysis

Region
Sub Region
Agency

Figure 29 - Approach to Transit Ridership Growth Planning (Fehr & Peers, 2019)

4.1.3.2 Implement Service Restructuring

We recommend that the agencies complete a network redesign process to better serve the prevailing land use and ridership patterns. We recommend that this effort be undertaken in conjunction with the SORTA *Reinventing Metro Plan* and the TANK 2020 *System Redesign* planning efforts, which already contains many of the following ideas. This would include the following actions:

- Supply a rapid high-frequency network, with higher frequencies than currently provided, especially at evenings and weekends. SORTA currently operates 7 routes (all radial) at high frequency (15 minute or better between 6 AM and 6 PM). We recommend that investment be prioritized on existing markets where transit is already competitive with auto, or can cost-effectively become the dominant carrier. We found that people are switching from transit to Uber primarily because of the shorter wait and travel times; investment here would counteract that. This could be part of an overall strategy of retrenchment to a profitable core, as laid out in detail by Levinson and King.⁵⁹
- Given its success in increasing ridership while other routes have seen decreases, we recommend Metro continues to build out the *Metro*Plus* concept, which is “geared toward providing limited stop service on [a] major important corridor with specifically ‘branded’ vehicles;” and where stops are limited to 2-3 per mile.
- Explore service in crosstown corridors where transit, while present in some capacity, is failing to capture a large share of a large travel market (as shown in **Figure 13**).
- More jobs are concentrated in outlying suburban clusters, and a large proportion of travel demand is not employment related, and instead is oriented around childcare, shopping, school travel, leisure, etc. Thus, Cincinnati could take the lead of Houston in reshaping the network around a frequent grid format to improve access to multiple job centers and services.
- Otherwise, there are opportunities to make routes more direct, with bus stop spacing optimized to remove unnecessarily close spacing.



Please refer to **Supplement I** for more information on two prominent service restructurings, Seattle and Houston, whose successes have informed these recommendations.

⁵⁹ Levinson, D. M. & King, D. A. (2019). *A Political Economy of Access*. Network Design Lab [page 321]

4.1.3.3 Adopt Supportive Policies

Riding the bus in Cincinnati can come with challenges that deter riders and that could be at least partially resolved through policy changes. For example, the fare system is complicated and fare payment can be a time-consuming process. We recommend that the transit agencies consider implementing transit-supportive policies, such as the following which have been demonstrated to work in other U.S. cities:

- Institute policies that would increase average bus speeds, such as all-door boarding and off-bus fare payment, especially along the rapid network. This could be tied in with the established *Metro*Plus* branding.
- Institute policies to break down barriers between agencies and make travel more seamless, such as integrated regional fare policy and ticketing, which would require inter-agency cooperation. This could involve free transfers across bus trips no matter the operating agency, or a coordinated regional zone-based system, each of which would make transit easier to use and navigate. These proposals would remove the financial penalty that customers pay when they take trips on transit which require a transfer through no fault of their own.



*Please refer to **Supplement J** for more information on three influential and successful transit policy changes: all-door boarding in San Francisco, fare policy reform in Portland, and data sharing in Pittsburgh.*

4.1.3.4 Invest in Transit-Supportive Infrastructure

Automobile congestion slows buses down to a crawl in downtown Cincinnati, and hot spots exist throughout the region that delay buses by minutes at a time. We recommend that the transit agencies work with cities to implement tactical improvements to physical transit infrastructure that will not only speed buses but provide more reliable bus travel times, boosting on-time performance. We recommend that agencies' data infrastructure be modernized to allow for better quality of information available to the public as well as to planners. These actions would include:

- Physical infrastructure
 - Build off the success of the Main Street bus-only lane by constructing additional bus-only lanes through congested parts of the city, notably the downtown area. Supplement these with other transit-supportive infrastructure such as queue jump lanes, bus stop amenities, and

- transit signal priority, particularly at speed hot-spots identified using big data speed mapping, such as the *Swiftly* platform.
- Anticipate autonomous vehicles by designating exclusive BRT lanes suitable for conversion to autonomous modes.
 - Improve bus performance on freeways through construction of high-occupancy toll (HOT) lanes on freeways, with direct access ramps for buses.
 - Technology and data infrastructure
 - Develop a clear picture of who internally uses agencies' real time data and ask them what could be done better. Review how the agency uses this data, such as AVL data, for the purposes of planning, and investigate ways to best harness this data for planning decisions in line with national best practices.
 - Continue to nurture data science teams within agencies' planning departments that are equipped to analyze data and produce statistics to support service change proposals.
 - Survey passengers to understand how they find real-time data, whether through smartphone apps or real-time information screens, and what their needs are related to this data. Understand which smartphone app providers have data on rider usage that can be accessed, e.g., Transit App has origin-destination data available. Consider ways to use this data to inform service planning.
 - Improve on-board technology to enhance safety and security.
 - Be the owner of your real time data, analyze it, and use metrics such as on-time performance to continuously improve routing.
 - Institute data-sharing with the public to increase transparency of operations, allowing the agency to better be held accountable to providing good service.



*Please refer to **Supplement K** for examples of infrastructure and technology improvements, including a list of effective street and stop infrastructure.*



4.1.3.5 Land Use and Pricing

The OKI *Strategic Regional Policy Plan* of 2005 and the *Elements of an Effective Local Comprehensive Plan* of 2016 contain over a dozen policy recommendations oriented toward strengthening regional transit and encouraging transit supportive land use. A high priority for the region will be to assess the degree to which those policy measures have been enacted and the effect they have had on reducing vehicle miles travelled and related congestion and air quality impacts. The region may need to reassert its commitment to those actions in order to address the continuing erosion of transit ridership and the broader set of regional goals expressed in the plan.

We recommend that stakeholders implement policies to assist in the shaping of land use development to support transit and other high-occupancy and sustainable modes. Specifically, we recommend that stakeholders:

- Uphold the Regional Plan which has an emphasis on compact infill development, TOD, and transit supportive land use, to increase region's low rating for jobs accessible by transit.
- Establish pricing of VMT to account for full cost including externalities (climate, economic, social) through carbon tax, VMT tax, and mileage based insurance premiums with revenues targeted for improvements to high-occupancy travel modes.

4.1.3.6 Establish On-Going Data and Resource-Sharing Agreements

To the extent that the pilots and inaugural deployments described above prove successful, we recommend that stakeholders establish the needed public/private partnership agreements required to sustain the programs and services. Among the key elements are:

- Ticketing and payment systems
- Traveler information and customer service portal
- Service deployment optimization platform
- Demand responsive service routing app.
- Data sharing for performance monitoring and refinement
- Source of Vehicles (public buses or TNC vehicles)
- Source of Drivers (bus drivers or TNC drivers)

These agreements may draw from successful examples of such partnerships in other regions including Dallas, Denver, and Innisfil, Ontario.

The degree to which services meet and respond to the public need can be increased if all parties (public and private) maintain a positive and collaborative relationship. For success to scale beyond initial pilots, these partnerships could pursue the following elements:

- Standardization of data provided to agencies such that it is consistent and the rationale for request of each dataset is clear
- Standardization of the process by which agencies contact and cooperate with mobility providers
- Sharing of information on traveler feedback and stakeholder concerns
- Standardization of cost structure for partnerships
- Partial automation of process used to define parameters for partnerships, such as service area, time of day, and level of subsidy
- Standardization of contract terms in a manner compatible with FTA requirements, to reduce complexity
- Removal of requests that mobility providers would not be able to meet, such as guaranteed estimated time of arrivals (ETAs)
- Creation of a portal for transit agencies to explore partnership service types, which could include:
 - Suite of services to choose from
 - Automated subsidy choice
- Automated geofencing
- Automate phone line add in for people without smartphones
- Collaboration on evolving data-processing tools and data standards

The above recommendations have the potential to help counteract transit ridership declines through a combination of enhanced fixed-route backbone and on-demand services providing a more attractive alternative to the private automobile and improving accessibility between neighborhoods while reducing cost per passenger trip.

Supplement A - The Traditional Mobility Paradigm

Like much of the U.S. — except a select few neighborhoods and coastal cities — most travel in the Cincinnati region is by private automobile; this is the singular defining feature of the traditional mobility paradigm. In contrast, transit serves a relatively small and dwindling proportion of trips, mostly limited to several established radial and crosstown corridors.

Today, the automobile mode dominates overall levels of travel and government expenditures, with only a few corridors where other modes of travel come close. We got here due to a path of land use and infrastructure decisions from the 1940s onwards, such as highway investment, public spending on roads, and low density zoning. Of the \$6.5 billion accounted for in the region's 2040 transportation improvement plan, eight percent are assigned for transit, three percent for bicycle and pedestrian projects, and 87 percent for roadways.²¹ Many of these trends are continuing: contemporary population growth is occurring at the urban fringe in a heavily automobile-centric manner, causing density to trend further downward. Such development is associated with greater vehicle miles traveled (VMT), infrastructure costs, and transportation costs due to increased auto dependence.⁶⁰

Of the 387,000 Hamilton County⁶¹ commuters in 2017, the American Community Survey (ACS) found 80 percent drove alone, 8 percent carpooled, and only 3.7 percent took transit to work.⁶² While the percentage of those who drive alone has fluctuated between 75 and 80 percent from 2009 onward, the percentage of transit commuters has steadily fallen from 5 to 3.5 percent over the nine-year period. Information on overall mode split (for all trip types) is not available.

Transit agencies provide fixed-route bus service, most ridership-oriented (i.e., with a goal of maximizing ridership), but some coverage-oriented (i.e., with the goal of maximizing geographic coverage). Bus ridership has steadily declined since the 1940s, from 130 million annual riders in the region in 1946 to 39 million in 1963 to 31 million in 2000 to 30 million in 2008 to around 20 currently million in 2018, as can be seen in Supplement D. This is against a backdrop of a 2 percent overall increase in both population and employment between 2010 and 2015.

⁶⁰ Economic Research Service/USDA (2001). *Development at the Urban Fringe and Beyond*. Retrieved <http://www.impactfees.com/publications%20pdf/aer803e.pdf>

⁶¹ Hamilton County contains the city of Cincinnati and most of its Ohio suburbs

⁶² United States Census Bureau / American FactFinder. "B08301: Means of Transportation to Work." 2013-2017 American Community Survey 5-Year Estimates. U.S. Census Bureau's American Community Survey Office, 2017. Web. 9 July 2019 <<http://factfinder2.census.gov>>

Supplement B -
Findings from
Crowdsource and
Ride-hail Pilots

Pilots involve use of two different vehicle types: crowdsourced (i.e., flexible transit, microtransit) and ride-hail (i.e., TNCs, either pooled or not). They also typically have one or more of the following four key service objectives:

- Institute feeder access to backbone transit
- Replace feeder bus to backbone transit
- Replace fixed route transit
- Enhance paratransit

Some examples in each combination are shown in the table below:

Major objective:	Crowdsource vehicles	Ride-hail vehicles
Institute feeder access to backbone transit	Via/LA Metro Marin Transit Connect	GoMonrovia! PSTA Direct Connect
Replace feeder bus access to backbone transit	AC Transit Flex	Go Dublin
Replace fixed route transit in its entirety	AC Transit Flex	Uber/Innisfil
Enhance paratransit	Marin Transit Connect	Lyft/DART

In this supplement, we present key considerations up front. This is followed up by a deeper dive into crowdsourced pilots, then ride-hail pilots. The section ends with a summary of lessons learned from recent transit/TNC partnerships as shared directly through interview with government agency employees.

6.1 Key Considerations

A fully private service might have lower costs and higher performance based on cost structure than a service operated by a public agency. Presently, TNCs have much lower labor costs than transit. However, costs could increase due to reclassification of employees, possible unionization, and city or state regulations requiring payment of living wages or minimum wage, as well as adjustments to business models as publicly traded companies. On the other hand, transit costs could also continue to increase, mainly dependent on the terms contained within labor agreements. When autonomous vehicles are available for widespread use on city streets—at least five years away and probably longer—the cost of private services that avail themselves of the technology, such as Uber, may become significantly lower. For transit agencies, although roughly 70 percent of costs are for labor, the savings resulting from scaling back services or autonomy would likely be less than 50 percent on average because of the expenses of non-driver, non-maintenance staff and due to labor agreements that prevent job loss.



Forging a public private partnership for such services will also need to address the challenges related to restrictions on federal transportation funding that do not allow allocation to private services such as Uber, and needs for standardization of contract terms including potential termination scenarios.

A role in the Cincinnati region's future might emerge if areas with suitable demand density and driving disincentives, like high parking costs at key destinations, can concentrate demand along certain corridors or transit first/last mile branches. If a pilot is cost-effective, this could allow re-deployment of some transit investments to improving backbone and other services and reduce solo vehicle miles traveled and needs to construct parking.

6.2 Crowdsourced Pilots

Public transit providers, including SORTA and TANK, have proven highly capable of providing quality backbone services, and Uber and similar private services have been successful at on-demand services for individuals, and in other regions where demand density is high enough, at ride-pooling services. Crowdsourced services have proven more difficult to sustain by both the public and private sectors. For most transit agencies dial-a-ride type services are a financial burden, with an average subsidy of over \$20 per trip.⁶³

Microtransit is a service type, a subset of "Crowdsourced Services," where fixed routes vary in response to demand either through adding and dropping of routes by deviating from fixed routes in response to calls for service within a defined service area. Users predominantly use cellphone apps to request a ride, and where the vehicle type is a bus with seating amount larger than a passenger car but smaller than a 40-foot bus.

In this category, private companies like Chariot and Bridj struggled even in cities with well-suited underlying travel patterns; both companies are now defunct. However, alternative service providers are finding success in partnership with transit agencies, often involving subsidies. In particular, providers who offer optimized vehicle deployment and routing apps through which agencies can use their own vehicles and drivers to provide crowd-sourced service are gaining ridership and lowering costs. Examples include Via in Austin and West Sacramento, Pantonium in Belleville, ON and Bakersfield, CA, and Transloc in the Citrus Heights area of Sacramento. The microtransit pilots (typically operated by Via, Pantonium, Transloc, etc.) have typically been in higher density suburban areas, predominantly serving first/last mile transit needs. While they have

⁶³ Kane, J.W., Tomer A., and Puentes, R. [2016, March 8] *How Lyft and Uber can improve transit agency budgets* (2013 data). Retrieved: <https://www.brookings.edu/research/how-lyft-and-uber-can-improve-transit-agency-budgets/>

shown mixed success at lowering costs and increasing ridership, they consistently rate highly on customer satisfaction.⁶⁴

These microtransit services have yet to find stable cost-effective service environments. Demand responsive microtransit services in Austin, Durham, Salem OR, Sacramento, and San Francisco suburbs (Marin County) have generated ridership at a rate of only 2-3 an hour and at a cost of \$20 to \$30 per passenger. Typical ridership on low performance fixed route services are around 10 passengers per hour, at costs of \$10-\$20 per passenger.

The San Francisco Bay Area's AC Transit Flex service⁶⁵ has found that a service area of 3-7 square miles is optimal and that an upper limit of microtransit productivity is about seven passengers per hour. According to experienced transit planner Jarrett Walker, the lowest performing publicly provided fixed route coverage services serve about ten passenger trips per service hour and that "microtransit is reliably worse than fixed routes in passengers per service hour."⁶⁶ In the Cincinnati region, eight Metro local routes and TANK express buses carry fewer than ten passengers per service hour on average, suggesting that negotiations with a service provider such as Uber or Via, Pantonium, or Transloc might lead to an agreement for one such provider to substitute for or overlay several of those lines.

The opportunities to make microtransit cost effective would stem from:

- Serving areas with relatively concentrated population or employment traveling to common destinations so trips can be pooled
- Operating the service at a lower unit cost than public providers
- Operating primarily deviated route service such as Uber Express Pool where riders may walk a few blocks to designated stops within designated time windows, instead of fully on-demand door-to-door service

6.3 Ride-hail Pilots

Unsubsidized pooled ride-hailing (UberPool, Lyft Line) have not proliferated beyond core urban areas in large regions with high demand densities. However, dozens of pilots have existed over the past few years

⁶⁴ Feigon S. et. al. (2018) TCRP 196. Private Transit: Existing Services and Emerging Directions.

⁶⁵ Urgo, J. [2018, May 15]. *Flex V. Fixed: An Experiment in On-Demand Transit*. Retrieved: <http://transitcenter.org/2018/05/15/adding-flexible-routes-improve-fixed-route-network/>

⁶⁶ Human Transit. (2018, June 28). *Is Microtransit a Sensible Transit Investment?* Retrieved from <https://humantransit.org/2018/02/is-microtransit-a-sensible-transit-investment.html>



where these types of service have been publicly subsidized in the hopes of effectively meeting public goals in lower density suburban (to varying degrees) areas.

The TNC pilots (typically operated by Uber or Lyft) have generally been in lower density suburban and rural areas, serving one or more of five general purposes:⁶⁷

- First/last mile connections, to either rail stations or BRT stops in higher density suburban areas, sometimes replacing low-frequency fixed route bus service – this format does not fit well with Cincinnati due to the paucity of high-capacity, high-frequency transit options,
- Paratransit trips, primarily at a lower cost than traditional reservation-based services, allowing the traditional service to be focused on more demanding trips,
- Late night travel needs, when fixed route transit doesn't traditionally run,
- Occasional trip needs such as "guaranteed ride home," when fixed route transit is not available, and
- General and broad demand in lower density environments, sometimes replacing low-frequency fixed route bus service. These have been cordon-based.

By directly competing against most private automobile trips, this latter category has the highest potential market share in suburban and rural areas across the country. Around a quarter of TNC pilots to date are targeting this category. For ultimate success at scale, this concept would need to be both lower subsidy and higher ridership than what it replaced or than coverage transit in general, fueled by a high degree of pooling, and a low cost structure. These are not the only indicators of success; rider satisfaction for example is an important one, but merely represent transit agencies' bottom line.

It is difficult to draw firm conclusions from pilots carried out to date because participants typically do not collect or release information on mode shift or net ridership change during and after pilots (TCRP), and few can provide a clear before/after assessment where a fixed route has been replaced with on-demand service and where unit cost/subsidy information has been readily shared. There are some indications that TNC pilots are producing cost savings over fixed routes, but this is partly because users are carrying a higher cost burden, paying fares higher than the transit fare replaced.

The two most extensive pilots have both freely shared trip numbers and subsidy information: Innisfil, Ontario (partnership with Uber) and Monrovia, California (partnership with Lyft). Both have subsidized all TNC trips within the service boundary, which coincides with their city limits. Innisfil is a suburban city of around 40,000,

⁶⁷ National Academies of Sciences, Engineering, and Medicine 2019. *Partnerships Between Transit Agencies and Transportation Network Companies*. Washington, DC: The National Academies Press.
<https://doi.org/10.17226/25425>

with a built-up area of around 5 square miles, located six miles from and separated by rural land from a larger city, Barrie. Monrovia is a suburban city of around 37,000, also with a built-up area of around 5 square miles bordered on three sides with adjacent suburbs of the Greater Los Angeles metro area. Each therefore have a population density in their built up area of around 7,000 people per square mile. Each has an average fare of around \$3-\$4 and an average subsidy of \$4-\$6. Monrovia has much higher ridership (66,000 per month vs 6,000 per month for Innisfil), likely due to the higher demand density it has being part of a much larger metro area with larger retail and employment attractions and having a light rail station as a focal point. Each is facing challenges of popularity in excess of the budget set aside to fund it. Monrovia has decided to raise fares to preserve operating dollars, and Innisfil has decided to place trip caps on users, rationing service.

These two pilots are the strongest demonstration of a proof of concept, but run up against two prominent tensions:

- Finding a demand density lower than that for which fixed route transit would be productive but high enough to elicit enough demand density to support TNC and ideally a substantial proportion of pooled trips
- Setting a low enough fare to encourage ridership, but not one that is so low that operating budgets are exceeded, all the while ensuring the fare is equitable.

Fixed route transit is able to achieve a virtuous cycle, where more ridership means more revenue that can be invested in more service, which drives more ridership, etc., continually decreasing unit costs. For pooled TNCs, the virtuous cycle is possible but weaker: more ridership can mean more opportunity to pool trips, which leads to lower cost per person trip. However, neither Monrovia or Innisfil have demonstrated that pooled trips can form the majority of overall trips and thus these agencies have resorted to raising fares and rationing trips to limit expenditures.

Therefore, the bigger question is in terms of macro funding. TNC pilots have proven popular; ridership is solid and rider satisfaction is high. However, the extent of pooling has been low, and productivity is limited to around 2-4 passengers per hour, in most cases. Nonetheless, due to the range of unit costs reported, there remains promise that such service can replace poor-performing coverage service at a similar subsidy per trip. However, if popular it cannot scale cheaply, and agencies must face a choice of either increasing money spent on this type of coverage service (either through raising more funding or reallocating funding from ridership-oriented service), limiting the amount of service offered through rationing, or raising the user cost to discourage usage, which could then lead to it not being affordable to low income people. Therefore, until an era where automation dramatically alters the cost calculus, the future for on-demand services is limited to tinkering around the edges of the transit system, i.e., reducing costs at the fringe.



A detailed review of ride-hail pilots is presented in the next section. This section categorizes pilot types into seven more nuanced strategies.

6.3.1 Detailed Review of Ride-hail Pilots

The number of partnerships between TNCs and government has grown substantially over the past 24 months. In this section, we present a review of a variety of other types of partnerships, each oriented around a distinct strategy.

6.3.1.1 First/Last Mile

We present findings from a review of different strategies, followed by a review of first/last mile-oriented pilots, before highlighting specific opportunities in the Cincinnati context. Our key takeaways are as follows:

1. While many pilots have been small in scale, the GoMonrovia program (although not predominantly a first/last mile pilot) has seen the most success with 1,000 trips per day, due to a low user fare (less than \$3), good marketing, and its simple rules.
2. Integrated ticketing and trip planning can make multimodal trips containing transit and Uber easier and more seamless, although due to limited integration between agencies currently, this would require a substantial investment in improving integration.
3. The Cincinnati region does not have high potential for first/last mile Uber service as it lacks backbone transit services such as bus rapid transit (BRT) or rail that would serve as effective anchors for it.
4. The true degree of complementarity and competitiveness for both full-trip and first/last mile services is difficult to discern due to the absence of local mode shift data. Nonetheless, Uber is operating in all of the same markets as transit in this region, and because of the weak economic logic of using Uber as first/last mile to bus, Uber is likely mostly competing directly against transit rather than as a complement.

6.3.1.2 Integrated Ticketing

Many companies exist that aim to integrate ticketing for transit and mobility providers through a smartphone interface. Masabi is one example. Their offering includes account based ticketing capabilities that enables transit agencies to deploy multi-format ticketing systems including mobile bar code tickets, smart cards, and contactless credit cards. Masabi has partnered with the MBTA in 2012 to extend its the ticketing process, by providing an alternative to waiting in a line at a ticket vending machine or paying on-

board with cash. Today over one-third of all tickets are sold through the mobile channel and the project saved MBTA up to \$70 million.⁶⁸ Masabi also partnered with the New York MTA in 2016.

Recently, Masabi and Uber announced a developing partnership to integrate public transit mobile ticketing into the Uber app. This integration will enable people to pay for multimodal trips between Uber and public transportation seamlessly within the same app, reducing some of the friction of transferring between those modes.

SORTA and TANK have some integrated fare products using magnetic swipe technology, as explained later in Section 3.6.1.3. However, they do not currently offer integrated payment via apps.

6.3.1.3 Trip Planning Integration

The strategy of incorporating transit trip planning and TNC trip planning within the same app is a fairly new phenomenon. Third party apps exist that have included functionality to both plan for and book a TNC trip, as well as the plan for a transit trip for some time (e.g., Transit app integrated Uber in summer 2017). More recently, Uber and Lyft have incorporated transit planning within their apps. Uber rolled out this functionality starting in Denver in February 2019, and Lyft started in Santa Monica in September 2018. No research was found documenting the effect of these integrations on ridership.

6.3.1.4 Transit Station Access and Circulation

Increasing TNC use and the implementation of first/last mile partnerships can change how transit stations operate, requiring additional or more formal designated pick-up and drop-off locations. This could also signal a shift from large park and ride lots to more curb space for pick-ups and drop-offs. The Go Centennial pilot found only a 1.9 percent increase in park and ride use at the light rail station where TNC rides were subsidized, compared to a 25 percent to 28 percent increase at other nearby stations.⁶⁹ This trend could potentially reduce the amount of space the community or transit agency would need to allocate for parking near transit stops.

In a recent study at the West Oakland Bay Area Rapid Transit (BART) station, the share of riders dropped off at the station (by private vehicle, taxi, or TNC) had increased from 18 percent to 19 percent of mode share from 2008 to 2015 respectively, with half of the observed drop-offs and pick-ups as TNCs in 2015. BART's 2015 Station Access Study surveyed users on the mode they used to access stations. Compared to survey results from 2008, there was an 8 percent increase in drop-off arrivals (including drop offs by private

⁶⁸ Metro Magazine. (2013, March 20). *Masabi secures \$2.8M in funding*. Retrieved from <https://www.metro-magazine.com/bus/news/290128/masabi-secures-2-8m-in-funding>

⁶⁹ Fehr & Peers, & Centennial Innovation Team. (2017, June). *Go Centennial* (Rep.). Retrieved from [https://www.centennialco.gov/uploads/files/Government/Iteam/Go Centennial Final Report_for web.pdf](https://www.centennialco.gov/uploads/files/Government/Iteam/Go_Centennial_Final_Report_for_web.pdf) [page 22]



vehicles, taxis, and TNCs) and a 7 percent decrease in other transit modes used to access the stations. This varied among the stations, with range of 6 percent to 33 percent of passengers using drop offs to get to the stations. While Cincinnati has only one train station (for Amtrak), on-demand services are already changing the parking and curb space needs of the region, as evidenced by the Cincinnati Curb Study.

6.3.1.4.1 Go Centennial – Centennial, Colorado

Go Centennial was a pilot study in Centennial, Colorado, a suburb outside of Denver, where Lyft and the City of Centennial collaborated to offer fully-subsidized first/last mile connections to and from the Dry Creek light rail station, in a partial replacement of dial a ride service. The pilot ran from August 2016 to February 2017. The fully-subsidized rides were only available on Lyft Line (a trip-pooling service) to encourage higher vehicle occupancy, and there was a wheelchair accessible van available for riders. Ridership at the Dry Creek station increased by 11.6 percent over the six-month study period, which was a larger increase than the nearby stations. While park-and-ride use also increased, it was at a much lower rate than nearby stations. There was also a 95 percent decrease in passenger wait time from booking with the available Call-n-Ride service to using Lyft, and a 78 percent reduction in total cost (user fee plus subsidy).⁷⁰ The study suggested several ways to increase ridership including better app integration with the light rail schedule, increased marketing, wayfinding, and increased service hours and service area.

6.3.1.4.2 Direct Connect – Pinellas County, Florida

The Pinellas Suncoast Transit Authority (PSTA) in Pinellas County, Florida launched a successful six-month pilot called Direct Connect in February 2016 that subsidized \$3 of every qualifying on-demand trip; the pilot has since been extended and the program now subsidizes \$5 of every qualifying trip and \$25 for wheelchair transport trips. The original pilot only subsidized trips that started or ended at two local bus stations where bus routes had been removed, and has now expanded to 24 transit stops. It partners with both Uber and United Taxi, with United Taxi accepting cash payments and call ahead reservations to give riders a range of options. Wheelchair transport is also available through phone reservation. PSTA states that the original pilot provided a similar number of rides as the two eliminated bus routes it replaced but at a savings of around \$70,000 annually.⁷¹ Data was not available on the savings per ride on a per-ride swapped basis, whether new riders were the same people as former riders, or any steps were taken to make sure the original people were continuing to be served and that there was no shifting from other modes to subsidized Uber. The expanded program is still currently in service, and PSTA has started an additional program called TD Late Night to provide free late-night rides to low income workers.

⁷⁰ Fehr & Peers, & Centennial Innovation Team. (2017, June). *Go Centennial* (Rep.). Retrieved from [https://www.centennialco.gov/uploads/files/Government/Iteam/Go Centennial Final Report_for web.pdf](https://www.centennialco.gov/uploads/files/Government/Iteam/Go_Centennial_Final_Report_for_web.pdf) [page 27]

⁷¹ Peterangelo, J. (2017, March). *The Last Mile: Connecting Workers to Places of Employment*. [page 43] Retrieved: https://publicpolicyforum.org/sites/default/files/LastMile_FullReport.pdf

6.3.1.4.3 Go Dublin and GoMonrovia – Dublin and Monrovia, California

Based on their many similarities, we present the results of these two pilots in the same subsection.

Go Dublin – Livermore Amador Valley Transit Authority (LAVTA) launched Go Dublin in January 2017, which is a pilot discount program with Uber, Lyft, and DeSoto cabs for rides within Dublin. With the discount, LAVTA pays half of the fare, up to \$5, for trips that start and end in Dublin (which contains the West Dublin/Pleasanton and Dublin/Pleasanton BART rail stations) if activated using the discount code “GODUBLIN” within either the Uber, Lyft, or DeSoto apps. Trips must be taken using the pool versions of those services: UberPool, Lyft Line, or DeSoto Share. The pilot program has generally experienced underwhelming ridership. The service was launched at the same time as a route restructuring.

GoMonrovia – GoMonrovia is a partnership between the City of Monrovia and Lyft where the City provides subsidized rides, augmenting but not replacing the City's dial-a-ride program. The goals of the program were to reduce costs while maintaining connections to key destinations like Old Town Monrovia and the newly-opened Gold Line light rail station. In this program, Lyft rides cost users \$3.50 for a non-shared ride and \$1.00 for shared rides (shared rides were originally \$0.50 but fare was raised due to popularity), except for trips starting/ending at Old Town or the Gold Line Station, which are \$0.50 for shared rides. The service area includes Monrovia and portions of neighboring cities as well as rides to medical appointments at physician's offices within three miles of the City's limits. Since the project launched in March 2018, ridership has grown from 5,000 per month to 66,000 per month (in comparison to about 3,200/month riders with the dial-a-ride program prior to launch).

While the Dublin pilot has seen lackluster ridership, the Monrovia pilot has been wildly popular. According to Monrovia staff, 90 percent of rides are through Lyft Line, and 50 percent of those rides are actual shared rides. The City's subsidy per trip has been declining over time to about \$4 (the previous dial-a-ride subsidy was about \$20/trip). While the program has been successful in attracting riders and reducing the subsidy per ride, the increase in overall trips served compared to the previous dial-a-ride program has led to increased overall cost, which staff is still working to solve. Also, the City is partnering with a third party to provide wheelchair access. Due to the small size of the service area, they anticipate only needing one driver to provide wheelchair service within 15 minutes of the call. The City provided extensive signage and wayfinding in Old Town and at the LRT station to market the program. The City has received fewer parking complaints from businesses, but there are new issues with increased pick-up/drop-off instances. Also, staff noted several anecdotal examples from staff about people either not buying a new car or selling an existing car due to the ease of the program, and Council has been open to reduced parking at new developments. Overall, City staff are very happy with the partnership with Lyft, and are turning this pilot into a permanent program. City staff credit its success partly to two key factors: simplicity of the program and extensive

marketing. A third factor that clearly differentiates it from the Dublin pilot is the low fare paid by the user (\$0.50–\$3.00 compared with \$4–\$6 for Dublin).

A comparison of key attributes is provided below in **Table 4**.

Table 4: Comparison of Go Dublin and GoMonrovia Pilots

Attribute	GoDublin!	GoMonrovia
Shared option	Lyft Line, Uber Pool, DeSoto Share	Lyft Line
Solo ride option	No	Yes
Subsidy policy	50% of trip, up to \$5	Remainder of trip (average of \$4)
Cost to passenger	\$4–\$6 (typical)	50¢ shared/\$3 single
Average subsidy per trip	\$3	\$4 (dial-a-ride was \$10)
Trips per day	25	1,000 (dial-a-ride was 100)
Ride length	91% under 6 miles	93% under 4 miles
% first/last mile to rail station(s)	25%	30%

Notably for both pilot programs, even with high capacity and high frequency rail stations as hubs, first/last mile has been a low proportion of overall trips, at between 25 to 30 percent.

6.3.1.4.4 General Findings

In sum, there are indications of positive effects on transit ridership for first/last mile services to rail. TNC services appear to fill gaps and can provide more cost-effective service provision for coverage transit services. Also, the levels of public subsidy per trip for the Dublin and Monrovia pilots is lower than many transit routes in Cincinnati.

Successful programs have the following attributes:

- simple and easy to use
- robust marketing and promotion
- cost competitive (compared to transit fares and/or parking costs)

Some key issues identified are:

- often onerous to provide a transit backup for WAVs and unaccompanied youth

- some pilots provide concierge services for those without smartphone access (GoMonrovia launched this in March 2019)
- Federal Transportation Administration (FTA) funds cannot be used to pay for TNC services

6.3.1.5 Compete Against Solo Driving

The town of Summit, New Jersey is home to many people who commute to New York City daily. The town has issues with commuters being unable to find parking at its rail stations. The city has elected to directly pay Uber to fully fund rides for 100 people and offer \$2 trips for all others to mitigate the problem of congestion at the transit parking lot.⁷² It has been estimated that the deal will cost the city \$167,000 vs \$10 million to build additional parking spaces to accommodate the demand. The service life of the parking lot investment was not reported.

An exurb of Toronto called Innisfil, Ontario, launched a program in 2017 where the city subsidized Uber travel instead of initiating a bus service.⁷³ Around 8,000 trips per month were taken (86,000 rides total in 2018). The fare structure featured city subsidy of trips to community hubs resulting in a fare of \$3–\$5, and they provided a \$5 discount on trips to other parts of the city. The program is viewed as being very successful in terms of utilization to the extent that the city is unable to subsidize any higher number of ongoing trips. Thus, on April 1, the city has reduced the amount of subsidy per trip and introduced a monthly trip cap (30 trips) so that overall subsidy levels stay under control. The city's total subsidy for the program was \$150,000 in 2017, \$640,000 in 2018, and \$900,000 has been allocated for 2019. The program provides a cautionary tale about how Uber vehicles have a high marginal cost per trip, because extra vehicles are required to meet demand at a much higher price point per trip compared with public transit bus, whose price point per trip is very low in a situation where the bus is so crowded that another vehicle is required to accommodate demand. In the case of Innisfil, the city did not financially plan for a situation where the service was highly popular.

6.3.1.6 Manage Peak Demand

Some major destinations and trip generators have formed temporary partnerships with TNCs to help manage peak demand. San Diego partnered with Uber to give discounts on shared rides to people traveling

⁷² Hawkins, A. J. (2016, October 3). *New Jersey town decides to pay Uber instead of building a parking lot*. Retrieved from <https://www.theverge.com/2016/10/3/13147680/uber-new-jersey-free-ride-parking-lot-train-commute>

⁷³ Bliss, L. (2019, April 29). *'Uber Was Supposed To Be Our Public Transit'*. Citylab. Retrieved: <https://www.citylab.com/transportation/2019/04/innisfil-transit-ride-hailing-bus-public-transportation-uber/588154/>



to the All-Star Baseball game and Comic-Con International in order to reduce parking demand and congestion. A coupon code was valid for rides on UberPool to and from select transit centers.⁷⁴

6.3.1.7 Supplement Paratransit

6.3.1.7.1 ADA Requirements

The Americans with Disabilities Act (ADA) prohibits discrimination against people with disabilities and guarantees that they have equal access to employment, goods, and services. The U.S. Department of Transportation develops ADA regulations for public transit service providers, including the operators of on demand (“demand responsive”) services and contractors to public transit agencies. These rules affect how the on demand service would operate in two ways:

- It must provide equivalent service to individuals with disabilities (including wheelchair users) and other individuals. The service provided to people with disabilities must be equivalent with respect to response time, fares, coverage area and hours of service, access to reservations and information, restrictions on use, and overall capacity and availability of service.⁷⁵
- While the on demand vehicle fleet may include some non-accessible vehicles, the fleet as a whole must provide an equivalent level of service to riders who use wheelchairs as it does to other riders.⁷⁶

The general requirement for accessible service applies not only to using the service but also to booking the service. These requirements do not apply to individual contractors under the service: for example, one contractor may have only vehicles that are not wheelchair accessible, while another may have only wheelchair accessible vehicles or a mix of accessible and non-accessible vehicles. Additional guidance for on demand service operators can be found in chapter 7 of *FTA Circular 4710.1: Americans With Disabilities Act Guidance*.

6.3.1.7.2 TNCs as Paratransit

Paratransit provides door-to-door transit service for residents that qualify for subsidized ADA service. It is much more expensive to operate than traditional transit routes, with average costs ranging from \$34.06 to \$43.65 per trip.⁷⁷ Per federal law, transit agencies must provide paratransit service and same day back-up service to the paratransit service. Agencies also have the option to provide supplemental same-day service

⁷⁴ Mass Transit. (2016, July 8). *MTS Announces New Partnership with Uber*. Retrieved: <https://www.masstransitmag.com/alt-mobility/shared-mobility/car-sharing/press-release/12229791/metropolitan-transit-system-mts-mts-announces-new-partnership-with-uber>

⁷⁵ Transportation, 49 C.F.R. §37.77 (c) (2018).

⁷⁶ Transportation, 49 C.F.R. §37.77 (b) (2018).

⁷⁷ Virginia Department of Rail and Public Transportation. (2015). *Feasibility of Using Private Operators and Independent Contractors for ADA Paratransit Services*.

but this is not a federal requirement. An advantage of this optional service is that fewer ADA criteria apply: drug and alcohol testing is not mandatory if there are multiple companies contracted for the service, subsidies can be set at any amount, and providers do not have to accept trip reservations the day before the trip. While the first two types of paratransit service have strict requirements that TNCs may not be able to meet, the optional same-day service is often provided by taxis and could potentially be provided through a partnership with TNCs.

The Massachusetts Bay Transportation Authority (MBTA) currently has a partnership with Lyft and Uber where users pay the first \$2 for an accessible ride and MBTA pays up to \$13 of the remainder. In 2015, the average trip on its standard paratransit service, “The Ride”, cost MBTA \$45, while the average Uber/Lyft ride cost the agency \$9. Trip duration was also reduced to an average of 25 minutes on Uber/Lyft compared to 59 minutes on The Ride. The agency was able to provide 28 percent more rides while reducing the total cost by 6 percent.⁷⁸

The largest barrier to a TNC paratransit service is the availability of wheelchair accessible vehicles. Since most TNC providers use a driver’s personal vehicle, some accommodations might have to be made such as transit agencies purchasing accessible vehicles or incentivizing drivers to provide accessible trips as these vehicles can cost more to maintain and it takes more driver time to provide these trips. The transit agency must also ensure that accessible service is provided at the same level as non-accessible service to meet ADA and federal regulations for equitable service. This includes having accessible vehicles available, charging the same fare for accessible service as non-accessible service, and having equivalent response times for riders with disabilities.⁷⁹ Other needs would be the integration of voice-interactive applications and the ability to call in to make reservations.

6.3.1.8 Supplement Service for Seniors

According to current surveys, only four percent of those aged 65 and older have used ride hailing services.⁸⁰ A recent Pew survey states that 24 percent of over 50s have used TNCs, which has increased from 7 percent between 2015 and 2018.⁸¹ While there are some barriers to adoption, aging residents with limited ability to drive themselves could benefit from point-to-point TNC service. This can also complement paratransit

⁷⁸ Blodgett, Moira; Khani, Alireza; Negoescu, Diana; Benjaafar, Saif. (2017). *Public/Private Partnerships in Transit: Case Studies and Analysis*. Minnesota Council on Transportation Access. Retrieved <http://hdl.handle.net/11299/192846> [page 9–11]

⁷⁹ Virginia Department of Rail and Public Transportation. (2015). *Feasibility of Using Private Operators and Independent Contractors for ADA Paratransit Services*. [page 5]

⁸⁰ Regina, C. R., & Gouri, M. S. (2017). *Disruptive transportation: The adoption, utilization, and impacts of ride-hailing in the United States* (Rep. No. UCD-ITS-RR-17-07). Davis, CA: Institute of Transportation Studies, University of California, Davis. [page 14]

⁸¹ Smith, A. (2016, May 19). *The New Digital Economy: Shared, Collaborative and On Demand* (Tech.). Retrieved <https://www.pewinternet.org/2016/05/19/the-new-digital-economy/>



service, as seniors that qualify for paratransit but do not need accessible vehicles can use this program and free up space on paratransit.⁸²

The City of Gainesville, Florida ran a pilot called Freedom in Motion that partnered with Uber to provide discounted rides to all seniors in the city. Rides averaged 4.9 miles per trip and the cost to the city was an average of \$10 a ride. The customer paid according to their income, with typical fares of \$0 to \$1. The largest challenge the program faced was getting users comfortable with technology, and it required a dedicated staff member to help train users on smartphone use, the Uber mobile application, and the TNC system generally.⁸³ Rider concerns about licensing and background checks of TNC drivers also came up as an issue.

6.3.1.9 Replace Coverage Transit

While urban centers often have the population density to support frequent transit service, suburban and rural areas may find that it is not politically feasible to serve low-density areas given the high subsidies involved. TNCs can provide an alternative without needing to establish fixed route service, which in those settings is low-productivity and thus typically has a “coverage” goal. The Pinellas Suncoast Transit Authority (PSTA) was able to save around \$70,000 annually with its pilot program, which provides TNC subsidies in two areas where the agency had eliminated fixed route service.

Seattle’s King County Metro undertook an exercise to identify low-productivity bus runs that may be better served by a dynamically-routed (TNC or microtransit) solution in comparison to operating fixed route service. They concluded that around 5 percent of non-express runs or 4 percent of non-express service miles would be cheaper to the agency if provided by TNC, and that over a third of the best candidates were during the overnight period (10 PM to 6 AM), followed by a quarter in the AM period (5 AM to 9 AM).⁸⁴

6.3.1.10 Assist During Temporary System or Station Closures

A study from the Stern School of Business modeled the impact of transit system closures on TNCs usage to explore the hypothesis that TNCs are well suited to handle exogenous shocks to transit systems.⁸⁵ The study found that average shock to public transit systems resulted in an increase of over 30 percent in TNC use.

⁸² Blodgett, Moira; Khani, Alireza; Negoescu, Diana; Benjaafar, Saif. (2017). Public/Private Partnerships in Transit: Case Studies and Analysis. Minnesota Council on Transportation Access. Retrieved <http://hdl.handle.net/11299/192846> [page 18]

⁸³ Blodgett, Moira; Khani, Alireza; Negoescu, Diana; Benjaafar, Saif. (2017). Public/Private Partnerships in Transit: Case Studies and Analysis. Minnesota Council on Transportation Access. Retrieved from the University of Minnesota Digital Conservancy, <http://hdl.handle.net/11299/192846> [page 13]

⁸⁴ King County Metro. (2017). *Shared Mobility Technical Report* (Rep.). Seattle, WA: King County Metro. Retrieved <https://issuu.com/metro-transit/docs/metro-shared-mobility-technical-rep?e=2675565/55078575> [page 53]

⁸⁵ Hoffman, K. et al (2016, November 12). *Ridesharing and the Use of Public Transportation*. Association for Information Systems. Retrieved: <https://aisel.aisnet.org/icis2016/DataScience/Presentations/14/>

This finding supports their hypothesis and supports the idea that transit agencies may benefit from leveraging partnerships with TNCs during station or system closures, such as during maintenance.

6.3.2 General Lessons Shared by Agencies

In this section we present a summary of lessons learned from recent transit/TNC partnerships as shared directly by government agency employees.

To transfer knowledge and best practices from other regions, in mid-2018 we interviewed three public agency staff who oversaw public/private partnerships innovations in the mobility space. They are David Block-Schachter, who at the time was Chief Technology Officer (CTO) at Massachusetts Bay Transportation Authority (MBTA) and is former CTO at Bridj, Jean-Paul Velez, Innovative Mobility Program Manager at King County Metro (KCM), and Evan Corey of the City of Seattle, New Mobility Manager at the Seattle Department of Transportation (SDOT). Key takeaways are presented below:

- **Recommendations for public agencies:**
 - SDOT: A failure that is seen over again is entering into an agreement with a private sector provider with no real end goal where parties cannot communicate the true intent of the partnership. Cincinnati's agencies should define key set of outcomes and principles for engaging with private partners, so that performance metrics and data asks can be set up to measure against the outcomes. Agencies need to create a true end goal.
 - SDOT: It is critical for agencies to define a key set of outcomes and principles for engaging with private partners, then to collect data to measure against outcomes. The private sector is excellent at helping agencies get smarter about data analysis.
 - KCM: Scoping and contracting takes more time than often imagined. Bureaucratic institutional inertia occasionally affects contracting.
- **Recommendations for private providers:**
 - MBTA: Many transit agency concerns, such as equity, are different to private sector concerns, they're demanding, and they need to be incorporated in order to be a good partner.
 - MBTA: Agencies have a hard time doing something that might go away after 6 months (e.g., a pilot). The Uber/Lyft pilot was 12 months, extended for another year. Therefore, a long-term plan and vision is recommended.



- **Data sharing:**

- SDOT: Private providers should help public agencies to evaluate programs, as they often have a stronger capability and availability to do so. Private partners that can continually demonstrate value of the partnership to agencies are those that are more successful in the long run. For data sharing, setting up clear contractual data agreements are essential.
- SDOT: Private partners would benefit from loosening their grip on data, as more sharing with agencies leads to better outcomes.
- KCM: Selection decisions for pilots have hinged on the willingness of the private provider to supply raw data on trip characteristics. Availability of WAVs and call center option for ride requests have also been important factors.
- KCM: Important data categories for public agencies to access are origin-destination trip patterns, the range of user profile characteristics, the availability of transit service as a viable alternative for trips, and costs to provide service.

Supplement C –

What Are We
Seeing Specifically
in Cincinnati?



7.1 Current Auto, Transit, and TNC Services in Cincinnati

In this subsection, key information about the presence of different modes of travel in Cincinnati are presented in turn: auto, carpool, transit, paratransit, taxis, and then TNC (Uber & Lyft).

7.1.1 Auto

Cincinnati residents typically use a private automobile for everyday trips. Most households have vehicle access with about 79 percent of households owning at least one vehicle; approximately 1.3 vehicles are owned per household and per person over the age of 16 in the city.⁸⁶

The region is well-served by freeways. A circular highway, I-275, surrounds the Cincinnati metropolitan area and interstate freeways pass through the city of Cincinnati. The freeways within the city largely extend in a radial fashion from the southern downtown core. The two most congested bottlenecks in the system are the I-71 and I-75 interchange half a mile west of downtown, and the I-75 and I-74 interchange located along Mill Creek four miles northwest of downtown.⁸⁷ There are no existing road pricing systems or toll lanes to address congestion.

Arterials in Cincinnati are generally broad boulevards with four lanes and widely spaced-intersections that allow for high automobile speeds. These arterials are particularly prevalent west of Mill Creek where there is no freeway access and the roadway network is more dispersed to accommodate open space and recreational areas. Most major intersections throughout the city have marked crosswalks for pedestrians, but few have high-visibility continental crosswalk striping. Sidewalks can be found along most arterials, though high speeds and distant crosswalk spacing reduce pedestrian accessibility. In contrast, the downtown network consists of one-way streets between 2- and 4-lanes in a grid pattern lined by wide sidewalks and frequent intersections with crosswalks.

General collectors in Cincinnati are typically 2-lane roads that branch from larger arterials. They can be found throughout the city connecting arterials to neighborhood streets. Neighborhood roadways consist of tighter grid patterns close to downtown and transition to a curvilinear loop pattern further out as areas become more suburban. Paved sidewalks of varying condition are generally present on both collector and neighborhood streets.

⁸⁶ U.S. Census American Community Survey 5-Year, 2017. Retrieved from <https://factfinder.census.gov>

⁸⁷ American Transportation Research Institute. "2017 Top 100 Truck Bottleneck List." Retrieved from <https://atri-online.org/2017/01/17/2017-top-100-truck-bottleneck-list/>

Residents and visitors have many parking options downtown with over 30,000 parking spaces. Off-street parking options include numerous garages and lots, including the Central Riverfront Garage, Queen City Square Garage, Fourth & Main Garage, and the 3rd and Central Lot. Typical daily rates for garages are about \$12 per day. On-street parking meter rates vary by location, with higher rates at downtown meters and lower rates in neighborhood locations. Gas prices in Cincinnati and nearby major cities have generally stayed consistent with national highs and lows over the past five years.

7.1.2 Carpool

Carrying more than 21,000 commuters a day plus many additional thousands of non-commute riders, fixed route transit is one element of a suite of mobility services in the Cincinnati region offering alternatives to the automobile. Private automobile trip reduction services offered by employers and agencies include OKI's RideShare which facilitates carpool and vanpool formation, and the region's employer Trip Reduction Program (TRP). OKI reports that 8 percent of workers commute in carpools.⁸⁸

7.1.3 Transit

There are two main transit agencies in the Cincinnati Metro Area: SORTA and TANK. SORTA operates 46 fixed route Metro bus lines, and a demand-responsive paratransit service called Access. Metro operates north of the Ohio River, within the City of Cincinnati and its Ohio suburbs. Twenty-five of the routes are local and 21 are express that operate only during commute periods. The bus network is almost entirely radial, focused around downtown Cincinnati. The high frequency lines (seven of which operate at 15-minute headways or better) all converge to downtown. The three Crosstown routes operate at 60-minute frequencies.

TANK operates mainly south of the river in the Northern Kentucky suburbs of Cincinnati. TANK operates 26 fixed route bus lines, and a demand-responsive paratransit service called Regional Area Mobility Program (RAMP). Many of the bus routes cross the river and stop in Downtown Cincinnati. TANK's routes include 10 local, 15 express, and the Southbank Shuttle that connects areas along the south bank with downtown Cincinnati.

In addition, the City of Cincinnati owns the Cincinnati Bell Connector downtown streetcar, which is operated under contract by Transdev. The streetcar operates on a 3.6-mile loop with 18 stations, including downtown, the stadium area, and the mixed use Over-the-Rhine district.

⁸⁸ Retrieved from *OKI Regional Plan 2040*: <https://2040.oki.org/other-travel-modes/>

All transit routes are shown below in **Figure 30**, a frequency map of Metro routes is shown in **Figure 31**, and a map of crosstown Metro routes is shown in **Figure 32**.

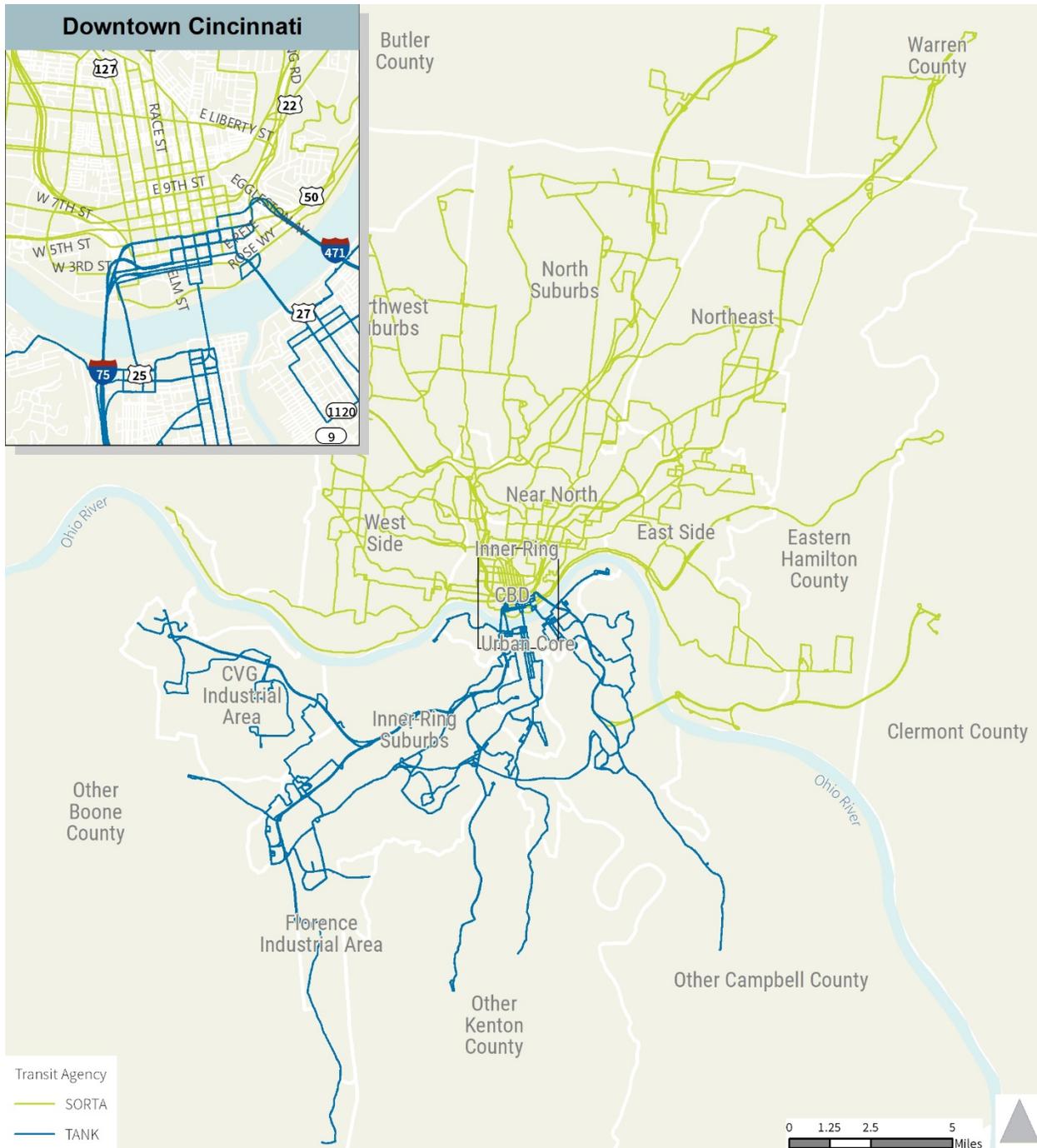


Figure 30 - Transit Routes in the Cincinnati Region
 Source: Data provided by Metro and TANK, mapped by Fehr & Peers.

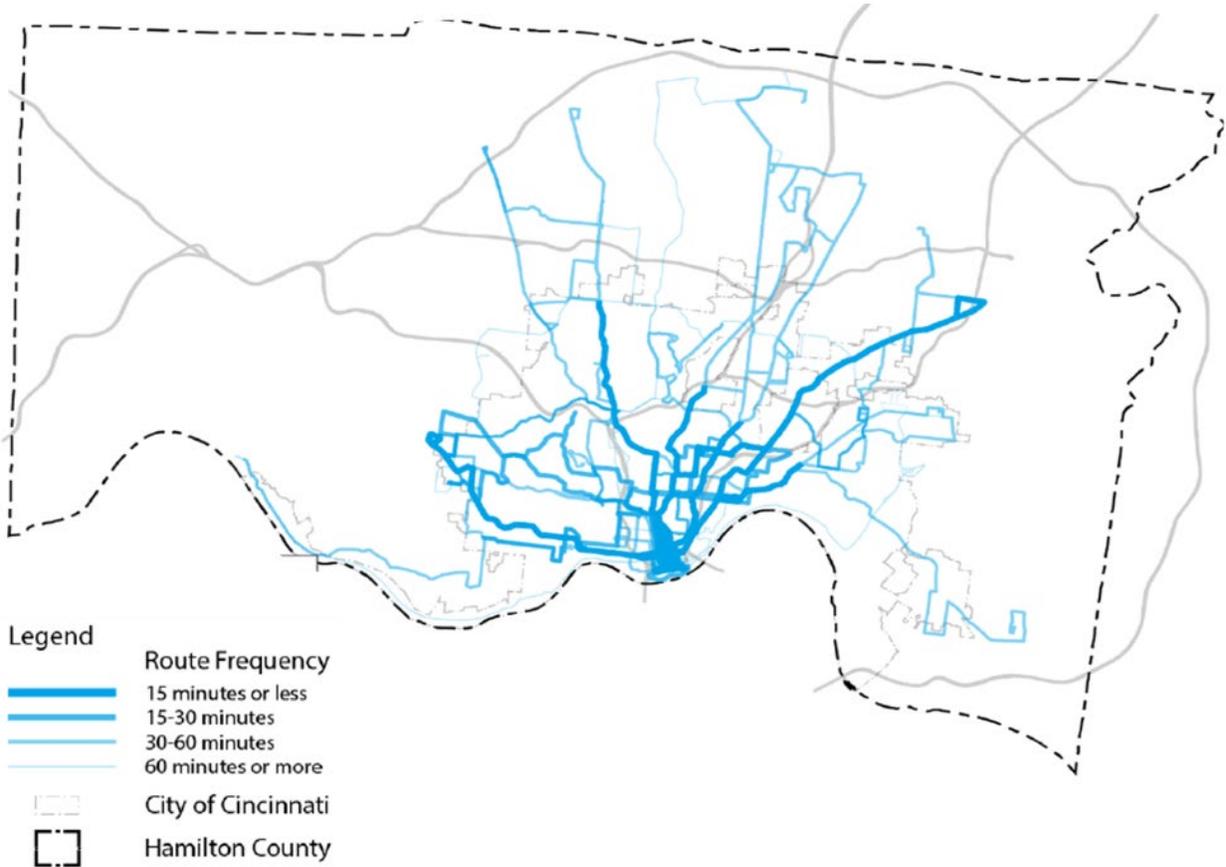


Figure 31 - Frequency Map of Metro Local Routes

Source: *Reinventing Metro Presentation – Current Service*

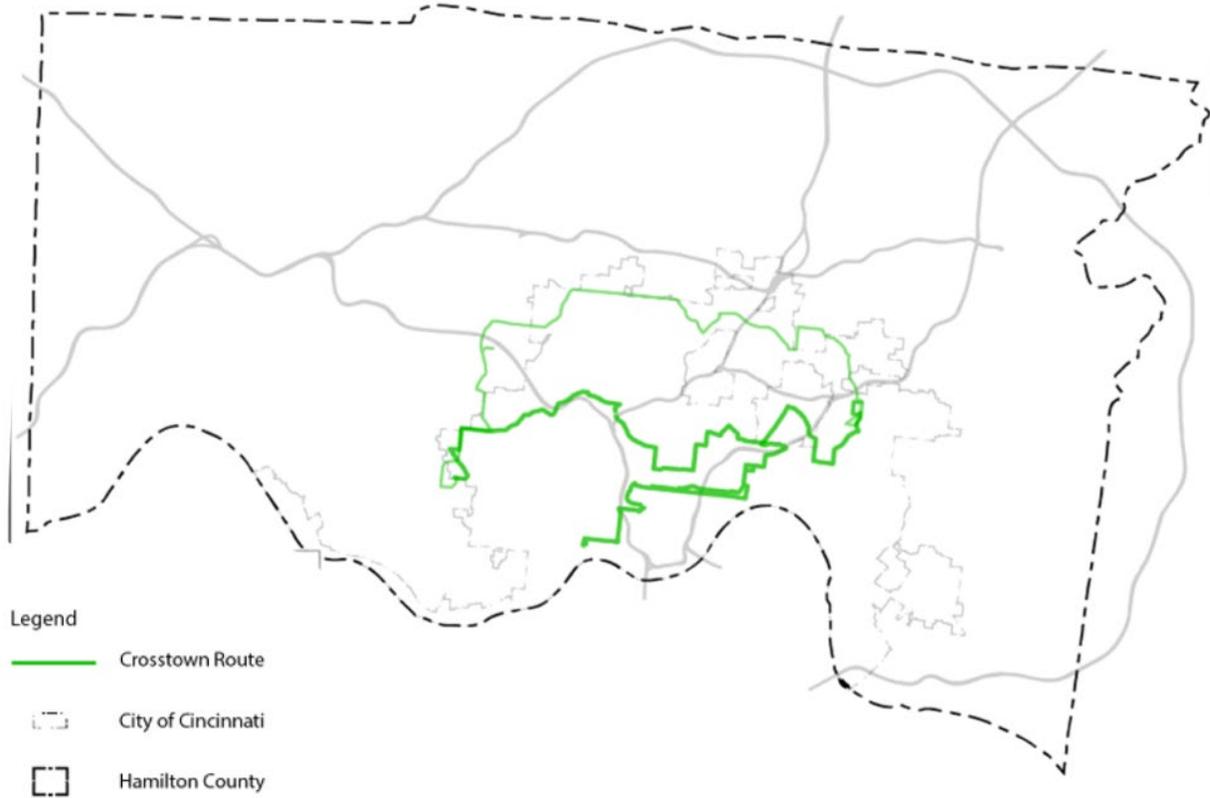


Figure 32 - Frequency Map of Metro Crosstown Routes Only

Source: *Reinventing Metro Presentation – Current Service*

7.1.4 Paratransit

With the passing of the Americans with Disabilities Act of 1990 (ADA), transit agencies are required to provide equivalent transit service to all, independent of abilities.

In response, Metro offers a paratransit service for those that cannot take passenger bus transit. The service is a small shared-ride bus service providing origin to destination service. The service area and hours of operation are equivalent to the regular Metro service, limited to areas within three quarters of a mile of regular, non-express, service. Across Boone, Campbell, Hamilton, and Kenton counties, around 64 percent of people live within three quarters of a mile of fixed route non-express service (as shown in **Table 5**).

Table 5: Proportion of People within 3/4 mile of Fixed Route Service

County	Population within 3/4 mile	Total Population	% Population within 3/4 mile
Boone County	24,780	127,709	19%
Campbell County	61,537	92,067	67%
Hamilton County	582,798	807,684	72%
Kenton County	92,264	165,008	56%
Grand Total	761,380	1,192,468	64%

In order to apply to the service, one must fill out paperwork and schedule an in-person transportation assessment at the Metro Fare Deal Offices in Silverton, Ohio. It can take up to three weeks to register and be approved for the service. The cost of the service is \$3.50 within Zone 1 and \$4.50 in Zone 2.⁸⁹ Total annual ridership has increased steadily from 198,000 in 2014 to 231,000 in 2018. Subsidy per passenger trip is about \$35.⁹⁰

TANK has developed The Regional Area Mobility Program (RAMP), a door-to-door paratransit service. Like the Metro paratransit service, it serves areas within three quarters of a mile of fixed TANK routes. Those needing service outside these boundaries can call ahead to schedule a pick-up or drop-off. To apply for the RAMP service, one must fill out an application and submit it to TANK’s Special Service Office. If there are questions about eligibility, an in-person evaluation will be coordinated at no cost to the applicant.⁹¹

7.1.5 Taxis

Per conversations with the local stakeholder team, Cincinnati does not have a robust taxi presence citywide, and service is largely concentrated at the airport and event centers. Taxi travel is niche and is permitted at the city level.

7.1.6 Uber & Lyft

Uber is ubiquitous throughout the Cincinnati metro area, with no geographic or temporal boundaries around where the drivers are allowed to operate. Service availability is, however, dependent upon driver participation. Uber offers four passenger car service types in the Cincinnati metro area: UberX, UberXL, Uber

⁸⁹ Go Metro. (n.d.). Access Program. Retrieved from <http://www.go-metro.com/accessibility/access-program>

⁹⁰ Email from Waleed Ismael, Service Planner at Metro, dated 7/30/2019

⁹¹ TANK. (2012, July). RAMP. Retrieved from <http://www.tankbus.org/Portals/tankbus/Documents/RAMP2012Web.pdf>



Select, Uber Black. The remaining service types, UberPool, Uber Express Pool, Uber Assist, and Uber WAV, are not currently offered. The service types are defined as follows:

- **Available in Cincinnati**
 - **UberX** is the entry-level cost option, with vehicles that seat four passengers such as regular sedans.
 - **UberXL** is the entry-level cost option, but with larger vehicles that seat six passengers, such as minivans and some SUVs. UberXL costs more than UberX.
 - **Uber Select** is a mid-priced option, with high-end vehicles that seat up to four passengers.
 - **UberBlack** is the luxury option, with insured livery vehicles that are commercially registered, typically a black SUV or luxury sedan. This is the most expensive Uber service.
- **Not Available in Cincinnati**
 - **UberPool** is an offering where the ride may be shared with one or more other Uber users, selected by an Uber algorithm, who are heading in a similar direction.
 - **Uber Express Pool** is similar to Pool but there may be a walk to the pick-up spot and from the drop-off point to the final destination.
 - **Uber Assist** is an option with drivers who are specifically trained to assist riders with vehicles and can accommodate folding wheelchairs, walkers, and scooters.
 - **Uber WAV** is an option that has drivers who are certified by a third party in driving and assisting people with disabilities. Vehicles can accommodate wheelchairs or motorized scooters. It is currently testing in a small number of cities.

Lyft is the only other TNC service currently operating in Cincinnati. While no local information exists about split of service, Uber claims to have over 65 percent of the bookings in the U.S. and Canada; it is likely that Lyft has a majority of the remainder.⁹²

7.2 Automobile Congestion

Congestion occurs when a facility is operating at or above capacity and leads to wasted time, increased pollution, and increased collisions. While descriptions generally lead with the negative, congestion is symptomatic of a healthy, thriving economy and/or people coming together for constructive purposes.

⁹² Uber (2019). *Form S-1 (Registration Statement Under The Securities Act Of 1933.)* Page 3. Retrieved: https://www.sec.gov/Archives/edgar/data/1543151/000119312519103850/d647752ds1.htm#toc647752_4

Congestion in Cincinnati—like other cities of its size—does not have a major effect on travel patterns as people travel freely throughout most of the day. As with most cities of a similar scale, congestion is mostly limited to the AM and PM commute periods on weekdays and typically recurs on parts of the network that serve as bottlenecks. The remainder of the time at these locations, and on the remainder of the network, traffic largely operates at free-flow speeds and resultingly the automobile is typically the fastest way to get between two different points in the region.

To analyze current and future traffic conditions, OKI developed a Congestion Management Process (CMP) report in 2015, studying delays along corridors and projecting future congestion in the region. In the CMP, OKI identifies 22 discrete corridors and 18 “Regionally-Significant Intersections” for analysis. Of the intersections, seven operate with a Level of Service (LOS) of D or lower in the morning peak and 14 in the PM peak period;⁹³ off-peak conditions are not presented. Several sections of I-75 experience high levels of congestion and delay during peak commute hours.

Under a business-as-usual scenario, congestion in the region is only expected to worsen. In 2015, more than 80 percent of the 323 million tons of freight in the region was moved by truck.⁹⁴ With total freight forecasted to increase by 56 percent by 2040,⁹⁵ OKI’s freeways are likely to become more congested. Impacts will be particularly extreme at critical links between the National Freight Network and the freeway system.

To further track regional congestion impacts, OKI has monitored travel times between six major destinations including the CVG airport, downtown Cincinnati, Kings Island, and others. Comparing data from 2011 to 2015, 24 of the 30 routes experienced a longer travel time in the latter year. Travel times were on average 10 minutes longer, or 41 percent higher, in 2015.⁹⁶

7.3 Trends in Transit Ridership

SORTA and TANK provided ridership data for each of the past five years, 2014-2018, absent TANK data for 2017 (due to a major service realignment that year). The general ridership trend for both agencies over this period is downward.

⁹³ OKI (2015). *OKI Congestion management Process: 2015 Findings and Analysis Report*. Retrieved: <https://www.oki.org/wp-content/uploads/2015/03/CMP-2015-Findings-Analysis-Report.pdf>

⁹⁴ *Ibid.*

⁹⁵ *Ibid.*

⁹⁶ *Ibid.*

7.3.1 SORTA

The weekday service hours provided by SORTA has remained nearly constant, decreasing only 1.3 percent over the past five years. Weekday ridership has substantially declined along with productivity, by 18.7 and 17.7 percent, respectively, as shown in **Figure 33**.

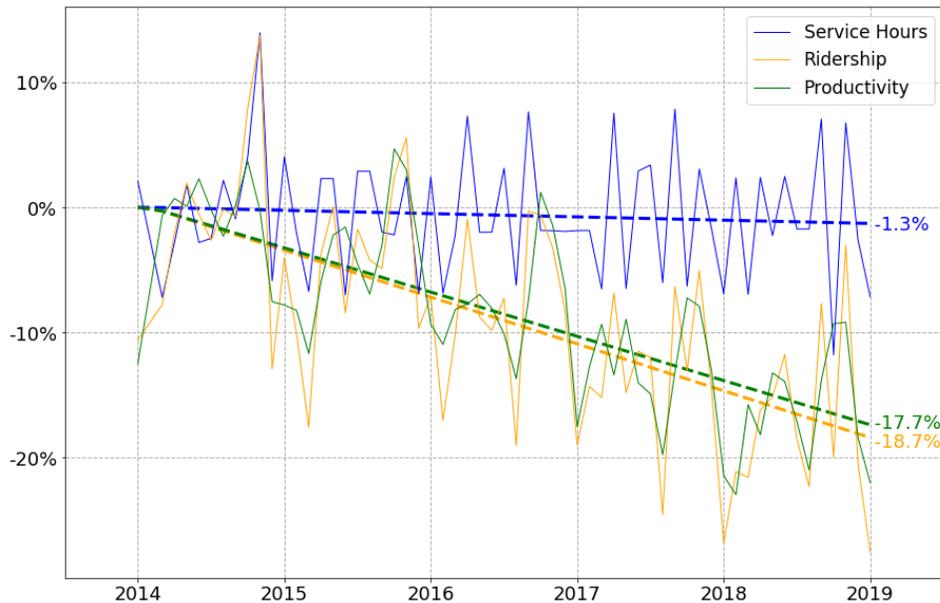


Figure 33 - Weekday SORTA Ridership, Service Hours, and Productivity (2014-2018)

The declines are more pronounced on weekends, as shown below in **Figure 34**. Again, service hours have generally been kept steady, but a decrease of 22.7 percent in ridership has led to a decrease of 22.8 percent in productivity.

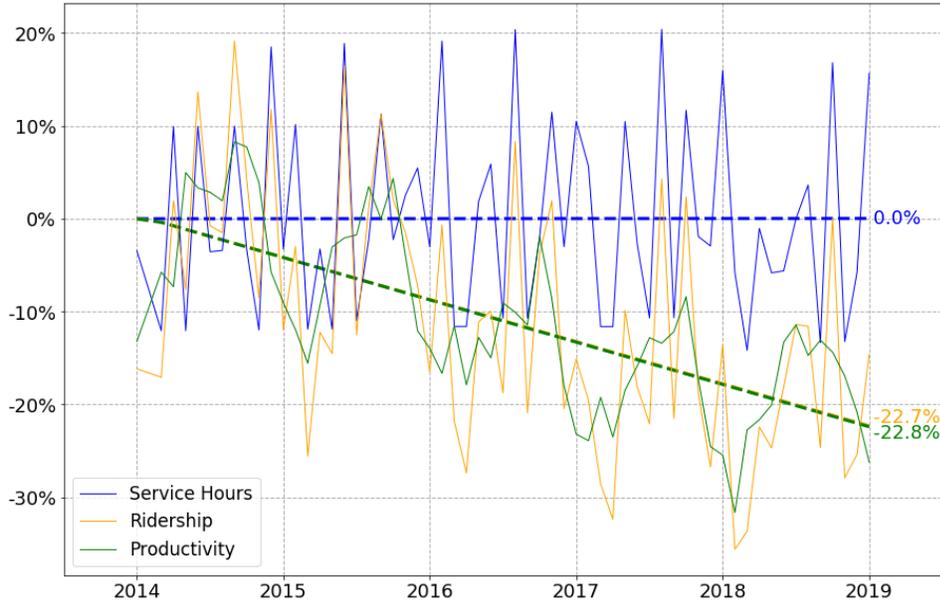


Figure 34 - Weekend SORTA Ridership, Service Hours, and Productivity (2014-2018)

Local routes have seen similar declines to express routes, although the latter has experienced a stronger decline in service hours provided. Service levels for local routes have stayed constant, and an 18.3 percent decline in ridership has led to an 18.0 percent decline in productivity (see **Figure 35**). Service levels for express routes have declined by 10.0 percent, and a 23.9 percent decline in ridership has led to a 20.8 percent decline in productivity (see **Figure 36**).

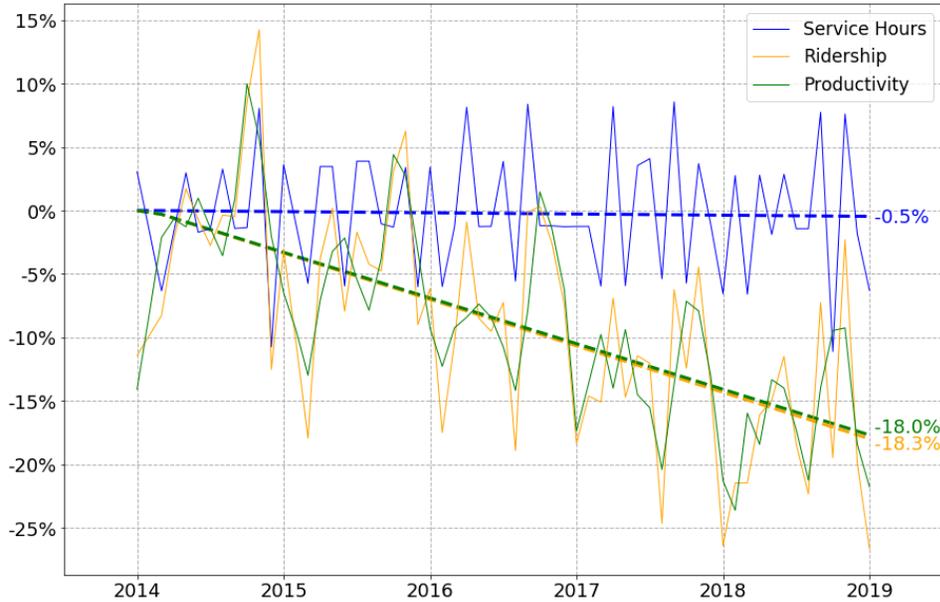


Figure 35 - Weekday SORTA Ridership, Service Hours, and Productivity for Local Service (2014-2018)

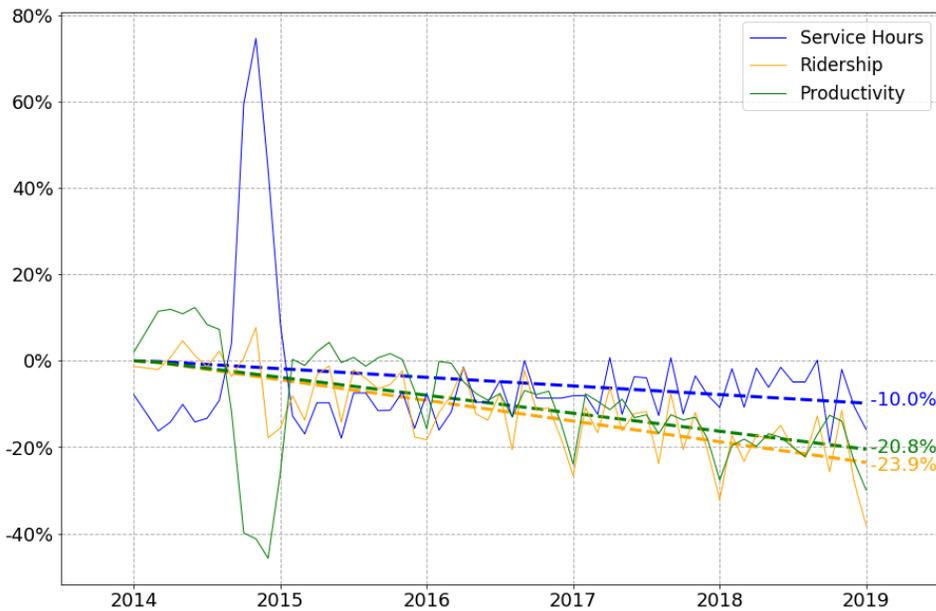


Figure 36 - Weekday SORTA Ridership, Service Hours, and Productivity for Express Service (2014-2018)

SORTA ridership has steadily decreased for nearly 90 percent of its routes, with only five bus routes exhibiting constant or modestly increasing ridership over the 2014-2018 period. The five largest declines in percentage terms over this period are for routes 1, 50, 72, 52, and 28, where the declines are between 41 and 68 percent. The five routes with the largest absolute declines are, in descending order, the 17, 4, 43, 11, and 78 routes, with declines ranging from 9,000 to 25,000. The respective declines are presented below in **Table 6**. Of these routes, all but route 78 are also among the five most heavily used in terms of ridership. Each of these five routes terminates in Downtown Cincinnati; they are each radial in nature, and each originates either north or east of downtown. The percent decreases in ridership on these major routes range from 18 to 29 percent over the five-year period, as shown in **Figure 37**.

Table 6: SORTA Routes with Greatest Percentage Decrease and Greatest Ridership Change (2014-2018)

Lines with Greatest Percentage Decrease			Lines with Greatest Ridership Change		
Route	Percent Decrease Over 5 Years	Monthly Ridership Change Over 5 Years	Route	Monthly Ridership Change Over 5 Years	Percent Decrease Over 5 Years
1	-68%	-5,120	17	-24,830	-25%
50	-59%	-3,410	4	-22,190	-29%
72	-52%	-1,250	43	-21,500	-18%
52	-43%	-1,680	11	-15,190	-26%



Figure 37 - Ridership for the Five SORTA Routes with the Greatest Ridership Change (2014-2018)

7.3.1.1 Route 90 – a Modest Increase

Bus route 90 has shown modest increases in ridership over the same period, attracting monthly riders at a faster rate than any other bus route. Route 90 is the only *Metro*Plus* bus line which is “geared toward providing limited stop service on [a] major important corridor with specifically ‘branded’ vehicles;” stops are limited to 2-3 per mile.⁹⁷ Route 90 operates only during the weekdays and exhibits slightly increasing service hours since 2015, as shown in **Figure 38**. Launched in August 2013, *Metro*Plus* experienced substantial increases in ridership until 2015, where it has trended slightly upward since; ridership remains approximately 140 percent above 2014 levels. Route 90 has the 11th highest average ridership across all SORTA routes.

⁹⁷SORTA (2016). SORTA Service Evaluation, Development, and Management Study Final Report. Retrieved: <https://reinventingmetro.com/uploads/pdfs/Aecom%20Final%20Report%20With%20Executive%20Summary.pdf>

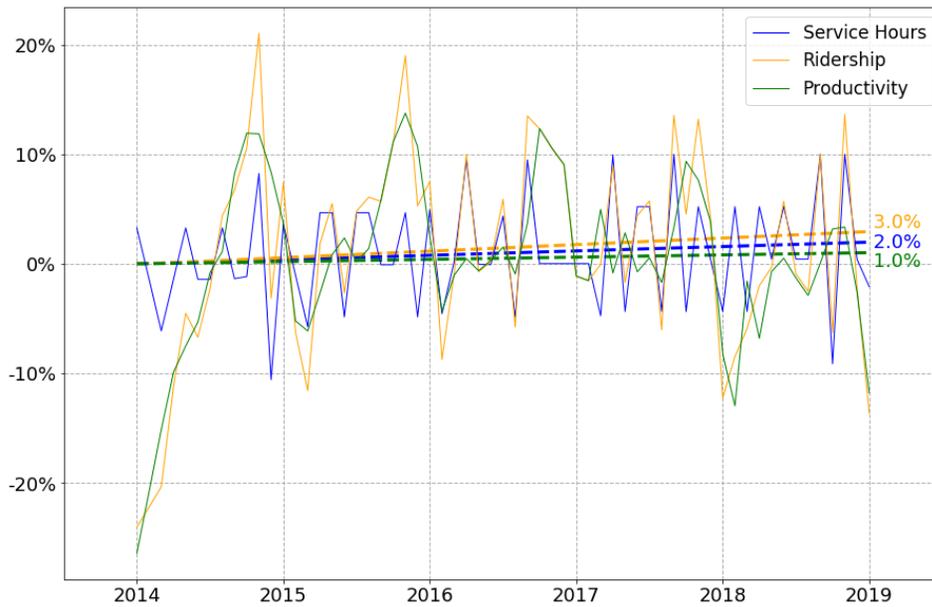


Figure 38 - SORTA Route 90 Metro*Plus Ridership, Service Hours, and Productivity (2014-2019)

7.3.2 TANK

TANK rolled out a major service adjustment in August 2017 that consolidated portions of routes 11 and 16, and eliminated routes 19X and 20. As a result, 2017 data is not included below. While overall service level remained relatively constant for SORTA, TANK increased overall service hours by 4.6 percent between 2014 and 2019, as shown in **Figure 39**. After a fluctuation in ridership in 2014 and 2015, overall ridership dropped substantially from 2016 to 2019. Ridership decreased 19.4 percent and productivity dropped by 23 percent over the five-year period.

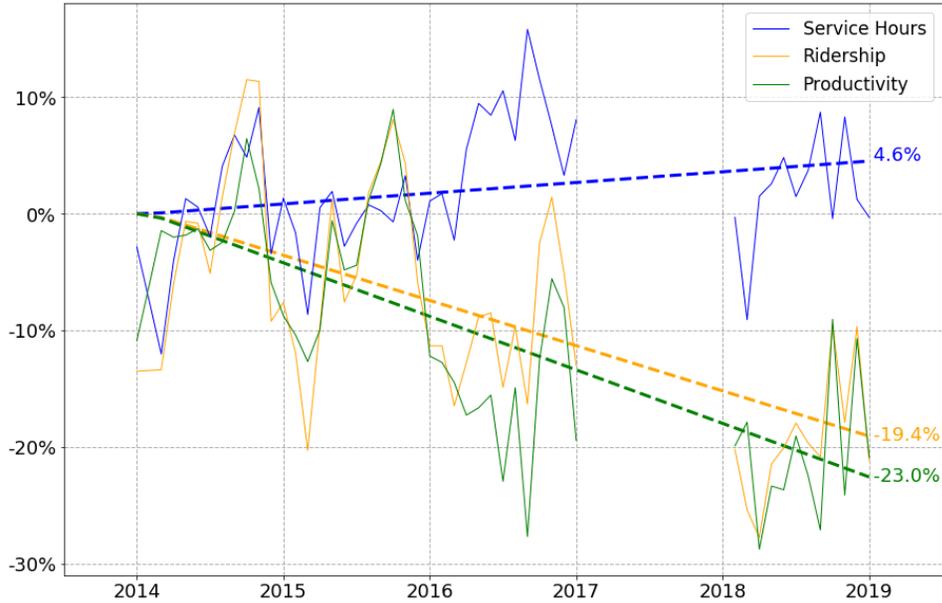


Figure 39 - TANK Ridership, Service Hours, and Productivity (2014-2018)

The sharpest decrease in productivity has occurred on the express routes, where service levels have increased by over 33 percent but have been accompanied by ridership declines of 11.8 percent. Local routes have suffered a 23 percent drop in ridership accompanying a 6.6 percent drop in service hours. These trends are shown below in **Figure 40** and **Figure 41**.

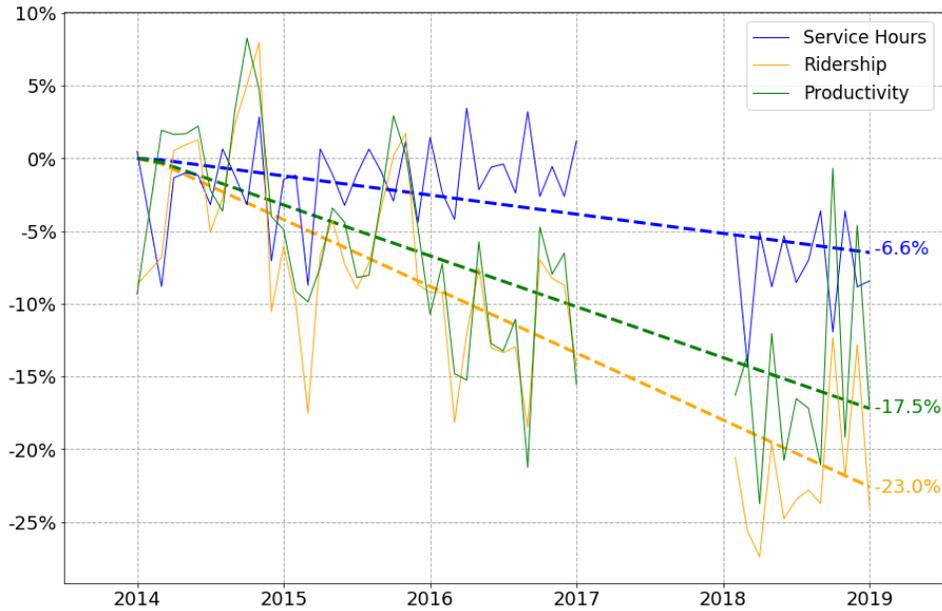


Figure 40 - TANK Local Ridership, Service Hours, and Productivity (2014-2018)

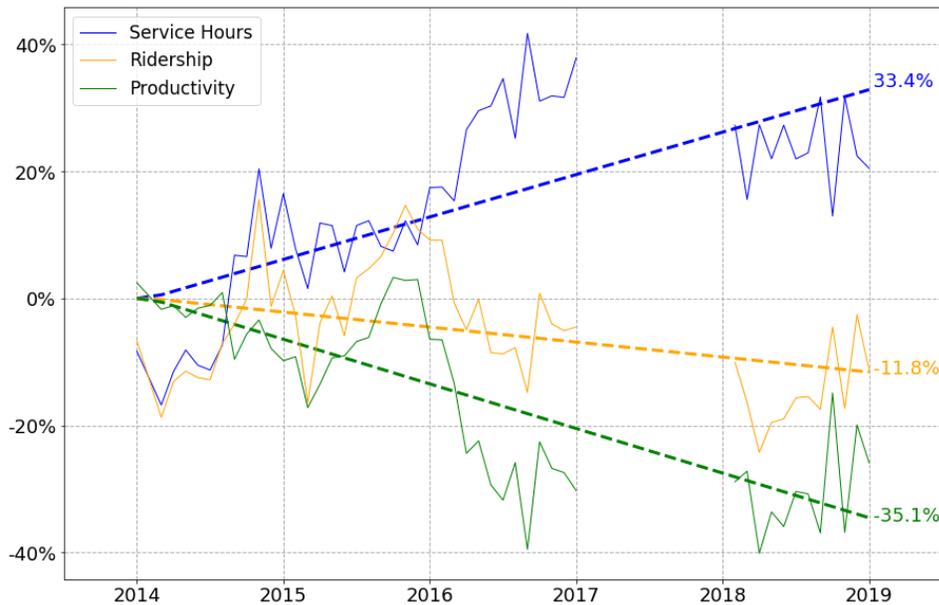


Figure 41 - TANK Express Ridership, Service Hours, and Productivity (2014-2018)

7.4 Transit and Auto Speeds

7.4.1 Bus Speed

In this section we present speed statistics for bus transit and private vehicle, sourced from the *Swiftly* and *Uber Movement* platforms, respectively.

We have used the *Swiftly* platform to assess SORTA bus speeds (TANK data is not currently available within the platform). *Swiftly* is a software that harvests, analyzes, and visualizes automatic vehicle location (AVL) data to provide summary statistics and maps that show transit system performance, service reliability, and real-time passenger information. A summary of transit speed phenomena are as follows:

- Bus speeds in downtown Cincinnati are generally <10 MPH almost across the board
- Bus speeds outside of downtown typically average >15 MPH for over three-quarters of the distance of each route
- Each route typically has a few to several “pinch points” outside of downtown where average speeds slow to below 15 MPH

SORTA systemwide average speed is 13 MPH, which is the same as that for nearby peer cities Columbus (COTA) and Louisville (TARC). For comparison, Houston Metro is 15 MPH, Seattle King County Metro is 13 MPH, while San Francisco Muni averages 7 MPH.⁹⁸

In **Figure 42** we present a couple of pertinent examples. SORTA route 4 (Kenwood – Blue Ash) is the route with the highest ridership decline from 2014-2018 at 29 percent. This route connects Downtown (at its southern end) to the neighborhood of Blue Ash, about 12 miles to the northeast. Most of the route operates at an average speed above 15 MPH, but there are a few noticeable hotspots where average speeds slow to below nine miles per hour, and in three cases to below six miles per hour.

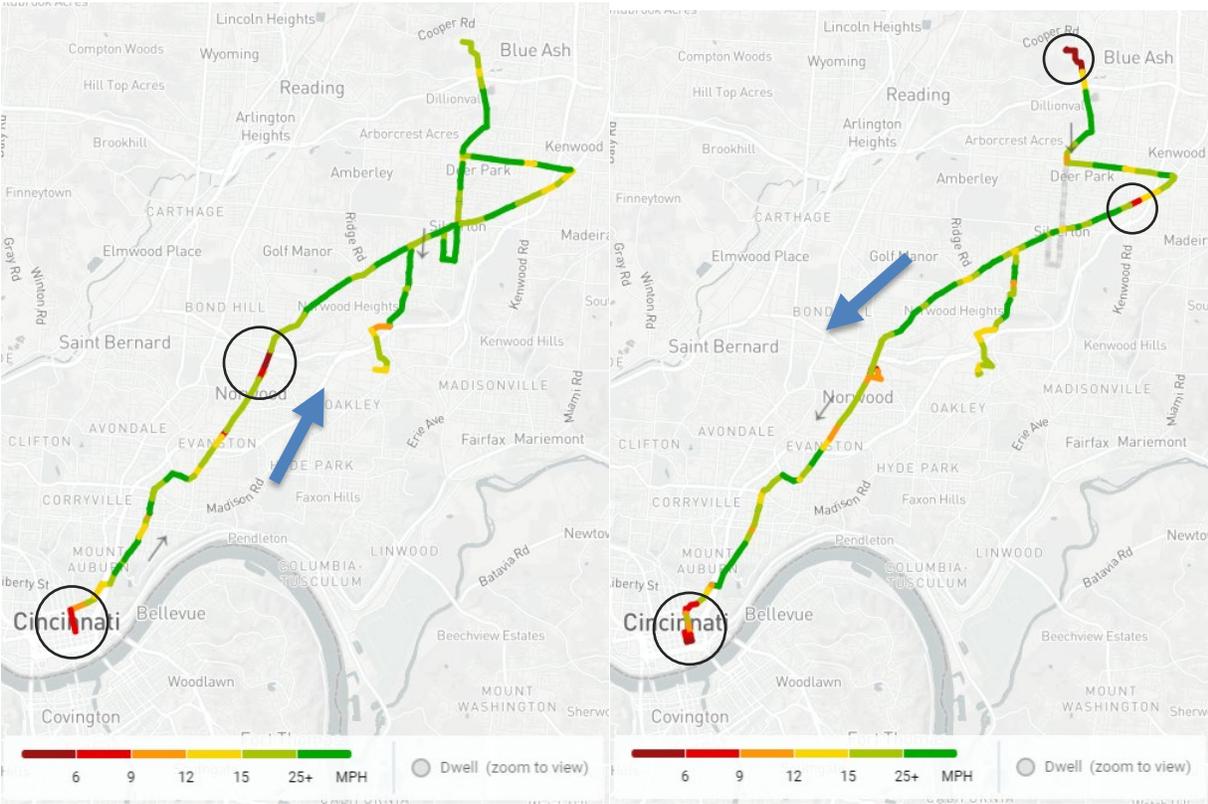


Figure 42 - Average Speeds for SORTA Route 4 on Weekdays from 4 PM to 6 PM for February through April 2019, Outbound on Left, Inbound on Right, with Hotspots Circled

Source: *Swiftly*

Next we zoom in to a particularly bad pinch point: the outbound segment at Norwood, where speeds average 5.7 MPH for a quarter mile in the northbound direction (see **Figure 43**). According to the *Swiftly* data this slowdown is not explained by the dwell at the stop at the northern end of the segment. Instead, it

⁹⁸ FTA. (2017). *National Transit Database*

is likely due to the bus sharing a regular lane with heavy traffic that may be backed up from the intersection with Joseph E Sanker Boulevard.

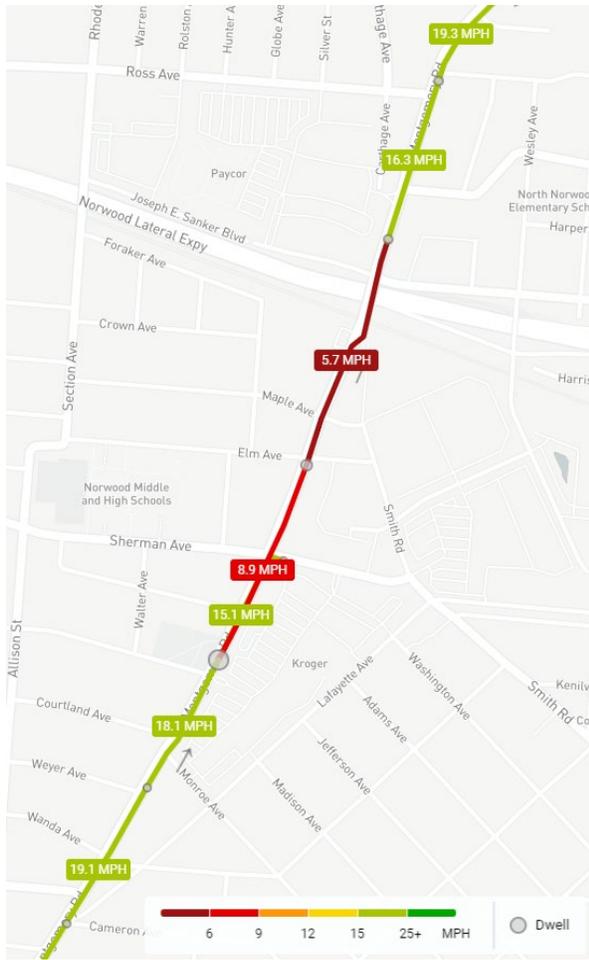


Figure 43 - Zoom in to Speed Hotspot for SORTA Route 4

Each of the five SORTA routes with the largest ridership decline are radial in nature and terminate in downtown Cincinnati. Defining downtown as the area north of the river, south of Central Parkway, east of Central Avenue, and west of Eggleston Avenue, average bus speeds across these routes are 9.3 MPH in the inbound direction and 8.4 MPH in the outbound direction, between 4 and 6 PM on weekdays (between February and April 2019). Speeds are generally slower (closer to 6 MPH) closer to the Government Center hub, and quicker (closer to 12 MPH) toward the edge of downtown. A breakout by route is shown below in **Table 7**.

Table 7: Average speeds within Downtown for the five SORTA routes with largest ridership decline, for Weekdays between 4 and 6 PM

Route	Inbound average speed (MPH)	Outbound average speed (MPH)
4	10.3	8.3
11	11.2	8.4
17	8.2	9.3
43	8.0	8.4
78	8.9	7.6
Average	9.3	8.4

Source: Swiftly. Date range: February-April 2019

The City striped their first bus only lane on the furthest right lane along Main Street in Downtown Cincinnati between 5th Street and Central Parkway, installed in November 2018. It is enforced between 7-9 AM and 4-6 PM on weekdays. According to Metro, around 635 buses travel the corridor each day with 90 percent using the far-right lane to pick up and drop off passengers.⁹⁹ However, Swiftly data is only available as of January 2019, such that we are unable to determine the speed effects of the lane. There are 10 routes for which Swiftly has data that operate along the full length of the lane.¹⁰⁰

7.4.2 Bus On Time Performance

On Time Performance (OTP) is a metric that summarizes schedule adherence, which is a measure of service reliability. Riders typically consult a schedule for routes where the headway is greater than 12 minutes, which is the case for most routes in Cincinnati, and so on-time performance is particularly important to minimize the time that riders spend waiting. We again used Swiftly to explore OTP for SORTA routes, defining on time as being within 1 minute early and 4 minutes late compared with schedule. For the five routes with the highest ridership decline (4, 11, 17, 43, 89), and looking at March 2019, average on-time performance was 65 percent, with 21 percent early and 14 percent late. Any OTP less than 75 percent is classified by the Transit Capacity and Quality of Service Manual (TCQSM) as Level of Service “F”, which is characterized as “the number of late trips is very noticeable to passengers”.¹⁰¹ There is a lot of room for improvement of on-time performance for these routes, which would improve the rider experience and likely reverse ridership loss.

⁹⁹ Retrieved from WCPO Cincinnati, *Cincinnati Metro Bus-only Lane Launches along Downtown’s Main Street Corridor*. <https://www.wcpo.com/news/transportation-development/cincinnati-metro-bus-only-lane-launches-along-downtown-s-main-street-corridor>

¹⁰⁰ These are routes 2X, 3X, 4, 16, 17, 19, 24, 43, 71X, and 77X.

¹⁰¹ Page 3-47, <http://onlinepubs.trb.org/onlinepubs/tcrp/docs/tcrp100/Part3.pdf>



A map of OTP at each stop for all routes is shown below in **Figure 44**. For the five routes highlighted here, corridors where OTP is particularly poor include the Reading Road corridor (Route 43), Clifton Avenue corridor (Route 17) and the Gilbert Avenue corridor (routes 4 and 11).

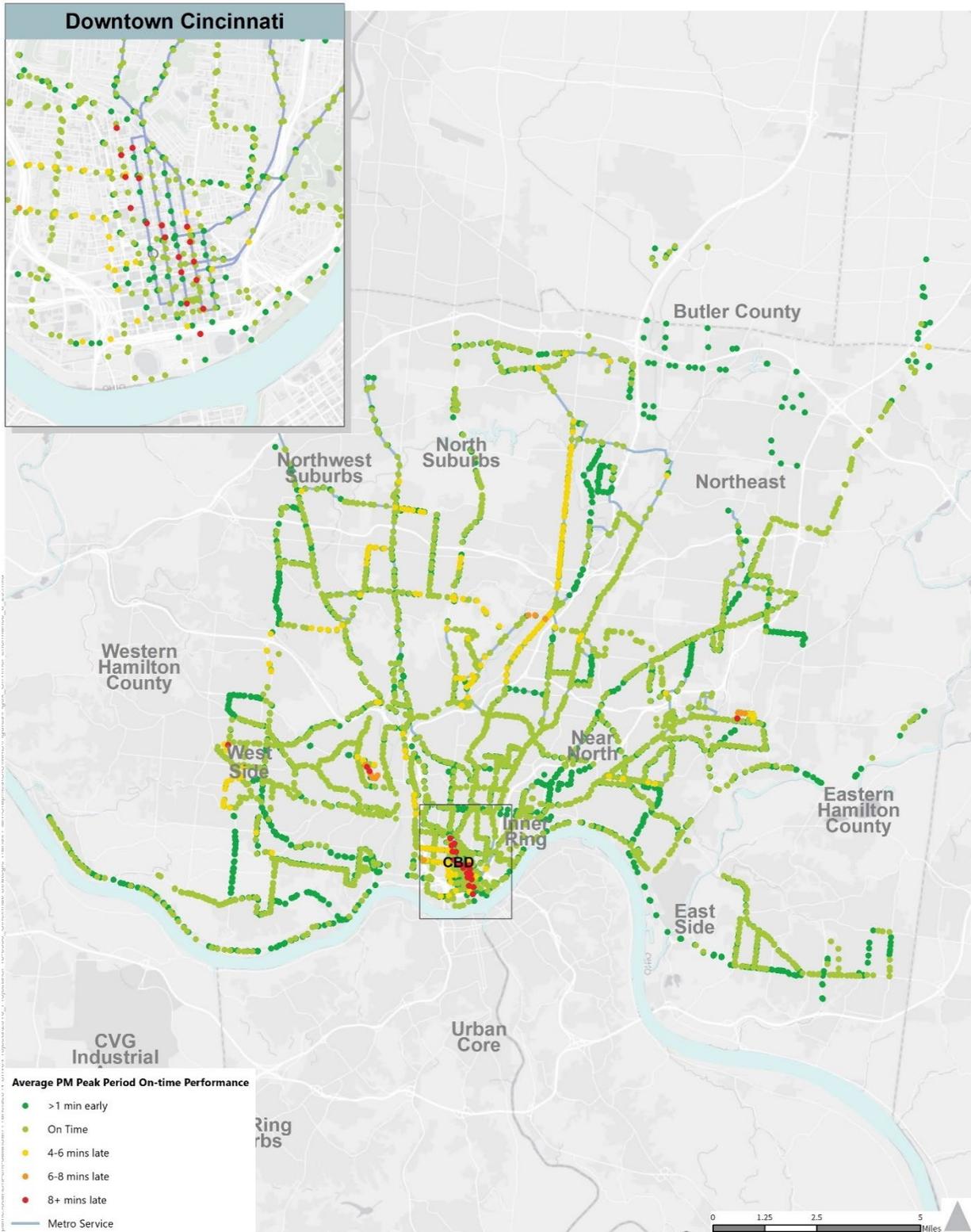


Figure 44 - Swiftly On-Time Performance Data, all SORTA Routes, March 2019
Source: Swiftly data mapped by Fehr & Peers



7.4.3 Auto Speed

We used the Uber Movement platform to evaluate automobile speeds. Uber Movement is a software that analyzes and visualizes Uber vehicle speeds and travel times on streets within a city, based on historical Uber vehicle data. We assume Uber speeds to be a proxy for general auto speeds. A summary of auto speed phenomena for the weekday peak period (4-6 PM) are as follows:

- Auto speeds in downtown Cincinnati are generally between 6 and 10 MPH almost across the board. There are some “pinch points” in downtown where the average speed across that block is <4 MPH.
- Speeds outside of downtown typically range between 12 and 25+ MPH for over three-quarters of the distance of each route

A map of speed data for the region, with an inset for Downtown is shown in **Figure 45** below. It shows that most street links in the downtown have average auto speeds in the peak period of less than 10 miles per hour. Aside from on Main Street, buses run in mixed-flow as part of general traffic. The combination of Uber Movement and Swiftly data indicate that traffic congestion is a primary factor for slow bus speeds in Downtown Cincinnati.

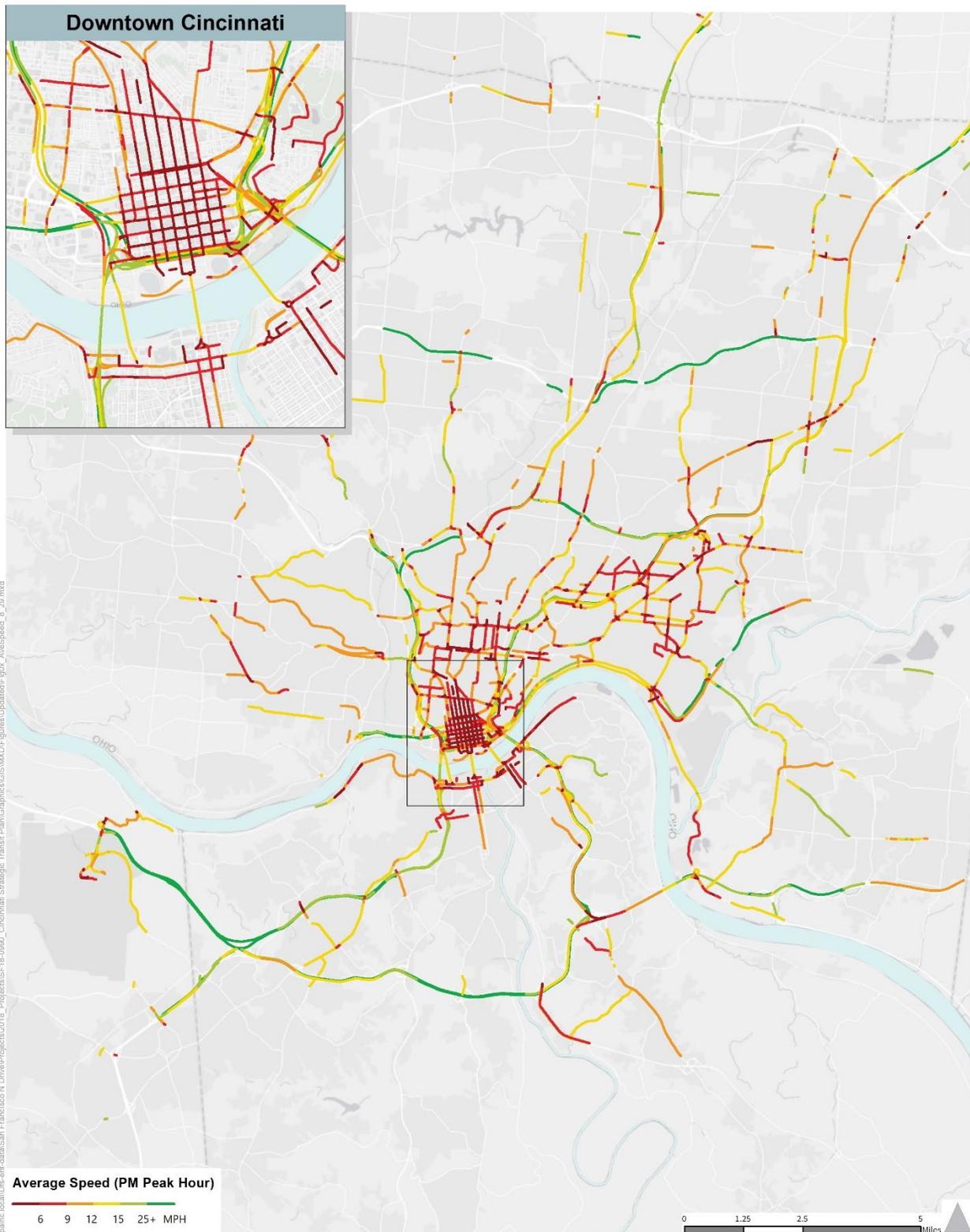


Figure 45 - Uber Speed Data for Cincinnati Region from October 2019
Source: Uber Movement data mapped by Fehr & Peers



7.5 Travel Patterns for Auto, Uber, and Transit

In 2014, Metro was averaging around 46,000 passenger boardings daily, TANK was averaging around 10,000 passenger boardings, and Uber was nascent, having just launched near the beginning of that year. By the end of 2018, Metro was averaging around 40,000 passenger boardings and TANK was averaging around 8,500 passenger boardings (a combined transit decrease of 8,500), and Uber was averaging around 10,000. Similar information for Lyft is not known. By comparison, on a typical weekday there are 7.6 million private auto person trips in the region.¹⁰³ A survey of Uber riders completed as part of this study finds that 13 percent of Uber trips would have been on transit had Uber not been available (see Section 7.7 for more detail).

In this section we present a comparison of travel patterns for auto, Uber, and transit. The chapter starts with a comparison of desire lines within the region, i.e., the volume of travel within and between subregions by mode. To understand regional market segments and travel behavior, two analysis levels were selected: the subregion, and the neighborhood/block level, where for denser areas it's the block level, and for less dense areas it's the neighborhood level. We then take a deep dive into some of the current differences in travel for auto, transit, and Uber in the Cincinnati region, such as trip end locations, trips by time of day, service type, length and duration.

7.5.1 Desire Lines at the Subregion Level

The following are a series of desire line maps for auto, transit, and Uber travel in turn. The weight of each desire line corresponds to the demand for travel by a particular mode between that origin-destination pairing. The spatial level of analysis is the subregion, defined in collaboration with stakeholders. The subregions delineate major employment areas, high activity areas, and other urbanized areas in the region and are shown in **Figure 46**.

¹⁰³ According to the OKI regional travel demand model.

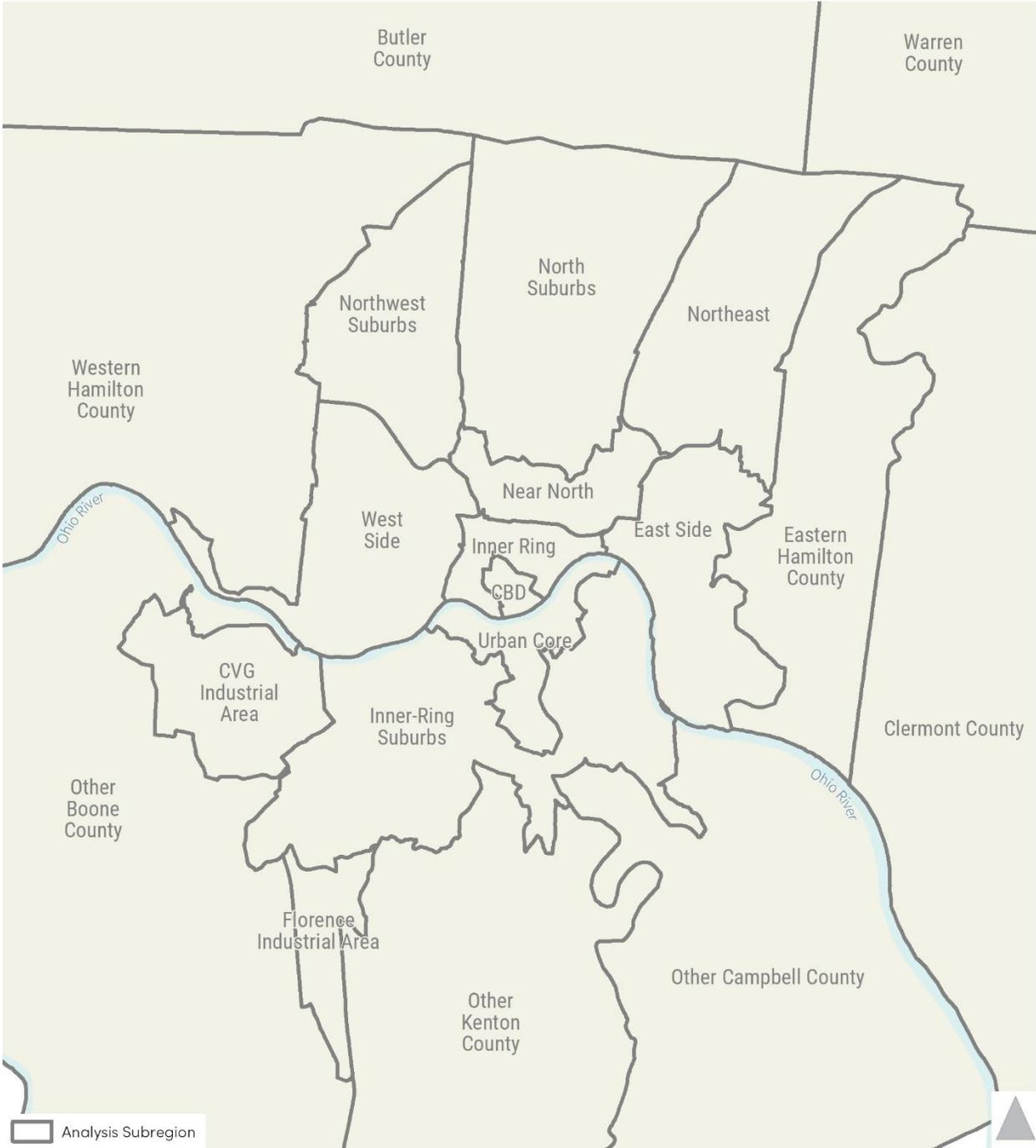


Figure 46 - Map of Analysis Subregions

7.5.1.1 Auto

Figure 47 below shows desire lines for bidirectional daily auto travel within the region’s core. The source for automobile flow data is regional travel demand model outputs, specifically the 2015 OKI model. Overall,

auto travel is well-dispersed throughout the region, both in the center, inner, and outer rings. The figure shows that auto travel is greatest within and between the northern suburbs, west side, near north, and east side. Auto trips appear to be more intra-zonal rather than inter-zonal, showing that people tend to drive to destinations within their subregion. There is also a lot of travel within the Kentucky inner-ring suburbs, and between that area and the Kentucky urban core. Comparatively few auto trips cross the river.

The greatest flow is 97,000 trips between the Kentucky Inner Ring Suburbs and the Kentucky Urban Core. The biggest intra-subregion flow is 291,000 daily trips within the North Suburbs.

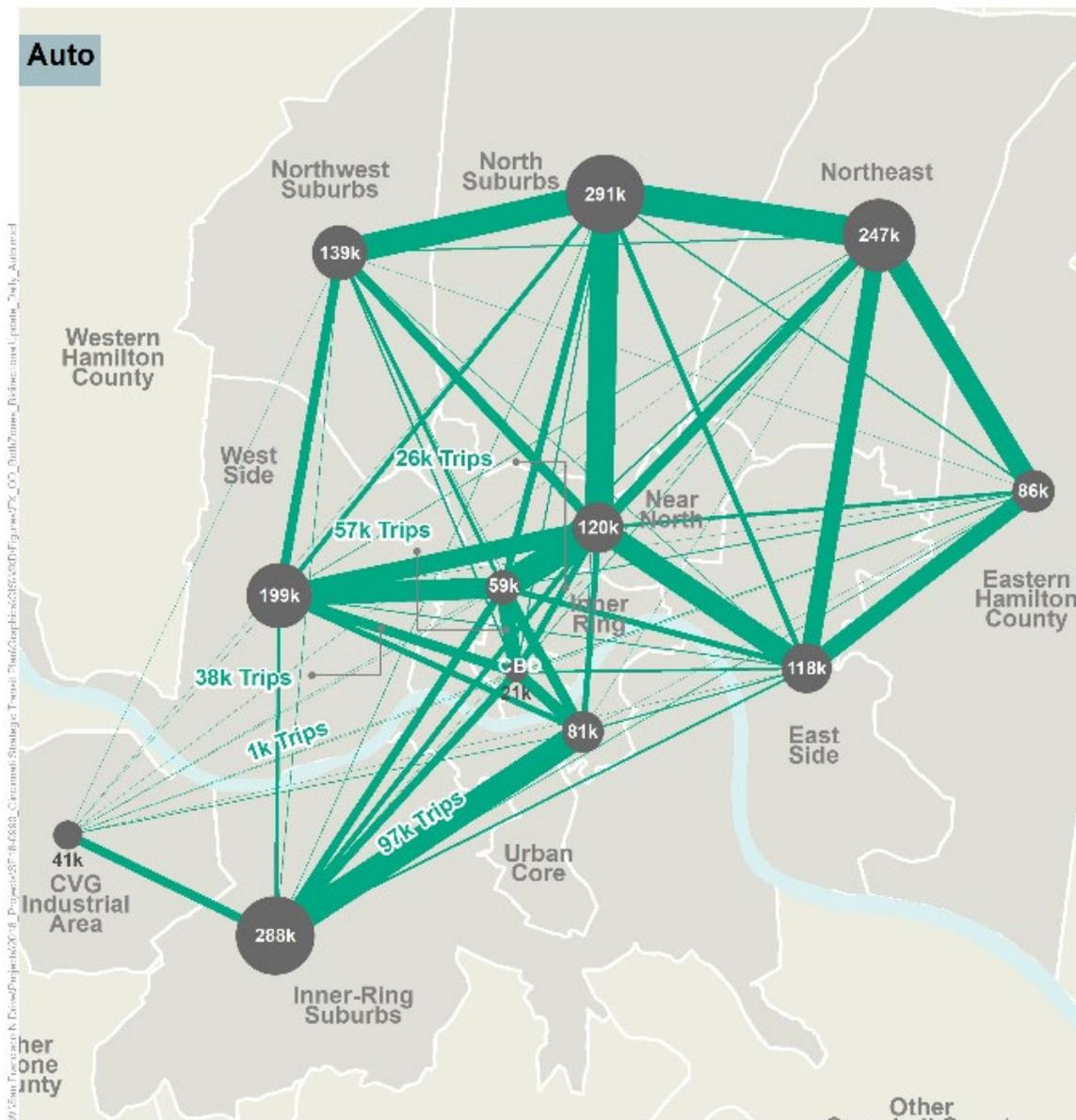


Figure 47 - Desire Lines for Daily Subregional Auto Person Trips

Auto travel to/from the CBD is comparatively small. The CBD is one of five major job clusters, and although the largest and the densest, the others are nearly as large in size:¹⁰⁴

1. Central Business District Hub, 50,862 jobs
2. Uptown Hub, 43,764 jobs
3. CVG Hub, 38,545 jobs
4. Blue Ash Hub, 31,632 jobs
5. North Tri-County Hub, 30,905 jobs

The multi-nodal nature of job density is shown in **Figure 48** below:

¹⁰⁴ Retrieved from *The Enquirer*, "Where are all the jobs in Greater Cincinnati? Not where you might think. New map shows area's employment hubs:" <https://www.cincinnati.com/story/news/2019/03/11/job-hubs-new-map-shows-where-jobs-located/3131113002/>

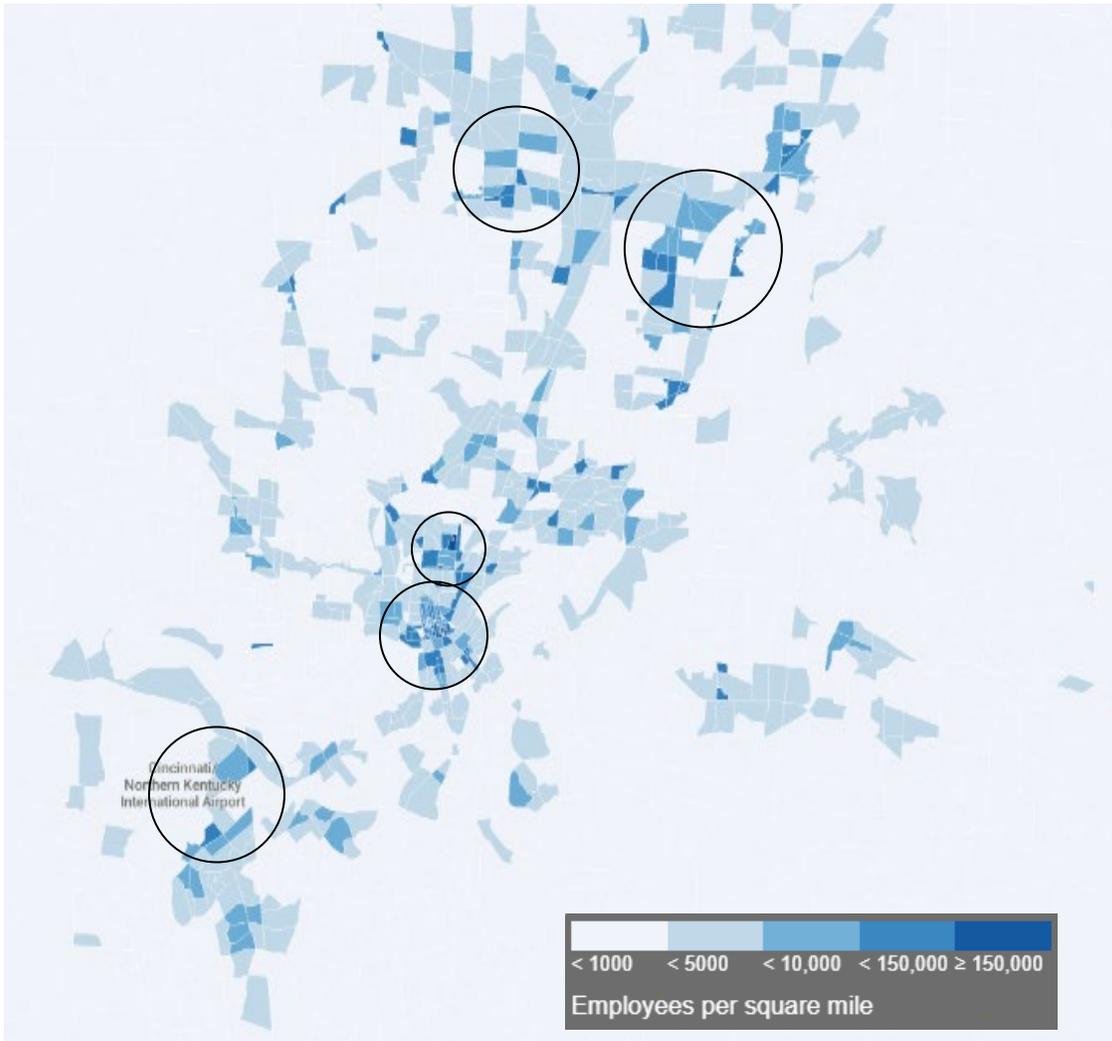


Figure 48 - Employment Density across the Region

Note: the five hubs are circled, from top-to-bottom: North Tri-County Hub, Blue Ash Hub, Uptown Hub, Central Business District Hub, and CVG Hub.

7.5.1.2 Transit

Figure 49 shows transit desire lines. The source is travel demand model outputs scaled by boarding data collected by each transit agency. This figure is at a different scale as transit trips are much smaller in quantity than auto overall. It's clear there are four main corridors for transit, and each is focused on the CBD. These corridors are trips to/from the CBD and the West Side, Inner Ring, Near North, and Kentucky Urban Core (i.e., Covington north of I-275). The biggest flow is 5,000 trips between the Cincinnati Inner Ring and CBD. The biggest intra-subregion flow is 4,800 trips within the CBD. The Near North and North Suburbs are well represented while the East Side is not. This matches our expectations as these areas are comparatively high in transit service. Trips to/from other subregions are relatively sparse.

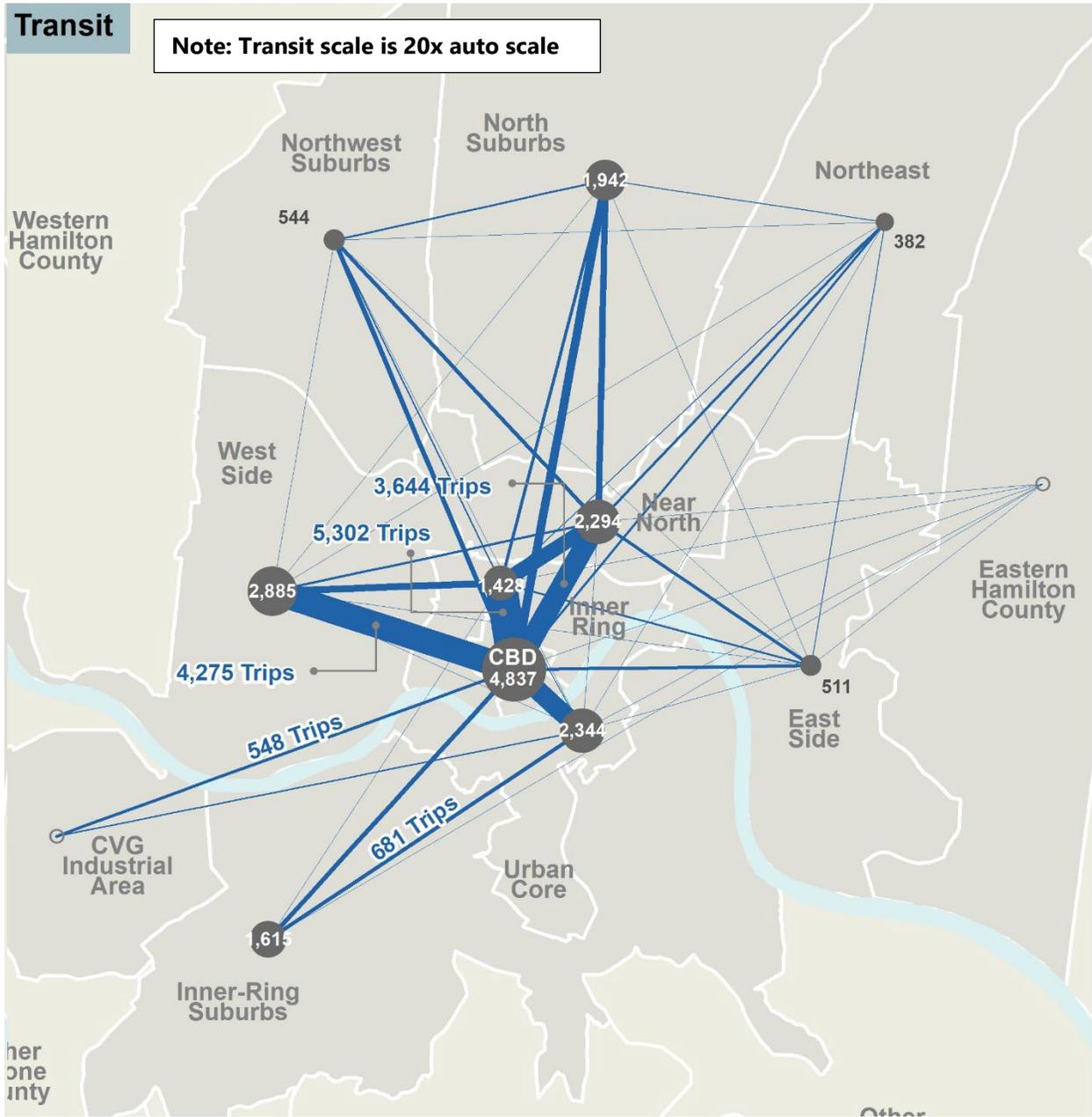


Figure 49 – Desire Lines for Daily Subregional Transit Person Trips

7.5.1.3 Uber

Figure 50 shows Uber desire lines, shown as daily person trips (where a ratio of 1.5 was used to convert trips to person trips, where “person” refers to passengers and not driver). Again, this is at another different scale as Uber travel is outweighed by transit travel. A few major corridors do emerge, but travel is more dispersed across the region than transit, although less dispersed than auto. The largest flows are between the CBD and Inner Ring, Near North, East Side, and CVG Airport area. The largest is 720 trips between the CBD and the Inner Ring, and the largest intra-regional flow is the 588 within the CBD. There is a lot of travel between the East Side and the CBD, with little travel to/from the West Side. Uber also has a relatively high number of cross-town trips.

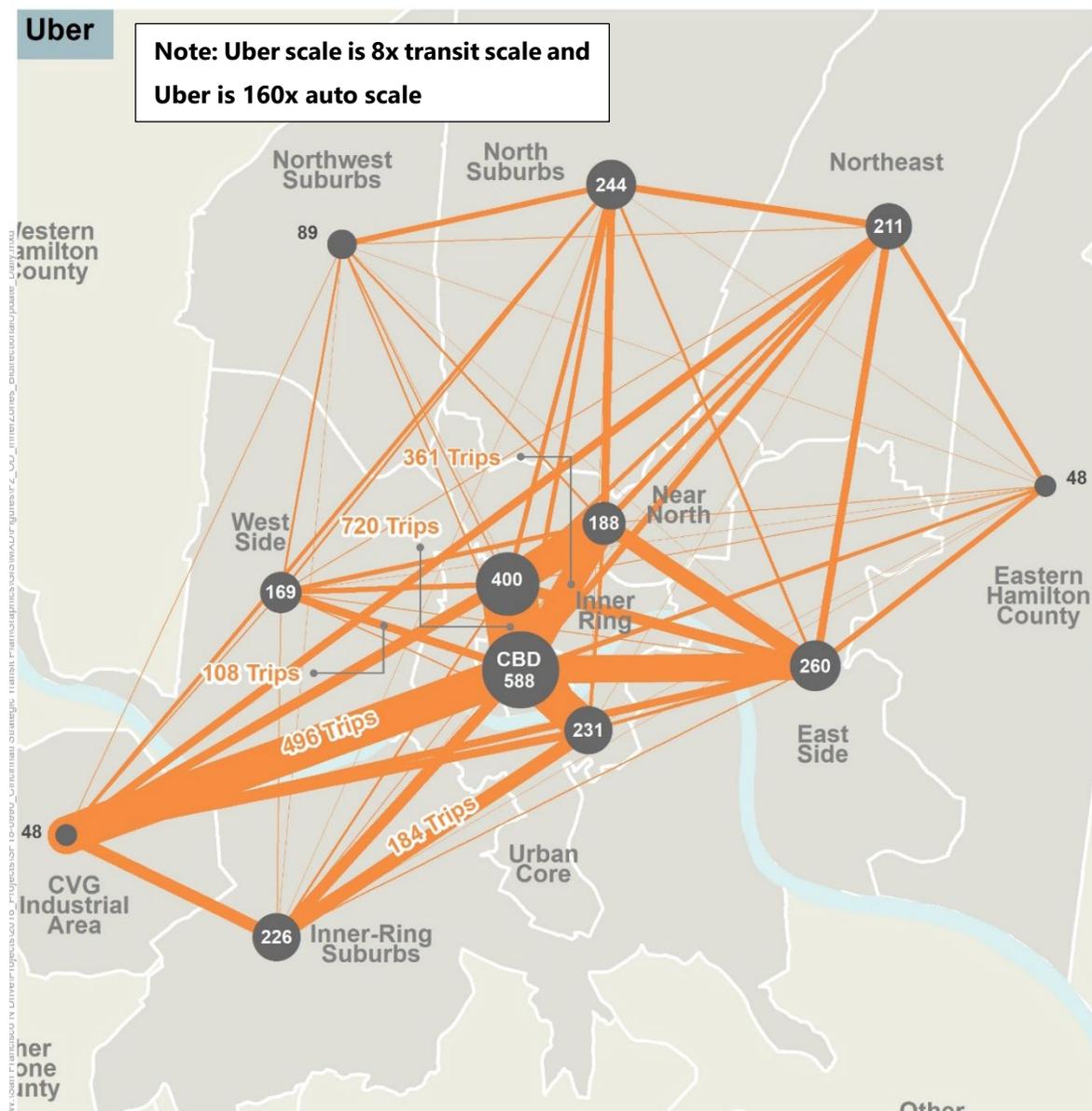


Figure 50 - Desire Lines for Daily Subregional Uber Person Trips

7.5.1.4 Auto vs Transit/Uber

The purple lines on the next map (**Figure 51**) indicate where a combination of transit and Uber captures at least 20 percent of the travel market, i.e., strongholds where non-private auto travel could grow.

Transit and Uber are more of a competitor to auto trips that start and end close to the regional core, the west side, or to/from the airport. Crosstown travel across the outer ring of subregions is captured mostly by auto, with less than <1 percent of trips completed with transit or Uber. While Uber is available in these parts, it is lightly used, and transit only serves a small fraction of the possible trips within this broad area.

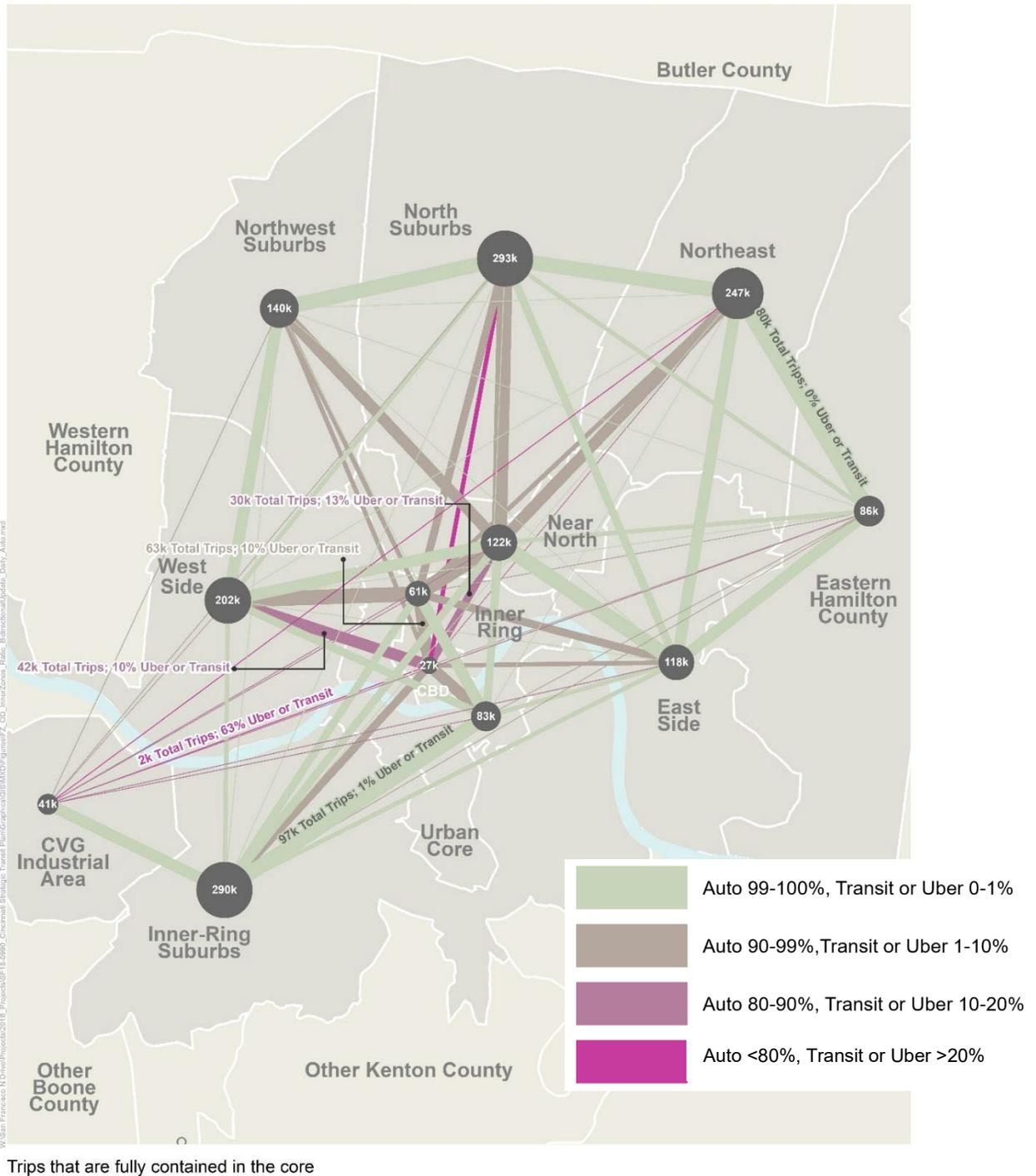


Figure 51 - Desire Lines for Daily Subregional Auto Travel versus Uber/Transit Travel

7.5.1.5 Transit vs Uber

As a complement to the previous figure, the next figure removes auto from the equation and shows in orange where Uber travel outweighs transit travel and in blue where transit travel outweighs Uber travel (**Figure 52**). For most major corridors, transit has over 75 percent of the market share (defining the market in this case as Uber + transit). Uber captures at least 25 percent of five large long-distance markets: airport to CBD, CBD to East Side, Eastside to Northeast, Cincinnati Inner Ring to Covington Urban Core, and Northeast to North Suburbs.

Transit captures around 33 percent of the airport-to-CBD market, through the Tank 2X Airporter Express Bus, whereas Uber captures 30 percent, and auto travel captures the remaining 37 percent. While the airport is the point of highest trip origin/destination density for Uber, those trips are dispersed across the entire region and not particularly concentrated to/from any particular OD pair, such as to/from the CBD. Uber has a majority of the market for many cross-town corridors, although these have a much lower overall magnitude of trips.

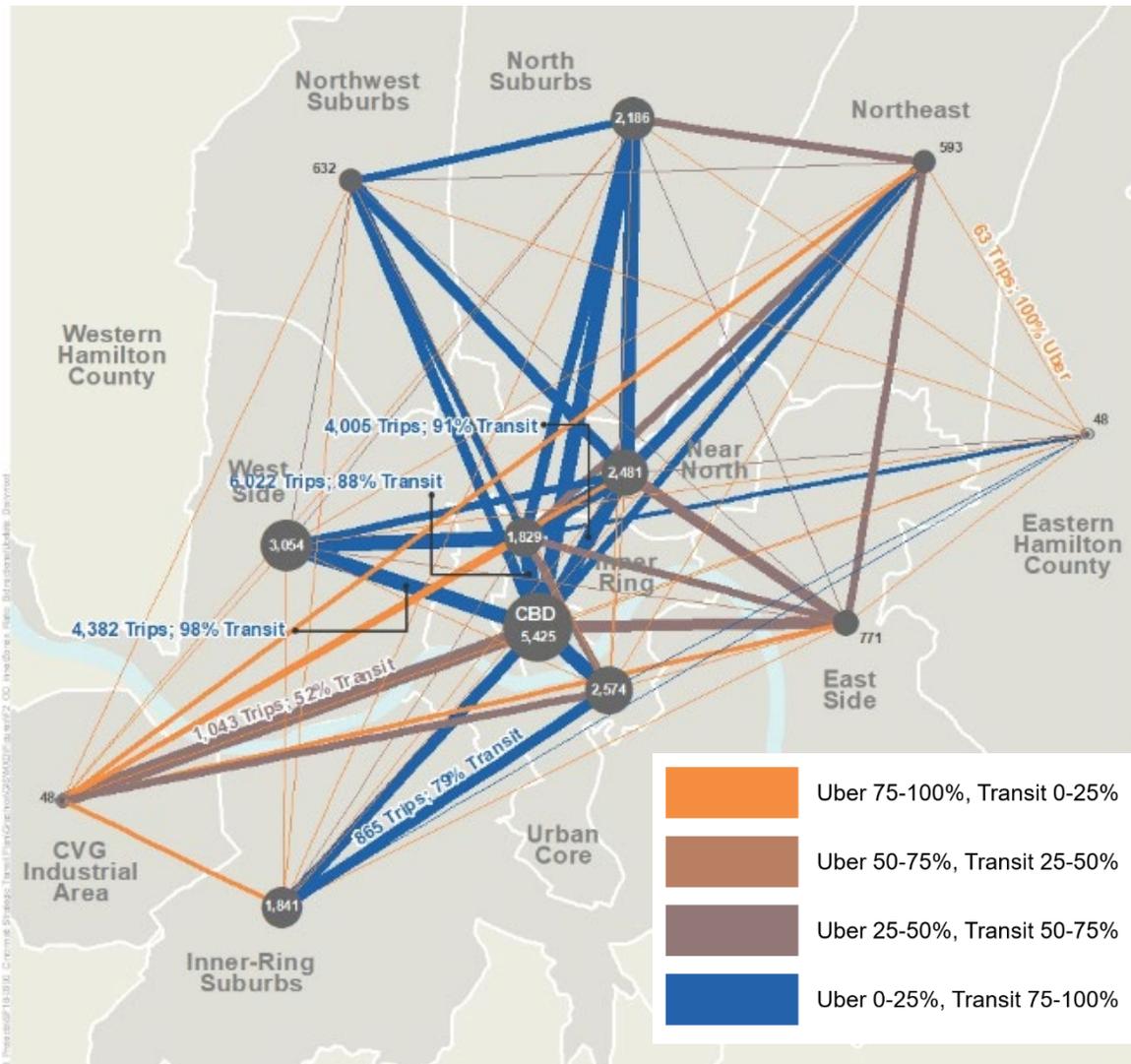


Figure 52 - Desire Lines for Daily Subregional Transit Travel versus Uber Travel

Note: Map only contains trips that are fully contained in the core (dark shaded area)

Overall, there are very few intra-subregional markets where transit and Uber are well-balanced. Almost all exhibit one mode having at least three times the share as the other mode. Because these mode splits are to a large part predicated on the underlying land use and transportation infrastructure in these areas (i.e., “streetcar suburb” transit-supportive densities vs auto-oriented suburban development), which cannot be easily altered, we conclude that the best integration would be to strengthen and collaborate in a way that reduces redundancies such that each submarket is well served by either one mode or the other, and that each provider is more cost effective in the markets they are focused on.

7.5.1.6 OD Pairs where Transit Captures an Undersized Part of the Market

Figure 53 compares transit share of travel against overall amount of travel. The purpose of this is to identify corridors where transit, while present in some capacity, is failing to capture a large share of a large travel market. A “large share” is defined as more than the 25th percentile of transit share percentages across all subregion pairs, and is shown in orange. This equates to 0.11 percent mode share. A “large travel market” is defined as more than the 75th percentile of bi-directional daily person trips across all subregion pairs, and is shown as thickest line. This equates to more than 21,000 person trips per day.

There are four such OD pairs, three of which cross the river and are near the downtown area but do not start or end in the CBD. This may be representative of how many of the transit routes that do cross the river either start or end in the CBD, such that trips that cross the river but bypass the CBD require transfers for passengers between buses. It suggests that either more seamless connectivity within the CBD (e.g., at Government Square transit hub) or more direct routing between these areas could lead to transit better serving demand.

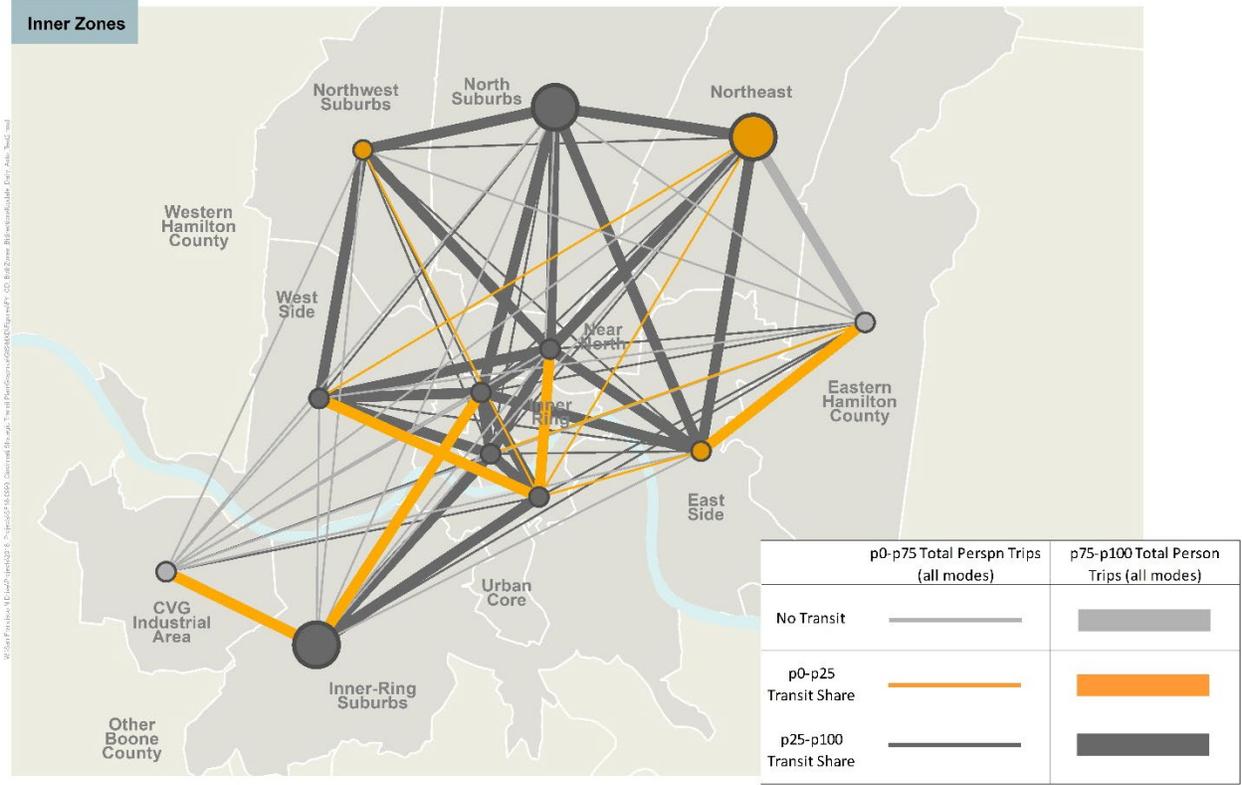


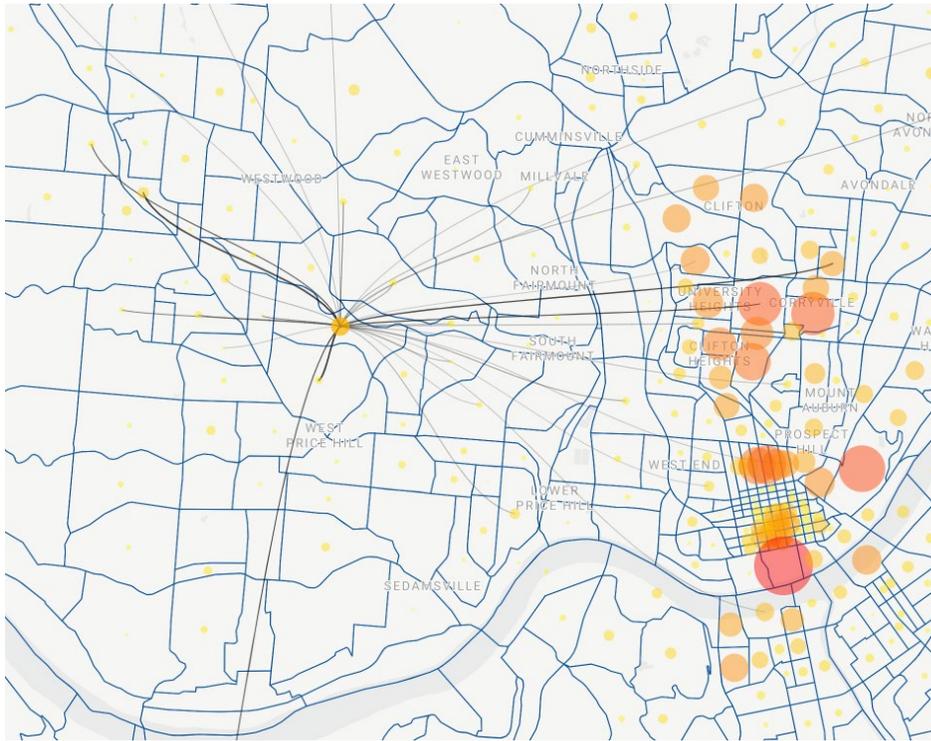
Figure 53 - Transit Share and Overall Daily Person Trip Comparison in Inner Core



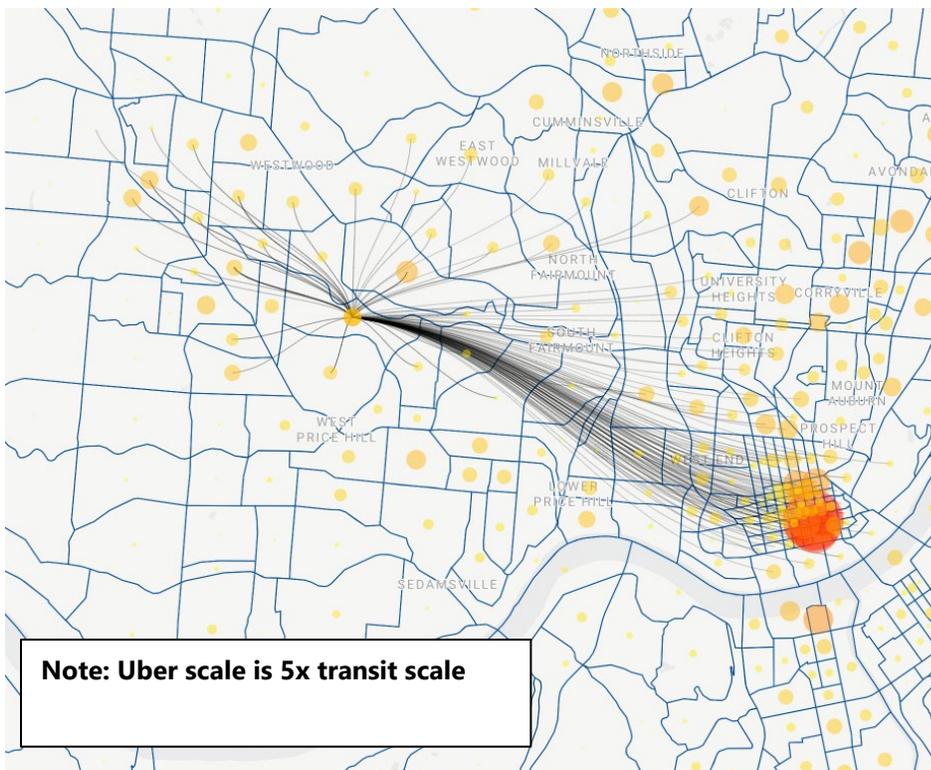
7.5.2 Travel at the Block/Neighborhood Level

In support of the desire line effort above, and in order to assist the public agencies in deciding where to commit their limited resources, we developed an interactive web map to show OD travel at the TAZ level.

The tool demonstrates that trip distribution patterns can vary substantially, as show in **Figure 54**. This figure shows trip distribution for the Erlene Drive area in west Cincinnati. Generally speaking, Uber travel is more dispersed while transit travel is more channelized in the axes in which transit runs. Uber also has a proportionally high amount of travel to/from the university, which is a cross-town trip. Transit does not have a comparatively high amount of travel in this cross-town direction.



UBER



TRANSIT

Figure 54 - Daily Uber and Transit Trip Distribution to/from TAZ 255 (Erlene Drive Area)

7.5.3 Trip Ends

We have generated a map of daily trip ends for transit and Uber using the travel database of OD trips. These maps are shown below in **Figure 55** and **Figure 56**. Uber has been exaggerated roughly five-fold so that comparative magnitudes are easy to see in each figure.

Uber travel is concentrated in a few key locations. The biggest demand generator is the CVG airport, where 14 percent of Uber trips either begin or end on a typical weekday. This trend of the airport being a dominant generator is consistent with Uber usage in major cities across the country where 15 percent of bookings are from trips either starting or ending at airports.¹⁰⁵ The stadium area between the river and I-71 that contains the ballpark, the professional football stadium, and the Underground Railroad museum, is the second largest demand generator. After this, Uber travel is fairly highly concentrated around downtown, to the near northern areas (between downtown and the University of Cincinnati), and in a cluster of eastern neighborhoods oriented around Oakley and Hyde Park. There is a spike in Uber ridership in Miami, Ohio, a city 40 miles to the northwest of Cincinnati. Miami is the home of Miami University. In contrast, Middletown, a city 40 miles to the north of Cincinnati, is larger than Miami but does not have a similarly high amount of ridership.

Transit is strongly oriented to and from downtown Cincinnati. Government Square Transit Center is a central transfer point for many Metro and TANK routes, and this is by far the highest demand generator. A second leg of a transfer transit trip is represented as a separate trip in this dataset. Transfers make up 28 percent of trips on Metro and 6 percent of trips on TANK.¹⁰⁶ Metro still brings approximately 20 percent of downtown Cincinnati's workforce to work.¹⁰⁷ The percentage of weekday transit trips that start or end at the airport is 0.61 percent, which is a reflection of the fact that a single route serves the airport (the TANK 2X Airporter which operates between the airport and downtown Cincinnati at 30-60 minute headways). While as a percentage of overall travel this is low, it captures a majority share (around 62 percent) of the combined transit/Uber travel market between the CBD and the airport (see Figure 51). Beyond downtown, transit ridership is more geographically spread than Uber, with particularly high ridership in the near north and western neighborhoods such as Price Hill, Westwood, and Fairmount, plus in Covington. These are areas with backbone transit service (i.e., frequencies of 15 minutes or better) and high proportions of low income population.

¹⁰⁵ Uber (2019). *Form S-1 (Registration Statement Under The Securities Act Of 1933.)* Page 38. Retrieved: https://www.sec.gov/Archives/edgar/data/1543151/000119312519103850/d647752ds1.htm#toc647752_4

¹⁰⁶ Email communications from Mark McEwan (Metro) and Frank Busofsky (TANK), dated November 14 and 15, 2018.

¹⁰⁷ Downtown Cincinnati, Inc. (n.d.). *Transit Options*. Retrieved from <https://www.downtowncincinnati.com/exploring-downtown/transit-options>

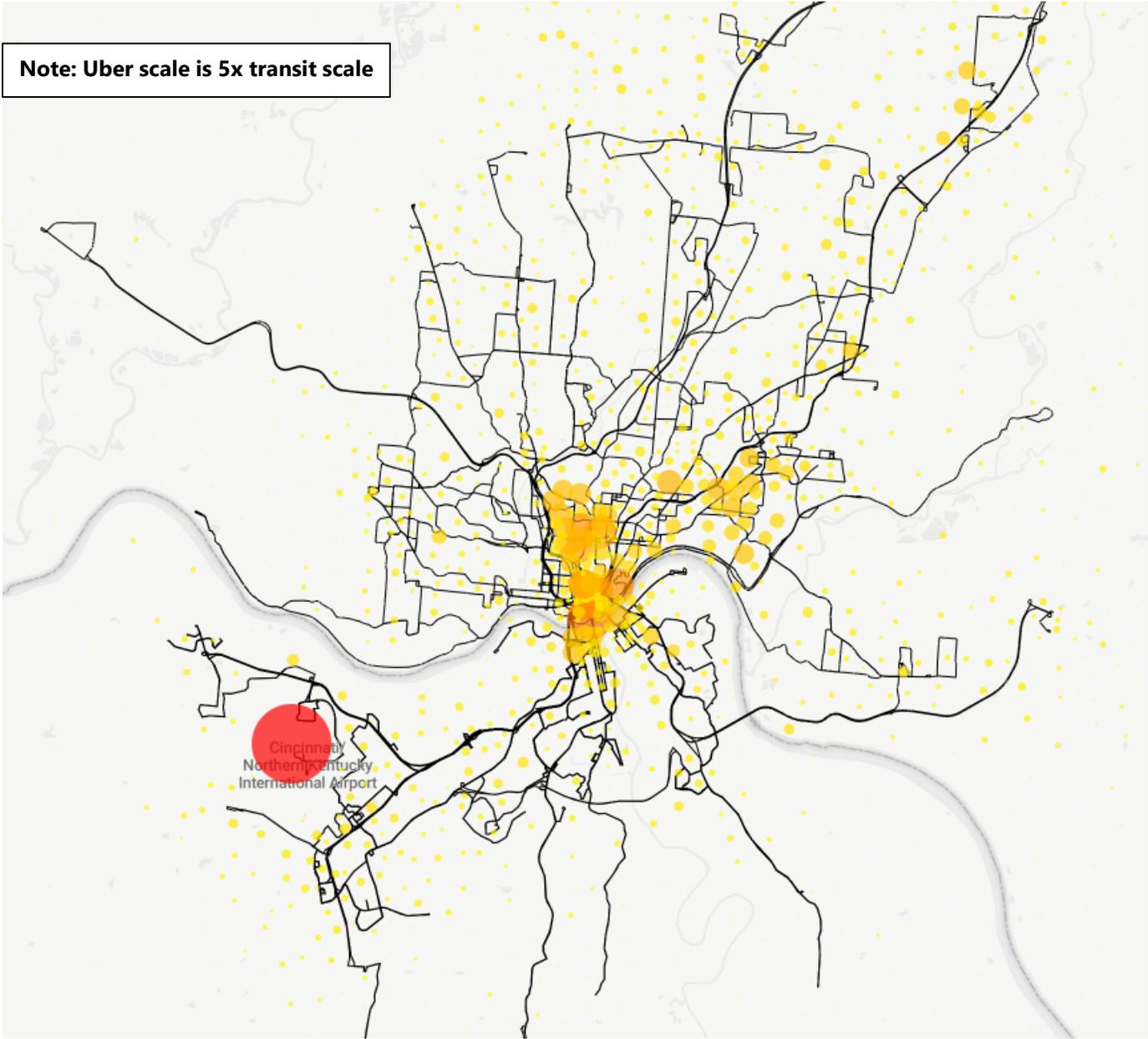


Figure 55 - Distribution of Daily Uber Trip Origins
Note: Larger and darker circles indicate more daily trips

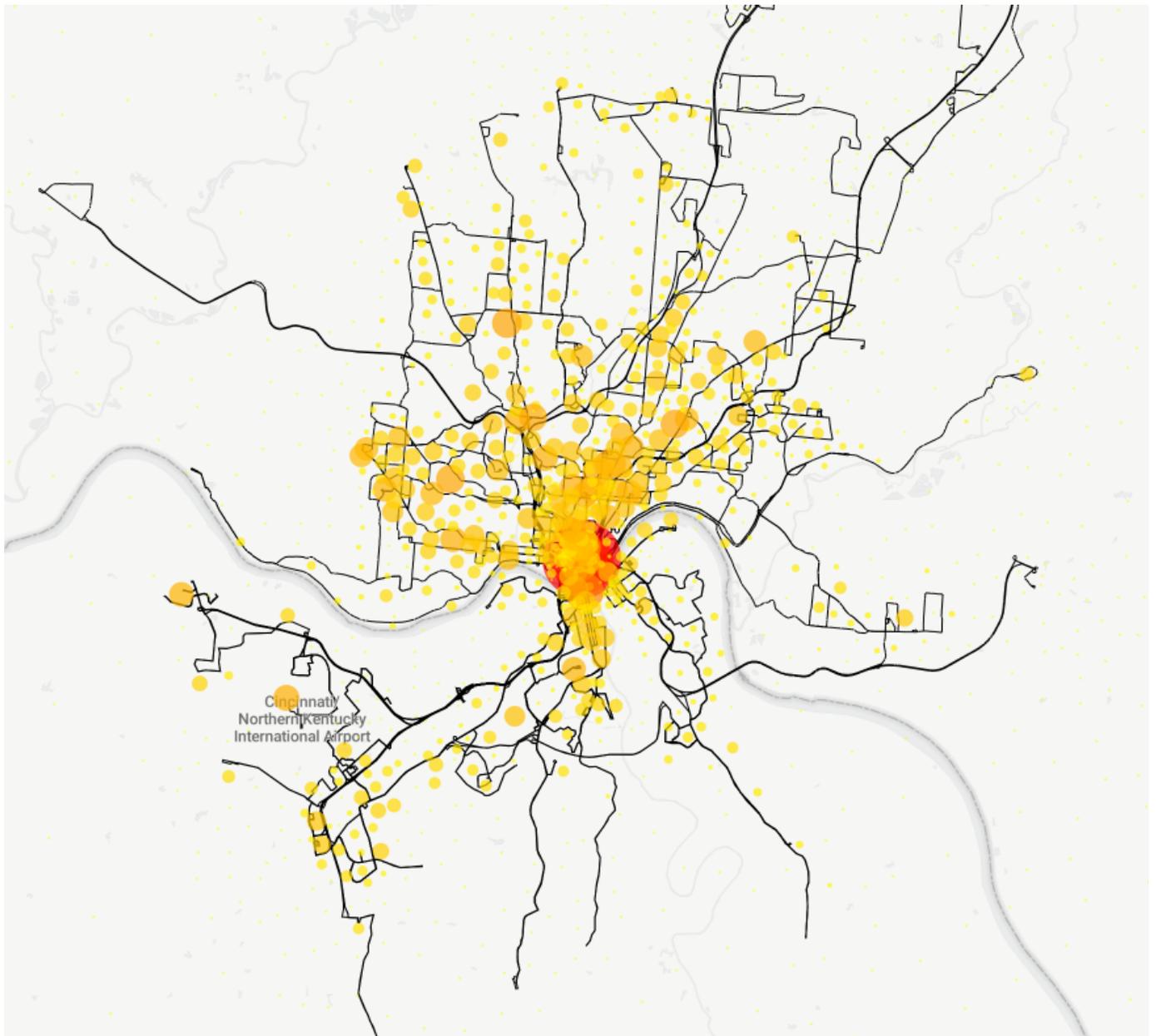


Figure 56 - Distribution of Daily Transit Trip Origins

Note: Larger and darker circles indicate more daily trips

7.5.4 Time of Day

Ridership data shows us that transit ridership heavily outweighs Uber during the weekday daytime. For example, transit trips outnumber Uber 6:1 in the weekday PM peak period. However, the gap narrows during evening and weekends to 2:1 for weekday evenings and 1.25:1 on the weekend. These statistics again assume an average of 1.5 passengers per trip for Uber.

There is a general consensus among researchers that ride hailing is more commonly used for recreational trips than for everyday commuting. Ride-hailing use peaks between 10 PM and 4 AM, with weekday peak-hour trips only making up 20 percent to 27 percent of total TNC trip volume for the week.¹⁰⁸

Trips per hour by mode are shown below in **Figure 57** and trips per time of day are presented in **Figure 58**.

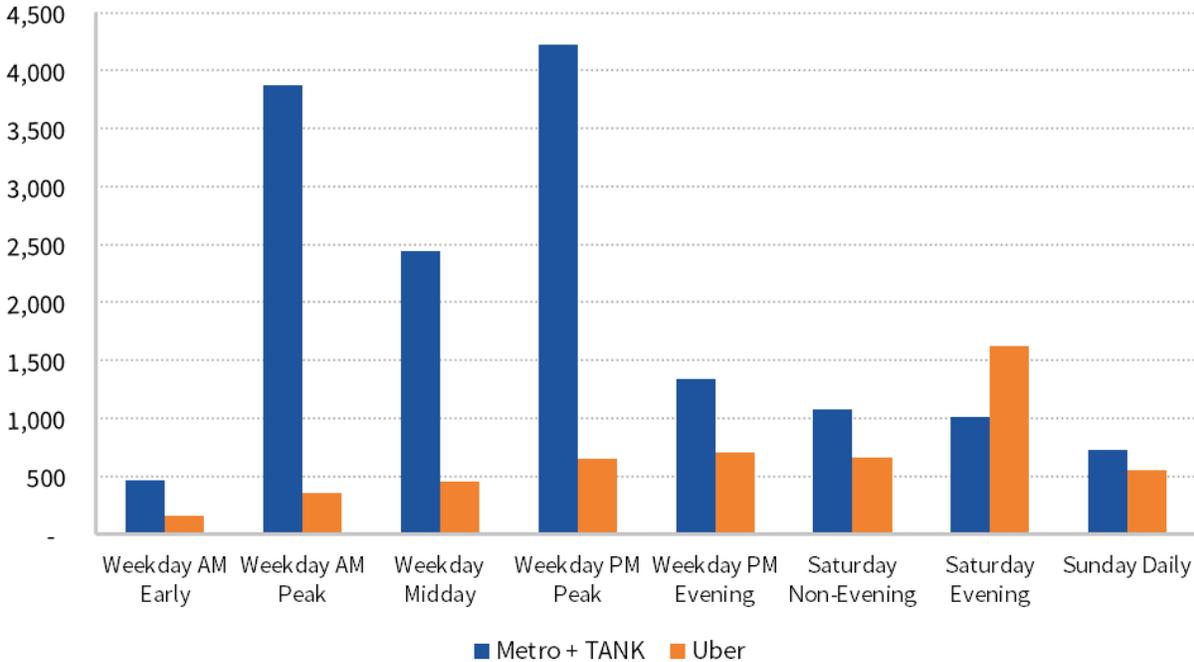


Figure 57 - Passenger Trips per Hour for Uber and Transit during Different Times of Week

¹⁰⁸ Feigon, S., & Murphy, C. (2018). Broadening Understanding of the Interplay Between Public Transit, Shared Mobility, and Personal Automobiles. 11–11. doi:10.17226/24996

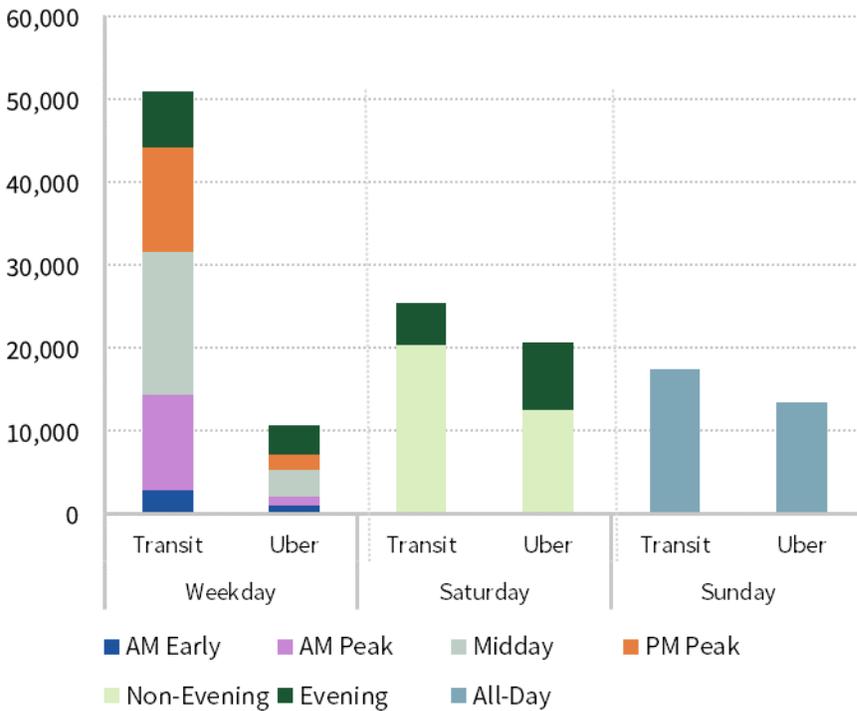


Figure 58 - Passenger Trips per Day for Uber and Transit

Figure 59 through **Figure 62** show PM peak and evening trips for Uber and transit, respectively. The size of the circles on each of these figures are not to scale across the different figures; instead circles are scaled such that the maximum value on each figure is the same size circle across the different figures. Weekday evening Uber trips are far less spread out than weekday PM period, and these evening trips are focused on trips between the downtown, near north, and Oakley/Hyde Park. Weekday evening transit trips appear to be about as well-dispersed and scaled as weekday PM period trips, with the exception of outlying areas served exclusively by express buses which do not run during the evenings.

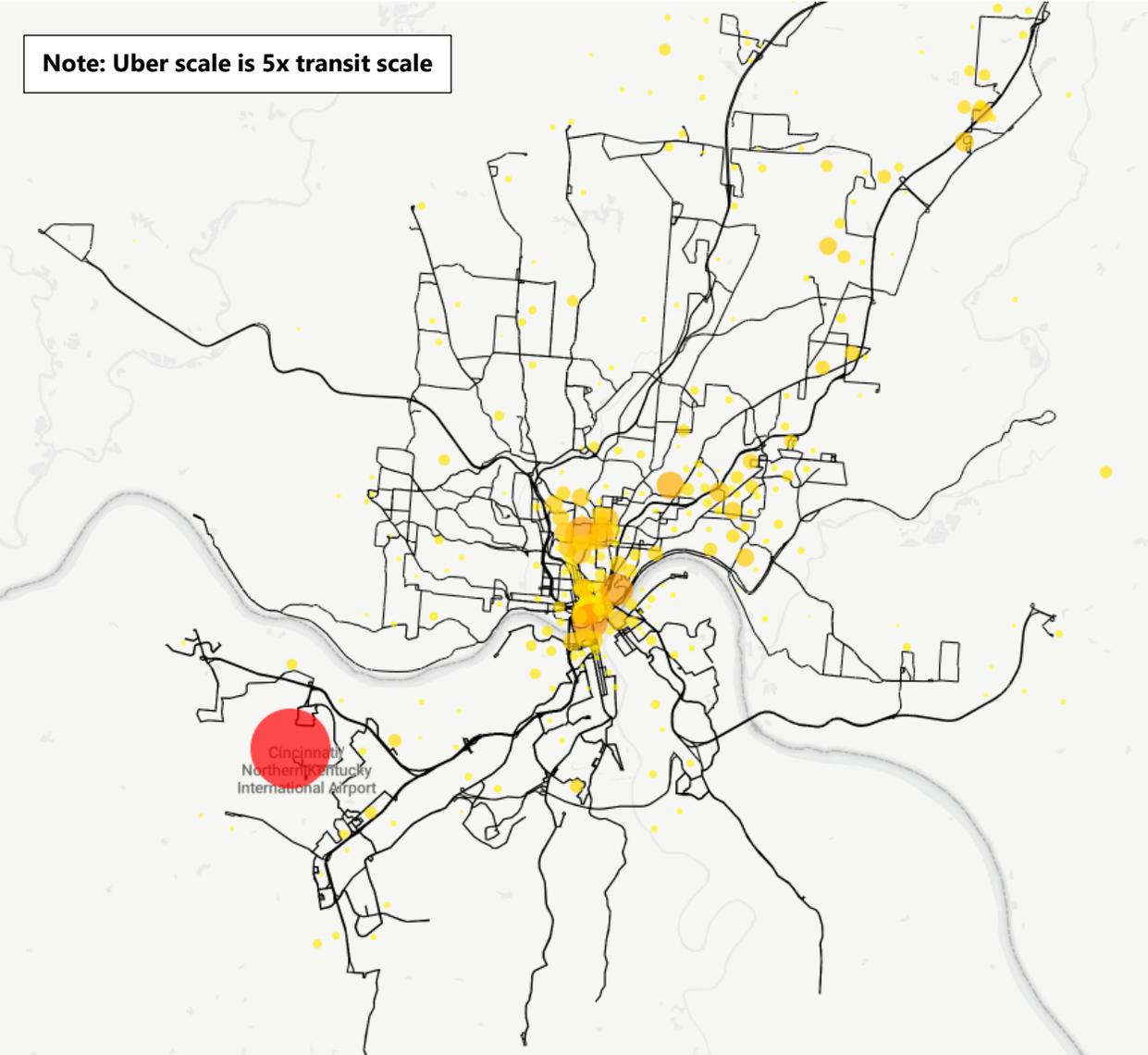


Figure 59 - Distribution of Weekday PM Peak Uber Trip Origins

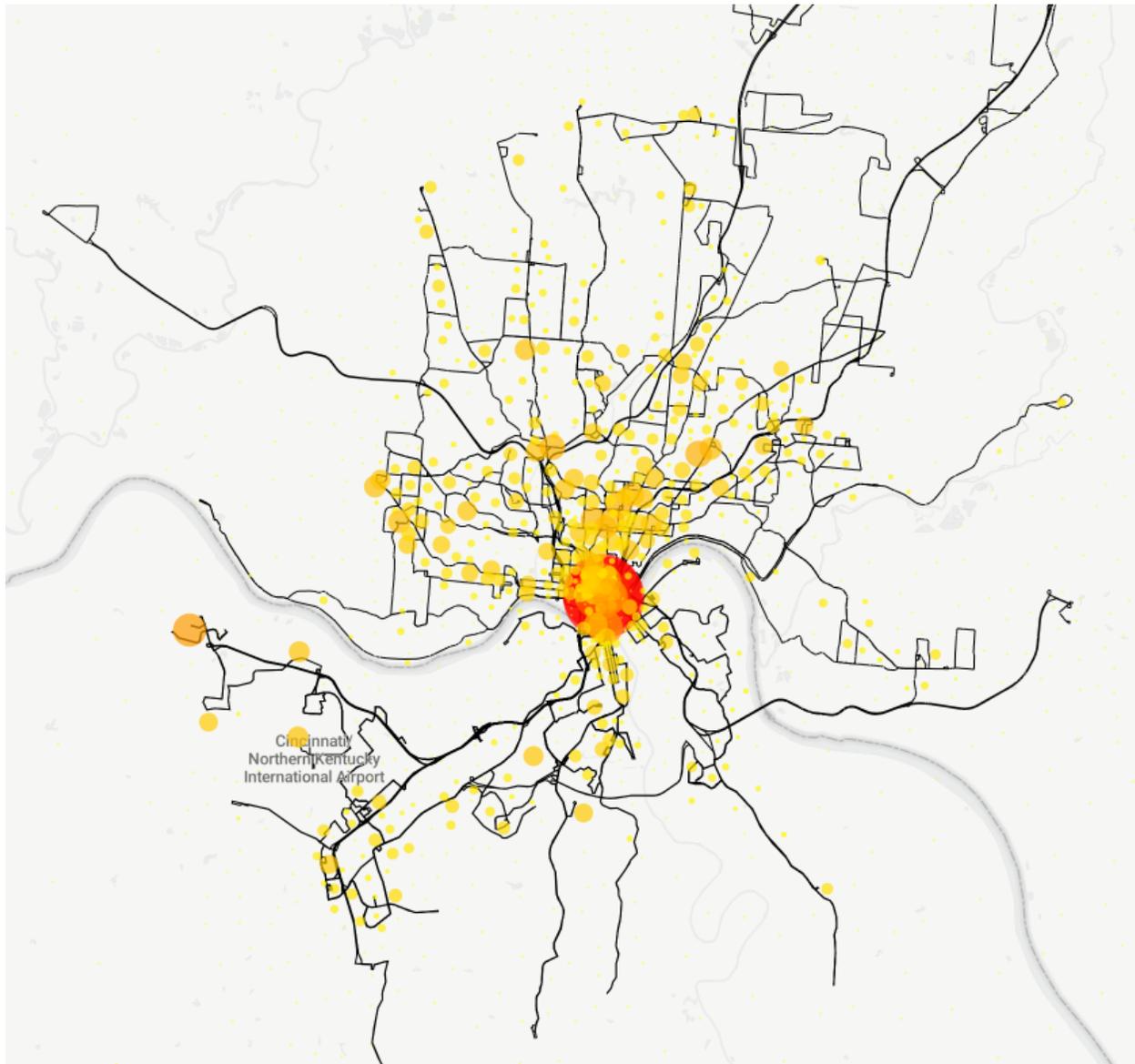


Figure 60 - Distribution of Weekday PM Peak Transit Trip Origins

Note: Larger and darker circles indicate more trips. Circles are scaled such that the maximum value on each figure is the same size circle across the different figures.

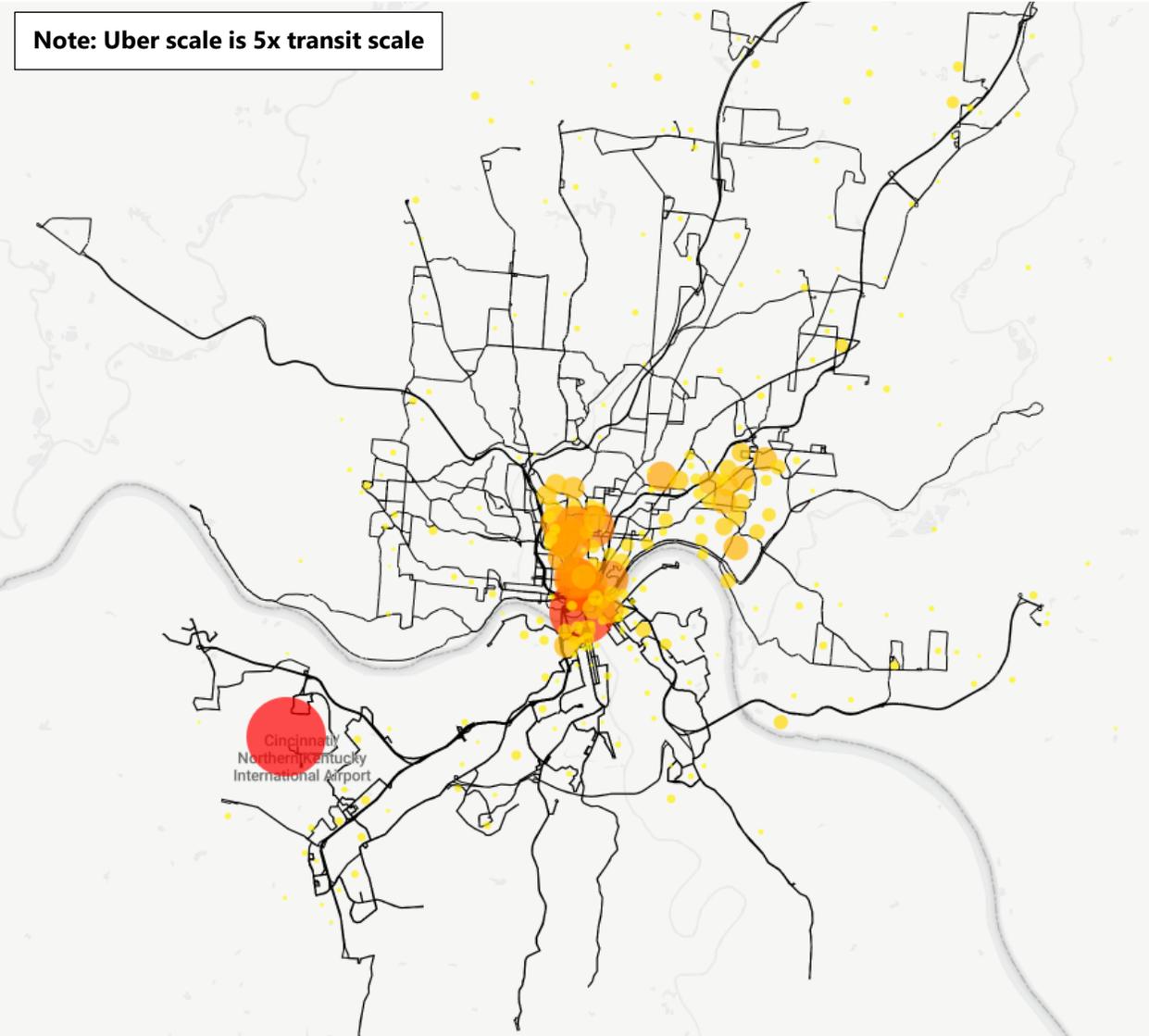


Figure 61 - Distribution of Weekday Evening Uber Trip Origins

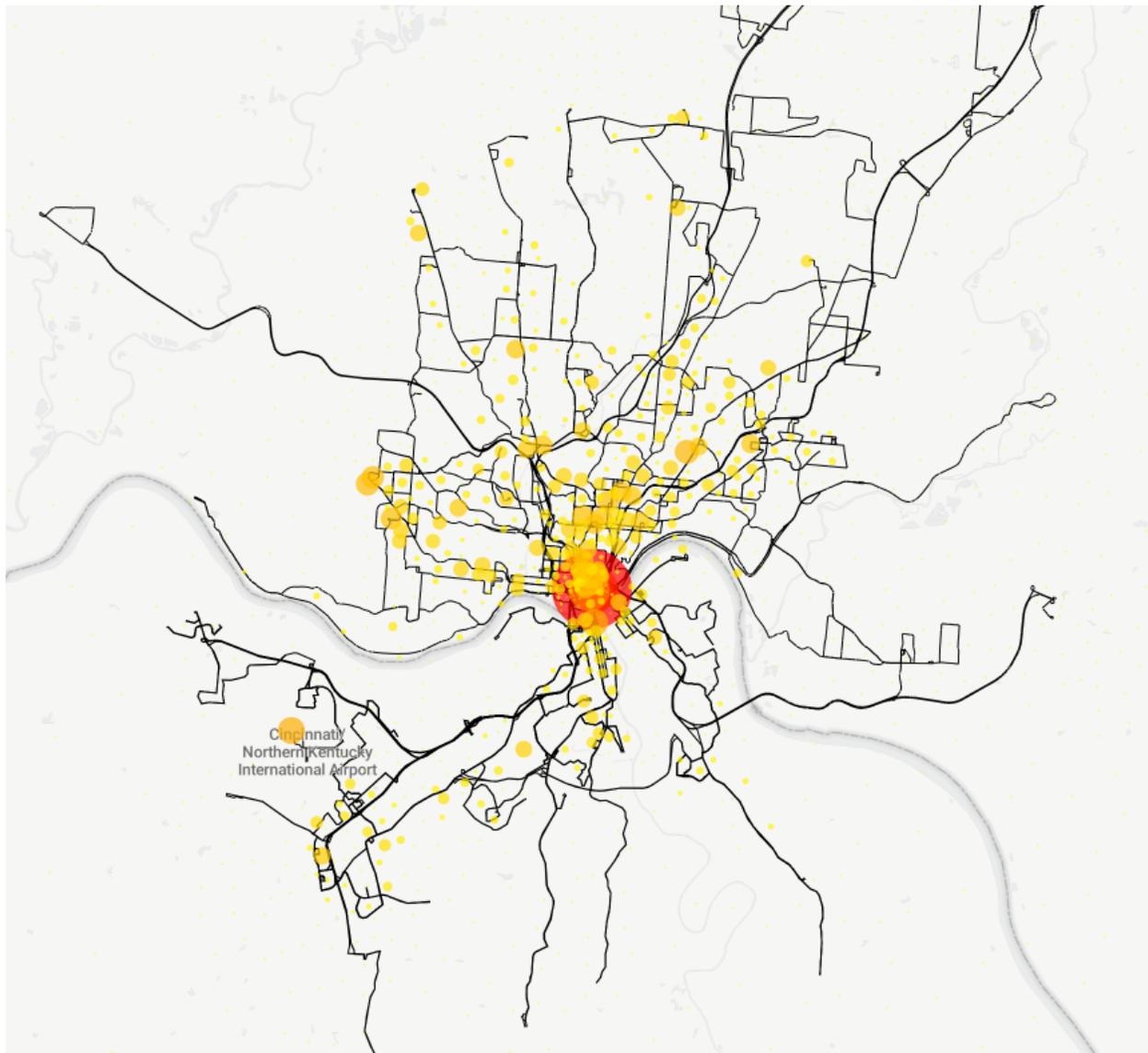


Figure 62 - Distribution of Weekday Evening Transit Trip Origins

Note: Larger and darker circles indicate more trips. Circles are scaled such that the maximum value on each figure is the same size circle across the different figures.

The trends shown above correspond with the national literature.

7.5.5 Service Type

Three service offerings were available during the 2017 calendar year, the timeframe for the dataset. UberX accounts for the vast majority of trips on Uber, especially on weekdays. UberXL is about twice as popular on the evening and weekend than weekday daytime. Uber Black is a very small proportion (averaging only

around 80 trips per day). The small proportion of Uber Black usage may indicate that most Uber riders are cost-sensitive; alternately, it may reflect a lack of vehicle type ownership within the driver pool.

7.5.6 Trip Distances and Duration

Uber provided data on trip duration in minutes and trip length in miles, aggregated at the OD pair level and averaged by time period. Metro and TANK do not collect data on passenger trip length. They do include a question on trip duration on their rider surveys.

Transit trip numbers for each OD pair are output from the travel demand model, to which we applied the average trip distance for Uber for that OD pair to get a distribution and weighted average of trip distances for transit. Assuming Uber trip distance for transit likely underestimates transit trip lengths, as buses typically take more circuitous routes than Uber, the accuracy of the results of this approach is dependent on the accuracy of the OD information output from the travel demand model.

7.5.6.1 Trip Distances

Uber trips are about the same length on average as transit trips. Uber has an average trip distance of 6.93 miles, which corresponds closely with the average trip distance across many metro areas nationwide, which is 6.1 miles according to Schaller.¹⁰⁹

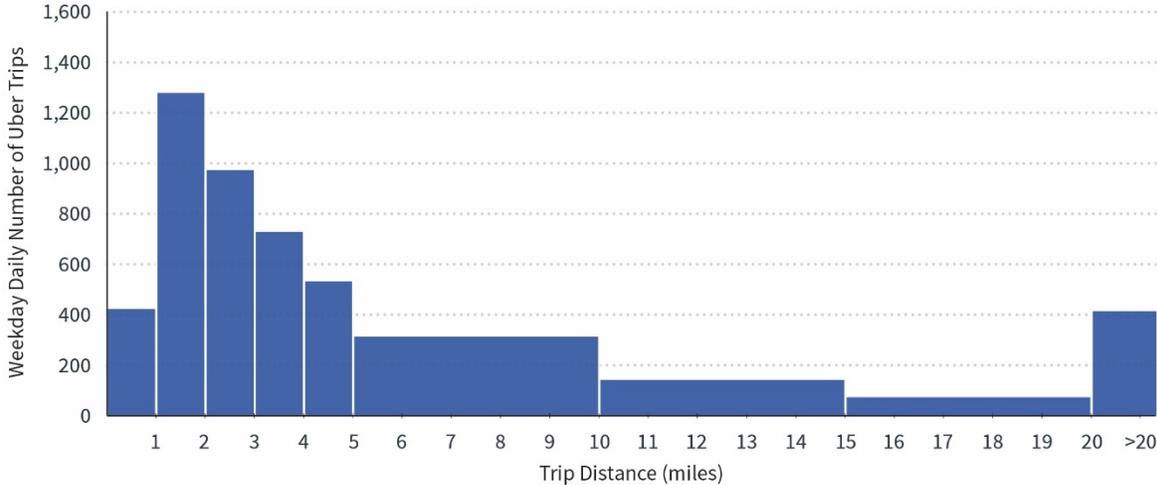


Figure 63 - Distribution of Uber Trip Distances in Miles (mean = 6.93 miles)

¹⁰⁹ Schaller Consulting. (2018, July 25). *The New Automobility: Lyft, Uber and the Future of American Cities* (Tech.). Retrieved <http://www.schallerconsult.com/rideservices/automobility.pdf> [page 13]



According to the National Transit Database, the average unlinked passenger trip length (i.e. each leg of a transfer is treated separately) is 5.64 and 6.67 miles for Metro and TANK, respectively.

7.5.6.2 Speed

The average Uber speed in the region is 24 MPH. According to the National Transit Database, average bus speed is approximately 13 and 15 MPH for Metro and TANK, respectively. The lower speed for buses reflects their need to decelerate, dwell, and accelerate at stops, and congestion during peak periods when transit service is at its highest, while Uber trips tend to occur after peak and on weekends when congestion is less. The average speed for Uber in Cincinnati is higher than the national average reported by Schaller based on NHTS data from 2017, which is 13 MPH within key urban metros, 20 MPH for suburban/rural areas, and 16 MPH overall.¹¹⁰ This may be due to comparatively low levels of congestion in Cincinnati, or a higher proportion of trips that use higher speed roadways than elsewhere in the county.

7.5.6.3 Total Trip Time

Uber has an average total trip time of 20 minutes. This is the sum of wait time, in-vehicle travel time, and any walk time to or from origin if necessary.

According to the 2018 Metro rider survey, a quarter of trips are <15 minutes, 29 percent are 16-30 minutes, a quarter are 31-45 minutes, and the remaining 20 percent are >45 minutes. This suggests an average bus travel time of a little under 30 minutes, although it is unclear from the survey question whether this includes wait time and bus stop access time.

7.6 Traveler Demographics and Trip Characteristics

In this section, we draw findings on the differing demographic profile and trip characteristics for transit and TNC from a combination of a literature review, local data, and a survey of Uber riders undertaken in July/August 2019.

We developed and deployed an Uber rider survey, crafted to understand OD travel patterns, trip purposes, and traveler characteristics of those who recently took an Uber trip in the Cincinnati region. The rider survey was deployed in June 2019 over a period of ten weeks via email to all people who had taken an Uber trip over the previous 48 hours. The return rate was 2.6 percent (1,831 out of 67,891).

¹¹⁰ Schaller Consulting. (2018, July 25). *The New Automobility: Lyft, Uber and the Future of American Cities* (Tech.). Retrieved <http://www.schallerconsult.com/rideservices/automobility.pdf>

Specific to Cincinnati, our key takeaways are as follows:

1. Express buses serve a whiter, wealthier population than local buses, and primarily serve trips to/from work.
2. Local bus services have a higher share of non-white riders, a higher share of low-income riders, have a higher proportion of child and senior riders, and higher share of non-work trips than express buses.
3. TNC riders are typically younger than transit riders, have higher incomes (at levels similar to express bus riders), and have a racial diversity similar to the region as a whole.
4. Transit serves as a fundamental way of getting around for a higher share of people, while TNC serves a role of filling in gaps or serving special trip purposes for most of its users.

7.6.1 Gender

For TANK, the female/male split was 58/42 and 59/41 for express and local riders, respectively. For Metro it is 52/48. For Uber in Cincinnati it is 50/48, with 1 percent preferring not to say (and 1 additional percent missing due to rounding). Across the U.S., according to Uber, the split for Uber is 52/47 with 1 percent preferring not to say.¹¹¹

A study of 4,787 American adults on the popularity of ride-hailing apps from the Pew Research Center found that ride-hailing apps were popular among 16 percent of men and 14 percent of women, reflecting the notion that ride sharing is fairly evenly popular among men and women.¹¹² Based on National Household Travel Survey data from 2016, Schaller found that across geographic groups, men are slightly heavier users of TNCs than women, although the differences are slight.¹¹³

Across all modes, the gender split is roughly even, except for TANK where the reason for such a high deviation from 50/50 is not known.

7.6.2 Age

Metro's riders are mainly aged between 18 and 65: 7 percent of riders are under 18, 20 percent 18-24, 37 percent 25-44, 31 percent 45-64, and 6 percent are over 65.¹¹⁴ For TANK express and TANK local, the demographic is almost entirely between 18 and 65, with express skewing the oldest. For TANK express: zero are under 18, 9 percent are 18-24, 18 percent are 25-34, 18 percent are 35-44, 52 percent are 45-64, and 3

¹¹¹ Civis Analytics. (2018). *Uber: Cincinnati Rider Comparative Analysis*.

¹¹² Pew Research Center. (2016, May 19). *Shared, Collaborative and On Demand: The New Digital Economy*.

¹¹³ Schaller Consulting. (2018, July 25). *The New Automobility: Lyft, Uber and the Future of American Cities* (Tech.). Retrieved <http://www.schallerconsult.com/rideservices/automobility.pdf> [page 11]

¹¹⁴ 2018 Metro rider survey



percent are over 65. For TANK local, 2 percent are under 18, 17 percent are 18-24, 24 percent are 25-34, 20 percent are 35-44, 33 percent are 45-64, and 3 percent are over 65.¹¹⁵

For Uber in Cincinnati, per the rider survey, the age breakdown is 39 percent are 18-29, 37 percent 30-49, 18 percent 50-64, and 5 percent are over 65, with 1 percent preferring not to answer.

Pew found that the median age of adult ride-hailing users in the United States is 33, and that 18- to 29-year-olds are seven times as likely to use these services as are those age 65 and older (28 percent vs. 4 percent).¹¹⁶ They also found that exposure to TNC services (i.e., people having downloaded the app) begins to drop off rapidly starting at around age 45. TCRP found that TNC users in major U.S. cities tend to be younger than TNC non-users.¹¹⁷ This generally seems to match the Cincinnati data, where the median age appears to be on the lower end of the 30-49 range. For transit, the median is on the upper end of the 25-44 range.

Overall, the median TNC rider age is lower than that for transit. However, the average age may increase with the aging of the smartphone-native generations.

7.6.3 Income

As of 2017, the median household income in the Cincinnati region was \$61,653.¹¹⁸ This is around \$1,000 higher than the national median. Recent census data shows that poverty is on the rise in Cincinnati. While this is not unusual amongst its peer regions, the City of Cincinnati's poverty rate is amongst the top five for cities with at least 250,000 residents. The 2018 federal poverty rate for a single person is an annual income of \$12,140. For a household of four people, it is \$25,100.¹¹⁹ OKI defines their "low income" environmental justice category as people in households where the median income is at or below the federal poverty level.

We use the \$25k and \$50k breakpoint in household income to reveal comparative income levels across modes because they are the breakpoints generally common within both transit and Uber data. In general, Uber riders and express bus riders have similarly high incomes, while local bus riders tend to have much lower incomes, with many in poverty. As shown in **Figure 64**, TANK express and Uber have only 37 percent and 35 percent of riders with household incomes under \$50k, respectively, while TANK local has 85 percent

¹¹⁵ 2014 TANK rider survey

¹¹⁶ Pew Research Center. (2016, May 19). *Shared, Collaborative and On Demand: The New Digital Economy*.

¹¹⁷ Kittelson & Associates, Inc., Parsons Brinckerhoff, KFH Group, Inc., Texas A&M Transportation Institute, & ARUP. (2013). *Transit Capacity and Quality of Service Manual, Third Edition. Transit Cooperative Research Program (TCRP), 165*, 30–30. doi:10.17226/24766

¹¹⁸ Census ACS. (2018). Cincinnati–Middletown Ohio Household Income. Retrieved from <https://www.deptofnumbers.com/income/ohio/cincinnati/>

¹¹⁹ HealthCare.gov. (n.d.). Federal Poverty Level (FPL). Retrieved from <https://www.healthcare.gov/glossary/federal-poverty-level-fpl/>

and Metro (express and local combined) has 84 percent.^{120,121,122} Twenty-nine percent of Uber riders have household income above \$100k whereas only 6 percent of Metro riders have household incomes above \$86k.

Only 12 percent of TANK express riders have income below \$25k, whereas 60 percent of TANK local riders do, 61 percent of Metro riders do, and 25 percent of Uber riders do.

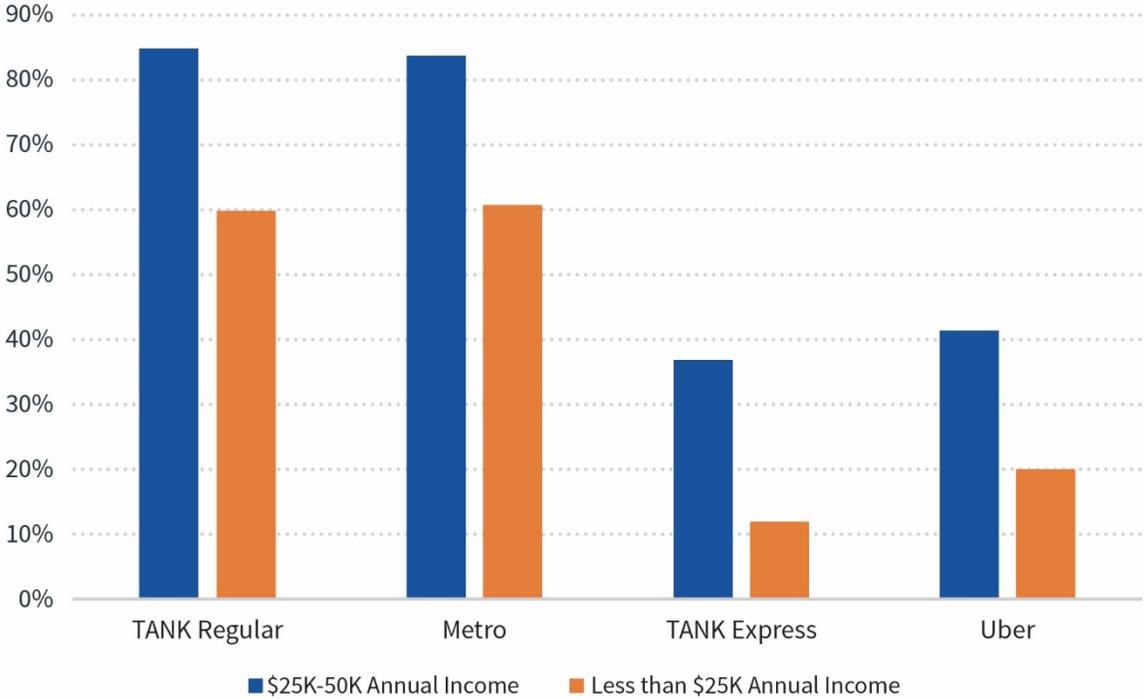


Figure 64 - Proportion of Riders with Annual Household Income <\$50k

These local trends generally match up with national trends, where TCRP found that ZIP codes with the most TNC use are higher income and TNC users tend to be higher income than non-TNC users.¹²³ In a 2018 survey, Pew found that the higher the income, the more likely the individual was to have tried a TNC (24, 35, and 53 percent respectively for <\$30k, \$30k-\$75k, and >\$75k categories).¹²⁴ An anecdote from Boston, from an interview with David Block-Schachter (formerly of MBTA) was that riders of the now-defunct Bridj microtransit service had a relatively similar income to the transit riders in the area that it served, which was

¹²⁰ TANK 2014 rider survey
¹²¹ Metro 2018 rider survey
¹²² Civis Analytics. (2018). *Uber: Cincinnati Rider Comparative Analysis*.
¹²³ Feigon, S., & Murphy, C. (2018). Broadening Understanding of the Interplay Between Public Transit, Shared Mobility, and Personal Automobiles. *Transit Cooperative Research Program (TCRP)*, 195. doi:10.17226/24996
¹²⁴ Pew. 2019. <https://www.pewresearch.org/fact-tank/2019/01/04/more-americans-are-using-ride-hailing-apps/>



a slightly wealthier and younger demographic than the region as a whole, likely in part because Bridj selected a market that they deemed most profitable, which is higher income areas.

In general, Uber and express bus riders are higher income whereas local bus riders are lower income with over half in poverty.

7.6.4 Race and Ethnicity

The City of Cincinnati is 49 percent non-Hispanic white, with 3 percent Hispanic (excluding black and Asian Hispanics), 43 percent black, 2 percent Asian, 3 percent mixed, and half a percent other. It is more diverse than the metro area as a whole which is 80 percent non-Hispanic white, with 3 percent Hispanic (excluding black and Asian Hispanics), 12 percent black, 2 percent Asian, 2 percent mixed, and 0.3 percent other.¹²⁵

In the Cincinnati region, according to the rider survey, the racial distribution of Uber riders is similar to the region as a whole: 72 percent of Uber riders are non-Hispanic white, 15 percent are black, 4 percent are Hispanic, 5 percent are Asian, 1 percent were Native American or Alaskan Native, 2 percent were multiple races, and 1 percent were other.¹²⁶ Metro has a comparatively much higher share of black riders, with 62 percent black, 29 percent non-Hispanic white, 2 percent Hispanic, 2 percent Asian, 3 percent Native American, Alaska Native, Pacific Islander, or Native Hawaiian, and 3 percent other.¹²⁷ TANK express service has a mostly white ridership, with 78 percent non-Hispanic white, 18 percent black, 2 percent Hispanic, 1 percent Asian, and 2 percent Native American or Alaska Native. TANK local service is also mostly white, although less so than express service: 68 percent of riders are non-Hispanic white, 27 percent black, 2 percent Native American and Alaskan Native, and zero percent other (including Asian).¹²⁸

Overall, Uber and TANK express have the lowest proportion of non-white (28 and 22 percent respectively), TANK local has 32 percent non-white, and Metro has by far the highest proportion of non-white riders (71 percent). These statistics largely reflect the communities in which service is oriented; much of Metro's service is oriented to minority neighborhoods in the west and north sides of Cincinnati, TANK's express service is focused on the whiter suburbs of northern Kentucky, while Uber serves the region as a whole, which is overwhelmingly white.

Daily Uber and transit ridership overlaid on top of poverty and minority environmental justice categories are presented below in **Figure 65** and **Figure 66**. **Figure 67** shows this data for the regional core. Transit

¹²⁵ Statistics Atlas. (n.d.). Race and Ethnicity in the Cincinnati Area (Metro Area). Retrieved from <https://statisticalatlas.com/metro-area/Ohio/Cincinnati/Race-and-Ethnicity>

¹²⁶ Fehr & Peers and Uber. (2019). *Survey of Cincinnati Uber Riders in June-August*.

¹²⁷ Metro 2018 rider survey

¹²⁸ TANK 2014 rider survey

generally maps more closely with these two populations with one notable exception: Uber has high ridership in the University Heights/Clifton Heights/Corryville area, which contain poverty and minority populations.

On a given weekday, 47 percent of transit and 42 percent of Uber trips originate from areas considered minority environmental justice communities, while 39 percent of transit and 31 percent Uber trips stem from areas considered poverty environmental justice communities.

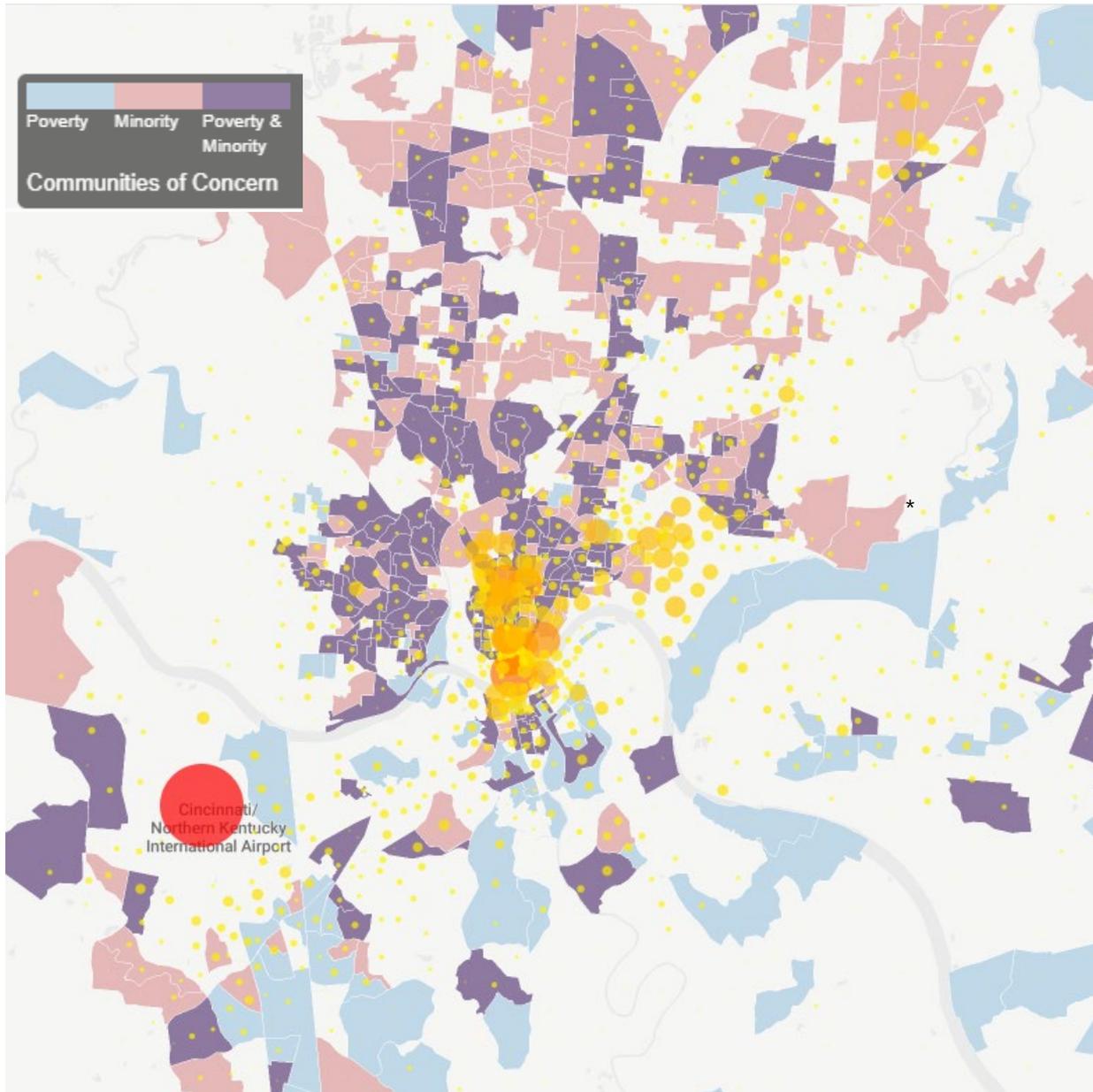


Figure 65 - Daily Uber Ridership and Low Income and Minority Communities

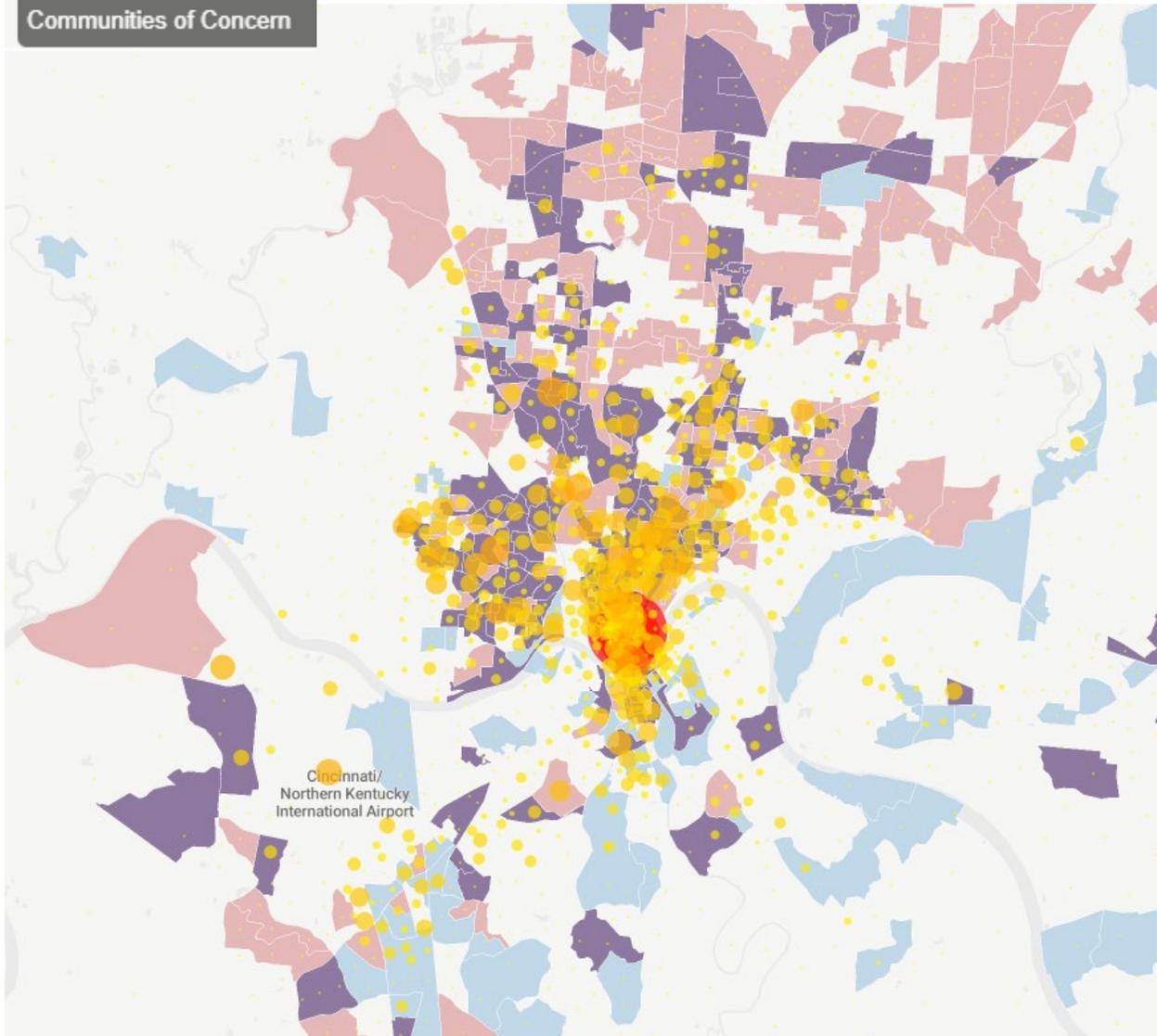
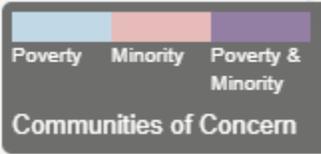


Figure 66 - Daily Transit Ridership and Low Income and Minority Communities



Nationally, Pew finds no substantial differences in TNC usage rates across races: whites, blacks and Latinos are equally likely to use TNCs. The 2015 survey found that 15 percent of blacks, 14 percent of non-Latino white, and 18 percent of Latino adults had tried a TNC service.¹²⁹ Another study found a 4 percent higher likelihood of a rideshare trip being cancelled for black riders when compared to white riders.¹³⁰ While indicating a slight racial disparity, these levels are significantly lower than taxi services where black riders were 73 percent more likely to have a taxi driver cancel their trip. These findings align with the Cincinnati data for Uber, i.e., there are not major discrepancies in level of representation across different races and ethnicities.

7.6.5 Car Ownership

According to the Uber rider survey that we have undertaken for this study, 20 percent of Uber riders do not own or lease a car in their household. This is compared with 2.4 percent of all households in the region.¹³¹ Of these, three-quarters have an annual household income below \$45k, compared with 36 percent of all Uber riders, showing that zero car ownership is uncommon among Uber riders, and is more likely for those with low income. Only one-tenth of those Uber riders who do not own or lease a car in their household have incomes above \$65k.

Of the 80 percent of Uber riders who do own or lease a car, around half did use one of their cars on the same day as the Uber ride, and about half did not. People taking Uber rides from 6 AM to 4 PM on the weekday are over 3 times more likely to not be using their private car for other trips that day, whereas people taking Uber rides from 4 PM to 12 AM on the weekday are 1.35 times more likely to have used their private car for other trips that day. On the weekend, the likelihoods of the two are around the same.

7.6.6 Frequency of Use

In Cincinnati, TNC riders use TNCs much less frequently than transit riders use transit. Seventy-six percent of Uber riders in Cincinnati use it for 0-3 trips per month. This is a higher proportion than the 60 percent of Uber riders nationally in this category.¹³² Only two percent of Cincinnati Uber riders say they use it more than 12 times per month (compared with 10 percent nationally). In contrast, 47 percent of Metro users state that they ride Metro every day and 90 percent of TANK riders state they ride at least three times a week. 42

¹²⁹ Smith, A. (2016, May 19). *The New Digital Economy: Shared, Collaborative and On Demand* (Tech.). Retrieved <https://www.pewinternet.org/2016/05/19/the-new-digital-economy/>

¹³⁰ Brown, A.E. (2018). *Ride-hail Revolution: Ride-hail Travel and Equity in Los Angeles*. Dissertation for UCLA [page 124]. Retrieved <https://escholarship.org/uc/item/4r22m57k>

¹³¹ Data USA (2020). *Housing Data from the U.S. Census American Community Survey, 1-year estimate, 2018*. Retrieved <https://datausa.io/profile/geo/cincinnati-middleton-oh-ky-in-metro-area#housing>

¹³² Civis Analytics. (2018). *Uber: Cincinnati Rider Comparative Analysis*.

percent of local riders state they ride 6-7 times per week, compared with only 10 percent of express riders, implying that local riders rely on the service for a broader variety of trip purposes.

Per the 2018 Pew study, while only a small share of TNC users report using TNC apps weekly, some groups are more frequent users than others. Urban users (19 percent) are more likely to use these services weekly than suburban (6 percent) or rural users (5 percent).¹³³

Ultimately, transit riders are more frequent while TNC users are more infrequent in their usage of the respective service. Transit serves as a fundamental way of getting around for a higher share of people, while TNC serves a role of filling in gaps for most of its users.

7.6.7 Trip Purpose

According to the Uber rider survey that we have undertaken for this study, 57 percent of trips had a purpose of social/recreation, 17 percent were to/from work (plus 6 percent for work-related business), 9 percent were for family/personal errands, 3 percent shopping, 3 percent medical, 0.6 percent place of worship, and 0.3 percent for school/university, with 4 percent other. This agrees closely to Schaller's findings, where using NHTS data from 2016 he found that work trips constitute around 20 percent of TNC trips, which is similar to the rate for personal auto use. Social and recreational trips and home-based non-work trips are other popular purposes.¹³⁴

Trip purpose varies substantially by household income, as shown below in **Figure 68**. Lower income and/or minority persons use Uber more for trips to and from work and less for social/recreational purposes, while higher income and/or white persons use Uber primarily for recreational trips.

¹³³ Pew (2019). <https://www.pewresearch.org/fact-tank/2019/01/04/more-americans-are-using-ride-hailing-apps/>

¹³⁴ Schaller Consulting. (2018, July 25). *The New Automobility: Lyft, Uber and the Future of American Cities* (Tech.). Retrieved <http://www.schallerconsult.com/rideservices/automobility.pdf> [page 13]

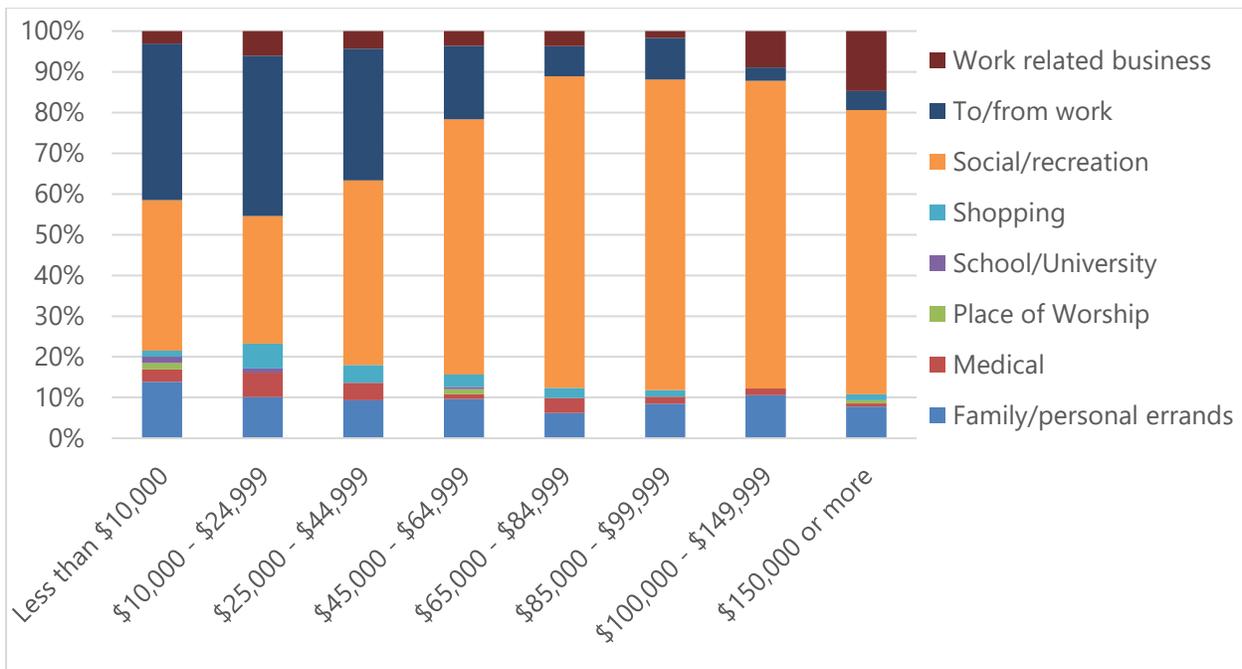


Figure 68 - Relationship of Trip Purpose with Household Income

Of trips to/from work taken by those with household incomes of <\$45k (14 percent of overall trips), 15 percent are happening on weekends. The rest are weekday trips: 24 percent are happening between 6 and 9 AM, 28 percent are happening between 9 AM and 4 PM, 21 percent are happening between 4 PM and 7 PM, and 12 percent are happening between 7 PM and 12 AM. Therefore, 55 percent of these work trips are happening outside of “traditional” commute hours, where transit is far less prevalent.

Of trips to/from work taken by those with household incomes of <\$45k, 33 percent are mode shifts from transit, 22 percent from bike/walk, 18 percent from auto, 14 percent from taxi, and 10 percent are new trips, with 3 percent other. Of the transit donor category, 90 percent of this shift to TNC is from weekday trips; for auto 80 percent are weekend trips.

TANK did not provide information on trip purpose, but Metro rider survey results show that work trips are 48 percent of trips, followed by school at 11 percent, shopping and 10 percent, and medical at 8 percent.¹³⁵ Thus, work trips are more common for transit than TNC and auto.

¹³⁵ Metro rider survey 2018.

7.6.8 Mode Shift

According to the Uber rider survey that we have undertaken for this study, 34 percent of trips are mode shifts from auto, 26 percent are from taxi, 16 percent are new trips not previously taken by any other mode, 13 percent are from bus, 7 percent are from walk, 3 percent are from friend drove them, and 1 percent are from bike. In instances where respondents listed multiple “donor” modes, each was given equal fractional weighting summing to one for that individual. The donor mode is more likely to be transit, bike, and walk for those of lower incomes, and is more likely to be auto and taxi for those of higher incomes, as shown in **Figure 69**. For car and taxi as donor modes, the most common trip purpose is overwhelmingly social/recreation (71 percent and 62 percent, respectively). For bus as donor mode, the trip purposes are much more spread with to/from work being the highest at 40 percent and social/recreation the next highest at 23 percent.

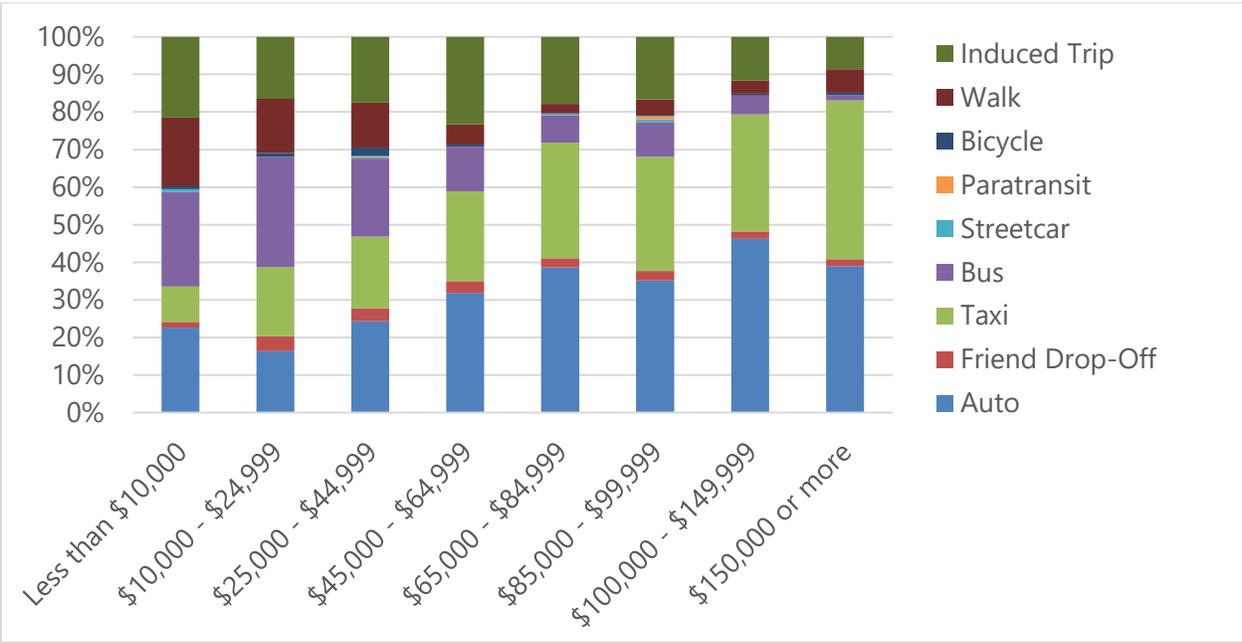


Figure 69 - Mode Shift to Uber by Household Income Category

7.6.9 Multimodal Trips

According to the Uber rider survey that we have undertaken for this study, 8 percent of Uber trips were taken as part of a round-trip or tour where another of the legs was transit. This suggests compatibility of the two modes in providing travelers flexible options for getting both to and from destinations depending on their respective relative service levels for each trip leg.

7.7 Why are People Shifting to Uber?

As part of the Uber rider survey undertaken as part of this project we asked why people shifted to Uber from another mode. Respondents could select more than one reason. Results in this subsection are filtered for where the mode is selected as the sole donor mode. For the three greater donor modes, the factors cited by at least 10 percent of respondents, in descending order are:

- **Auto:** easier, safer,¹³⁶ more cost-effective
- **Taxi:** easier, more cost-effective, safer, lower wait time
- **Bus:** lower travel time, easier, lower wait time

A breakdown of each response for these three modes is given in **Figure 70**.

Low income/minority people appear to be shifting to Uber from transit and walking as it provides a more reliable transportation option without the need to own a car or drive. Travel time and wait time are a much bigger factor for people shifting from transit.

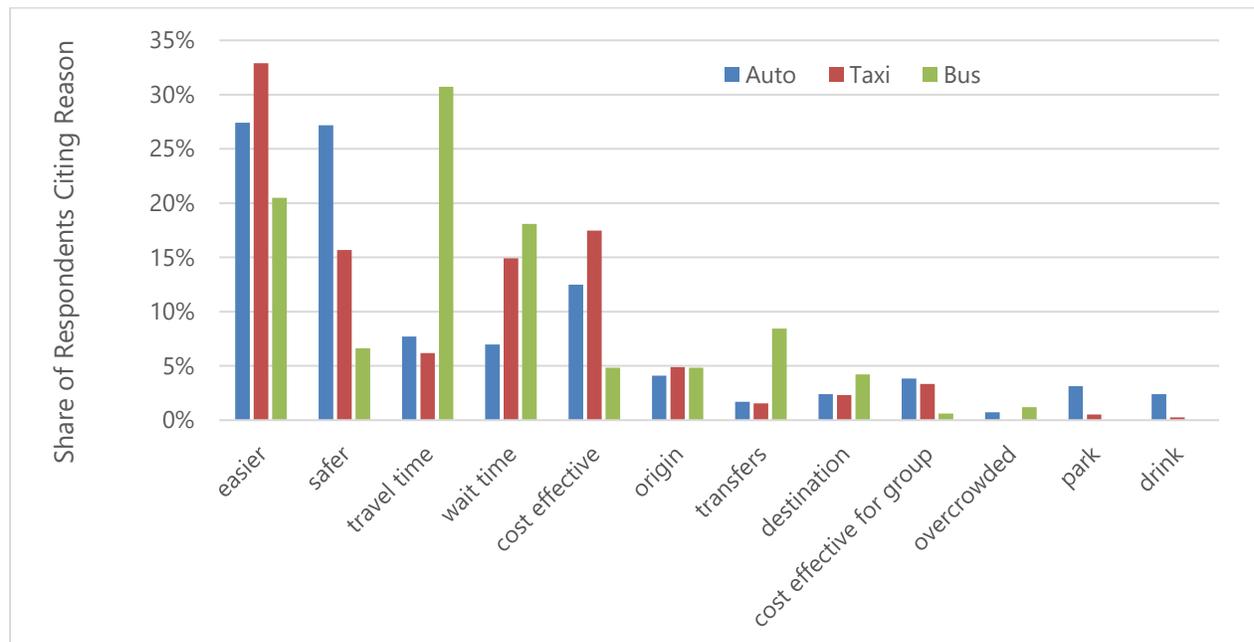


Figure 70 - Reasons Cited for Shifts from Auto, Taxi, and Bus to Uber in Cincinnati

¹³⁶ The most common write-in explanation given for respondents who selected “safer” than the auto was that Uber gave them the option to attend a social event to drink alcohol, suggesting that it decreases the incidence and safety risks involved with operating a vehicle under the influence.

7.8 Comparative Trip Costs of Auto, Transit, and Uber

This section reveals the comparative cost to the user and the agency of driving a personal vehicle, taking transit, and taking Uber. For this question, local context is essential. We examine the average cost of personal vehicle ownership and of driving. This is followed by an overview of the fare system for Cincinnati transit before presenting an analysis of route productivity and subsidies for transit routes. We compare the cost to provide a trip for Uber and for transit. Finally, we describe the ways that the upfront and marginal costs of each mode influence individual mode choice. Our key takeaways are as follows:

1. The upfront costs of personal vehicle ownership are high, but once a vehicle has been purchased, the marginal cost to take each trip is relatively low.
2. The fare system in Cincinnati is quite complex, there is limited regional fare integration, and payment using cash is widespread.
3. Metro has the best farebox recovery ratio (30 percent) of peer cities.
4. Average transit subsidy per passenger is \$5–6 and Metro express routes underperform on this metric compared with other bus routes.
5. Bus service in Cincinnati has a lower cost per person trip to the user than Uber.

7.8.1 Auto

The cost of driving a personal vehicle can be thought of as consisting of two components: the upfront costs of purchasing the vehicle and paying for insurance, and the marginal costs of gas and parking for each trip taken. The average cost of a new car is over \$35,000.¹³⁷ Taking into consideration monthly vehicle payments in addition to the other fixed costs (vehicle registration, insurance, maintenance, etc.), the average monthly cost for a new car owner is \$733 per month.

One alternative to personal vehicle ownership is membership in a carsharing service such as Zipcar, which charges members a monthly or annual fee for access to a shared fleet of vehicles. Carsharing provides the benefits of a personal vehicle without the large upfront purchase or recurring maintenance costs. In the Cincinnati area, Zipcar memberships are \$7 per month or \$70 per year. Members also pay hourly or daily fees each time they use a vehicle.

¹³⁷ Kelley Blue Book estimate for a new light vehicle. <https://mediaroom.kbb.com/2019-01-03-Average-New-Car-Prices-Up-More-Than-1-Percent-Year-Over-Year-for-December-2018-Closing-the-Strongest-Year-of-Growth-Since-2013-According-to-Kelley-Blue-Book>

Marginal costs for each driving trip consist primarily of the cost of gas and the cost of parking. Gas prices closely track the national average, which is currently around \$2.75/gallon.²⁹ Compared to neighboring Dayton, OH and Louisville, KY, prices remain similar albeit slightly higher in Louisville. Prices fell from a high of \$3.90/gallon in 2014 to about \$1.90/gallon in early 2015 and fell again to \$1.43/gallon in 2016. Since then, gas prices have generally hovered between \$2.00 and \$3.00 per gallon.

The price of parking is often a larger component of the marginal cost of a trip made by personal vehicle. Typical daily rates for parking garages in Cincinnati are about \$12 per day. On-street parking meter rates vary by location. Within downtown, standard rates range from \$1.25 to \$2.75 per hour, while neighborhood rates range from \$0.75 to \$1.25 per hour.²⁸ Drivers can use the CincyEZPark app to pay for on-street parking meters without using coins or credit cards.

7.8.2 Transit

7.8.2.1 Transit Fare Systems

7.8.2.1.1 Metro Fare System

Metro has a zone-based fare system, where fares range from \$1.75 per trip within Zone 1 (which is the City of Cincinnati) steadily ascending with zone numbering to \$4.25 per trip to/from Zone 5 (Warren County). Each transfer costs 50 cents. Day passes are offered for Zones 1 and 2 (\$4.50 and \$6.30, respectively). 30-day passes can be purchased at the equivalent cost of 40 single fares. A map of the zone boundaries is shown in **Figure 71**.



Figure 71 - Fare Zone Map for Metro Service

Source: Fare Information – Go Metro. (n.d.). Retrieved from <http://www.go-metro.com/fare-information>

Metro offers various reduced fares for qualifying individuals, which are as follows:

- Children under 35 inches ride free (i.e., children typically aged 2 and under).
- Children between 35-45 inches pay half fare (i.e., children typically aged between 2 and 6).
- ACCESS Card – Shared-Ride service pass for riders with disabilities. These are for rides on ADA-specific shuttle buses where fares range from \$3.50-\$4.50.
- Fare Deal Card – Half-price fare card for riders who are 65 or older, have a Medicare Card, have disabilities, and/or have an ACCESS Card. Alternative to paying per trip, a monthly pass (sticker) can be purchased for \$38.50 (valid for travel in all zones).
- University of Cincinnati, Cincinnati State University, or Antonelli College Discount Card – Pass for students and faculty of these educational facilities allowing for unlimited rides in any zone for \$1 fare.
- XTRA Service Smart Card – Pass options for students in Cincinnati Public Schools, although there is no discount fare.

Acceptable fare media are coins, bills, passes as listed above (which come in the form of magnetic swipe cards), and regional stored value cards (which are also magnetic swipe).

Figure 72 shows that cash forms the majority of fare payments. Cash is a comparatively time-inefficient way to pay for fares, suggesting that buses could be sped up through a transition to quicker fare media (such as contactless tap cards).

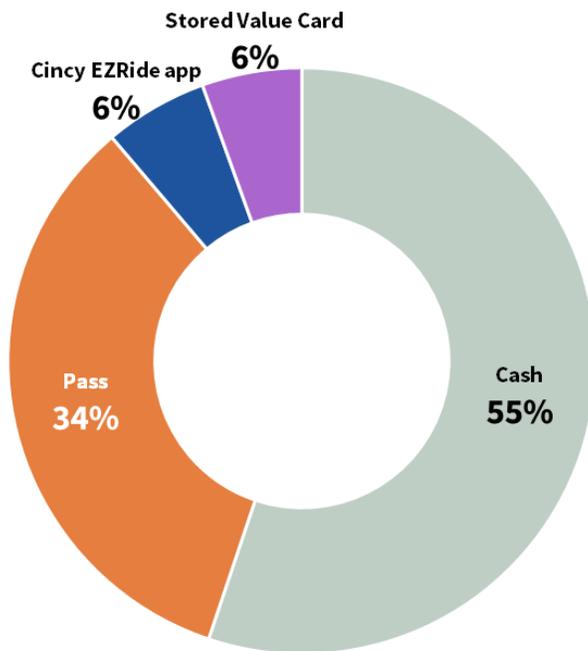


Figure 72 - Fare Media Used on Metro

7.8.2.1.2 TANK Fare System

TANK does not have a zone-based fare system. Instead, fares are \$1.50 for local routes, \$2.00 for express routes, and \$1.00 for the Southbank shuttle. Each transfer costs 25 cents. 1-day, 3-day, and 5-day passes are offered at \$3.50, \$10, and \$15. Ten-ride passes are offered that provide a 10 percent discount. Monthly passes are offered (\$53 for local and \$70 for express).

Fares for seniors and people with disabilities are half price. Children under 45 inches ride free (i.e., children typically aged 6 and under). A special student fare of \$1 per trip is available.

Acceptable fare media are coins and bills. Monthly passes are magnetic swipe cards and ten-ride passes are ticket books. Reduced fare cards are photo ID cards with passes indicated through stickers. The share of fare media used on TANK is shown below in **Figure 73** and shows that by a slightly higher majority than for Metro, cash is the largest fare payment media.

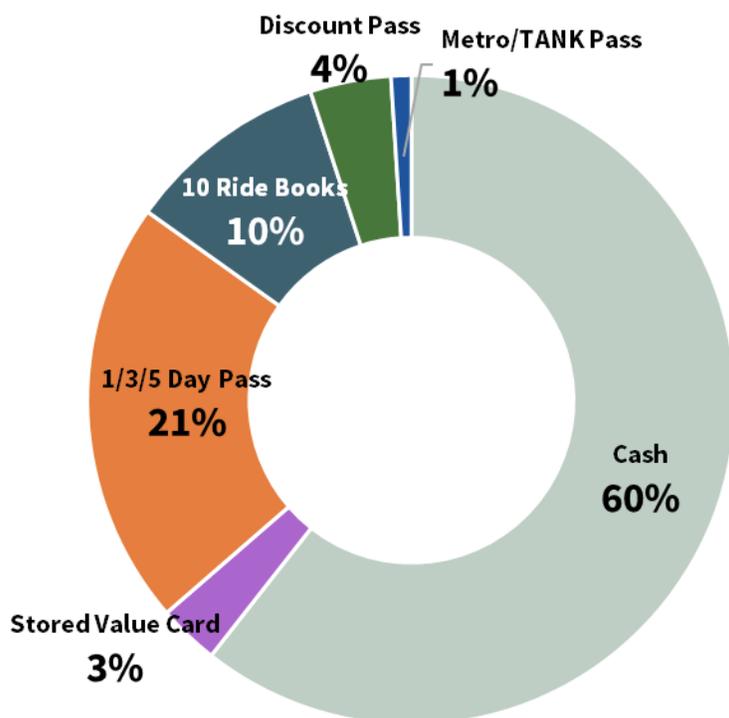


Figure 73 - Fare Media Used on TANK

7.8.2.1.3 Regional Coordination on Fares

Shared Metro/TANK monthly passes are available at a cost of \$105 for local only and \$115 for express and local buses. These allow travel on TANK services and within Zone 1 of Metro service area (i.e., the City of Cincinnati) and come in the form of magnetic swipe cards.

Regional Stored-Value Cards (also magnetic swipe), are available in \$10, \$20, and \$30 quantities, and are good on all Metro and TANK buses. They can be used like cash to buy transfers, pay all zone fares and discounted fares such as Fare Deal, children’s fares or UC or Cincinnati State fares, and even for multiple riders.

Fares for transfers across agencies vary between 75 cents and \$1.

7.8.2.2 Transit Agency Productivity & Subsidies

Metro’s overall farebox recovery ratio is around 30 percent, which affords it a favorable ranking compared with peer cities (see **Figure 74**). TANK’s ratio is 20 percent, which would place it middle of the pack against these cities that serve a more urban population.

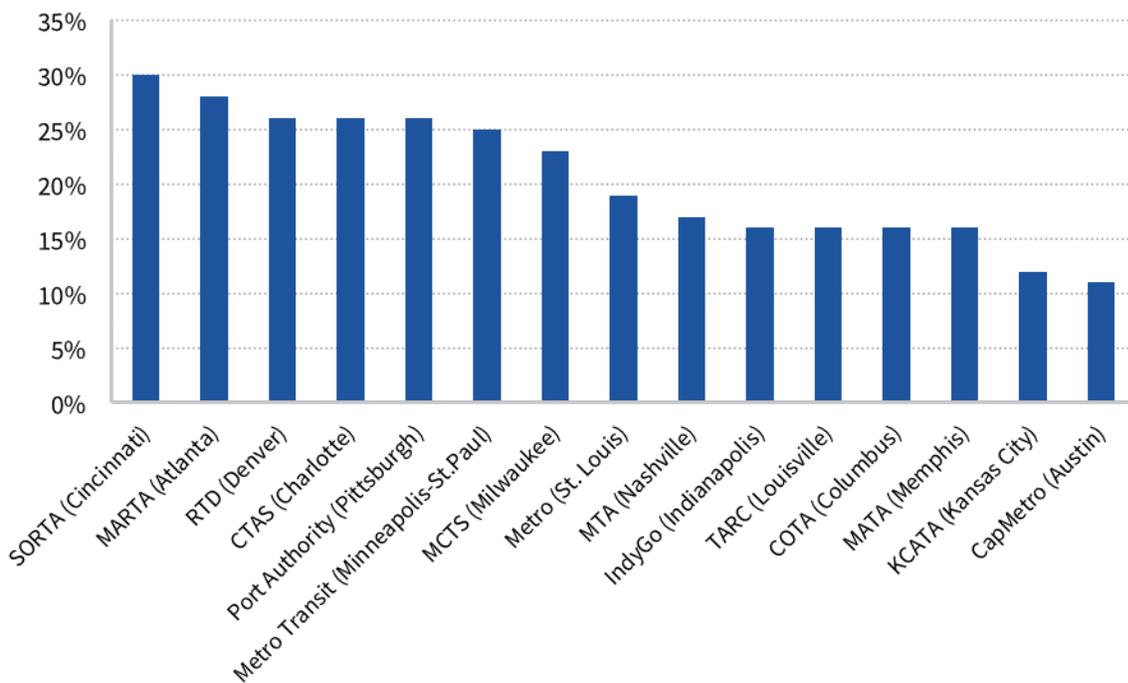


Figure 74 - Farebox Recovery Ratios of Peer Systems (National Transit Database, 2016)

Source: Mid-America Regional Council (MARC). (2018, September). *Peer Cities Transit Report Summary (Rep.)*. Retrieved http://www.marc.org/Transportation/Plans-Studies/pdfs/2018PeerCitiesTransitReport_summary.aspx

Metro and TANK both provided data by route on productivity, revenue, and subsidies. Of the 72 routes studied, eleven had a subsidy per passenger of greater than \$10 of which two routes had a subsidy per passenger of greater than \$15. Of those eleven routes, seven are Metro Express, one is TANK Express, and one is Metro Local. Twenty routes had a subsidy of less than \$5 of which twelve are Metro Local, four are TANK Express, 3 are TANK Local, and 1 is Metro Express. **Figure 75** shows a comparison of passengers per revenue hour and subsidy per passenger. Around 13 passengers per revenue hour are required to keep subsidy per passenger below \$10, and similarly around 0.8 passengers per revenue mile are required for the same.

Figure 76 shows a comparison of passengers per revenue mile and subsidy per passenger.

Figure 77 shows average subsidy by route type, demonstrating that local routes typically have a lower subsidy per passenger and also a lower spread of subsidy. Metro Express routes appear to be an outlier with a particularly high subsidy per passenger.

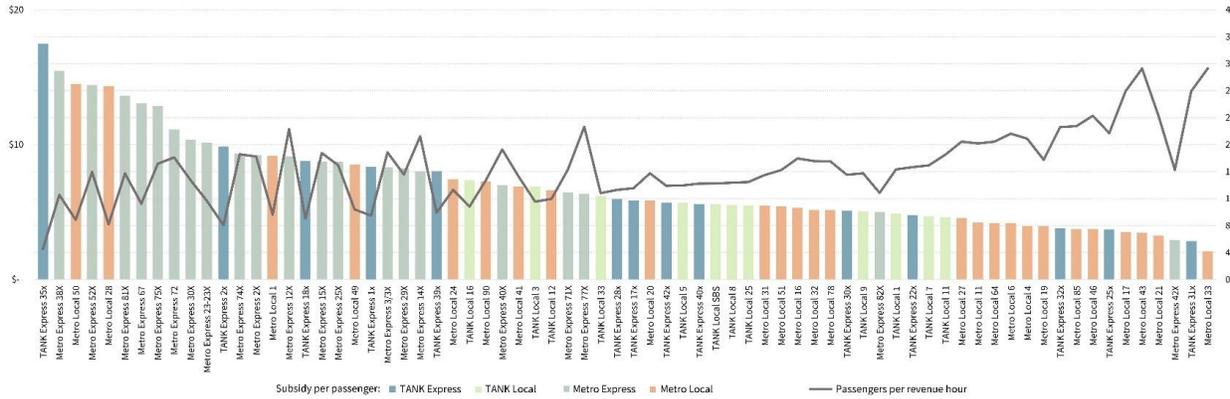


Figure 75 - Comparison of Passengers per Revenue Hour and Subsidy per Passenger

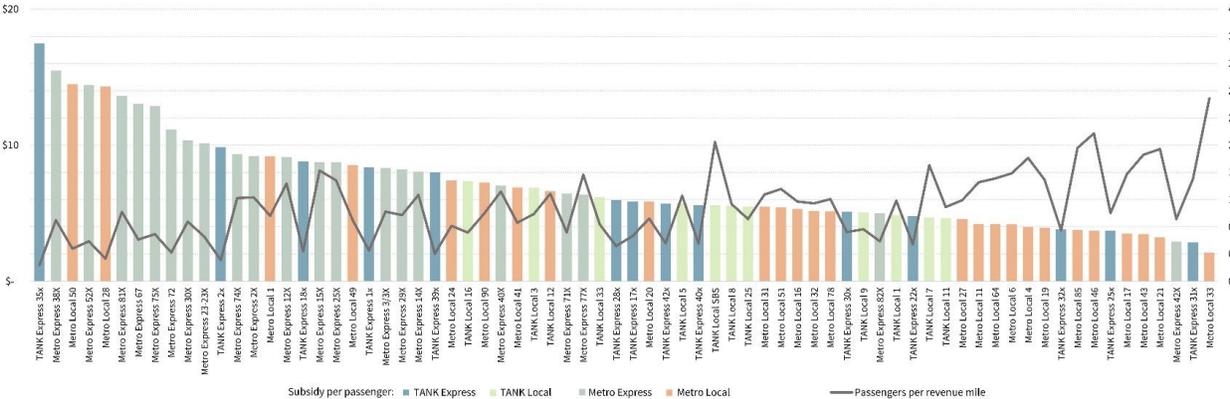


Figure 76 - Comparison of Passengers per Revenue Mile and Subsidy per Passenger

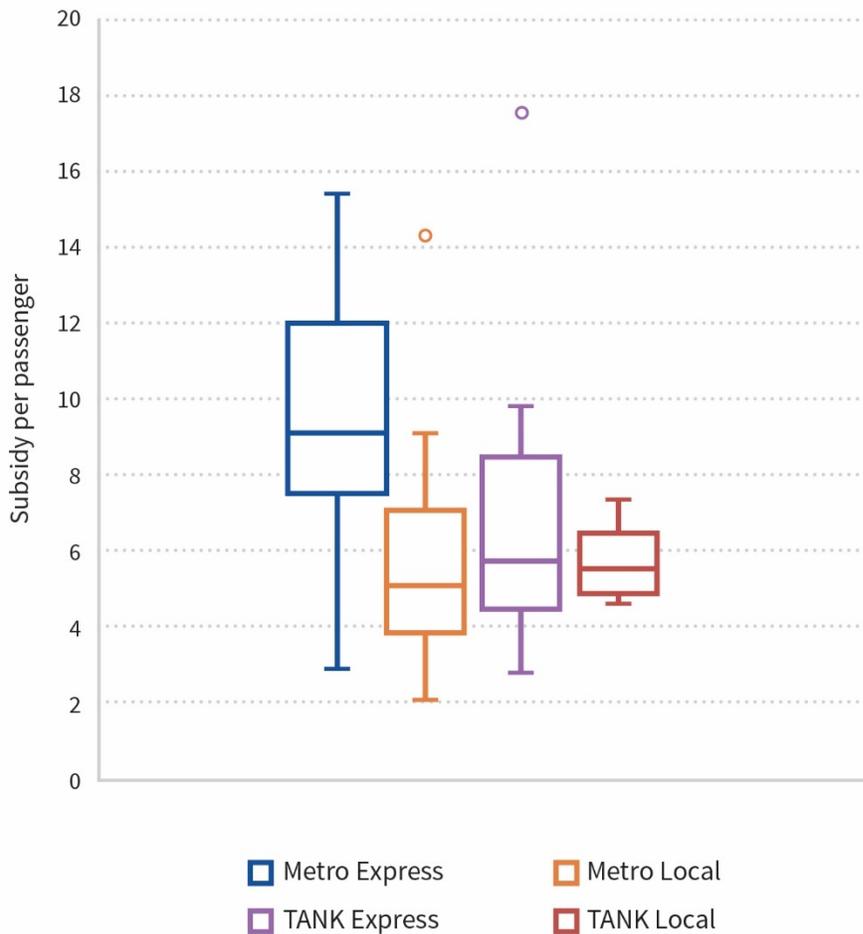


Figure 77 - Subsidy per Passenger by Route Type

7.8.3 Uber/Transit Cost Comparison

For the purposes of this study, we are assuming that the fare paid by the user is the total cost of the trip to Uber (including driver payment). The Uber fare includes costs and profits consistent with Uber's present business model, and we assume that it will continue to do so for purposes of the study, although we acknowledge that this may change in future. Therefore, the rider fare would also be a reasonable estimate of the cost to the transit agency of providing an Uber trip. This assumption allows us to compare the costs to a transit agency of providing each type of trip.

A comparison of the cost profiles for Uber and transit is provided below in **Figure 78**, where the sample is each individual trip taken over the course of a month. The Uber cost is the cost to the user and is assumed to represent Uber's gross cost of providing the service, that Uber's user revenue meets its expectations revenue versus the cost to provide the service and includes its targeted return on its investment. This is the

fully loaded cost for transit and does not include fare revenue. It demonstrates that most transit trips cost the agency between \$4 and \$6 with few above \$8. The typical cost for Uber is higher at \$6 to \$10 for most trips with very few less than \$6. Uber’s higher typical cost could be explained by either longer trips, a lower cost-efficiency per mile service, or costs expended on zero-occupancy travel waiting for trips.

TNCs have much lower labor costs than transit. However, costs could increase due to reclassification of employees, possible unionization, and city or state regulations requiring different wage levels or structures. In the long run, costs could also decrease substantially if labor is replaced with automation. For comparison sake, transit may also continue to experience changing labor costs, and could also see cost reductions due to automation.

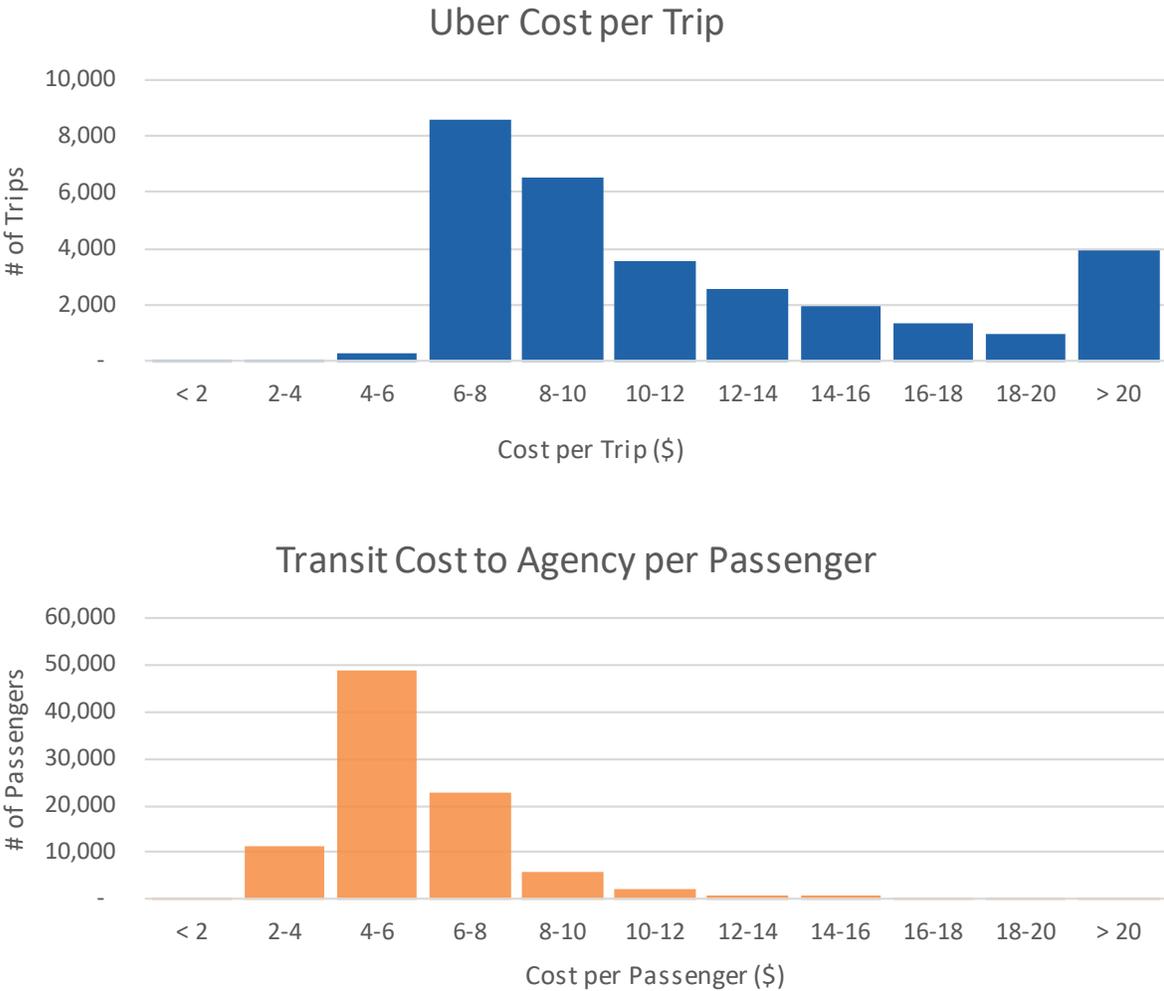


Figure 78 - Cost per Trip to Agency for Transit Trips and Cost per Trip to Passenger for Uber Trips



7.8.4 Impact of Trip Costs on Mode Choice

While the monetary cost is not the sole determinant of the mode one chooses to use to make a trip, it is an important factor in the decision-making process. The upfront and marginal costs of each mode can vary by an order of magnitude or more. Using a personal vehicle requires a high upfront cost; in comparison, the initial investment for carshare, transit, or Uber is low to minimal. The marginal cost of taking a transit trip is generally lower than for other modes. However, time – and the value of time – is another factor impacting decision-making. Despite the low cost of a bus fare in Cincinnati, where transit is infrequent or indirect, many individuals choose to drive or take a TNC instead. In particular, if it is inconvenient to make necessary trips (commuting, shopping, school), by other modes, those with the means will generally purchase a personal vehicle.

An indicative summary of upfront and marginal trip costs for a three mile trip (the average length of a transit trip in the region) is shown in **Table 8** below, comparing auto to carshare, transit, and Uber. The value of time is not included in this assessment. A chart showing the range of marginal cost per trip is then shown in **Figure 79**. These charts make clear the low marginal cost of driving compared with transit (assuming parking costs are low, which they are in all but the downtown core), and the low marginal cost of transit compared with carshare and Uber, although, because they exclude the auto upfront costs, don't reflect the impact of driving on the economic well-being of the traveler

Ultimately, to counter the car, a basket of non-automobile options to fit different needs would need to replace it. This is the concept behind Mobility-as-a-Service (MAAS). Transit users should be incentivized to get subscriptions (i.e., transit passes) so that they have the easy option of taking transit at no marginal cost.

Table 8: Upfront and Marginal Cost Comparison for a Typical 3 Mile Trip

	Car		Zipcar (Carshare)		Transit		Uber	
Upfront Monthly Costs	Insurance	\$92.00	Membership	\$7.00	Transit pass	\$70.00		
	Car Payment ¹	\$530.00						
	Registration, fees	\$12.00						
	Maintenance	\$99.00						
Total		\$733.00		\$7.00		\$70.00		
Marginal Costs	Gas ²	\$0.33	Rate min. (1 hr)	\$8.50	Fare min. ⁴	\$1.00	Fare min. ⁵	\$6.00
	Parking min. (4 hrs)	\$0.00	Rate max. (4 hrs)	\$34.00	Fare max.	\$4.25	Fare max.	\$15.00
	Parking max. (4 hrs) ³	\$11.00					Tip	\$1.00
Total min.		\$0.58		\$8.50		\$1.00		\$6.00
Total max.		\$11.33		\$34.00		\$4.25		\$16.00
Total per Trip (min.)		\$6.69		\$8.56		\$1.58		\$6.00
Total per Trip (max.)		\$12.94		\$34.06		\$4.83		\$16.00

Notes:

1. Monthly car payment, registration, fees, and maintenance based on national average
2. Gas cost calculated using a rate of \$2.75/gallon for 25 mpg vehicle.
3. Parking maximum assumed hourly rate of \$2.75, the maximum meter rate in Downtown Cincinnati
4. Transit range includes TANK fare as low as \$1.00/trip up to \$4.25 for Metro trip into Zone 5. Fare is zero if transit pass is purchased.
5. Uber fare range for UberX 3 mile trip in Cincinnati.

Sources: CarInsurance.com for average Cincinnati auto insurance costs; Zipcar for carshare costs; Nerdwallet for average monthly car payments; CincyInsights for Downtown parking costs; Uber data provided to Fehr & Peers for Uber fare data

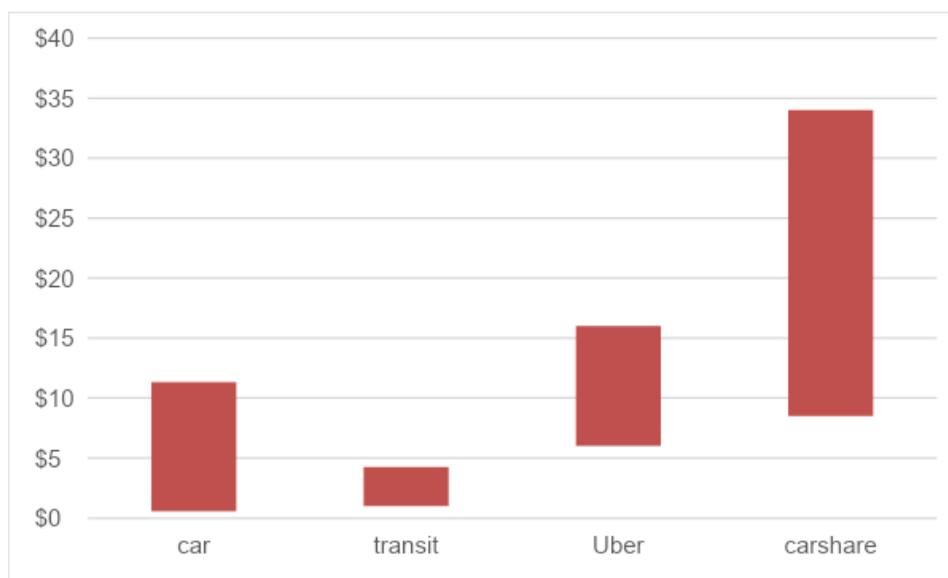


Figure 79 - Range of Marginal Costs for a Typical 3-Mile Trip

Supplement D –
The Forces Behind
Declining Transit
Ridership and
Increasing Auto Travel

8.1 A Half-Century of Ridership Decline

Transit ridership in Cincinnati has been in steady decline for at least the last 50 years. Ridership per capita dropped from 35 in 1963 to 10 in 2018, a loss rate of 1.3% a year on average. From 1991 through 2018, Cincinnati’s transit agencies lost almost 50% of their ridership, or about a 57% drop in ridership per capita. In this context, any loss attributable to TNCs appears to be almost negligible.

From 2014 through 2018, the period during which the TNCs became active, the average annual transit ridership loss per capita in Cincinnati (0.476 trips) was only about 5% higher than the average annual loss during the preceding four years (0.453 trips). However, 2014-2018 saw a 3.2% annualized decline in ridership per capita, compared with 1.3% for the preceding 51 years, demonstrating that transit ridership decline has become faster over the past few years than over the previous 50.

Overall, most of the ridership loss since when TNCs first appeared in 2014 is likely attributable to other factors that have been contributing to steady decline since at least as far back as 1963 (see **Figure 80** below). The comparative degrees of these factors are estimated in Section 8.3.

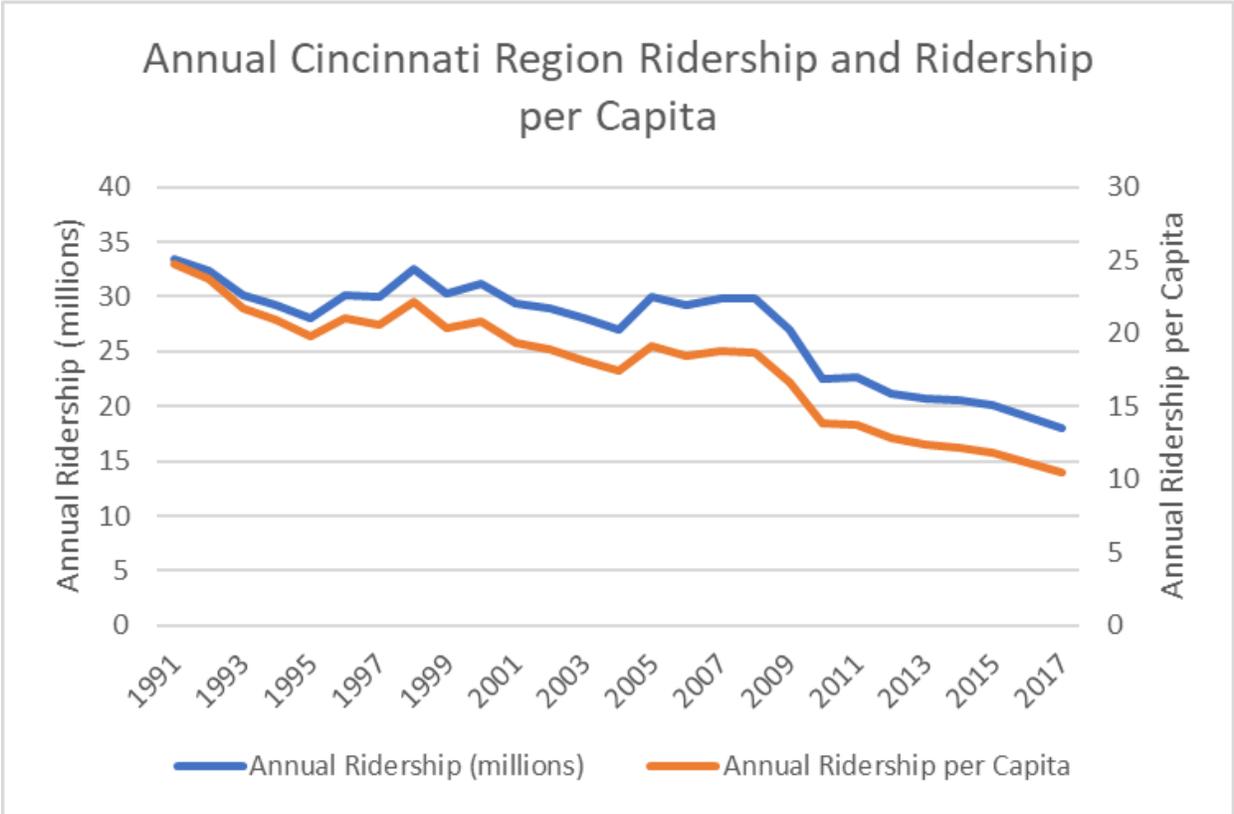


Figure 80 - Annual Bus Ridership in Cincinnati Region
Sources: FTA, "National Transit Database," Federal Transit Administration, at <http://www.ntdprogram.gov/ntdprogram>
Wartman, S. (2018). The curse of the subway: A look at Cincinnati’s troubled century of mass transit. The Cincinnati Enquirer <https://www.cincinnati.com/story/news/2018/04/25/transit-history/397132002/>



8.2 Backdrop of Increasing Auto Travel and Declining Transit Ridership

8.2.1 The Traditional Mobility Paradigm

Like much of the U.S. — except a select few neighborhoods and coastal cities — most travel in the Cincinnati region is by private automobile; this is the singular defining feature of the traditional mobility paradigm. In contrast, transit serves a relatively small and dwindling proportion of trips, mostly limited to several established radial and crosstown corridors.

Recognizing that the history of urban planning is complex and multi-faceted, and that our attempt is a gross distillation of just a few of the key points, we present below a summation of how we got to where we are today. The introduction of the automobile to cities at the beginning of the 20th century had the following effects: it led to the suburbanization of land use; expansion of both the road network and demand to use it; and a decrease in transit supply and demand, whether done directly or indirectly. Today, the automobile mode dominates overall levels of travel and government expenditures, with only a few corridors where other modes of travel come close. These topics are linked and discussed in sequence below.

8.2.2 Suburbanization of Land Use

While hilly in parts, the Cincinnati region faces relatively few natural constraints on development—such as terrain or bodies of water—and the region has no urban growth boundary. This is similar to many mid-sized cities in the Midwest. Land use and residential density is also heavily regulated through zoning, which mostly prohibits densification in already zoned areas. These factors contribute to acute suburbanization and generally low population densities across the region. Compared to the 47 U.S. urban areas with a population greater than 750,000, the Cincinnati region’s population density is one-third lower than the average.¹⁴¹ Contemporary population growth is occurring at the urban fringe in a heavily automobile-centric manner, causing density to trend further downward. Such development is associated with greater vehicle miles traveled (VMT), infrastructure costs, and transportation costs due to increased auto dependence.¹⁴²

¹⁴¹ U.S. DOT (n.d.) *State and Urbanized Area Statistics*. Retrieved <https://www.fhwa.dot.gov/ohim/onh00/onh2p11.htm>

¹⁴² Economic Research Service/USDA (2001). *Development at the Urban Fringe and Beyond*. Retrieved <http://www.impactfees.com/publications%20pdf/aer803e.pdf>

8.2.3 Expansion of Automobile Supply and Demand

The extensive freeway network and hierarchical road network (arterials, collectors, etc.) facilitate fast travel from the urban fringe to other parts of the region. Of the 387,000 Hamilton County¹⁴³ commuters in 2017, the American Community Survey (ACS) found 80 percent drove alone, 8 percent carpooled, and only 3.7 percent took transit to work.¹⁴⁴ While the percentage of those who drive alone has fluctuated between 75 and 80 percent from 2009 onward, the percentage of transit commuters has steadily fallen from 5 to 3.5 percent over the nine-year period. The national average light vehicle occupancy is 1.67 persons per vehicle according to the 2017 National Household Travel Survey,¹⁴⁵ and we have no reason to believe it would be much different in the Cincinnati region. However, according to the 2012 Greater Cincinnati Household Travel Survey¹⁴⁶ and the 2017 National Household Travel Survey,¹⁴⁷ the average occupancy in Cincinnati is a little higher at 1.9 and 2.0 passengers per vehicle, respectively. Further research is required to reveal the reasons for this discrepancy.

8.2.4 Decreasing Transit Supply and Demand

Fixed route public transit is offered in the region but the amount of service provided has fallen dramatically over past decades as changing land use demands and automobile-centric designs and policies have gained traction. Transit agencies provide fixed-route bus service, most ridership-oriented (i.e., with a goal of maximizing ridership), but some coverage-oriented (i.e., with the goal of maximizing geographic coverage). Ridership service typically operates at 15- to 60-minute headways during the day, and coverage service typically operates at 60-minute headways. This is supplemented with paratransit for qualifying seniors and people with disabilities. While the region's population and economic output has grown over the past decade, the region is experiencing a decline in overall transit ridership at an average clip of three percent per year between 2012 and 2018.¹⁴⁸ This trend is not unique to Cincinnati, and similar trends are occurring in most mid- and large-size U.S. cities.¹⁴⁹ Furthermore, national transit ridership declined 2 percent in 2018, with increases only in commuter rail (0.6 percent) and demand responsive transit services such as paratransit

¹⁴³ Hamilton County contains the city of Cincinnati and most of its Ohio suburbs

¹⁴⁴ United States Census Bureau / American FactFinder. "B08301: Means of Transportation to Work." 2013-2017 American Community Survey 5-Year Estimates. U.S. Census Bureau's American Community Survey Office, 2017. Web. 9 July 2019 <<http://factfinder2.census.gov>>

¹⁴⁵ Retrieved from Green Car Congress, "Average vehicle occupancy in US remains unchanged from 2009 to 2017," <https://www.greencarcongress.com/2018/07/20180731-fotw.html>

¹⁴⁶ OKI (2012). *Greater Cincinnati Household Travel Survey*. Retrieved: http://www.dot.state.oh.us/Divisions/Planning/SPR/Research/reportsandplans/Reports/2012/Planning/134421_FR.pdf

¹⁴⁷ 2017 National Household Travel Survey

¹⁴⁸ OKI (2015). *OKI Congestion management Process: 2015 Findings and Analysis Report*. Retrieved: <https://www.oki.org/wp-content/uploads/2015/03/CMP-2015-Findings-Analysis-Report.pdf>

¹⁴⁹ Congressional Research Service (2018). *Trends in Public Transportation Ridership: Implications for Federal Policy*. Retrieved: <https://fas.org/sgp/crs/misc/R45144.pdf>



(2 percent).¹⁵⁰ However, the decline in Cincinnati is particularly pronounced. While annual regionwide ridership dropped precipitously around the Great Recession from 30 million in 2008 to 23 million by 2010, it declined further to 21 million in 2015. This is against a backdrop of a 2 percent overall increase in both population and employment between 2010 and 2015. This trend has persisted even through the 2016 introduction of the Cincinnati Bell Connector, a 3.6-mile streetcar loop that connects several areas in the city's downtown region. Ridership on the Bell Connector today is far below estimates from the project's feasibility study. It was projected that five years after the streetcar's unveiling—originally slated for 2010—daily ridership would range from 5,000 to 7,900;¹⁵¹ records from the month of June 2019, three years after the line's opening, saw daily ridership between 700 and 3,500.¹⁵² This shortfall equates to a few percentage points of the annual ridership total.

8.2.5 Auto-Centric Funding

Automobile predominance is reflected in the state's funding practices for transportation projects. Most state investment is in the road network. While there is little expansion in entirely new roads, road and interchange expansions are common, which generally by definition reinforce the suburbanization of land use. Of 77 Hamilton County and City of Cincinnati projects listed in the OKI 2018-2021 TIP, just 15 are transit specific.¹⁵³ Of the total funding contained within the 2040 TIP, 24.9 percent is assigned for transit operations and capital funds. The transit capital projects focus mainly on bus replacement and retroactive maintenance as opposed to transit expansion. Transit in Cincinnati is mainly funded from local taxes, such as an 0.3 percent earnings tax.¹⁵⁴ This tactic is unique as many other U.S. agencies rely on countywide levies to build a larger funding pool. The Cincinnati City Council is currently considering a new funding model that would institute a 0.7 percent or higher county sales tax increase to fund transit, replacing the 0.3 percent earnings tax.¹⁵⁵ Such a move to a more stable funding source could solidify the region's commitment to improving transit.

¹⁵⁰ Retrieved from American Public Transportation Association, *Public Transportation Ridership Report, Fourth Quarter 2018*: <https://www.apta.com/wp-content/uploads/2018-Q4-Ridership-APTA-1.pdf>

¹⁵¹ HDR (2007). *Cincinnati Streetcar Feasibility Study*. Retrieved <https://www.cincinnati-oh.gov/streetcar/linkservid/17D4E8BF-EE36-4924-94AAFBB630857475/showMeta/0/>

¹⁵² City of Cincinnati Reports (2019). *Cincinnati Bell Connector Ridership June 2019*. Retrieved <https://www.cincinnati-bellconnector.com/about-the-streetcar/about/ridership-and-reports>

¹⁵³ OKI (2018). *Transportation Improvement Program*. Retrieved <https://tip.oki.org/>

¹⁵⁴ Ohio Department of Transportation (2014). *Ohio Statewide Transit Needs Study – Transit Funding*. Retrieved: <http://www.dot.state.oh.us/Divisions/Planning/Transit/TransitNeedsStudy/Documents/TransitFunding.pdf>

¹⁵⁵ Swartsell, Nick (August 16, 2019). *Is a Plan to Fix Metro Finally Getting Ready to Roll Forward?* Retrieved: <https://www.citybeat.com/news/news-feature/blog/21082947/is-a-plan-to-fix-metro-finally-getting-ready-to-roll-forward>

8.3 Quantifying Factors Behind Transit Ridership Decline

Increases in automobile usage and VMT as documented above have occurred concurrently with decreases in transit ridership in the region. Of the 50 largest U.S. cities, Cincinnati has lost more ridership in percentage terms than 40 of them.¹⁵⁶ Several factors have been cited for this effect, with some believing that the rise in TNC use is largely responsible for the decline. As will be explained in detail, the ridership decline issue is far more complex, involving many factors, of which TNC is only one, and a relatively small element.

8.3.1 Technologic Factors

While the introduction of TNCs has certainly affected mobility, many reports and articles have reported differing results on how they have impacted transit ridership. A 2018 study by the University of Kentucky found that for each year after a TNC was introduced to a city, train ridership declines 1.3 percent and bus ridership declines 1.7 percent,¹⁵⁷ but it stops short of claiming causation.

One report found that among major American cities, once a rider uses a ride-hailing service they reduce their bus use by 6 percent; light rail use decreases only 3 percent; and commuter rail use sees an increase of 3 percent.¹⁶⁰ On the national scale, transit ridership experienced growth from 2010 to 2014, but has decreased by approximately 8 percent since 2014.¹⁶¹

A study for Los Angeles Metro, covering many suburban and moderate-density urban areas of Los Angeles County, found that 7 percent of those who abandoned transit said they switched to TNCs.¹⁶² However, TransitCenter—a foundation that advocates for improved transit systems—puts this 7 percent into perspective, stating that only one-quarter of all transit ridership decline is attributed to those who abandon transit altogether. The majority of losses appear to be due to users partially reducing their transit use, exchanging some trips for other modes.¹⁶³ TransitCenter instead claims TNC use is associated with increased transit demand; they find that for each day per month that a survey respondent increased their TNC use,

¹⁵⁶ O'Toole, Ronald (November 8, 2018). *Cato Institute*. "Charting Public Transit's Decline."

¹⁵⁷ Schenke, Jarred (May 2, 2019). *Bisnow Atlanta*. "Even Transit-Oriented Development Can't Stop the Ridership Drop."

¹⁶⁰ Clewlow et al. (October 2017). *Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States*.

¹⁶¹ Florida Department of Transportation, Freight Logistics and Passenger Operations, Transit Office (February 2019). *Understanding Ridership Trends in Transit*

¹⁶² Fehr & Peers and Regional Ridership Improvement Task Force (November 14, 2018). *Ridership Growth Action Plan*.

¹⁶³ TransitCenter (2019). *Who's On Board 2019*. Retrieved: http://transitcenter.org/wp-content/uploads/2019/02/TC_WhosOnBoard_Final_digital-1.pdf



their transit use increased 0.15 days per month.¹⁶⁴ This suggests that the availability of TNC service provides those considering using transit a greater confidence that, if they do so, TNCs will be able to serve certain unusual travel needs such as “guaranteed ride home.”

Clearly, analyses of how TNC usage have thus far impacted transit ridership provides any number of conclusions, although their emergence has certainly provided new options to travelers. Increased coordination of TNC and transit services may help cities meet their transit ridership goals and enable agencies to invest in improving core service quality.

8.3.2 Service Factors

As many reports have found, there is a link between transit ridership and customer satisfaction in the level of transit service provided, although the direction of causation is difficult to identify. A Florida DOT study found that national transit service, in terms of vehicle revenue miles, has remained largely constant since 2010 even while transit experiences decreasing ridership.¹⁶⁵ This combination of effects increases agency cost per passenger-mile, leading to budgetary constraints that may justify a transit agency to reduce service levels. Other reports show increased ridership, or a deceleration of ridership loss, on transit systems undergoing capital and operations improvement programs. In Cincinnati, the picture is similar: SORTA has reduced bus service by around 1 percent in the 4-year 2014-2018 period, while ridership has dropped 13 percent in the same period. TANK has increased bus service by 4 percent in that period while ridership has dropped 14 percent. These trends are examined in more detail in Section 7.3.1 and 7.3.2, where ridership is presented for bus only (not including demand-response or streetcar).

Philadelphia’s SEPTA recorded a gain in heavy rail ridership in 2018 after having spent \$750 million annually since 2011 on a complex modernization program.¹⁶⁶ Similarly, several regions of Florida are experiencing growth in heavy rail demand after the introduction of the SunRail and Tri Rail commuter lines.¹⁶⁷ Seattle and New York City—two cities experiencing opposite trends in ridership, with the former recording an 8.3 percent increase and the latter a 3 percent decrease from 2014 to 2017—found ridership to increase after each implemented new Bus Rapid Transit without decreasing otherwise available service.¹⁶⁸ Using data from 25 transit authorities in North America, researchers at McGill University quantified the relationship between

¹⁶⁴ Transit Center, *Ibid.*

¹⁶⁵ University of South Florida, Florida Department of Transportation, *Understanding Ridership Trends in Transit*, 2019

¹⁶⁶ Ehrenhalt, Alan (June 2019). *Governing*. “It’s Been a Rough Year for Mass Transit.”

<https://www.governing.com/columns/assessments/gov-transit-disconnect.html>

¹⁶⁷ University of South Florida, *Ibid.*

¹⁶⁸ Regional Ridership Improvement Task Force (November 14, 2018). *Ridership Growth Action Plan*.

service provided and ridership. They claim that a 10 percent increase in vehicle revenue miles operated by the agency is associated with an 8.27 percent increase in ridership.¹⁶⁹

Houston is another city that experienced ridership growth after redesigning its bus network. Opting for less-circuitous routes with greater frequency, the same schedule regardless of day, and greater speeds due to fewer at-grade rail crossings, Houston saw a boost in ridership of 8 percent in the year following the August 2015 system update; this marked improvement required a \$12 million investment, or just 4 percent of Houston Metro's annual budget.¹⁷⁰ Between 2014 and 2018, regional ridership has increased 6 percent although regional population has increased 8 percent, resulting in a 2 percent decline in per capita transit ridership. For some agencies, providing adequate transit supply and improving transit frequency, reliability, and speed appear to induce demand for the system.^{171,172} Seattle is another example of a region that has undertaken a major route restructuring that has led to increase in transit ridership; generally, ridership has increased over the past few years following a series of route restructurings and investments in more service.¹⁷³ Seattle has also experienced high population growth over the past decade. Despite this, per capita transit ridership for the region has steadily grown from 2010 through 2018 and increased by 6 percent in the process.^{174,175} Notably, both Houston and Seattle have leveraged capital investment in light rail by following it with improved connectivity via increased bus service.¹⁷⁶

The same McGill University study highlights the consequences of increasing fares, stating a 10 percent increase in transit fare is linked with a 2.19 percent decline in ridership. Other studies have similarly warned that transit fares, fuel prices, and TNC rates greatly impact willingness to take transit.¹⁷⁷ Metro in Cincinnati has not experienced a fare increase since 2009, but with the budget deficit projected to grow in the future it is possible that SORTA will resort to a fare hike to plug the gap.

Overall customer satisfaction with a transit system shows correlation with ridership. Transit users have indicated safety, reliability, cleanliness, necessity of transferring, walking distance to the stop, and more as

¹⁶⁹ Boisjoly et al. (2018). *Invest in the ride: A 14-year longitudinal analysis of the determinants of public transport ridership in 25 North American cities*

¹⁷⁰ Goffman, Ethan (March 31, 2018). *Houston Bucks the National Trend of Transit Bus System Decline*. Retrieved: <https://mobilitylab.org/2018/03/21/houston-bucks-national-trend-transit-bus-system-decline/>

¹⁷¹ Population data: <http://worldpopulationreview.com/us-cities/houston-population/>

¹⁷² Ridership data: <https://transitcenter.org/theres-a-reason-transit-ridership-is-rising-in-these-7-cities/>

¹⁷³ SDOT Blog, *A closer look at Seattle's rising transit ridership*: <https://sdotblog.seattle.gov/2018/01/03/a-closer-look-at-seattles-rising-transit-ridership/>

¹⁷⁴ Population data: <http://worldpopulationreview.com/us-cities/seattle-population/>

¹⁷⁵ Ridership data: <https://transitcenter.org/theres-a-reason-transit-ridership-is-rising-in-these-7-cities/>

¹⁷⁶ Retrieved from TransitCenter.org: <https://transitcenter.org/theres-a-reason-transit-ridership-is-rising-in-these-7-cities/>

¹⁷⁷ Coogan et al. (2018). *Understanding Changes in Demographics, Preferences, and Markets for Public Transportation*. <https://www.nap.edu/catalog/25160/understanding-changes-in-demographics-preferences-and-markets-for-public-transportation>



key factors in how they form opinions around transit.¹⁷⁸ If taken on a five-point scale, TransitCenter concludes that a one-point increase in customer satisfaction results in almost one extra day per month of transit use, “even when controlling for age, home and work locations, changes in income, and other demographic and household factors.”¹⁷⁹

8.3.3 Commuting, Demographic, and Macroeconomic Factors

Commuting, demographic, and macroeconomic factors also impact transit ridership and are often beyond a transit agency’s control. Telecommuting is the “fastest changing ‘mode’ for commuting to work,”¹⁸⁰ increasing from 2.25 percent of workers nationwide in 1980 to 7 percent in 2016. A Florida DOT report associates 1.3 percent of the decline in transit ridership to telecommuting alone, going further to state that up to 38 percent of all ridership decline may be due to greater online communication reducing the need for in-person interaction.²² Likewise, many Millennials are choosing to live close enough to their place of work in urban cores—where transit service is often strong—that walking, biking, or using a scooter are satisfactory commute modes.¹⁸¹ And facing a future in which autonomous vehicles may flourish, Millennials state they would be even less likely to travel by public transportation.

The demographic of fellow users and social perceptions of transit further influence transit ridership. One study analyzed the relative importance of 12 explanatory factors on transit ridership. It found the normative factor, or “the idea that one’s social network would approve of one using transit and they would use transit themselves,” to be the most influential.¹⁸² As those who are able to shift modes begin to decrease their use of transit, the profile of transit riders becomes further polarized, creating discomfort for some riders who feel they may no longer identify with their fellow transit patrons.¹⁸³

Greater macroeconomic factors also have strong influences on ridership trends. It is widely held that transit is viewed as an inferior good to driving, meaning demand for transit decreases as income rises. This phenomenon is displayed in the Cincinnati region and throughout the U.S. as both experience a prolonged

¹⁷⁸ Regional Ridership Improvement Task Force (November 14, 2018). *Ridership Growth Action Plan*.

¹⁷⁹ TransitCenter (2019). *Who’s On Board 2019*. Retrieved: http://transitcenter.org/wp-content/uploads/2019/02/TC_WhosOnBoard_Final_digital-1.pdf

¹⁸⁰ Florida Department of Transportation, Freight Logistics and Passenger Operations, Transit Office (February 2019). *Understanding Ridership Trends in Transit*

¹⁸¹ Ehrenhalt, Alan (June 2019). *Governing*. “It’s Been a Rough Year for Mass Transit.” <https://www.governing.com/columns/assessments/gov-transit-disconnect.html>

¹⁸² Coogan et al. (2018). *Understanding Changes in Demographics, Preferences, and Markets for Public Transportation*. <https://www.nap.edu/catalog/25160/understanding-changes-in-demographics-preferences-and-markets-for-public-transportation>

¹⁸³ Florida Department of Transportation, Freight Logistics and Passenger Operations, Transit Office (February 2019). *Understanding Ridership Trends in Transit*

economic expansion after the Great Recession. Similarly, drivers appear to react elastically to increases in fuel prices. As gas price increases, drivers decrease their VMT and, if available, substitute transit for some trips; demand shifts back toward driving once fuel price drops.¹⁸⁴ **Figure 81** highlights this relationship, showing national transit ridership and fuel price trends since 2006.

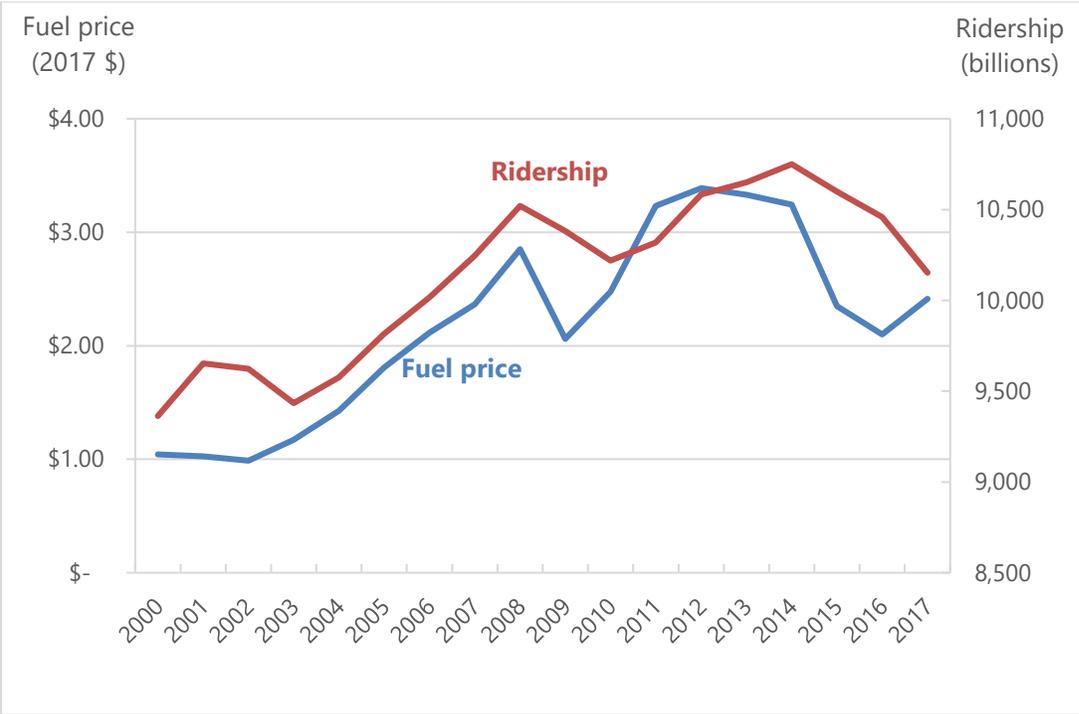


Figure 81 - National Transit Ridership and Fuel Price Trends since 2006

Source: American Public Transportation Association, *Transit Factsheet Appendix A*; U.S. Energy Information Administration, *Monthly Energy Review* (August 2019), Table 9.4

8.3.4 Summary of Factor Effects on Transit Ridership

Synthesizing the many studies that have analyzed these factors, we may approximate to which degree each factor is responsible for the decline in transit ridership. The following analysis is based on national trends, but adaptations for the Cincinnati context are provided.

¹⁸⁴ Ehrenhalt, Alan (June 2019). *Governing*. "It's Been a Rough Year for Mass Transit."
<https://www.governing.com/columns/assessments/gov-transit-disconnect.html>



8.3.4.1 TNC Mode Substitution

A report from the Florida DOT estimates that up to 31 percent of the transit decline is attributable to the introduction of TNCs.¹⁸⁵ Nationally, public transit has lost nearly 850 million passenger trips in the last five years.^{186, 187}

In Cincinnati, SORTA and TANK daily ridership has declined from approximately 55,500 daily boardings in 2014 to 48,000 by 2018 (a 2.6% annualized decrease over a 4-year period). As of 2018, Uber provides nearly 10,700 daily trips in the Cincinnati region, and increasing this figure by 25 percent to approximate for Lyft trips (given that Uber has 65 percent of the U.S. market and Lyft has a majority of the remainder),¹⁸⁸ over 13,000 daily TNC trips occur in the region. A survey of Uber riders completed as part of this study finds that 13 percent of Uber trips would have been on transit had Uber not been available (see Section 7.7 for more detail). This equates to about 1,700 TNC users who would have taken transit, or 23 percent of the decrease in daily transit passenger trips in the region. Thus, based on the best available data (user survey data) for deriving insight on actual mode shifts from Uber to transit, we conclude that very approximately one-fifth of the recent annualized decline in transit ridership may be attributable to TNC mode substitution. This is a coarse estimate that comes with caveats that: the survey may or may not be a representative sample of Uber riders in the region (and low sample size and sampling bias may be issues); responses may not truly be revealed preference; and this does not factor in transit usage increases due to Uber (i.e. complementarity, covered in the next subsection).

8.3.4.2 TNC Complementarity

Another 8% of respondents to the Uber rider survey said that they had used transit for the other leg of their overall round trip, suggesting that they might not have otherwise used transit were not Uber available as a first/last mile mode or as a guaranteed ride home. When also factoring in the ability for Uber to enhance the bundle of options that allow people to own fewer vehicles, we conclude that such complementarity may have a small, yet positive effect on transit ridership (of roughly 5-10% of the recent annualized decline in transit ridership), partly counteracting the decrease due to TNC mode substitution.

¹⁸⁵ Florida Department of Transportation, Freight Logistics and Passenger Operations, Transit Office (February 2019). *Understanding Ridership Trends in Transit*

¹⁸⁶ APTA (April 12, 2019). *Public Transportation Ridership Report*. Retrieved: <https://www.apta.com/research-technical-resources/transit-statistics/ridership-report/>

¹⁸⁷ The Cato Institute points out that one-third of TNC rider survey respondents claim they would have instead taken transit; as an upper limit, the report estimates that up to 90 percent of all transit ridership loss may be due to TNCs. However the study misapplies a stated mode shift rate from a transit rich dense urban setting to national average TNC use, and produces an unreasonable conclusion, not supported by other research on the topic.

¹⁸⁸ Uber (2019). Form S-1 (REGISTRATION STATEMENT UNDER THE SECURITIES ACT OF 1933.) Page 3. Retrieved: https://www.sec.gov/Archives/edgar/data/1543151/000119312519103850/d647752ds1.htm#toc647752_4

8.3.4.3 Telework and Online Activities

As stated previously, telecommuting is steadily increasing; for example, the percentage of workers in Atlanta who telecommute increased from 5.7 percent in 2008 to 7 percent in 2016.¹⁸⁹ The rise in telecommuting is estimated by the same Florida DOT study to be the cause of between 1 and 2 percent of the declining ridership.¹⁹⁰ Analysis of the NHTS from 2009 to 2017 shows an 11 percent decline in overall transit trips per capita, part of which may be attributable to greater online connectivity.¹⁹¹ Considering the conclusion that riders are reducing their transit use rather than abandoning it, and when also accounting for an overall increase in online communication, we estimate 5 to 10 percent of ridership loss is due to increased telework and online interaction.

8.3.4.4 Gasoline Prices

Longitudinal studies find that transit ridership decreases between 0.8 percent¹⁹² and 2 percent¹⁹³ for a 10 percent decrease in fuel price; as average fuel prices across the U.S. have decreased approximately 40 percent from the 2014 peak to 2018,¹⁹⁴ we estimate that up to 8 percent of the national transit loss is due to decreasing fuel prices. Average fuel prices in the Cincinnati region have dropped between 35 and 50 percent over the same period and thus may contribute up to 10 percent of ridership loss.¹⁹⁵

8.3.4.5 Service Hours

Some studies have found that transit ridership losses are heavily dependent on the level of service provided—including coverage, frequency, cleanliness, and safety. More than 20 percent of the 4,000 metropolitan residents surveyed stated that transit services being too slow was the main reason for substituting ride-hailing for transit.¹⁹⁶ Transit service in the Cincinnati region, however, has remained relatively constant or even increased in the last five years. Weekday SORTA service declined by only 1.3

¹⁸⁹ Schenke, Jarred (May 2, 2019). Bisnow Atlanta. "Even Transit-Oriented Development Can't Stop the Ridership Drop."

¹⁹⁰ Florida Department of Transportation, Freight Logistics and Passenger Operations, Transit Office (February 2019). *Understanding Ridership Trends in Transit*

¹⁹¹ F&P to insert footnote referring to \\Fpcolodata.fpainc.local\DisciplineGroups\Planning\Travel Characteristics\Household Travel Surveys\TNCs in NHTS 2009 and 2017

¹⁹² Boisjoly et al. (2018). *Invest in the ride: A 14-year longitudinal analysis of the determinants of public transport ridership in 25 North American cities*

¹⁹³ Manville, M.; Taylor, B.D. and Blumenberg, E, (2018, January). *Falling Transit Ridership: California and Southern California*. UCLA Institute of Transportation Studies.

¹⁹⁴ U.S. Energy Information Administration (2019). *Weekly U.S. Regular All Formulations Retail Gasoline Price*. Retrieved: https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMM_EPMR_PTE_NUS_DPG&f=W

¹⁹⁵ U.S. Energy Information Administration (2019). *Weekly Ohio All Grades All Formulations Retail Gasoline Prices*. Retrieved: https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMM_EPM0_PTE_SOH_DPG&f=W

¹⁹⁶ Clewlow et al. (October 2017). *Disruptive Transportation: The Adoption, Utilization, and Impacts of Ride-Hailing in the United States*.



percent while TANK service increased by over four percent; weekend SORTA service didn't change. While SORTA did experience a decrease in Express service provided, TANK saw Express service increase around 40 percent since 2014. It is unclear if peak service was impacted, although from the trends described here we conclude that, in Cincinnati, service was stable or declined on a per capita basis and so might have contributed to some of the transit ridership loss.

8.3.4.6 Inexpensive Auto Acquisition

Increasing household access to a vehicle may also contribute to decreasing ridership. In a study of the Orange County Transportation Authority, 70 percent of those who left transit stated they did so because they acquired a car.¹⁹⁷ The authors also claim that vehicle ownership has a larger influence on ridership than fare price and service level provided. This large estimated percentage—from historically car-centric Southern California—is unlikely to be representative of all U.S. cities. The percentage share of zero vehicle households in Cincinnati decreased by 0.2 percent, or 300 households, from 2014 to 2017.¹⁹⁸ With approximately 21 million annual transit trips and a regional population of 2.12 million, we estimate 0.03 transit trips per capita per day. At a rate of 2.5 persons per household, these 300 households account for about 21 transit passenger trips per day. Considering a regional daily ridership loss of about 8,300, we estimate that less than 1 percent of the Cincinnati transit ridership loss is due to the increased share of vehicle-owning households. A similar calculation may be performed on the national level, where zero-vehicle households decreased by 0.3 percent. Assuming 0.1 daily trips per capita and a decrease in unlinked passenger trips of approximately 500 million from 2014 to 2017,¹⁹⁹ increased access to vehicles may be associated with up to 7 percent of the national ridership decline.

8.3.4.7 Fares

One study concludes that ridership may decrease 2 percent following a 10 percent increase in fare;²⁰⁰ the average national transit fare has increased 13 percent²⁰¹ and, therefore, fare price increases may be responsible for approximately 3 percent of the ridership loss. Again, fares have remained constant for SORTA since 2009 and for TANK since 2012. SORTA was unsuccessful in raising bus fares by 9 percent in

¹⁹⁷ Manville et al. (January 2018). *Falling Transit Ridership: California and Southern California*.

¹⁹⁸ United States Census Bureau / American FactFinder. "B08201: Household Size by Vehicles Available." 2014-2017 American Community Survey 5-Year Estimates. U.S. Census Bureau's American Community Survey Office, 2017. Web. 16 August 2019 <<http://factfinder2.census.gov>>

¹⁹⁹ National Transit Database (October 2018). *2017 National Transit Summary and Trends*. Retrieved: <https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/ntd/130636/2017-national-transit-summaries-and-trends.pdf>

²⁰⁰ Boisjoly et al. (2018). *Invest in the ride: A 14-year longitudinal analysis of the determinants of public transport ridership in 25 North American cities*

²⁰¹ Bureau of Transportation Statistics. *Average Passenger Fares*. Retrieved: <https://www.btsf.gov/content/average-passenger-fares-current-dollars>

2018 and has recently announced an effort to increase local sales taxes to boost funding;²⁰² thus, fare increase is unlikely to be a motivator for decreased transit use in Cincinnati.

8.3.4.8 Scooter and Bike Share

Several scooter and bike share programs exist in Cincinnati that may detract from transit use, with one report estimating 3 percent of ridership decline is due to increased use of bike and scooter share programs across the nation.²⁰³

8.3.4.9 Other Factors

The remaining approximately 60 percent of ridership decline is attributable to various factors that have not been fully quantified or to an unknown level of error in the assertions made so far. A large set of these various factors may be related to perception and preference: normative behaviors that impact our opinion of transit, changing Millennial preferences for living within walking distance of work, and how safe or comfortable transit riders feel when they travel with others whom they do not identify with. Although suburban migration may move transit riders out of urban transit cores, the degree to which this factor has reduced ridership is difficult to quantify. In Cincinnati, suburban migration has decreased following the Great Recession and has remained lower than 2000-2010 levels, although net migration to the suburbs is still occurring.²⁰⁴ However, while urban cities experienced greater growth than suburbs from 2010 to 2015, this trend may have ended. Further research may distill the implications of living preferences on transit ridership.

8.3.4.10 Summary

The degree to which each of these factors has contributed to transit ridership loss is likely to change as further research is conducted, but this analysis serves to outline the complexity of the trend. A summary is presented below, noting that the degree to which TNC users have shifted from transit instead of other modes is directly related to the relative magnitude of transit use in the area to begin with. In areas where most travel occurred by transit or taxi before TNCs arrived, most of the travel that shifted to TNC came from those modes, while in areas dominated by auto travel, most of the conversion to TNC came from auto travel.

²⁰² LaFleur, Pat (August 6, 2019). *City Council Poised to Take First Step Toward New Funding for Cincinnati Metro*. Retrieved: <https://www.wcpo.com/news/transportation-development/move-up-cincinnati/city-council-poised-to-take-first-step-toward-new-funding-for-cincinnati-metro>

²⁰³ Florida Department of Transportation, Freight Logistics and Passenger Operations, Transit Office (February 2019). *Understanding Ridership Trends in Transit*

²⁰⁴ U.S. Department of Housing and Urban Development (June 1, 2017). *Comprehensive Housing Market Analysis - Cincinnati, Ohio-Kentucky-Indiana*. Retrieved: <https://www.huduser.gov/portal/publications/pdf/CincinnatiOH-comp-17.pdf>



Factor	% of Transit Ridership Loss
TNC Mode Substitution	20%
TNC Complementarity	(5% - 10% gain)
Telework, and Online Activities	35% - 40%
Gasoline Prices	15% - 20%
Inexpensive Auto Acquisition	5% - 10%
Scooter and Bike Share	up to 5%
Suburban Migration Transit Service Quality and Security Lifestyle Preferences, Cohort Norms Displacement of Transit Dependents Lower Shares of Foreign Born Pricing, Payment Ease Competition	10%-40%

8.4 Policy Interventions to Reverse Declining Ridership

Because SORTA and TANK have been losing ridership at a high rate for at least the last 50 years, a reversal will take a number of adjustments to the way in which service is provided and, possibly even more importantly, additional investment in transit service improvements and the way in which land use development, pricing and other incentives support effective transit, paired with reductions in low-occupancy travel.

The OKI *Strategic Regional Policy Plan of 2005* and the *Elements of an Effective Local Comprehensive Plan of 2016* contain over a dozen policy recommendations oriented toward strengthening regional transit and encouraging transit supportive land use. A high priority for the region will be to assess the degree to which those policy measures have been enacted and the effect they have had on reducing vehicle miles travelled and related congestion and air quality impacts. The region may need to reassert its commitment to those actions in order to address the continuing erosion of transit ridership and the broader set of regional goals expressed in the plan.

In addition to those broad regional planning strategies and specific service adjustments for SORTA and TANK, we recommend a number of overarching updates to the way in which transit is provided in the interest of collaborative steps that the agencies can take with TNCs and other innovative service providers to strengthen the range of transit and transit-supportive services available in the region. These include:

- Regional Plan with emphasis on compact infill development, TOD and transit supportive land use, to increase region's low rating for jobs accessible by transit.²⁰⁵
- Introduction of a Mobility as a Service (MaaS) app such as that provided by Uber to integrate TNC and transit services including seamless transfers and fare payment
- Strengthened backbone transit corridors with supportive land use and BRT service (per *Reinventing Metro*) in exclusive lanes and with TNC feeders.
- Agreement with TNCs on suburb-to-suburb demand densities that justify pooled and route diversion ("crowd sourced") services
- An on-demand route optimization platform with transit agency buses and drivers or privately provided buses and drivers
- Outsourced private services for medical and other occasional dependent needs.
- Pricing of VMT to account for full cost including externalities (climate, economic, social) through carbon tax, VMT tax, mileage based insurance premiums with revenues targeted for improvements to high-occupancy travel modes.
- HOT lanes on freeways, with direct access ramps for buses.
- Anticipation of autonomous vehicles. Designating exclusive BRT lanes suitable for conversion to autonomous modes.

Accommodation of autonomous transit promises to yield substantial benefits. The Federal Transit Administration estimates that Autonomous Rapid Transit (ART) will be more than 40 times as cost effective as BRT and that ART will begin to operate in exclusive lanes in 2020-2030 with a safety driver and between 2025 and 2035 without a driver.

Supportive regional policies from the 2005 *Strategic Regional Policy Plan* and the 2016 *Local Comprehensive Plan Update* are listed below.

²⁰⁵ In 2005, OKI Regional "Commission members indicated a strong preference for encouraging more redevelopment and infill development, using less land to accommodate future growth, and preserving open space." "On April 14, 2005 when the Board of Trustees validated the work of more than 180 Land Use Commission members, dozens of expert peer reviewers, and hundreds of citizens by adopting this strategic regional policy plan and its recommended policies."

<p>2005 Strategic Regional Policy Plan</p>	<ul style="list-style-type: none"> • OKI will develop technical assistance and models to help communities identify subregional congestion impacts. OKI will continue to promote travel demand management and education programs, such as Rideshare, van pools and trip reduction, that shift travel demand from single-occupant vehicles and peak travel periods, reducing the need for new capital investments in surface transportation. • All levels of government will continue to promote reduction in vehicle miles traveled through such measures as provision of a street and parking network designed for pedestrians, the disabled, bicyclists, transit, and automobiles. • Regional corridor studies will consider transit systems along congested corridors that connect urban and suburban centers to help reduce vehicle miles traveled. • Local and regional investments in transportation facilities and services will support compact, pedestrian-, bicycle, Strategic Regional Policy Plan 35 OKI Regional Council of Governments and transit-friendly land uses, where appropriate, and facilitate travel demand management strategies. • Local comprehensive plans will support a mix of land uses, higher density development, and non-motorized connections to reduce single-occupant vehicle trips, where appropriate. • Local governments will use the goals, objectives, and policies of their comprehensive plan to encourage mixed-use, transit-friendly development, where appropriate. • Local governments will use the goals, objectives, and policies of their comprehensive plans to provide for increased housing densities near transit stops and neighborhood business centers, where appropriate. • OKI and local governments will encourage patterns and forms of development and redevelopment that maximize multi-modal transportation where appropriate and reduce the total amount of daily vehicle miles traveled. • Local comprehensive plans will encourage compact, transit-friendly, pedestrian-oriented development and redevelopment, where appropriate, in an effort to minimize the per-unit cost of public facilities and services.
<p>2016 Local Comprehensive Plan Update</p>	<ul style="list-style-type: none"> • Establish land use, site, and building design guidelines for development in exclusive public transit corridors to assure the accessibility of new development to public transit. • Establish a consistent policy with the future land use element to encourage land uses that promote public transportation in appropriate areas. • Provide an interconnected network of streets and related facilities to promote walking and bicycling that is coordinated with land uses and other community design features and ensures convenient access to public transportation. • Provide for compact, transit-friendly, pedestrian-oriented development and redevelopment with complementary design and mix of uses where appropriate.

Cooperation with the TNCs will be an important part of strategies included in this report's recommendations. Data from the transit agencies, Uber trip records, and rider surveys indicate that less than 20% of those who previously used transit are using TNCs instead, and that the net effect of TNC

availability has reduced Cincinnati transit ridership by between 6% and 13%. The remaining approximately 90% of transit's ridership loss is a result of a number of factors, each of similar or greater proportion than the TNC effect. These include per capita transit investments that have not kept pace with the region's rate of population growth,²⁰⁶ a reduction in overall travel due to telework, teleconferencing, on-line shopping and on-line social engagement, reductions in gasoline prices, availability of low-cost auto loans, suburban migration into areas less well served by transit, and shifting social norms. The next section contains a more complete discussion of the forces that have led to reduced transit use.

While the Mobility Lab partners have little influence over some of the key factors, they do have the ability, either individually or through cooperative efforts, to influence many of the primary factors that have contributed to transit ridership loss. More effective coordination between TNCs and transit agencies can combat some of the main reasons for ridership loss by, for example, more demand responsive service offerings for suburban areas and an integrated package of mobility services that makes auto ownership less necessary. Primary examples are listed below.

²⁰⁶ Retrieved from The Transport Politic, *Is Transit Ridership Loss Inevitable? A U.S.-France Comparison*:
<https://www.thetransportpolitic.com/2019/09/09/is-transit-ridership-loss-inevitable-a-u-s-france-comparison/>



Combating the Decline in Transit Ridership	
Factors over which Mobility Lab Partners have little or no influence	Fuel prices
	Rising incomes
	Increased telework and online interaction
Factors over which the Mobility Lab partners have some influence	Suburban growth – even though there is increasing preference to live near downtown Cincinnati, 55% of recent regional growth has been suburban
	Overall regional population density – one-third lower than national average
	Increasing congestion, but lack of preferential treatment for transit.
	Minimizing transit fare increases
	Transit service decline on a per capita basis
	Lack of significant service level improvements of the types producing ridership gains in Philadelphia, Houston and Seattle
Opportunities for collaboration between transit and TNCs	Allocation of 87% of regional transportation dollars to highways and less than 8% to transit
	Reversing the regional increase in auto ownership
	Service for non-routine trips and trips during low levels of transit services such as evenings and weekends
	First/last mile to transit, assuming transit service upgrades to BRT or rail modes with discrete stations and park-ride locations
	Guaranteed ride home for transit users with return trips outside periods of high transit levels of service.
	Dispatch facilitators such as Via, Pantonium and Transloc that use transit agency buses and drivers and provide on-demand service at fares of \$3-\$4 per ride, plus an additional unknown amount of subsidy per trip
	TNC services with pooling options such as UberPool and Lyft Line, capable of providing rides at \$5 to \$11 per ride combined fare and subsidy.

Supplement E - Rider Survey Form



Start of Block: Main Questions

Q1.1 Thank you for taking part in our survey. Your responses will help us to improve the rider experience in Cincinnati. The survey should take less than 10 minutes of your time, and to thank you [insert incentive]

Q1.2 For the following questions, please think about the last Uber trip that you took. When did you start your last Uber trip?

- Weekday AM Commute (6-9AM) (1)
 - Weekday Midday (9AM- 4 PM) (2)
 - Weekday PM Commute (4-7PM) (3)
 - Weekday Evening (7PM-12AM) (4)
 - Saturday Evening (7PM-12AM) (5)
 - Saturday Day (6AM - 7PM) (6)
 - Sunday (7)
-

Q17 Where did you get picked up for your last Uber trip?

Neighborhood (1)

District (2)

▼ Downtown (1) ... Winton Hills ~ Winton Terrace (140)

Q15 Where did you get dropped off for your last Uber trip?

Neighborhood (1)

District (2)

▼ Downtown (1) ... Winton Hills ~ Winton Terrace (140)

Q1.5 Which of the following best describes you?

- My household does not own or lease a car (1)
- My household owns or leases one or more cars, but I did not use any on the day of my last Uber trip (2)
- My household owns or leases one or more cars which I used for other travel on the day of my last Uber trip (3)



Q1.6 Think back to before you had Uber or a similar app-based service. How did you take this particular trip then? (Check all that apply)

- I did not take this trip then (1)
- Taxi (2)
- Car (3)
- Bus (4)
- Bike (5)
- Walk (6)
- Paratransit (7)
- Streetcar (8)
- Other (please specify): (9) _____



Q1.7 What were your main reasons for choosing Uber for this trip? (Check all that apply)

- Shorter travel time (1)
 - Shorter wait time (2)
 - Easier to use (3)
 - Safer (4)
 - Public transportation (SORTA/TANK) is not close enough to my origin (5)
 - Public transportation (SORTA/TANK) is not close enough to my destination (6)
 - Too many transfers on public transportation (SORTA/TANK) (7)
 - Public transportation (SORTA/TANK) is not reliable (8)
 - Public transportation (SORTA/TANK) is overcrowded (9)
 - Uber is more cost effective (10)
 - Uber is more cost effective for a group of our size because we can split the cost (11)
 - Other (please specify): (12) _____
-

Q1.8 What was the main purpose of your trip?

- To/from work (1)
 - Work related business (2)
 - Social/recreation (3)
 - Medical (4)
 - Family/personal errands (5)
 - Shopping (6)
 - School/University (7)
 - Place of Worship (8)
 - Other (please specify): (9) _____
-



Q1.9 If your recent Uber trip was part of a round trip (begin and end at the same spot) or a loop trip (more than one stop), how did you complete the other parts of your trip?

- My trip was one-way (1)
 - Uber (2)
 - Lyft (3)
 - Taxi (4)
 - Car (5)
 - Bus (6)
 - Bike (7)
 - Walk (8)
 - Streetcar (9)
 - Paratransit (10)
 - Other (please specify): (11) _____
-

Display This Question:

If your recent Uber trip was part of a round trip (begin and end at the same spot) or a loop trip... != My trip was one-way

Q1.10 Still thinking about this round trip or loop trip, before you had access to Uber or a similar app-based service, did you use a private car to complete any part of this trip?

- Yes, and I still use a private car for part of this trip (1)
- Yes, but I no longer use a private car for any part of this trip (2)
- No, I used other options besides a private car for all or part of this trip (3)
- No, I did not take this trip before Uber or a similar ride-sharing app was available (4)
- This is the first time I have taken this trip (5)

End of Block: Main Questions

Start of Block: Demographics

Q2.1 The following questions are for classification purposes only.

Q2.2 What is your current age?

- 18-29 (1)
 - 30- 49 (2)
 - 50 - 64 (3)
 - 65+ (4)
 - Prefer not to answer (5)
-



Q2.3 What is your approximate annual household income?

- Less than \$10,000 (1)
 - \$10,000 - \$24,999 (2)
 - \$25,000 - \$44,999 (3)
 - \$45,000 - \$64,999 (4)
 - \$65,000 - \$84,999 (5)
 - \$85,000 - \$99,999 (6)
 - \$100,000 - \$149,999 (7)
 - \$150,000 or more (8)
 - Prefer not to answer (9)
-

Q2.4 How would you describe yourself in terms of race or ethnicity? (Check all that apply)

- American Indian or Alaska Native (1)
- Asian (2)
- Black or African American (3)
- Latino/Latina (4)
- Native Hawaiian or Other Pacific Islander (5)
- White (6)
- Other (please specify): (7) _____
- Prefer not to answer (8)

End of Block: Demographics



Supplement F –
Ensuring Equitable
Outcomes



TNCs provide an opportunity to improve accessibility and the quality of trips taken by people across the Cincinnati region. However, without appropriate consideration of differing needs of underserved communities across the region, government subsidy of TNCs could serve to exacerbate inequities in transportation outcomes. Federal law (Title VI) requires the performance of an equity analysis prior to the implementation of any major service change. While this sets a baseline level of effort, we believe that considering equity throughout the planning process will foster increased community buy-in and support that will improve the chances of success of the pilot. The goal should be that each community receives the transportation resources they need to have access to the same opportunities.

OKI has categorized five environmental justice (EJ) populations, as described below. OKI identifies concentrations of EJ populations within the OKI region by establishing thresholds equal to the regional averages for the various target populations per recent census data.²⁰⁷ Because they have been selected by OKI, we also adopt these five categories as representations of communities that are traditionally underserved and most in need of equitable outcomes.

1. **Elderly:** Persons aged 65 or older
2. **Minority population:** Persons from every racial category except White Alone plus all Hispanic persons
3. **People with disabilities:** Non-institutionalized persons aged 16 to 64 years with any disability
4. **Population in poverty:** Persons below the poverty level
5. **Zero car households:** Occupied housing units for which no car is available

There are barriers to TNCs adequately serving these populations. For the elderly, there is a steep learning curve for the technology (as discussed earlier in Section 3.8.2.4). Many aren't familiar with smartphones and some don't have them. For minority population, there exists the phenomenon of race-based cancellation of rides. For people with disabilities, there is the difficulty of receiving a vehicle and/or driver able to meet their needs, whether wheelchair-accessible or other. For people in poverty there are the higher fares compared with transit, which are often prohibitively expensive. People in poverty are also more likely to be unbanked, and there may be a lack of trust about giving credit information to corporations such as Uber. Another vulnerable population, although not an environmental justice category designated by OKI, are children. Under-18s are not allowed to hail rides using Uber. Likely due to this fact, only around one-third

²⁰⁷ OKI. (2016, June). *2040 Regional Transportation Plan: Chapter 3, Demographics (Rep.)*. Retrieved https://www.oki.org/departments/transportation/pdf/2040plan/finalchapters/ch3_demographics.pdf

(34 percent) of ride-hailing users feel that these services “are a good way for parents to make sure their children get around safely when they can’t drive them”.²⁰⁸

While each stakeholder aspires to improving outcomes as a clear goal, to avoid worsening outcomes for vulnerable populations, stakeholders may wish to commit to a “first, do no harm” approach, which would require that the proposed pilot does not include any service cuts. Over time, pending the outcomes of the pilot, service deemed surplus to requirements could be removed. This approach could be paired with re-investing any savings into transit investment in environmental justice communities such as low-income communities and communities of color to ensure that outcomes are improved for vulnerable populations.²⁰⁹

Pilot service should include ADA-accessible vehicles (see Section 3.8.2.3.1), a way for people to book trips over the phone and schedule them in advance (like dial-a-ride), and extensive marketing to alert people and provide instructions.

A community-driven process to help select the pilot geography and parameters would help to ensure equitable outcomes.

Agencies should consider seamless fare payment, such as linking the fare to bus passes, and making fares affordable to certain groups who qualify due to hardship, i.e., no more costly than what they presently pay for bus service accounting for any senior, student, or other discounts.

To best support the EJ populations above, we recommend that project stakeholders undertake the following steps prior to the launch of a pilot:

1. Identify the most vulnerable users and open dialogue with them to ensure that valuable feedback can be received to help inform the pilot and on an ongoing basis.
2. Perform a comparative analysis of the TNC pilot program to service it is supplementing or replacing. I.e., measure the effect on transit trip-making in total weekly trips for several population groups that currently experience disadvantages in transportation. This can reveal negative impacts to disadvantaged areas that could be rectified prior to the pilot launching.
3. Select evaluation metrics that capture the strengths and weaknesses of a potential pilot from an equity perspective.

Collecting data on the following evaluation metrics would help to meet the third point above:

²⁰⁸ Smith, A. (2016, May 19). *The New Digital Economy: Shared, Collaborative and On Demand* (Tech.). Retrieved <https://www.pewinternet.org/2016/05/19/the-new-digital-economy/> [page 30]

²⁰⁹ TransitCenter. (2019). *Inclusive Transit: Advancing Equity Through Improved Access & Opportunity* (Rep.). TransitCenter. Retrieved <http://transitcenter.org/wp-content/uploads/2018/07/Inclusive-1.pdf> [page 29]

- 
- Procedural Equity
 - **Stakeholder Representation:** number of stakeholder groups represented through involved Community-Based Organizations (CBOs)
 - **Distribution of Funding:** percent of budget dedicated to CBOs
 - Transportation and Land Use
 - **Accessibility of Destinations:** job accessibility within a specified time frame (comparing pilot service to existing service)
 - **Environmental Impacts:** geographic distribution of increase in vehicle miles traveled/greenhouse gas emissions (VMT/GHG), comparing EJ populations versus non-EJ populations
 - Transportation Outcomes
 - **Accessibility of Transportation System:** number of homes/jobs within a 15-minute walkshed of transit compared to theoretical number of homes/jobs accessible within a 15-minute TNC wait-time or less
 - **Affordability:** fare per ride for TNC pilot versus existing service (include low-income/senior/youth discounts if relevant)
 - **Diversity of Users:** race/ethnicity of transit passengers versus TNC pilot program (would require demographic data from Uber)
 - **Collision:** safety benefits/impacts measured through predictive crash modeling due to more/less cars on the road (could be geographically distributed)
 - **User Perceptions:** perceived personal safety and security in TNCs versus buses; Perceived user-friendliness of TNC pilot versus existing service
 - Transportation System
 - **Fare Structure:** qualitative fare structure assessment with an equity-lens (e.g., cost + user-friendliness of transit pass versus personal bank card for TNCs)
 - **Infrastructure Quality:** impact to pavement quality due to increase in VMT over time and across geographies
 - **Transit Service:** average TNC wait-time in a low-income/minority area versus general population compared to transit; Average TNC wait time for accessible vehicle versus paratransit

- Other
 - **Labor:** qualitative assessment of labor agreements in TNCs versus transit (union versus contract employee)
 - **Quality of life:** qualitative quality of life assessment (e.g., societal benefits of transit versus enhanced mobility from TNCs)
 - **Youth:** percent of population <18 years old (percent of population that would be unserved by TNC pilot if restricted to over 18s)
 - **Marketing:** percent of population within pilot program area that was aware of program

Supplement G – On-Demand Pilot Types and Concepts

11.1 Supply First/Last Mile

Some of the most promising pilots across the country are anchored around providing first–last mile service, as they support ridership–oriented routes by feeding passengers to backbone transit services. This concept would be enhanced through fare card integrations, and fare coordination where first and last–mile trips could be discounted or free via subsidy. GoDublin averages 25 percent of trips being first/last mile and GoMonrovia averages 30 percent, so first/last mile is a small fraction of their overall usage, despite the transit service being high capacity rail.

11.1.1 First/Last Mile Concept

The Cincinnati region currently does not have any transit service against which first/last mile TNC service could be reasonably anchored. Specifically, no bus rapid transit, heavy rail, or light rail systems exist, and a cursory analysis of Uber travel to access express bus park–and–ride lots found negligible usage, not to mention ample free parking capacity that would make competition against the private automobile very difficult. Therefore, a first/last mile–anchored concept is not under further consideration.

11.2 Augment or Replace Coverage–Oriented Transit

11.2.1 Subregion Concept

A pilot could be configured to serve a defined area in a manner that improves upon the quality of service currently provided by coverage–oriented transit. This new service could supplement service at first. If the pilot can offer at least a similar quality of service at a lower price to the coverage–oriented service, then in the long run it could replace the coverage service, with any savings being reinvested into the ridership–oriented service, establishing a virtuous cycle of investment in transit. This concept is the same as that behind AC Transit Flex, a flexible microtransit service that was deployed in Alameda County, California replacing coverage–oriented fixed route service.²¹⁰

We foresee high potential for a service like this to meet the needs of some paratransit customers. Paratransit service is comparatively expensive as it requires investment in specific ADA–accessible vehicles and special training for operators. A frequent complaint of paratransit is that trips must be booked far in advance (often at least a day) which eliminates the ability to make on–demand trips. If pilot service is deployed to include

²¹⁰ TransitCenter. (2018, May 15). Flex V. Fixed: An Experiment in On–Demand Transit. Retrieved from <http://transitcenter.org/2018/05/15/adding-flexible-routes-improve-fixed-route-network/>



ADA-accessible vehicles, then it could provide an on-demand component to paratransit, for a lower price than traditional paratransit.

Coverage service is a many-to-many service which is a structure that is not a natural fit for UberPool because pooling requires many people having roughly similar travel patterns. Depending on the demand density, there may not be the critical mass to serve “pooled rides” in which case either the wait times for a pooled service could be very long or trips would need to be un-pooled. Therefore, areas with moderately high density and discrete destinations such as colleges or hospitals, but too dispersed for continuous fixed route bus service, might be a domain where pooled service is feasible.

It is unclear whether the subsidy per trip required to keep a solo or pooled trip to equal or less than the bus fare would be higher or lower than for coverage bus. If lower, and if the same number of trips and equitable usage is maintained, then savings should be applied to core “ridership” bus service. If number of riders is lower, then the agency would need to consider whether the riders will recognize and adjust over time to the benefits and whether “quality” of trip being ostensibly better for some is worth the societal and environmental costs of less transit travel. Also, the new service could be serving new destinations and allowing for a greater variety of tripmaking, e.g., door-to-door service to the doctor. This is the mixed blessing of providing some better access to necessary services but resulting in mode shift from those who would otherwise drive or walk.

Ultimately, we conclude that TNCs are likely the most appropriate option to examine to help meet the agencies’ coverage-oriented goals.

11.3 Replace Ridership-Oriented Transit

11.3.1 Express Bus Replacement Concept

The idea of replacing ridership-oriented transit is compatible with the “Reduce Costs at the Fringe” strategy, and it can manifest itself with the replacement of a low-performing ridership-oriented route. We think that an express bus could be a good candidate for this. Some of the express buses are amongst the lowest performing routes in the system, and a pilot could augment or replace such a route with a subsidized pooled ride-hailing option.

11.3.2 Major Corridor Bus Replacement Concept

A higher impact pilot could be directed at a corridor with high demand density and targeted to achieve high ridership, although this would potentially compete against high-performing transit, which is not consistent with overall objectives. A consequence could be an increase in curbside pick-up/drop-off activity

at destinations, such as Downtown Cincinnati if that is a selected destination. In this case it would be deployed in a corridor with backbone transit service to replace that backbone service.

11.3.3 Other Considerations on Replacing Ridership–Oriented Transit

As a general rule, TNC has a lower ceiling of productivity per vehicle than transit, due to its smaller vehicle size. While statistics on TNC productivity (i.e., trips per hour) are not publicly known and were not made available for this study by Uber, we estimate that the productivity of TNCs would be around 3 trips per vehicle–hour, assuming an average total travel time (including wait time) of 20 minutes. Using the average occupancy of 1.5 persons per trip, this comes out to an estimated productivity ceiling of 4.5 person trips per vehicle–hour. This may be an overestimate as the value for the wait time assumed only includes the wait time experienced by the rider once the ride is hailed; it does not include the time the driver spends waiting for the next match after completing the previous trip. Every bus route in the Cincinnati region has a productivity of at least 4.5 passengers per revenue hour (see Section 3.6.2), suggesting that TNC would not be competitive on a productivity basis alone. However, even if TNCs were only a quarter as productive, if their cost per person trip was a quarter that of transit, then they would be breakeven in terms of operating cost per rider.

The comparison above is based on productivity statistics averaged out over a long period. While TNC productivity would not necessarily increase above the ceiling in the busier evening period, transit productivity is lower as the decrease in ridership outweighs decrease in service. This suggests that there may be a breakeven point on a productivity basis at off–peak times, although we do not have the transit productivity data by time of day to confirm this.

While transit outperforms on productivity, there is a potential scenario in which Uber could be cheaper on a cost–per–passenger trip basis. The unit cost to operate an Uber vehicle is lower than a bus for two reasons: lower labor cost due to contract employment, and lower vehicle cost due to it being a much smaller vehicle. There hypothetically exists a breakeven point where if the demand density is high enough and the unit cost low enough, the subsidy per rider for an UberPool would be lower than that for a bus rider (assuming equal fare). However, we do not understand this breakeven point to have been reached anywhere in North America to date, although the presence of agency subsidies could create these conditions.

Somewhat of a precedent exists in San Francisco, whereby Chariot (a now defunct private shuttle operator) operated shuttle routes with vehicles of around 12 seats, that overlapped and competed against over–subscribed local bus routes, and in some cases eliminated some intermediate stops, resulting in more direct connections. However, we do not understand Cincinnati to have similar conditions where oversubscribed routes require alleviation or where bus speeds can reach the depths found on some San Francisco routes,



and more to the point believe that adding increased frequency to those routes would be the most cost effective way to scale up capacity.

11.4 Compete Against Solo Driving

11.4.1 Major Corridor Concept

This concept could be most effective in areas with high cost of driving, either time cost through congestion, or monetary cost through high tolling or parking prices. As part of thinking about long-term strategy, the agency should decide whether it is reasonable for transit agencies to subsidize Uber rides for people who would otherwise driving themselves (or for that matter walk or ride a bicycle); there may be a greater public good in terms of reduced parking demand and environmental benefits (in the form of lower emissions if sufficient number of trips are pooled) as well as support for complementarity that might offset increased traffic that would mean that other regional funds might be used to subsidize.

11.4.2 Employment Cluster Concept

Alternatively, a pilot could be focused exclusively on serving a job cluster with enough demand density to sustain it, but workplaces sufficiently dispersed or shift times sufficiently unorthodox that service via fixed route transit service would be too circuitous or inefficient. Through discussions with the stakeholder agencies, we have identified an employment cluster that has potential for this concept: airport-supportive warehousing near CVG. Potential service to this area is discussed later in this chapter.

Supplement H - Designing a Pilot



12.1 Subregion Concept

A pilot could be configured to operate in a subregional cordon area with no existing transit service, but enough demand density of trips of all trip purposes (currently using automobile) which could shift to TNC. The Innisfil program is an example of this concept. Such an area would need to have trip origins and destinations sufficiently dispersed that a fixed route transit service would not be able to adequately capture the demand.

12.1.1 Subregion Concept

12.1.1.1 Selecting an Appropriate Location

There are a multitude of factors to consider in selecting an appropriate location for such a pilot. These factors must reflect the values of the region, but also learn from the lessons of previous pilots.

The decision of which geography to select includes three key tradeoffs:

- **Smaller Area vs. Larger Area**
 - A smaller area allows for only the lowest-performing segments of poor-performing routes to be replaced, as a starting point for a scaled-up pilot in the longer term.
 - A smaller scale allows for outreach to be more targeted, monitoring to be more straightforward, the pilot to be targeted at specific communities, and restriction of trips to those that are shorter, which would likely result in less subsidy and exposure to cost.
 - A larger area captures more trip types, allows for the pilot to be targeted to full bus routes, and includes longer, cross-region trips, which may be more susceptible to successful pooling.
- **Outlying Area vs. Central Area**
 - Running the pilot in an outlying area allows the pilot to be targeted at an area more likely to have low-performing transit currently; it may also reduce the proportional contribution to congestion, as the streets are less congested. However, there may not be a critical mass of available drivers to provide the minimum level of service desired.
 - Running the pilot in a more central area may result in a higher demand density per square mile and higher potential for pooling as a result.
- **Simply-defined Boundary vs. Highly-tailored Extents**
 - A clearly-defined boundary that is easily understood by the rider offers simplicity, directly improving the user experience.

- Having highly-tailored extents, for example specific bus routes or origin-destination pairs, would enable targeting the pilot more closely to desired trip patterns, purposes, and locations to be captured, which could improve outcomes.

Given these tradeoffs, we think that a smaller area is more appropriate as a starting point as it reduces risk of being too popular too quickly, and by being focused it could deliver clearer findings. We think that an outlying area is preferable because it enables truly low-performing segments of the bus network to be targeted. We believe that a simply-defined boundary will drive ridership as people can understand in an instant where they can and cannot go using the service.

Based on these inclinations, we have developed a set of rules that a pilot area should meet:

1. Area is well bounded by distinct and well-known borders (so that it is intuitive to the community)
2. Area has high "compactness", i.e., is a shape that allows for similar distance trips in multiple directions, rather than a long and thin shape that constrains travel in some directions
3. Area has only limited Metro or TANK transit service currently, perhaps only in one direction or axis (to prevent direct competition against ridership-oriented transit)
4. Area generally has low-productivity coverage-oriented transit service (so as not to directly compete against high-productivity transit service)
5. Area has enough current Uber service so that financial incentives would not be required to produce an acceptable vehicle availability
6. At least for the initial investments, area is home to a high proportion of low income or minority population, so that resources are invested in communities with the highest need. (Transportation equity is best achieved by targeting transit investment in low-income communities and communities of color)²¹¹
7. Area contains enough key destinations (e.g., retail areas, grocery stores, medical facilities) to ensure that there is demand for self-contained trips within the cordon
8. Area has potential to support pooled trips. The density threshold for successful pooling is not yet known as information on typical densities that support UberPool have not been provided by Uber.

In addition, we have developed some rules for areas that should be excluded from consideration:

1. Area has constrained automobile capacity (such as downtown), so that TNC service does not contribute substantially to congestion and its environmental and economic impacts

²¹¹ TransitCenter. (2019). *Inclusive Transit: Advancing Equity Through Improved Access & Opportunity* (Rep.). TransitCenter. Retrieved <http://transitcenter.org/wp-content/uploads/2018/07/Inclusive-1.pdf> [page 29]

- 
2. Area has high incomes (as these populations can mostly afford Uber without the subsidies)
 3. Area mirrors express route service areas, as express routes mainly serve high-income households. Also, these long and thin corridors would not make for a productive cordon
 4. Area well served by backbone transit (so that subsidized service does not compete directly against ridership-oriented transit)
 5. Area is too small (i.e., trip lengths would be too short for Uber and service would be competitor to walk and bike trips and not automobile)
 6. Area is too large (as more subsidy could be needed than can reasonably be afforded)

Applying the rules above, acknowledging that it may not be possible to meet every single rule, we have identified two pilot locations: Colerain Township and Avondale/North Avondale. These are discussed in the following sections.

12.1.1.1.1 Area 1 – Colerain Township

The Colerain Township area is to the immediate northwest of the City of Cincinnati, around 11 miles from Downtown Cincinnati. It has an area of around 27 square miles, a population of 53,200, and employment of 20,700. The average household income is around \$59,000, which is a little less than the median for the region. Most of the housing is suburban, although some parts of the area are more exurban in setting. Many TAZs have average incomes in the range of \$24,000 and \$50,000, as shown in **Figure 82**. There is a substantial presence of minority, low income, and elderly population: seventeen of the TAZs are designated by OKI as minority, with four of those also low income, and three of those also elderly, as shown in **Figure 83**. Metro routes 17 (60-minute frequency), 19 (30-minute frequency), and 74X (12-minute frequency during peak period) run through the area along Colerain Avenue (SR 27). All three serve Downtown Cincinnati. However, large parts of the area are greater than a mile from any bus stop and therefore not within walking distance of transit. Key destinations within this area are shown on **Figure 84**, and include Stone Creek Towne Center (shopping center), Northgate Mall, Colerain Hills shopping center, other strip malls, senior centers and assisted living facilities, churches, community centers, recreational areas, and a large recycling plant. These would each likely generate trips.



Figure 82 - Median Income Distribution for Colerain Township Pilot Area

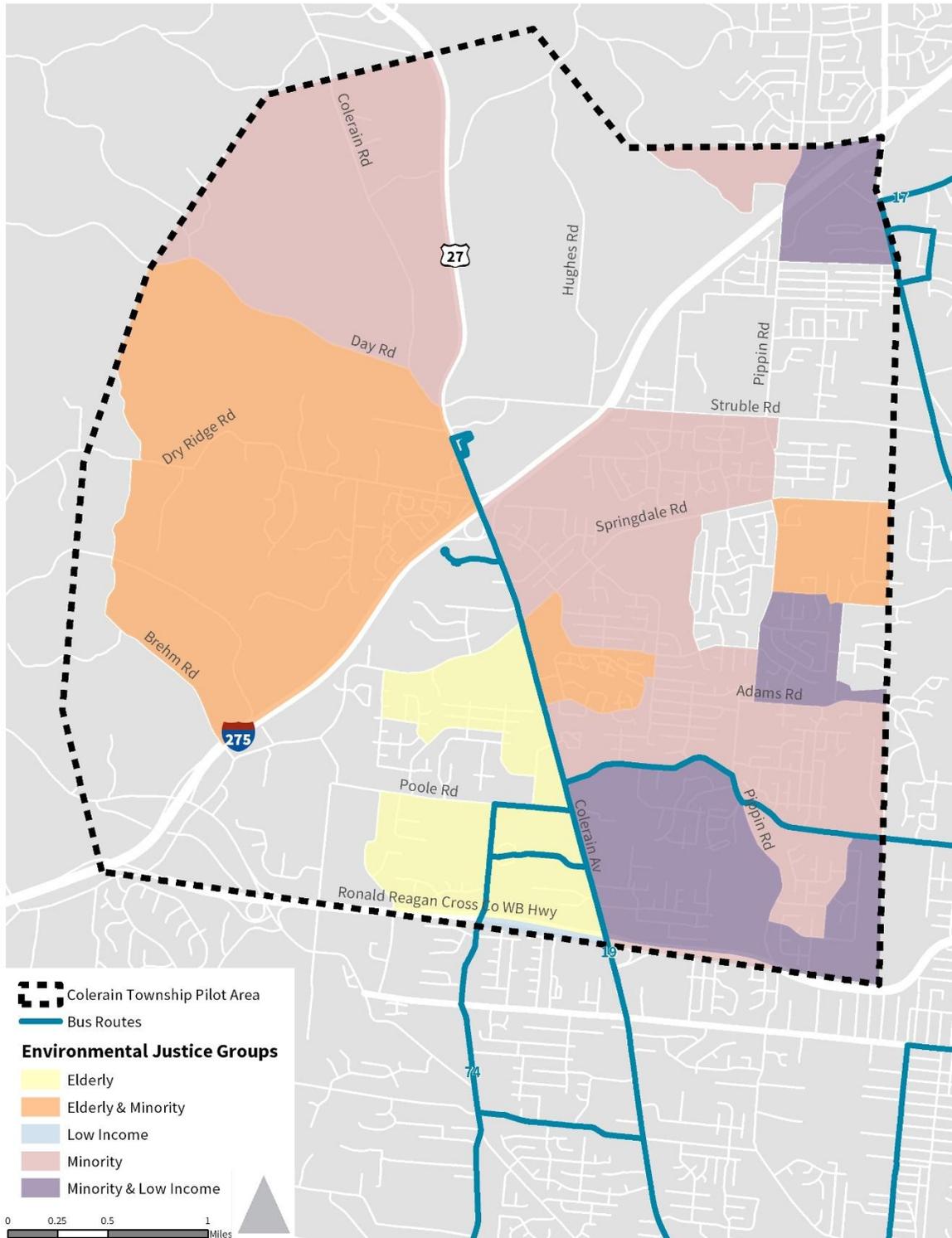


Figure 83 - Environmental Justice Groups within Colerain Township Area

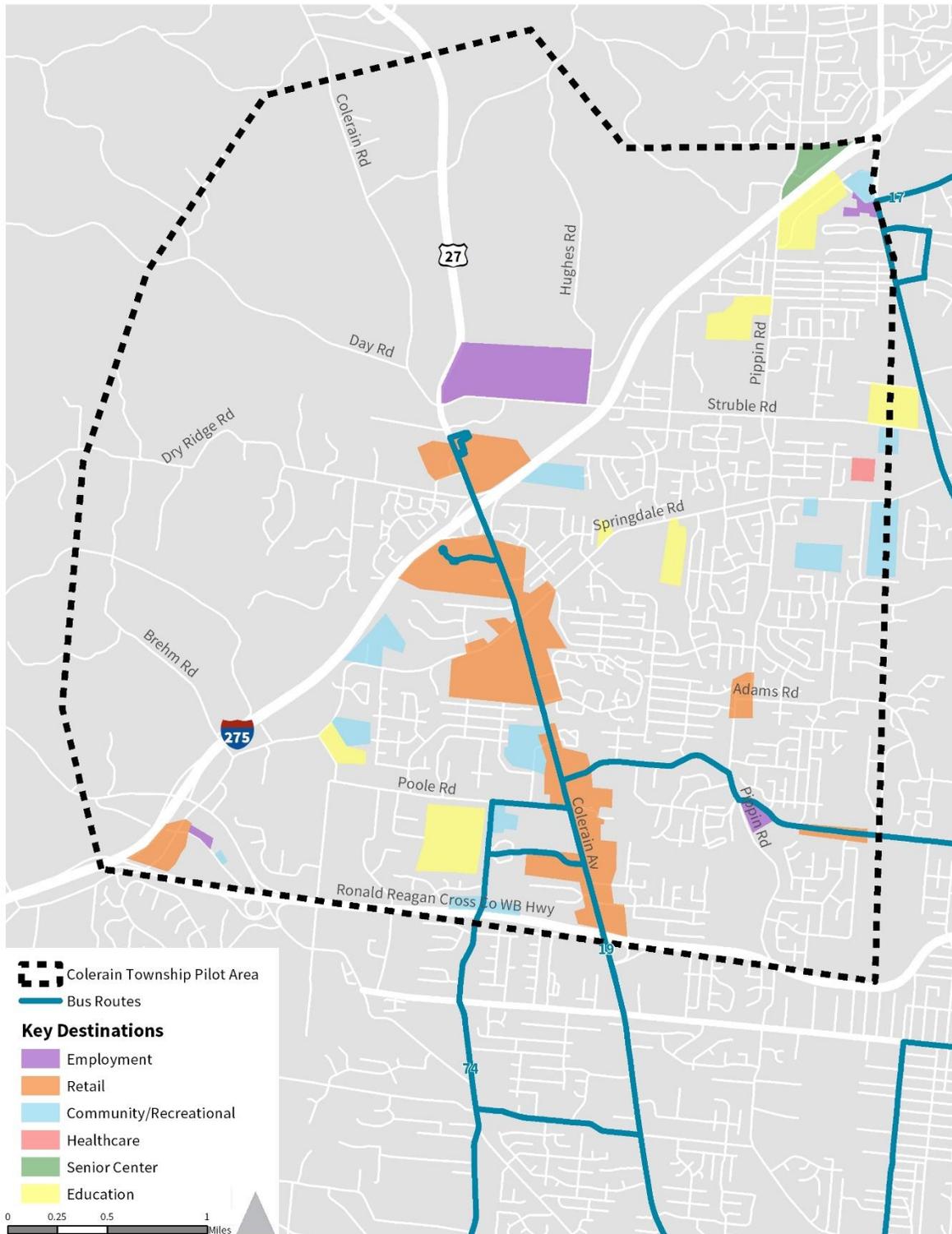


Figure 84 - Key Destinations within Colerain Township Pilot Area

Current travel in this area by Uber and transit is shown below in **Table 9**. This shows that transit outweighs Uber for travel within the area currently and that the total submarket is 211 trips per weekday. Data is not available to estimate automobile market size for trips within this area.

Table 9: Current Daily Travel in Colerain Township

Period	Trip Type	Uber	Transit
Weekday (all day)	Self-contained in zone	27	184
	Begins or ends in zone	89	673
Weekday Evening (6 PM to 12 AM)	Self-contained in zone	5	40
	Begins or ends in zone	18	80

It is unclear whether this meets a minimum demand density to support UberPool, although we suspect it does not. The rationale behind this pilot would be to deploy pooled ride-hailing as a replacement for the coverage bus service in this area.

Given a typical trip length within this area would be around 4 miles, and that an Uber trip of this length costs around \$13 (given a typical average of \$3 per mile for trips starting and ending in the pilot area), less a fare of \$1.75 (so as to be the same as transit), the typical subsidy could be around \$11.50. While the three routes in the area (17, 19, and 74X) have average subsidy per trip of \$3.50, \$3.94, and \$9.34, respectively, the subsidy per trip at this furthest end of the route may be much higher as ridership is likely lower than the route as a whole.

12.1.1.1.2 Area 2 – Avondale/North Avondale

We do not recommend a pilot in this geographic area, per the conclusion to this section. However, the work done to arrive at this conclusion is presented below.

The Avondale/North Avondale area does not follow a legally-defined boundary, but instead we have defined it as bounded by Clifton Avenue to the west, I-75 and Ross Avenue to the north, Victory Parkway to the east, and Martin Luther King Drive to the south. It includes parts of Clifton, Avondale, North Avondale, and St. Bernard. Aside from the small neighborhood of St Bernard, it is located within the City of Cincinnati just inside its northern limit, 4 miles north of Downtown Cincinnati. It has an area of around 8 square miles, a population of 35,323, and employment of 48,630. The average household income is around \$32,000, which is much lower than the median for the region. The housing is suburban. Much of the area has incomes below \$30,000, as shown in **Figure 85**. There is a substantial presence of minority, low income, and zero car population, with some elderly and people with disabilities too, as shown in **Figure 86**. Metro service is quite

good, with the 19, 78, 46, 51, and 43 routes prominently serving the area. While all parts of the area are within a mile of a bus stop, not all trips patterns within the area are served by transit. Key destinations within this area are shown on **Figure 87**, and include The University of Cincinnati School of Medicine and Hospital, buildings for Xavier University, religious centers, YMCA center, general retail, offices of the Herald, the zoo, and the botanical gardens.

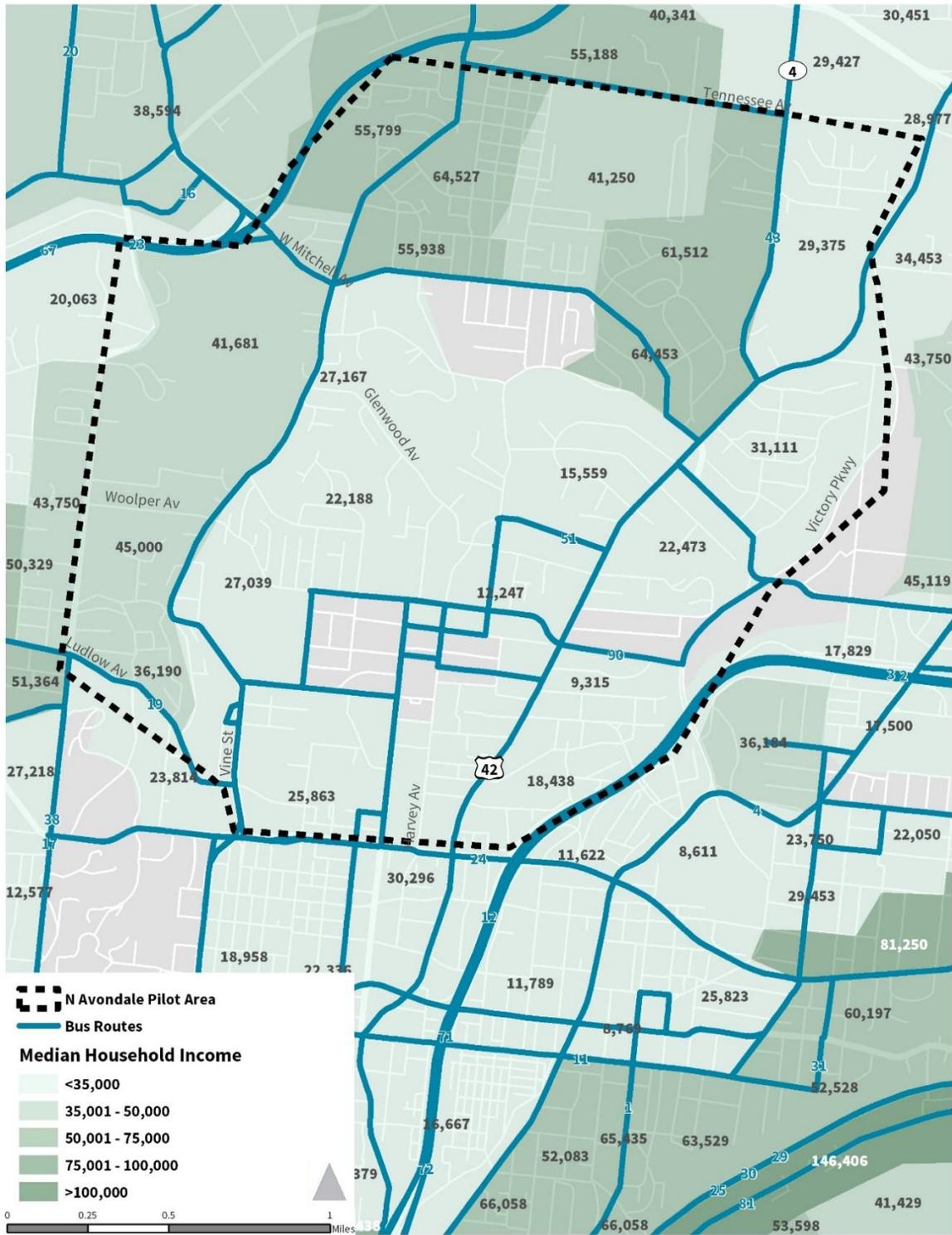


Figure 85 - Median Income Distribution for Avondale/North Avondale Pilot Area

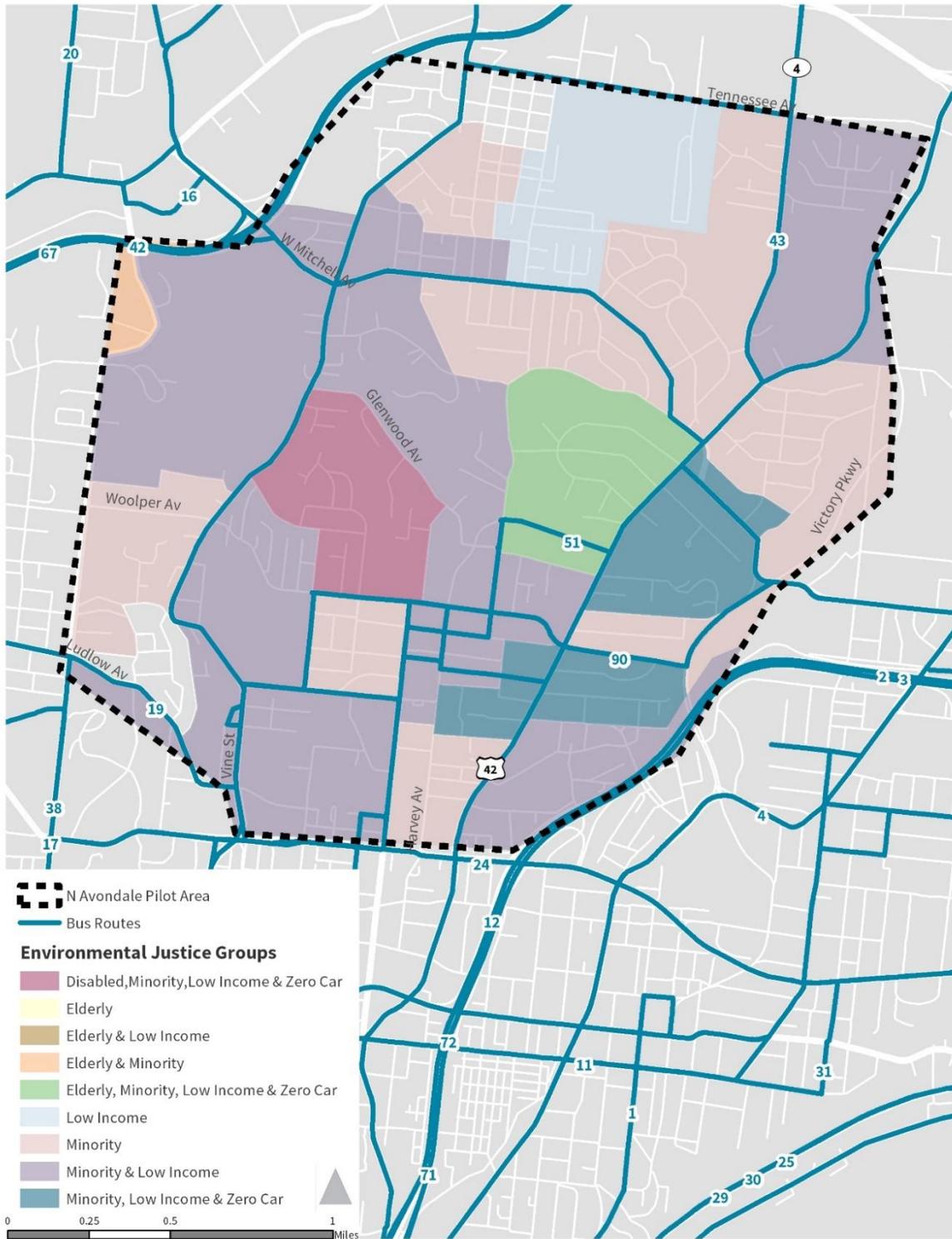


Figure 86 - Environmental Justice Groups within Avondale/North Avondale Area

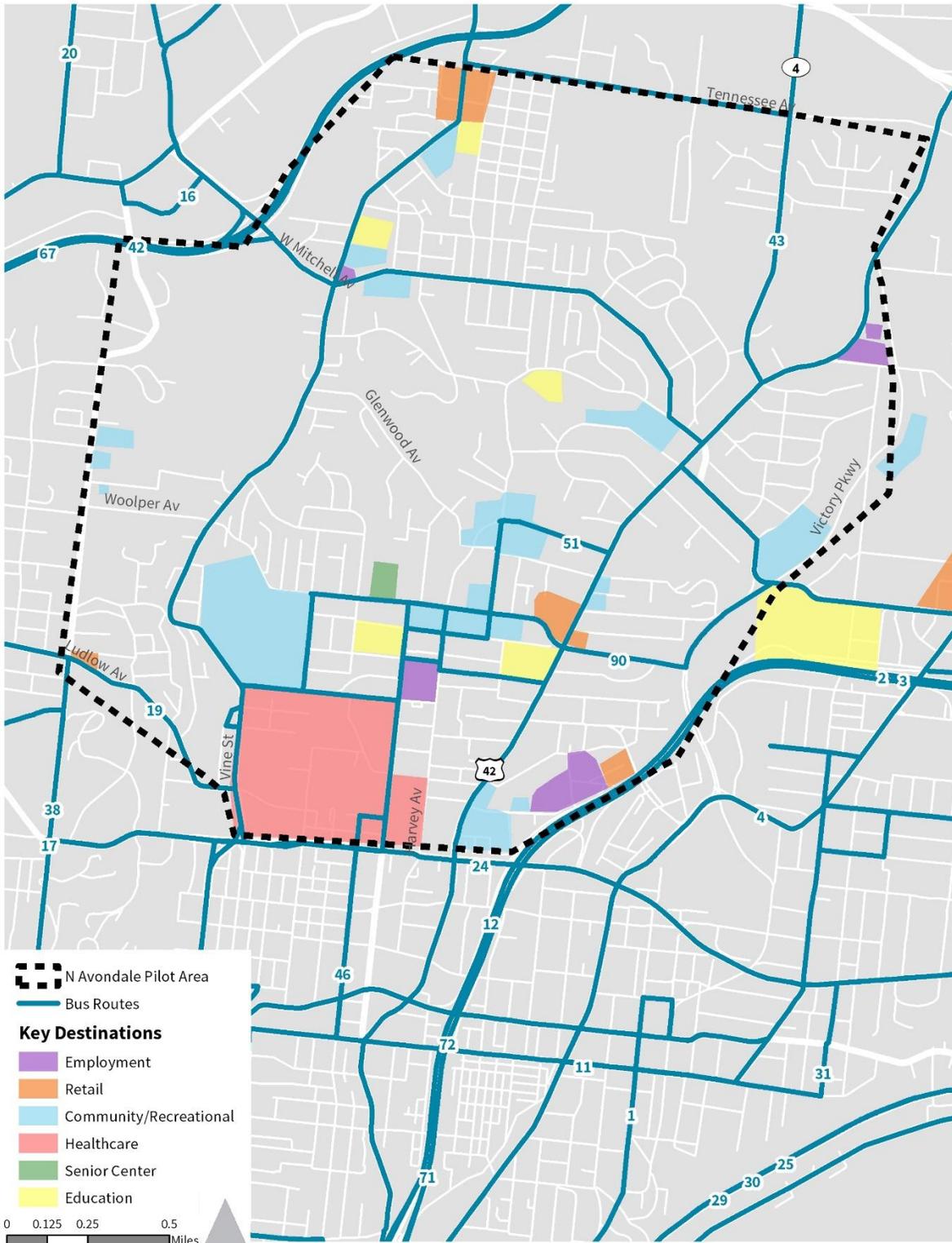


Figure 87 - Key Destinations within Avondale/North Avondale Pilot Area

Current travel in this area by Uber and transit is shown below in **Table 10**. This shows that transit outweighs Uber for travel within the area currently and that the total submarket is 1,279 trips per weekday. Data is not available to estimate automobile market size for trips within this area.

Table 10: Current Travel in Avondale/North Avondale

Period	Trip Type	Uber	Transit
Weekday (all day)	Self-contained in zone	44	1,235
	Begins or ends in zone	622	6,544
Weekday Evening (6 PM to 12 AM)	Self-contained in zone	9	154
	Begins or ends in zone	175	906

It is unclear whether this meets a minimum demand density to support UberPool, although we suspect it might. It has a much higher demand density than Colerain Township. The rationale behind this pilot would be to deploy pooled ride-hailing as a replacement for the coverage bus service in this area, but because the area contains the middle parts of routes in the area it may be challenging to re-route service to isolate and remove coverage bus service.

Given a typical trip length within this area would be around 2 miles, and that an Uber trip of this length costs around \$9 (given a typical average of \$4.40 per mile for trips starting and ending in the pilot area), less a fare of \$1.75 (so as to be the same as transit), the typical subsidy could be around \$7.05. The five routes in the area (19, 78, 46, 51, and 43) have average subsidy per trip of \$3.94, \$5.13, \$3.73, \$5.43, and \$3.47, respectively, and because most routes have their middle part in this area, the routewide average subsidy per trip is probably similar to that in this part of each route. Therefore, the typical subsidy for an Uber trip is larger than that for transit, but could be brought in line if UberPool were to achieve an average occupancy of two persons.

Ultimately, we do not recommend the Avondale/North Avondale concept as it overlaps too much with ridership-oriented fixed route service and could serve to undermine it.

12.1.1.2 Express Bus Replacement Concept

This concept involves the replacement of a low-performing ridership-oriented route with subsidized TNC service, as part of the “Reduce Costs at the Fringe” strategy. Some of the express buses are amongst the lowest performing routes in the system, and a pilot could augment or replace such a route with a subsidized pooled ride-hailing option. Legibility of any pilot is essential and as such the geographic boundaries and/or nodes of this concept should be carefully drawn. The pilot could take the form of cordon a certain distance



from the route or the stops of the current route. However, it may be difficult for people to instinctively understand which areas fall within or outside the pilot. An improvement in terms of legibility could be made through defining the pilot as a “route” operated by TNC with the same pick-up and drop-off points as the current route and direct-to-destination service for the people in each pool. A good candidate could be a low-performing express bus on the fringe of the region, such as the TANK 35X, which has a subsidy of \$17.39 per trip.

12.1.1.3 Major Corridor Bus Replacement Concept

In order to have the best chance of capturing a positive feedback loop of ridership increase this concept would be best be deployed in a high productivity transit corridor despite it being a lower-subsidy environment than a low-productivity corridor. The desire line on **Figure 11** indicates that these corridors are CBD to West Side, CBD to Inner Ring, CBD to Near North, and CBD to North Suburbs. This is the same service concept as “Express Bus Replacement Concept” above, but deployed in an area to achieve “Grow the Market” instead of “Reduce Costs at the Fringe”. “Grow the Market” is a strategy where on-demand service would undermine fixed route service.

12.1.1.4 Major Corridor Concept

In order to have the best chance of capturing a positive feedback loop of ridership increase, this concept would be best be deployed in a high automobile travel demand corridor. Closer scrutiny of automobile travel data would be required prior to identifying any particular areas for this concept.

12.1.1.5 Employment Cluster Concept

In this section we select an appropriate location for an employment cluster pilot, consider how travel demand might be quantified, evaluate known demand patterns, design a service offering, and then consider potential funding strategies given that there may be an opportunity for cost sharing between government and employers.

12.1.1.5.1 Selecting an Appropriate Location

We believe that an employment cluster pilot could fit a few different locations in the region which have a sufficient clustering of workplaces, but not a high enough density to support high frequency backbone transit service. These locations are:

1. The warehouses and commercial uses clustered to the west, north, and east of the CVG airport (although not the airport itself).
2. The suburban offices and retail jobs loosely clustered along Kemper Road and Northland Boulevard in Springdale and Sharonville.

3. The offices, warehouses, and medical facilities surrounding Summit Park in the Blue Ash neighborhood.

Of these, we consider the CVG area to be most promising because the job types are more likely to not conform to regular shift patterns, making an on-demand service a better fit.

12.1.1.5.2 Travel Patterns in the CVG Area

The CVG area is the largest travel demand generator for Uber trips with 15 percent of weekday trips in the region beginning or ending there. However, 14 percent of these are to/from the airport terminal whereas only 1 percent is to/from the surrounding area. The largest global hub of Amazon Air is located to the northwest of the airport and the largest global hub for DHL Aviation is located to the south of the airport. There are many separate warehouse facilities generally within three miles of the airport perimeter to its west, north, and east (as shown in **Figure 88**). There are also multiple hotels to the north and east. In sum, these workplaces house a total of almost 30,000 employees.

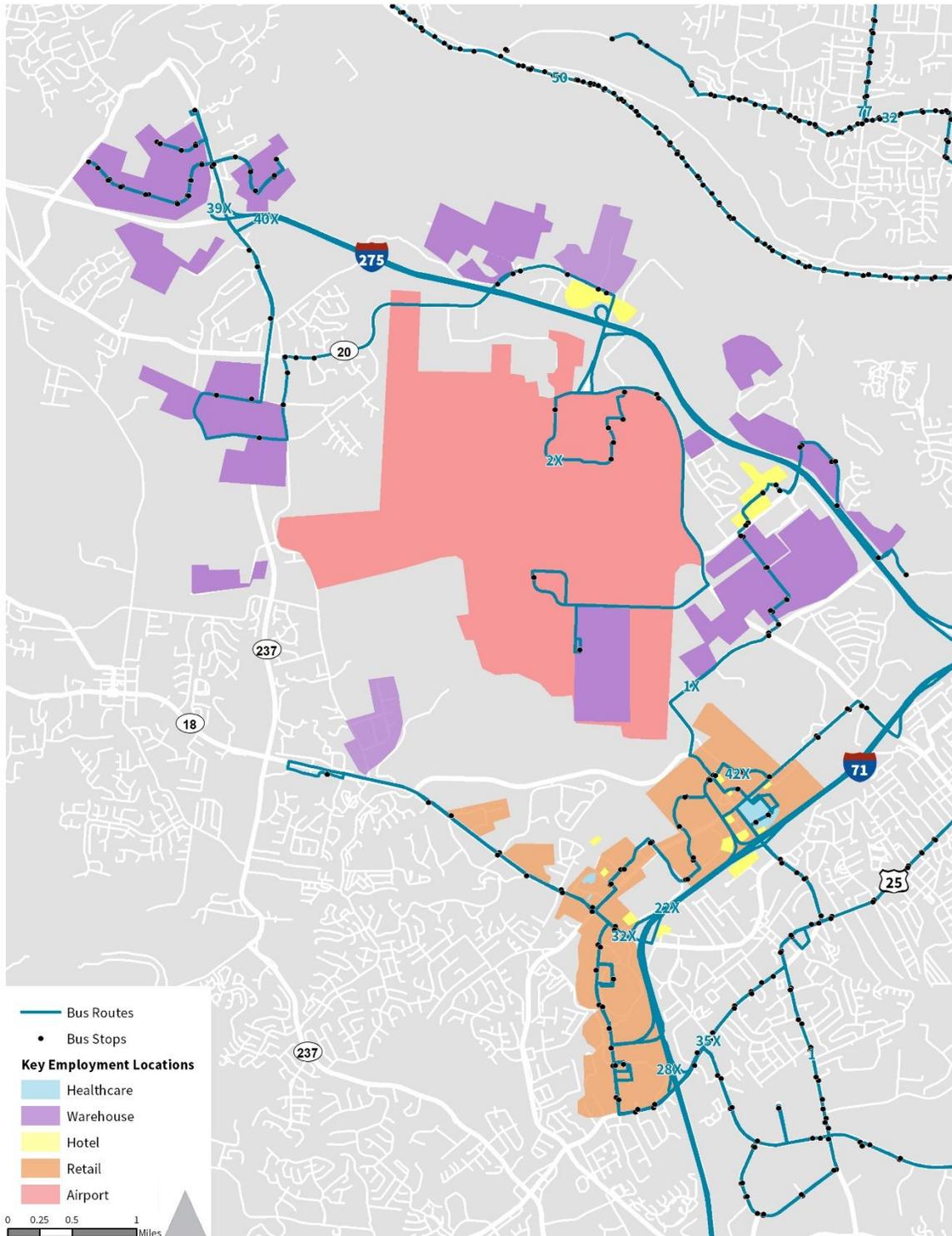


Figure 88 - Employment Locations in the Vicinity of CVG Airport

The OD trip web map developed by Fehr & Peers for this study provides some insights on the travel patterns of transit and Uber riders, as described below:

- **Transit:** Currently there is only one TANK bus route that serves the airport (2X) and two more transit routes that serve areas to the immediate north and the west of the airport (39X and 40X). The TAZ with the highest ridership in the surrounding area is that containing the Amazon fulfillment center to the immediate northwest of the intersection of Route 237 and I-275. Most trips from the CVG area go to/from downtown Cincinnati, with other trips going to other locations in Northern Kentucky, mainly Covington (see **Figure 89**). Note that distribution is concentrated to two TAZs as it is based on estimates from TANK staff, rather than travel demand model outputs which were not available for these TAZ pairs for the transit mode.
- **Uber:** There is very high demand to and from the airport terminals. Beyond the airport, there is some Uber activity from each TAZ surrounding the airport. The TAZ with the highest ridership is that containing a variety of warehouses off Route 20 to the north of I-275 and two hotels (Country Inn & Suites and the airport Marriott). Interestingly, there are negligible trips during the weekday evening to/from these TAZs, so trips are happening at other times of day. Most of the Uber trips from the surrounding CVG area are to other areas within a 6 mile radius of the airport in each direction with very few trips going as far as north of the river, or even to Covington (see **Figure 90**).

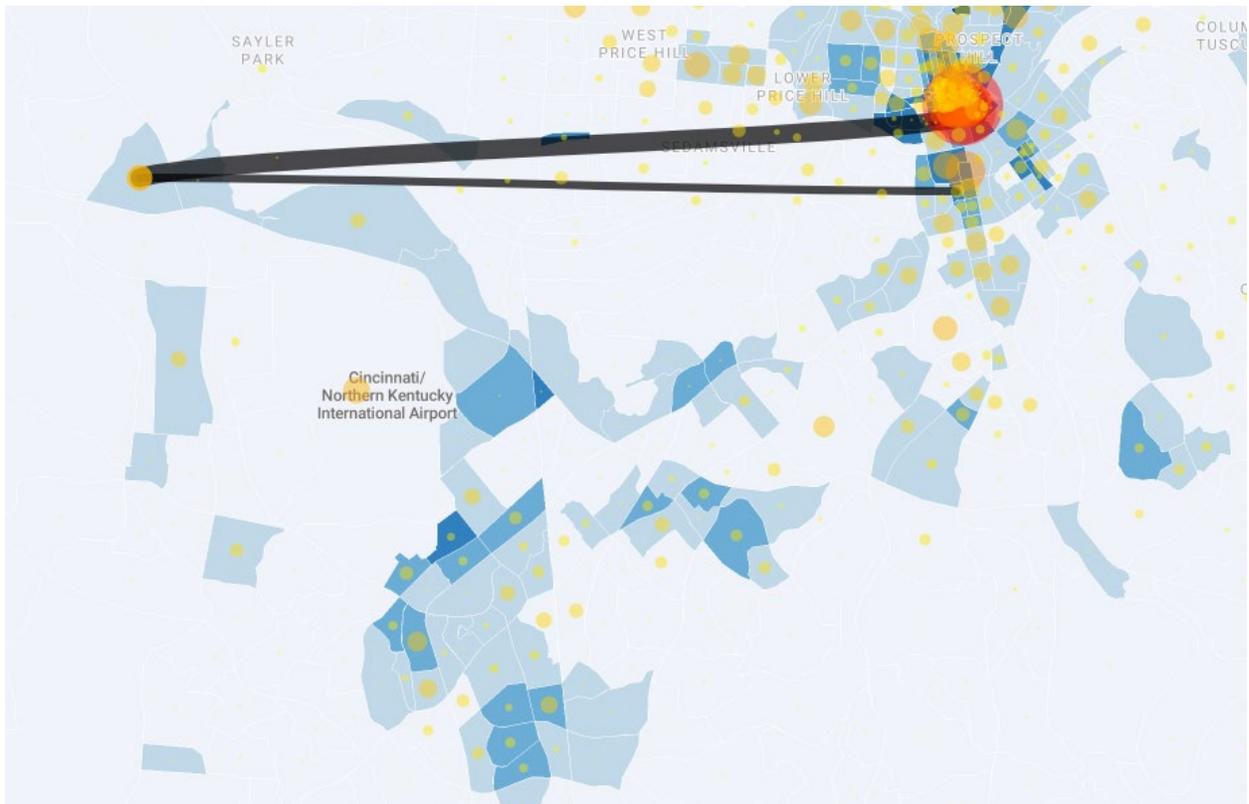


Figure 89 - Weekday Daily Travel Demand for Transit to/from the Busiest TAZ near CVG Airport

Note that distribution is concentrated to two TAZs as it is based on estimates from TANK staff, rather than travel demand model outputs which were not available for these TAZ pairs for the transit mode.

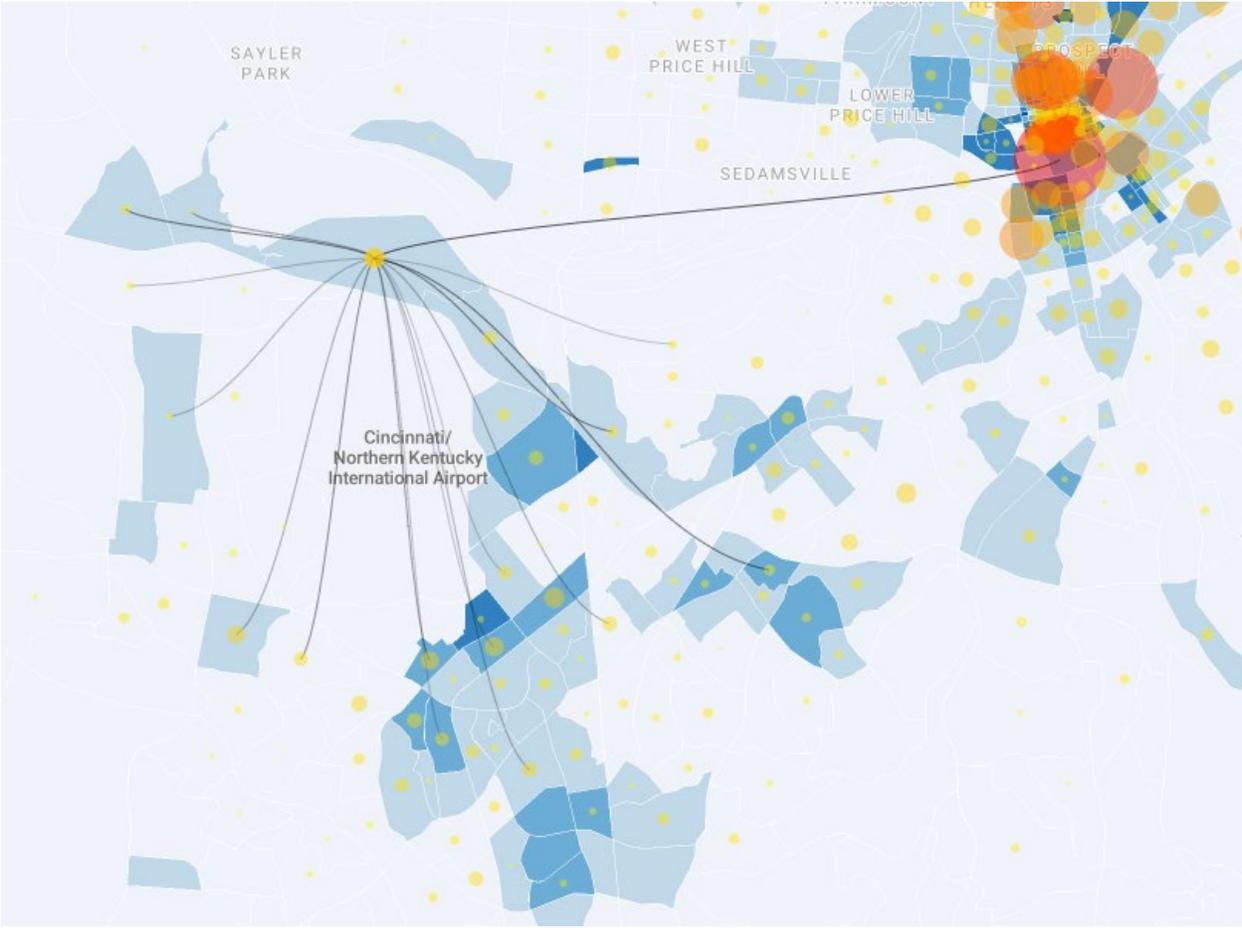


Figure 90 - Weekday Daily Travel Demand for Uber to/from the Busiest TAZ near CVG Airport

These travel patterns reveal that a negligible amount of people use Uber to commute to these destinations from other parts of the region more than 6 miles away, which is to be expected given the high availability of free parking and long travel distances involved that favor driving over TNC. However, they do not provide any conclusive sense about overall travel demand as the dominant mode, automobile, is not included in the web map.

We have identified three methods that could be used to estimate overall existing demand including auto trips, presented below. Given the shortcoming of the travel demand model and the limitations of the study scope, this step has not been undertaken as part of this study.

- **Travel Demand Model:** The regional travel demand model provided by OKI included travel times and costs for each TAZ OD pair as well as demand by mode for each OD pair, all for their peak and off-peak models. However, the traditional travel demand models are calibrated regionally and do not provide a more granular breakdown to the city level or for any particular area. The



travel demand model also does not consider the recent phenomenon of non-traditional trips such as e-commerce and TNC, which are a focus of this study.

- **Big Data on Travel Patterns:** Big data can be used to reveal aggregated OD travel patterns, with breakouts for origin-destination patterns and select link analyses. Currently its strength is in producing reliable proportional distribution of origins and destinations rather than counting trips by mode. One major vendor is StreetLight Data, who offer aggregated travel data based on smartphone and vehicle GPS location data. This data source must be scrutinized to ensure enough sample size and correction for representation of all income levels of the regional population given biases in penetration of location devices amongst the population.
- **Employer Survey:** Employer surveys can be designed to collect data on the employee travel behavior patterns. They provide the most accurate and recent data on the employee's origin and destination, travel schedule, occupancy, etc. We are not aware of any existing employer surveys in the area. This approach also gives the opportunity to perform before and after surveys to measure pilot performance, and even user and non-user opinions.

Of these methods, we believe that the most value would be gained from an employer survey.

12.1.1.5.3 Service Patterns for the CVG Pilot

Given the clustering of jobs in this area, we see potential for a pooled TNC service, such as UberPool. Employees in the warehouse, retail and service facilities with similar work schedules could use UberPool in different combinations to get to or from work. In general, the higher candidate pool, the more likely a match would be made and the lower the marginal cost per trip. We present pros and cons of three of the most promising service types in **Table 11**, below:

Table 11: Pros and Cons of Different Uber Service Types to/from the CVG Area

Service	Pros	Cons
<p>UberPool between CVG–adjacent workplaces and centralized transit hub near but not at the airport (express buses headed for the airport would stop here too)</p>	<ul style="list-style-type: none"> • Most beneficial for airport employees • Limits trip lengths to around 4 miles, therefore also limiting subsidies • Possibly more connections at the future airport express bus/TNC hub 	<ul style="list-style-type: none"> • Far fewer transit connections to this hub compared to downtown transit center, especially to areas in Hamilton County • Effective service limited to operating hours of bus routes, which are designed around regular shifts (9–5). • May be long waiting time at the transit/TNC hub if UberPool schedule and transit route connections are not matched properly • Drivers are disinclined to accept short trips around the airport as they are less profitable than longer trips • Drivers are disinclined to accept short trips around the airport as they are less profitable than longer trips
<p>UberPool between CVG–adjacent workplaces and downtown Cincinnati transit center</p>	<ul style="list-style-type: none"> • Well–tailored for people who live in downtown or have short travel times to downtown transit center • Limits trip lengths to around 15 miles, therefore also limiting subsidies 	<ul style="list-style-type: none"> • Connects through only downtown transit center that may result into longer trips; most trips require two transfers possibly making trips uncompetitive against driving • Effective service limited to operating hours of bus routes, which are designed around regular shifts (9–5). • Only provides good accessibility to part of the region that has reasonable trip times to/from transit center
<p>UberPool for the complete home–to–work trip</p>	<ul style="list-style-type: none"> • Serves the whole region, including areas with no transit service or low transit demand • Provides quickest possible travel time for most trips • Most flexible choice of route • Most intuitive service to customers • 24/7, i.e., not limited to hours of operations of transit service • Drivers prefer trips that start near the airport to be longer as they’re more profitable 	<ul style="list-style-type: none"> • Longest trip lengths, therefore highest subsidies required • May be hardest to pool trips, although employee survey would identify areas of highest demand and potential for which service could be initially targeted.

Of these, we believe that the complete home–to–work trip would be most effective, with the demand density proviso, and should be selected for a pilot.



12.1.1.5.4 Funding Strategies for a CVG Pilot

Because this service is highly focused on providing accessibility for work trips and thus providing a benefit to employers as well as to the public interest, there is an opportunity for both government and employers to contribute to the success of the program. Currently, transit agencies cannot spend federal money on TNC trips, but other resources like revenue bonds (e.g., sales tax, property tax, user fees), tax increment bonds (additional property tax revenues around transit), private capital, and state infrastructure banks, etc. are generally available for transit programs and may be able to be spent on the pilot.²¹² For example, the Go Monrovia pilot program is funded by regional sales tax revenue. Additionally, employers can offer commuter benefits to the employees who take the pilot. The benefits can be in the form of prepaid commuter benefits card, transit/TNC pass, and parking cash out. In each case, both the employers and employees save money that would otherwise go to parking.

²¹² DeGood, K. (n.d.). *Thinking Outside the Farebox: Creative Approaches to Financing Transit Projects* (Rep.). Retrieved <http://t4america.org/wp-content/uploads/2012/08/T4-Financing-Transit-Guidebook.pdf>

Supplement I – Service Restructurings



Various U.S. cities have recently restructured their transit systems to provide higher frequencies in high-performing corridors, and to expand the number of high-performing (or “Rapid”) corridors, in some cases at the expense of coverage-oriented services. Ultimately, transit boards must make a political decision whether or not to reallocate their investment in coverage-oriented service to ridership-oriented service to achieve these ridership gains.

The increased frequency is branded slightly differently by each transit agency, but emphasis has been on increasing frequency on routes to between 10 and 15-minute headways to establish a robust “high frequency network.” A significant point in increasing frequency is eliminating the difference between weekday and weekend, which typically means increasing weekend frequency to match traditionally higher weekday frequencies. Other core changes typically include straightening route alignments to more closely emulate a grid-like network, consolidating stops, and re-considering the balance of reinvestment of resources away from coverage-oriented routes to ridership-oriented routes. High frequency networks have been deployed in Houston, and Seattle, and these case studies explained in more detail below. These are the only two major U.S. cities to have seen bus ridership increases between 2015 and 2018.²¹³ Other recent redesigns include Austin TX (a 4.5 percent increase in ridership, although service was increased by 9 percent)²¹⁴ and Columbus OH (a 2-4 percent increase in ridership).²¹⁵

13.1.1 Houston

Houston began a systemwide restructuring in 2014 with in depth planning and public engagement. Houston’s goal centered around providing more frequent service every day of the week in a cost neutral approach. With an approved plan in early 2015, the new Reimagined Network was implemented in late 2015 and was cost neutral. This network increased the number of frequent routes serving minimum 15 minute frequencies to many more residents. However, ridership per capita for the region declined by 2 percent between 2014 and 2018.^{216,217} Their approach also acted on increasing reliability through eliminating network delays associated with circuitous routes and freight rail crossings. The reality of the restructuring turned out to be a slight operating cost increase, expanded frequent service to reach 1 million people with 1 million jobs and expand weekend service to be nearly identical to weekday service.²¹⁸ The previous

²¹³ Retrieved from Mobility Lab, “Houston bucks national trend of transit bus system decline:”
<https://mobilitylab.org/2018/03/21/houston-bucks-national-trend-transit-bus-system-decline/>

²¹⁴ Retrieved from TransitCenter.org: <http://transitcenter.org/2019/08/08/one-year-in-austins-revenue-positive-bus-network-redesign-is-gaining-riders/>

²¹⁵ Retrieved from StreetsBlog USA, *The Columbus Bus Network Redesign Boosted Ridership:*
<https://usa.streetsblog.org/2018/08/14/the-columbus-bus-network-redesign-boosted-ridership/>

²¹⁶ Population data: <http://worldpopulationreview.com/us-cities/houston-population/>

²¹⁷ Ridership data: <https://transitcenter.org/theres-a-reason-transit-ridership-is-rising-in-these-7-cities/>

²¹⁸ Retrieved from Human Transit, *Houston: Great Ridership News on the New Network:*
<https://humantransit.org/2015/10/houston-good-ridership-news-on-the-new-network.html>

population base with frequent service ranged between 290,000 and 534,000 based on proximity to transit ¼ mile and ½ mile respectively. These increased by 142 percent and 111 percent, respectively, as can be seen below in **Figure 91**.

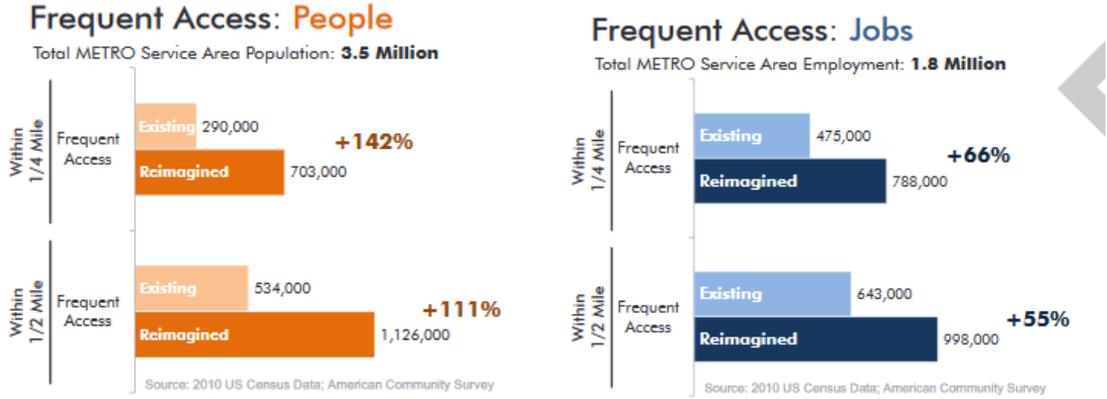


Figure 91 - Metro Service Area Population Close to Buses Before and After Service Reimagining
 Source: <http://transitsystemreimagining.com/web/wp-content/uploads/2014/05/Draft-Network-Plan-Chapter-For-Web.pdf> Metropolitan Transit Authority of Harris County, Houston, Texas

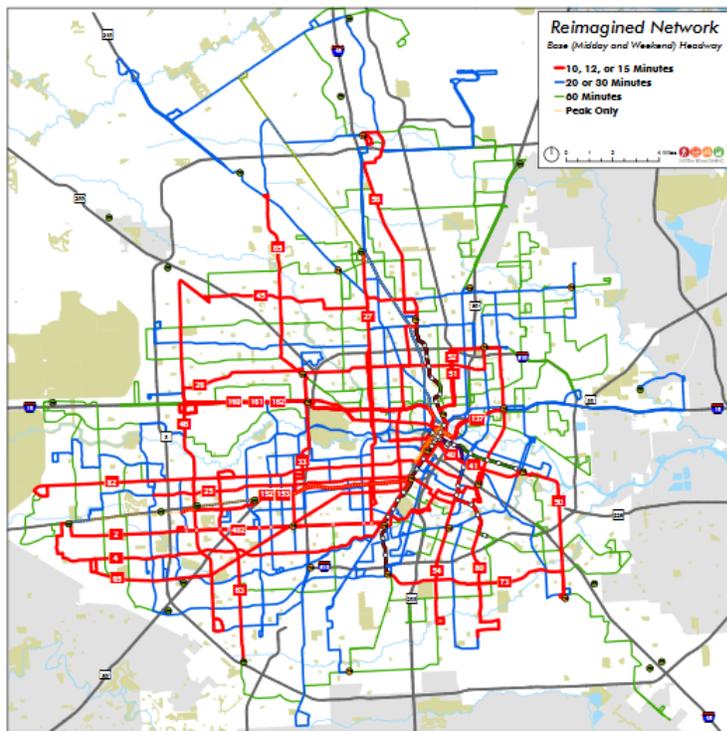
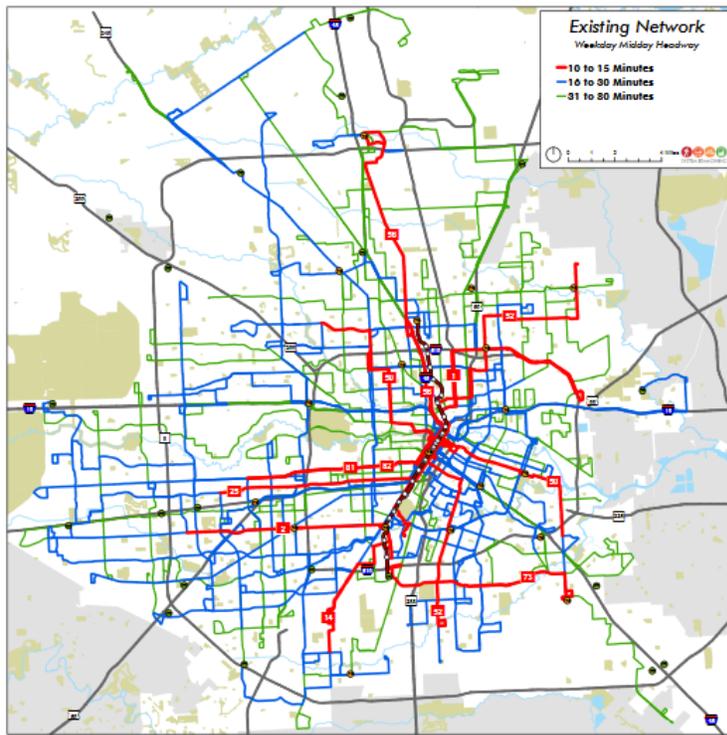


Figure 92 - Houston Bus Network Before (Weekday only) and After Restructuring (7 Days a Week)
Source: <http://transitsystemreimagining.com/web/wp-content/uploads/2015/02/ExSatSunRNFlip.pdf> - Metropolitan Transit Authority of Harris County, Houston, Texas.

13.1.2 Seattle

Seattle has seen ridership increases after implementing a transportation benefit district to raise funds specifically to enhance the transportation network. After transit service reductions were implemented due to funding shortfalls, Seattle voters approved the creation of the Seattle Transportation Benefit District to address the transit funding shortfalls. The collected revenue has allowed the improvements to transit to focus on addressing overcrowded routes, improving schedule reliability, and increase frequency and areas served with equity in mind.²¹⁹ These improvements have increased the proportion of all city residents living within a 10 minute walk of 10 minute headway service from 25 percent in 2015 to 67 percent in 2018.²²⁰ Much of the improvements have been focused around the Urban Villages and Urban Centers. According to Seattle's Comprehensive plans their urban centers are the densest neighborhoods with a diverse mix of uses, housing and employment opportunities. The urban villages are identified by a balanced mix of housing and employment less dense than the centers. The strive to balance a mix of goods, services and employment for residents, however some villages are more centered around residential and goods and services but not employment. This increase in transit ridership has coincided with a decrease in the single occupancy vehicle (SOV) mode share. Between 2015 and 2018, there was a 2.6 percent increase in per capita transit ridership in the region.^{221,222} Revision of systemwide goals allows the agency to proactively address service changes and updates.

²¹⁹ SDOT Blog, "More good news for the Year 3 Seattle Transportation Benefit District Performance Report:"
<https://sdotblog.seattle.gov/2018/11/16/more-good-news-for-the-year-3-seattle-transportation-benefit-district-performance-report/>

²²⁰ *All Aboard: Seattle Transportation Benefit District Year 1 Performance Report, June 2015-June 2016:*
<http://www.seattle.gov/Documents/Departments/Transit/STBDYear1Report-2016.pdf>

²²¹ Population data: <http://worldpopulationreview.com/us-cities/seattle-population/>

²²² Ridership data: <https://transitcenter.org/theres-a-reason-transit-ridership-is-rising-in-these-7-cities/>

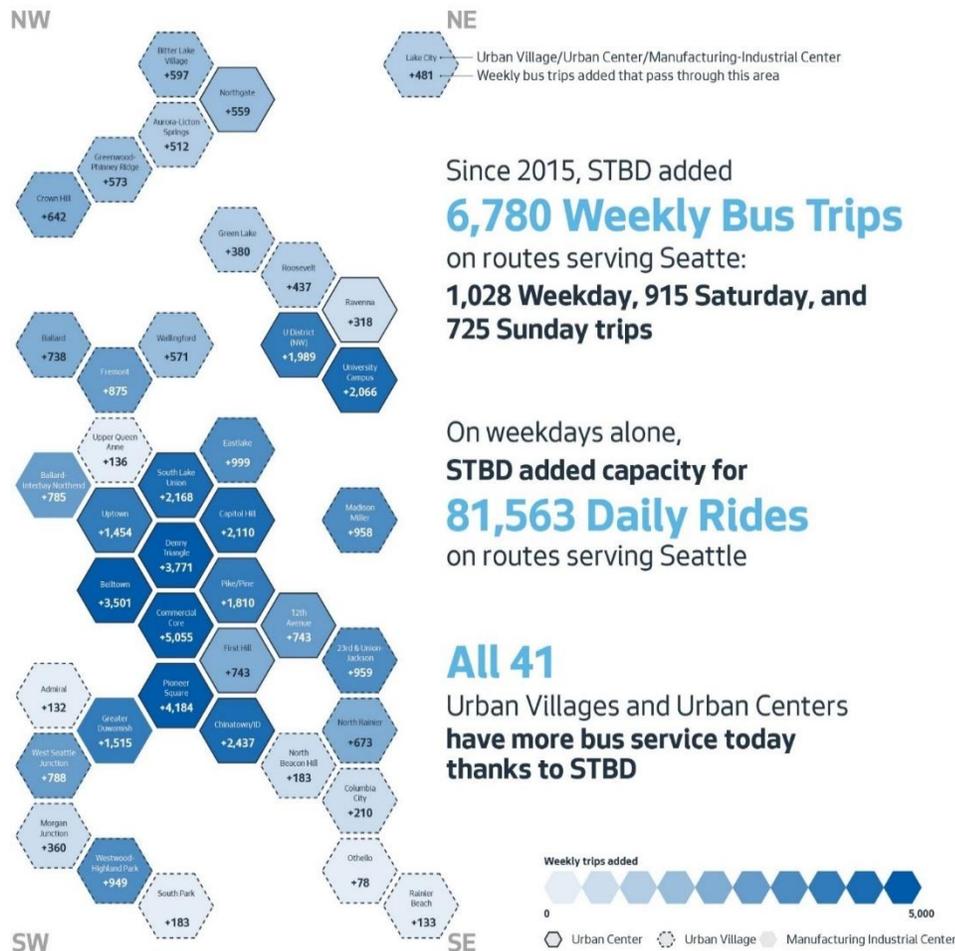


Figure 93 - Change in Weekly Trips by Neighborhood in Seattle

Source: http://cosssdotblog-wpengine.netdna-ssl.com/wp-content/uploads/2018/11/HexCapacity_UPDATED-08.jpg

Supplement J - Transit Policy Changes



Transit agencies adopt policies covering a broad swath of different functions. Over the past few years, some specific policy decisions have emerged that have served to improve the performance of transit agencies and in some cases, boost ridership. The policies; all door boarding, fare reform, and data sharing, are described in turn in this section. Transit policies are tools which an agency can implement or often need to partner with jurisdictions they serve, their MPO, local advocacy and businesses. Fiscal, operational, congestion management and multimodal integration policies are pieces of the puzzle.

14.1.1 All-door Boarding – San Francisco

All-door boarding is an effective operations policy, first enacted in the U.S. by San Francisco MTA. San Francisco remains the only U.S. city with systemwide all-door boarding. The all-door boarding began on their light rail system in the late 90's and in recent years the extent of lengthy boarding queue lines for buses led to calls to expand the policy systemwide, which was done in 2012. This policy required installation of farecard tag devices at rear doors and was successful in part due to extensive outreach to all types of riders: commuters and tourists alike. All-door boarding has helped to maximize revenue hours, reduced dwell times, and improved fare compliance.²²³ The need for additional fare inspectors has benefits beyond improved fare collection, and the improved convenience improves the rider experience and perception.

14.1.2 Fare Policy Reform – Portland

Portland's TriMET has enacted multi-pronged reforms to its fare payment policy, focusing on an account-based, contactless, regional fare collection system, with industry leading features like open APIs (Application Programming Interface), stored value, fare capping, open payments, and virtualized smart cards. The goal was to create a regional fare policy enabling revenue sharing and to allow electronic and thus seamless transfers between agencies. Fare capping was an idea inspired by Transport for London and was implemented to ensure more equitable transit access. Passengers can earn a monthly pass as they ride with daily payments accumulating to a monthly level. The ability to cost save with a monthly pass is enabled for all in the pay as you go model through fare capping because people that don't have means to pay the upfront price at the start of the month don't end up paying more by the end of the month. Providing an account-based system has enhanced transit access and mobility services for the unbanked constituents. The other side of an innovative fare policy is being creative with processing the data by developing tools

²²³ SFMTA, *All-Door Boarding Evaluation Final Report*, December 2014:
<https://www.sfmta.com/sites/default/files/agendaitems/2014/12-2-14%20Item%2014%20All%20Door%20Boarding%20Report.pdf>

that enable staff to efficiently and effectively manage reporting and much more. Below we present a short list of TriMet’s fare policy innovations, as described by a TriMet representative:²²⁴

1. **Automated accounting processes** – backend creates the entries for the general ledger, summarizes them and exports to a commercial off the shelf accounting software where the agency can do things like create customer invoices.
2. The agency has a **data warehouse** where they will be able to run custom reports for accounting and service planning, without impacting performance of customer facing functions
3. The agency built **automated reconciliations** that (using unique transaction identifiers and bank files) match value loads with deposits from the bank and retail network
4. The agency has **anti-fraud mechanisms** such as address verification for payment methods and velocity checks that would detect if transit accounts are being duplicated and used by multiple people.
5. The system is reliable – the agency has **physically redundant servers** with hot functionality allowing them to seamlessly switch in the event of an outage.
6. The agency has **real time device monitoring** allowing them to remotely monitor their card readers. Should one go down, they are pop and swap, allowing for easy maintenance.
7. Lastly, the agency has **revenue sharing**. This is almost as important as stored value in terms of future potential. They already have the automated processes in place that divide up revenue earned in the system amongst regional partners, based on business rules defined by intergovernmental agreements.

14.1.3 Data Sharing – Pittsburgh

Making information freely available in specified formats and rapidly accessible can allow agencies to hold themselves more accountable. This also more clearly demonstrates that they have the public’s best interest in mind by helping researchers, consultants, advocacy groups, and citizens better conduct business, creatively develop services, and support the integration of land use and transportation in the region¹⁶³. The Pittsburgh Port Authority has created a transparent ecosystem for their constituents and community members to actively participate in knowledge sharing about the Authority. To optimize the transparency, the Port Authority has established a partnership with the Western Pennsylvania Regional Data Center, who are a body that supports key community initiatives by making public information easier to find and use. The Data Center provides a technological and legal infrastructure for data sharing to support a growing

²²⁴ Retrieved from *TriMet News*, “TriMet plans to phase out most non-Hop paper and mobile tickets and passes by Dec. 31, 2019:” <http://news.trimet.org/2019/04/trimet-plans-to-phase-out-most-paper-tickets-and-passes-by-december-31-2019/>



ecosystem of data providers and data users. The Data Center maintains Allegheny County and the City of Pittsburgh's open data portal, and provides a number of services to data publishers and users. The Data Center also hosts datasets from these and other public sector agencies, academic institutions, and non-profit organizations. The Data Center is managed by the University of Pittsburgh's Center for Social and Urban Research, and is a partnership of the University, Allegheny County and the City of Pittsburgh.²²⁵ This partnership allows the Port Authority to promote innovation for its services to commuters and its own staff with the liberation of data and hosting of those resources.

²²⁵ The Port Authority of Pittsburg: <https://www.portauthority.org/inside-Port-Authority/Transparency/system-data-and-statistics/>

Supplement K -
Infrastructure and
Technology
Improvements



15.1 Examples of Infrastructure Improvements

Many of the operational enhancements implemented from new policies require improvements to infrastructure. An ideal starting point to improve infrastructure would be from the Transit Asset Management Plan. From this plan scheduled improvements can maximize efficient capital improvements. Furthermore, leveraging detailed inventory's such as a bus stop inventory will enable the agency to prioritize passenger facilities in need of enhancements. Examples of infrastructure improvements include:

- Street infrastructure
 - Far side of intersection stop placement
 - Transit only lanes or shared bus/bike lanes (SBBLs)
 - Bus queue jump lanes at intersections
 - Accessibility and adjacent sidewalk width
 - Intermodal connectivity nearby, e.g., bike racks, bike lockers, bike share, car share
- Stop infrastructure
 - Boarding / alighting platforms
 - Bus stop shelters and benches
 - Ticket vending machines
 - Station based farecard tagging devices
 - Real-time information signage
 - Route schedule and map
 - Good lighting
 - Self-compacting Cloud-connected trash receptacle to reduce maintenance visits
 - WiFi hotspot

15.2 Examples of Technology Improvements

Contemporary Intelligent Transportation Systems (ITS) for transit are quite broad, and more so when integrating intermodal systems. Technology can be broken down into the following buckets: passenger-

enabled technology, curb-enabled technology, and vehicle-enabled technology. The quality and fidelity of data an agency collects, maintains, shares, and analyzes influences the technology it can enable and implement for service improvements.

SORTA operates the CincyEZ Ride transit app for mobile ticketing and trip planning. Hosting real-time data feeds in the GTFS-RT proto buffer format allows third party apps to consumer vehicle location and trip update data to share with passengers. Using the real time arrival information is also extremely valuable for in app use, and enhancing passenger experiences at stops and transit centers. Outsourcing trip plans to third party applications should coincide with the privilege to receive the Origin / Destination pairing. SORTA has an extensive list of suggested apps for riders to leverage for trip planning and real time vehicle access.²²⁶ The majority of commuters simply want to know when their transit vehicle will arrive to their stop. Because SORTA has endorsed Transit App, this provides a conduit to request anonymized OD pairings from Transit App.

Typical ITS use of technologies for BRT such as Transit Signal Priority (TSP) at a fleet-wide scale is possible today. Typical TSP has been conducted on a corridor basis with significant hardware installation at signal control cabinets and on vehicles. Cloud-based signal priority can be used to improve transit travel times and vehicle throughput.

Other technology enhancements include collision avoidance technology, connected vehicle technology, preventative maintenance diagnosis data, onboard cameras for passenger safety, external cameras for incident review, and notifications on mobile apps for access to safety personnel. Mobile app integration with other modes in the creation of a Mobility as a Service platform with integrated payment is difficult to attain for a transit property, however TriMet has evolved their trip planner to do just that. The open source software integrates transit, bicycling, TNC's, car-share, bike-share, and scooters, in real-time. TriMet has been able to accomplish this because of their forward-thinking approach to hire software developers and technocratic transportation planners.

²²⁶ Retrieved from Go Metro, Mobile Apps & User Created Resources: <https://www.go-metro.com/mapsandschedules/maps-schedules/mobile-app-user-created-resources>