Shared Micromobility in the City of Sprawl: A Case Study of Phoenix, Arizona

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Abstract

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Micromobility has emerged as a promising response to 21st century urban transportation challenges, particularly in the face of growing concerns around carbon emissions, traffic congestion, and mobility equity. Yet most research on this mode to date draws on data from high-density, transit-rich urban environments, and does not adequately reflect the urban form of most U.S. cities, which are increasingly characterized by low-density development, auto-centric infrastructure, and decentralized activity centers. Phoenix presents a compelling case through which to investigate what factors best create environments where shared micromobility is likely to thrive in low-density urban contexts. This thesis offers an in-depth exploration of a specific micromobility program utilizing interviews and public records review, and uncovers root causes of implementation challenges and programmatic nuances. Findings indicate that a complex network of stakeholder-specific considerations, including city government, private operators, and users, shapes successful micromobility environments in Phoenix. The City evaluates micromobility through transit connectivity, parking availability, demographics, budget, political bias, regulatory frameworks, public planning, safety, and operators' capacity. For operators, key considerations include population density, the regulatory environment, demographics, and culture. From the user's perspective,

important elements are community diversity, street design, infrastructure, the program footprint, culture, micromobility economics, and safety.

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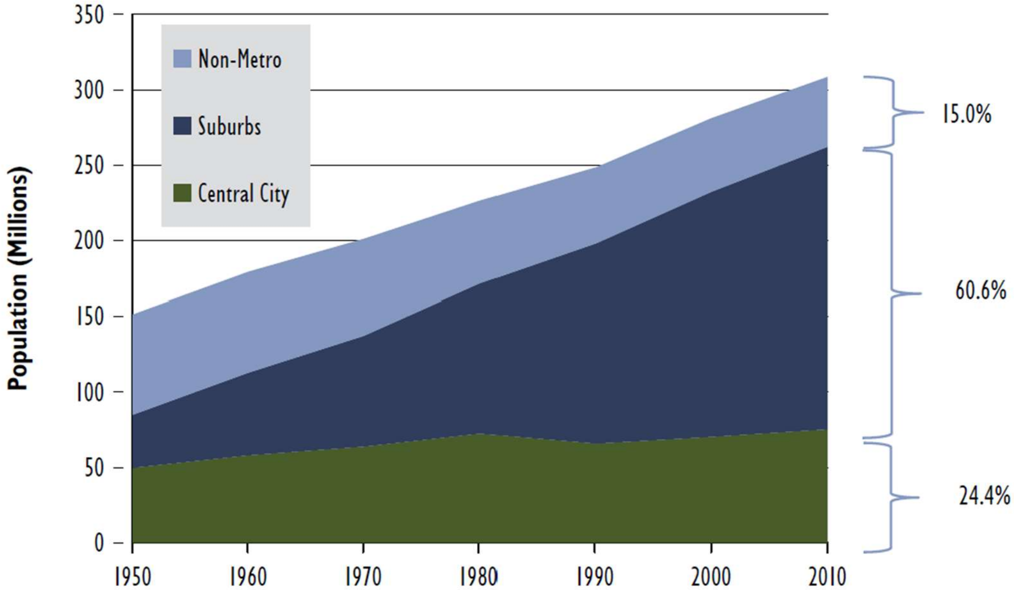
Introduction

Micromobility, such as e-scooters and e-bikes, have emerged as a promising response to 21st century urban transportation challenges, particularly in the face of growing concerns around carbon emissions, traffic congestion, and mobility equity. However, existing academic literature on micromobility overwhelmingly draws from high-density, transit-rich urban environments, particularly in European and Chinese cities, as well as North American metropolises like New York, Chicago, and San Francisco. These contexts, while important, do not adequately reflect the urban form of most U.S. cities, which are increasingly characterized by low-density development, auto-centric infrastructure, and decentralized activity centers.

A critical gap remains in understanding how micromobility can function and thrive in low-density urban environments. Phoenix, Arizona, the fifth most populous city in the United States, exemplifies this challenge. With its sprawling urban footprint, limited transit infrastructure, and emerging private micromobility market, Phoenix presents a compelling case through which to investigate the environmental, budgetary, political, infrastructural, and behavioral factors that influence micromobility systems in low-density contexts.

Understanding low-density metropolitan spaces are important as they are increasingly the most populated built environment type in the U.S. (O'Callaghan, 2016). In 1890, one third of the U.S.'s population lived in urban spaces (Coughlan, 1995), yet, by 2019, "Suburbs [were] home to roughly … 80 percent (215 million) [of the U.S. population]. Almost four in 10 Americans live in the most suburban communities… those with high levels of car commuting, home ownership, and single-family houses" (Florida, 2019). Figure 1 depicts population growth across built environment typology in the U.S. from 1950 to 2010, demonstrating that most urban growth is occurring in mid to low-density suburban neighborhoods outside of city centers, reflecting sprawling land use patterns and auto-centric travel culture (AASHTO, 2013).

Figure 1. Population growth across built environment typology over time (AASHTO, 2013, 13)



In the United States, an inverse relationship between housing density and emissions per capita concerns climatologists and transportation planners (Ewing et al., 2002; Schmidt, 2004), yet achieving U.S. suburban transportation decarbonization via vehicle electrification is a timely and costly endeavor. In suburban spaces, efforts to diversify suburban transportation from internal combustion engines are largely concentrated on increasing the market share of single-occupancy electric vehicles and rarely consider non-motorized transportation as a strategy (Fransen et al., 2019). The conversion rate to transition a community's vehicle fleet from gas-powered vehicle to electric vehicles is approximately 15 years, and electric vehicles must also be paired with charging infrastructure deployment (Bauer et al., 2021; U.S. Department of Transportation, 2023). Additionally, while electrifying single occupancy vehicles in suburban contexts can mitigate carbon dioxide, it does not reduce other externalities associated with driving, such as congestion, tire dust pollution, deaths by vehicle collisions, or diminished accessibility and negative health impacts from reduced physical activity (Rodrigue, 2024).

Another justification for this study is what Stehlin and Payne call "mesoscale infrastructure" (2021). That is, micromobility facilitates a mobility that tends, "to fall between the spatial scales of walking and that of driving or public transit" (1066) and the infrastructure development for micromobility sharing tends to be greater than that for biking and walking, but less than that for driving or riding transit. Stehlin and Payne state, “This scale is an…attempt to address the deep infrastructural gaps produced by uneven urban and regional development” (2021, 1066).

Lastly, studying micromobility in low-density cities is increasingly important due to shifting socioeconomic patterns and longstanding issues of transportation equity. Socioeconomic demographics of low-density cities and suburban areas have changed since the mid-twentieth century; According to Florida, “Suburban poverty has risen sharply…the suburban poverty rate is 10 percent” (2019), and according to Airgood-Obrycki & Rieger, “More impoverished people now live in suburbs than in cities” (2019, 1). Low-density cities can greatly benefit from alternative transportation modes, but have historically been excluded from micromobility service (Stehlin and Payne, 2021). This pattern has resulted in limited accessibility for communities in outlying or underserved areas. The City of Bellevue’s post-pilot analysis of its micromobility program reinforces this point, finding that operators failed to rebalance devices equitably across the city, in violation of the city-operator contract, instead concentrating service in the downtown core (City of Bellevue, 2020). These practices raise important questions about who micromobility systems are designed to serve and what values underpin their deployment. As Stehlin and Payne (2021) argue, these systems often reproduce patterns of uneven urban development, extending access only to a select group of cities aiming to attract capital, tourists, or a creative workforce. This contrasts with what Connolly (2014) writes, “[The] guiding purpose of infrastructure, especially transport systems,…[is] to equalize spatial relations.” Dockless micromobility programs, initially promoted as tools for expanded access, have often exacerbated these issues by exploiting public underinvestment and bypassing regulatory frameworks designed to ensure equity (Stehlin and Payne, 2021). As poverty demographics shift and privately-funded transportation modes operate where there is access to capital, the need to reassess micromobility in low-density environments becomes obvious.

Despite this urgency to better understand micromobility in low-density cities, research to improve and better understand micromobility is largely concentrated in dense, urban contexts (Faghih-Imani et al., 2014, 2017; Jaber et al., 2023; Peters & MacKenzie, 2019; Zhou, 2015; Zou, 2023) and rarely garners attention in suburban or low-density contexts (McAndrews et al., 2018). It is not yet understood how micromobility may influence the transportation needs of urban residents who live in less-dense areas of the city and make daily transportation choices within the place they reside.

Research Question

This research explores factors that explain the micromobility phenomenon in a North American low-density context. The central research question is: *What factors best create environments where shared micromobility is likely to thrive in low-density urban contexts?* This framework will help establish criteria that elucidate not only how and why micromobility appears in suburban-like settings, but also the levers that influence the success and longevity of bike- and scooter-share programs in unlikely places.

The goal of this research is to offer an in-depth exploration of a specific micromobility program and uncover root causes of its implementation, programmatic nuances, and political and social relationships that are integral to the program's history. The first chapter that follows establishes definitions of micromobility and low-density, and reviews existing literature to establish the current climate within and academic understanding of the field. The methods chapter that follows discusses the selection and purpose of a case study; Interviews and policy review are also discussed here.

While micromobility emerged as a transportation mode nearly 65 years ago, its introduction to North America was fraught with cease-and-desist orders, solidifying a legacy of distrust. This history is reviewed in the third chapter, as it establishes an important relationship between device supplier and regulator. These actors and others are reviewed in the fourth chapter. The following two chapters identify and discuss, respectively, which factors within the case study's environment are required to foster an environment where shared micromobility is likely to thrive. This research concludes with a discussion on the highest priority factors, recommendations for future research, and limitations within this research.

Literature Review

Micromobility Through Four Generations

Micromobility refers to lightweight vehicles, either manual or electric, that are designed to transport individuals short distances (Berney, 2024; MacKenzie, 2023). This paper focuses specifically on fourth-generation shared-use micromobility systems in public spaces, focusing on scooter and bicycle fleets. According to Shaheen et al., these systems, "[Enable] users to gain short-term access to transportation modes on an 'as-needed' basis" (Shaheen et al., 2020). Central to fourth-generation shared-use micromobility systems are smartphone 'apps' that "aggregate and optimize these mobility options" (Shaheen et al., 2020).

The concept of publicly accessible shared bicycles originated in the 1960s, evolving from free bikes to contemporary free-floating systems over four waves of development. The first wave of bicycle sharing started in the 1960s in Amsterdam, with free bicycle libraries (Stehlin & Payne, 2021). Nearly three decades later, the second wave of bike sharing emerged roughly 400 miles south, in Copenhagen, with the Bycken system. This system relied on coin-operated automated kiosks to unlock bicycles (Stehlin & Payne, 2021).

The third wave of bike sharing is characterized by electronic docking stations with computerized kiosks. Bikes could be checked out immediately or through a long-term subscription, and were paid for at a kiosk with a credit card. Originating in Europe, it did not take long for the trend to expand globally. Notable systems during this time were Barcelona's Bicing and Velib', Velo'v in Paris and Lyon, and London's Barclays Cycle Hire (now Santander Cycles). In 2008, Hangzhou, China revealed an expansive third-wave bike sharing system, and by December 2020, 15 of the world's 20 largest third-wave bike sharing systems globally were located in China. The largest system contained over 40,000 bicycles and 2,700 stations and was Suzhou and Wujiang's shared system (Shaheen et al., 2010; Stehlin & Payne, 2021).

Bike share migrated to the United States by 2008, with Denver hosting the first pilot project, followed by Minneapolis, Washington, D.C., Miami, Boston, Chicago, and the San Francisco Bay Area. Smaller cities, such as Madison, Chattanooga, and Greenville, S.C. also experimented with shared micromobility. In 2013, New York City unveiled Citi Bike (Shaheen et al., 2014; Stehlin & Payne, 2021).

The final wave of bike share, which appeared between 2017 and 2018, is defined by venture capital-funded “dockless” bike-and-scooter sharing platforms (Mooney et al., 2019). Unlike earlier models that required docking stations, privatized “dockless” sharing platforms do not require a station, instead relying on smartphone apps to locate and unlock devices. Chinese firms, such as Mobike and Ofo, and U.S. firms, such as Bird, Lime, and Spin, are examples of fourth-generation private micromobility operators. Dockless systems promise broader and more equitable coverage, while appealing to municipalities by reducing the resources a city needs to invest in the system, such as planning capacity and public funds (Stehlin & Payne, 2021, p. 1068). Fourth generation bike share was initially offered at a much lower rate than publicly-run micromobility; typically about $1 to unlock the device and a per minute operating fee between $0.15 and $0.30, with no subscription required (Mooney et al., 2019; Shaheen et al., 2010).

Shared Micromobility Determinants

The fourth-generation micromobility craze inspired a wave of academic research seeking to discover key variants, ranging from rider incentives to barriers within the built environment to bike share use. The library of micromobility research also included how bike share impacts physical activity, university students’ commutes, park and leisure trips, and e-bike substitution impacts.

The success of bike share programs, often measured by ridership levels and system integration, varies significantly across different urban contexts. As Guo (2022) discovered in their fourth-generation micromobility research, there are many “complex non-linear relationships between built environment and travel behavior,” citing variances in urban contexts. A growing body of research has identified a range of determinants that influence bike share usage, including the built environment, infrastructure quality, socio-demographic characteristics, and the design and availability of the service itself (Guo et al., 2022; Mallonee, 2025a; Zou, 2023). This literature review examines key findings on what makes bike share systems successful, using studies from North America, Europe, and Asia. It outlines the multifaceted conditions under which bike share programs thrive, analyzing physical and social dimensions of urban space and transportation planning, and discusses the implications for urban policy and design.

In the broad field of travel demand modeling, three dimensions of the built environment are noted for their influence: density, diversity, and design (Cervero & Kockelman, 1997). Later, these “3 Ds” evolved to include seven dimensions (“the 7 Ds”) of the built environment that influence travel demand (Ewing & Cervero, 2010): density, diversity, design, destination accessibility, distance to transit, demand management strategies, and local demographics (Ewing & Cervero, 2010). The seven Ds of travel demand remain prevalent in the literature dissecting shared micromobility determinants (Guo et al., 2022). For example, when studying the relationship between density and dockless bike share usage, Chen and Ye (2021) found a positive association between employment density and population density and trips, where bike sharing trips increased as employment density increased to 12,000 jobs per square kilometer, and bike sharing trips increased as population density increased to 20,000 persons per square kilometer. Beyond these thresholds, Chen and Ye (2021) found bike sharing trips to remain stable. Additional research bespoke to micromobility link elements such as socioeconomic status and service availability (Z. Chen et al., 2020; Fishman, 2015; Reck et al., 2020).

Bike infrastructure falls within the influences of the built environment broadly, yet warrants special attention. The availability and quality of bike infrastructure remain pivotal to the success of bike share programs. Research found access to dedicated bike lanes substantially increases the attractiveness and safety of cycling as a transport mode (El-Assi et al., 2017; Guo et al., 2022).

The presence of parks and recreational amenities may play a role in attracting leisure-based travel, thus shaping bike share usage patterns. Bike share stations near parks, universities, and other activity nodes increases ridership, especially in city centers where recreational and institutional land uses are concentrated (Chen & Ye, 2021; Faghih-Imani et al., 2017; Mateo-Babiano et al., 2016, El-Assi et al., 2017). Mateo-Babiano et al. (2016) found that parks attract the most leisure-oriented bike share trips. Evidence from the Spanish cities of Barcelona and Seville reinforce this pattern. Faghih-Imani et al. (2017), found that recreational areas were among the strongest predictors of bike share riders in these cities. In Chengdu, Chen and Ye (2021) found a nonlinear relationship between the density of leisure services within a Traffic Analysis Zone (TAZ) and dockless bike share usage: Restaurants, leisure services, and other non-commuting elements collectively had an effect on bike share usage equal to 24% of all total build environment effects. In university settings, El-Assi et al. (2017) found that student populations frequently utilize bike share for daily commutes.

Bike share programs are often framed as solutions to the first- and last-mile transit issue, effectively bridging service gaps within public transit systems. Despite growing interest in integrating bike share with public transit, current research does not agree on the terms of this relationship. In part this is due to contextual differences in land use, infrastructure, and design which may differ at origin points, along the travel corridor, or around the station area itself.

Evidence from multiple cities suggests that bike share integration with transit and bus systems may increase ridership and multimodal connectivity (Lin et al., 2018). In Toronto, for example, one study found a strong correlation between transit entrances and egress areas and bike share usage (El-Assi et al., 2017). The effects of built environment variables can vary significantly depending on whether bike share is used to access transit, such as from home to a transit station, or to egress from it, such as traveling from a transit station to work (Guo, 2022). Areas with less accessible transit stops but numerous bike stations often experience higher bike share usage (Chen et al., 2020; Shen et al., 2018; Duran-Rodas et al., 2019).

However, transit-bike share integration is not universally beneficial. Guo (2022) highlights that in some contexts, particularly where transit stations are closely spaced, walking becomes the more preferrable mode over cycling, thereby reducing the relevance of bike share as a feeder mode to transit (Guo & He, 2020; Y. J. Ji et al., 2018; Lin et al., 2018). In Beijing, one study found the optimal transfer distances for encouraging bike share usage in conjunction with metro services fell within 0.8 to 1.5 kilometers, beyond which ridership may decline (Zhao & Li, 2017).

Jin et al. (2019) show that bike share's relationship with transit is shaped by both cooperation and competition, and the built environment plays a crucial role in determining whether the bike share system functions as a feeder to transit or a replacement for it. Several studies have found that in metropolitan areas with high-quality transit networks, the adoption of bike share as a transit connector tends to diminish (Ji et al., 2018; Ni & Chen, 2020; Liu et al., 2020). Bike share can directly compete with high-quality bus and rail networks for short-distance trips, limiting its role as a feeder mode and first/last-mile solution (Guo & He, 2020). This competition can undermine the extent to which bike share is integrated with transit systems, as these transit networks may achieve the first/last-mile function more conveniently or economically (Martin & Shaheen, 2014; Guo & He, 2020).

Findings from cities like Melbourne and London reveal that bike share systems can displace transit usage, particularly during peak hours (Fishman et al., 2014; Transport for London, 2014). This substitution effect may have some positive effects, but complicates efforts to quantify the environmental and accessibility benefits of bike share. The extent of the bike share substitution effect on public transit often depends on variables including cost, service reliability, and the surrounding built environment (Jin et al., 2019).

Electric bicycles and electric scooters introduce new complexities into the micromobility landscape, especially regarding substitution effects. A randomized controlled trial by Söderberg et al. (2021) demonstrates that e-bikes can replace trips previously made by cars, transit, or walking, though the extent of substitution varies across contexts. Electric micromobility vehicles' ability to cover longer distances with less rider exertion demonstrates a departure from lessons learned under traditional pedal bikes. Electric micromobility vehicles can reduce topographical barriers and shorten travel times within a service area.

In the suburbs of Chinese cities, dockless bike share is popular and may offer observations that can be translated abroad. Guo et al. found that many Chinese cities, where dockless bike share is very popular, suburban areas have a high volume of dockless bike share usage (even higher than city centers in some cases) (2022). For example, in suburban neighborhoods in Nanjing, China, a preference for dockless bikesharing systems (over docked systems) emerged, increasing in preference as distance to the CBD increased (Y. Ji et al., 2020). Furthermore, Guo et al. (2022) noted that the physical infrastructure of bike share stations limits its use in suburban locations, but that trend is not applicable to dockless bike share.

Some studies have sought to explore what micromobility means in North America's unique setting. Specifically, according to Guo et al. (2022), "In North America the city is often low-density and low-mixture, making the car a common choice of transport mode. Furthermore, suburbanization encourages long-distance motorized trips. As a result, cities are more likely to be automobile-oriented and unsuitable for non-motorized travel." In a study of micromobility patterns across U.S. cities, Tuli and Mitra (2025) clustered their analysis of micromobility patterns across 458 programs in U.S. cities by population size and found a predominance of small shared micromobility fleet sizes (less than 250 vehicles) in cities. A fleet size of more than 500 vehicles is defined as "large". They found that large cities had a higher share of moderate financial and technical challenges while smaller cities experienced high financial and technical barriers.

In Austin and Houston, Texas, Alcorn and Jiao (2023) found that traditional indicators of bike share usage in dense urban areas (for example, proximity to transit stations, and high population and/or employment densities) were less significant in predicting bike share station usage as factors within leisure and recreation categories. Stehlin and Payne also analyzed bike share in Austin, as well as Philadelphia, Pennsylvania, and the San Francisco Bay Area (2021) and found the deployment of these systems lacked rigorous municipal planning and was often located based on assumptions about access to capital. Additionally, in a study of dockless bike share use in the Boston suburbs, programs were found to expand bike share services into new communities, often those lacking reliable public transit service and in neighborhoods with a higher share of zero-car households (Gehrke et al., 2021).

Rural, small, and low-density communities can also offer lessons in bicycle planning. In particular, McAndrews et al. (2018) describe ten communities in Colorado that experience difficulty gaining political or cultural support for recreational or transportation cycling and infrastructure. This research found that cycling investments in these communities required upfront stakeholder education on the value of cycling.

The Low-Density City

This research seeks to understand shared micromobility within low-density urban contexts, yet there is a epistemological lack of definition for the low-density city as well as its cousin, the suburbs. Contemporary definitions of the suburbs waver. Suburbia in the United States, once synonymous with Levittown, New York, captures social and popular cultural perspectives in addition to form and the built environment. Post-war urban growth, which developed in a sprawling manner, has confused what was once a clear boundary between dense, urban spaces and sprawling, green grass white fenced yards of the suburbs. Coughlan writes about Adams' (1970) four-stage evolutionary model of major innovations that affect movement and spatial organization in the American metropolis: 1) the Walking-Horsecar Era (pre 1850 to late 1880s), when urban densities normally exceeded 75,000 people per square mile; 2) the Electric Streetcar Era (late 1880s to 1920); 3) the Recreational Automobile Era (1920 to 1945), when families began to relocate from boisterous city life to the quiet wooded retreats of suburban environments; and 4) the Freeway Era (1945 to the present), noted by improvements in transportation, such as commuter rail and highway expansion, that spurred car-dominant large-scale suburban development, such as those in Irvine, California and Levittown, New York (Coughlan, 1995, 13). The U.S. Census does not define a suburb, but it does define metropolitan and micropolitan areas, as well as urban and rural, and what a principal city is (Florida, 2019).

As a result of this confusion, a 2019 study by the Joint Housing Center from Harvard University sought to establish parameters around the most important, and frequently used definitions of the suburbs (Airgood-Obrycki & Rieger, 2019). The three most important typologies of an urban landscape Airgood-Obrycki & Rieger (2019) defined are: 1) "census convenient"; 2) "suburbanisms"; and 3) "typology". These three ways of defining the suburb are: 1) non-principal cities in metropolitan areas with fewer than

100,000 people; 2) commuting patterns, home ownership rates, and single-family homes (creating an eight score continuum ranging from urban to suburban areas); and 3) typology based on population density and age of housing stock (Florida, 2019). Under the census convenient definition, census tracts within a metropolitan area are categorized as either suburban or city tracts. City tracts "are the first named place in the metropolitan area name plus any other named places with a population of at least 100,000" and suburban tracts are the remaining tracts within the metropolitan area. The second definition, suburbanisms, is a spectrum from one (most urban) to eight (most suburban) that rates tracts based on how many suburban or urban qualities a tract inhibits. For example, low rates of car commuting are more urban qualities while higher rates of single-family housing are more suburban qualities. The final typology, "Typology," divides the metropolitan area into three categories: core city; inner ring; and outer ring. Tracts are categorized based on the age of buildings and housing density (Airgood-Obrycki & Rieger, 2019). These three independent and valid definitions demonstrate how density no longer clearly defines an American city or suburb.

The city of interest in this study, the low-density city, is that with vastly different suburban and urban contexts based on Airgood-Obrycki & Rieger's 2019 classifications. This research focuses on the city with high elasticity and low density that will likely have an overestimated urban core per the census convenient definition and a high suburban rate per the typology definition.

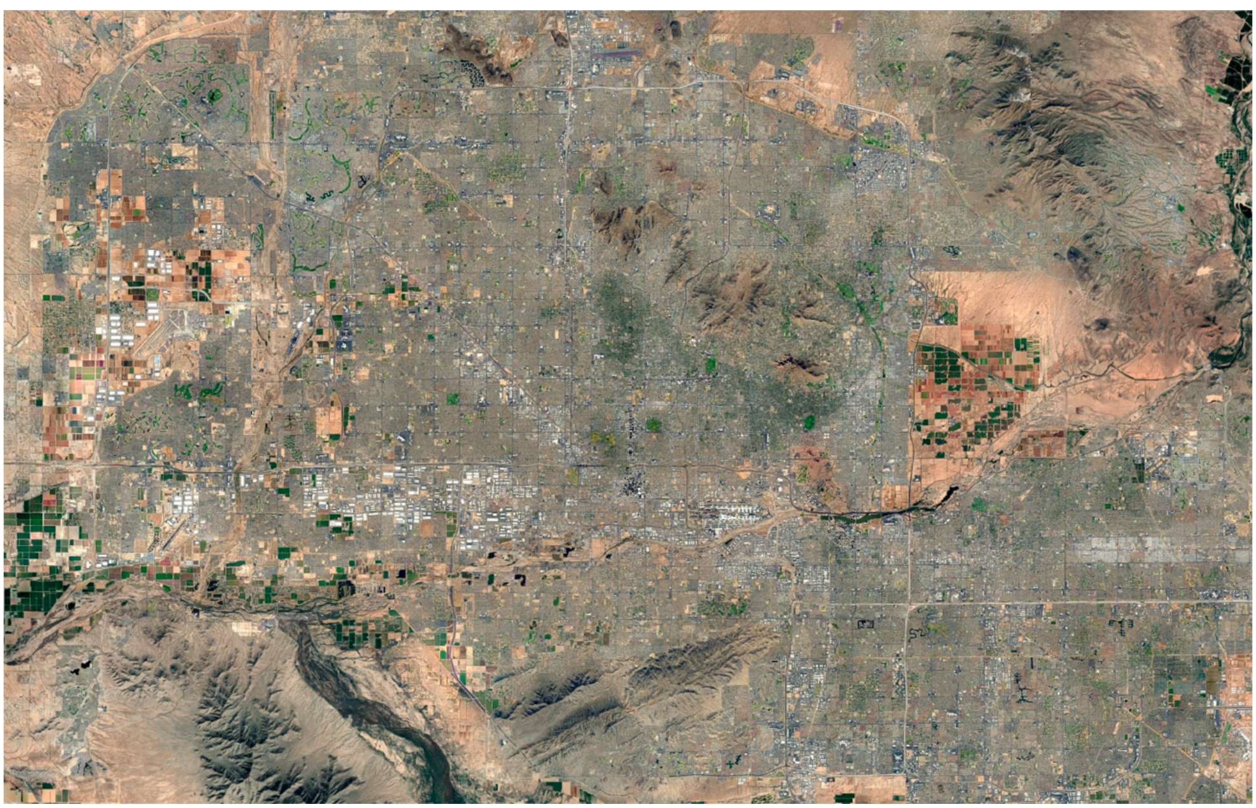
Methods

Case Study: Phoenix, Arizona

To investigate micromobility in the low-density city, it's essential first to establish a grounded understanding of its presence and characteristics in such contexts. Thus, a case study approach was selected as the best methodological framework, allowing for an in-depth exploration of micromobility in a specific low-density urban environment. The importance of case studies to the urban planning field has been well documented (Cropper, 1982; Repetti & Desthieux, 2006; Yin, 2009). According to Crowe et al, "The case study approach allows in-depth, multi-faceted explorations of complex issues in their real-life settings," and, "the case study approach is particularly useful to employ when there is a need to obtain an in-depth appreciation of an issue, event or phenomenon of interest, in its natural real-life context" (2011, p. 1).

Phoenix was selected as the case study for micromobility in the low-density city for several reasons. First, its sheer size and projected growth make it highly significant. According to the 2023 City of Phoenix Active Transportation Plan, Phoenix is the 5th largest city and the fastest growing large city in the United States (Maricopa Association of Governments, 2023), with a 2024 population of approximately 1.6 million (United States Census Bureau, n.d.). Figure 2 depicts the footprint of the greater Phoenix area; the footprint expands beyond Phoenix's area of approximately 518 square miles into neighboring cities of Tempe, Scottsdale, and Glendale. Second, Phoenix has been cited as the "world's least sustainable city" (Dougherty, 2020), highlighting the urgent need, and opportunity, for meaningful interventions. Third, as a Sun Belt city, Phoenix presents characteristics and trends that are widely generalizable to other rapidly urbanizing areas in the region.

Figure 2. Google Earth Aerial of the Greater Phoenix Metropolis (Google Earth, n.d.)



Lastly, the Phoenix region is a hub for innovation and forward-looking development. Phoenix has several attractive merits for innovative planning design. These include: 1) low-risk for the construction industry as the population across the Sun Belt continues to grow and housing continues to be in demand (Dougherty, 2020); 2) the region's new focus on density and sustainable transportation modes (Dougherty, 2020; Sisson, 2024); and, 3) the Valley Metro Light Rail which travels 30 miles, connecting Phoenix, Tempe, and Mesa (Boudway, 2023). Forward-looking development, including Phoenix Transit-Oriented Development (TOD), which developed a code of transit-oriented development (City of Phoenix, 2024b), and innovating investments occurring in this area (Sisson, 2024).

Two important methods that inform the case study are interviews and policy review. During interviews and policy review, themes emerged that help explain how and why micromobility appears in unlikely places, specifically Phoenix. These themes were compiled into a complete factor list. The complete factor list was refined further using two filters. The first ran each factor through a series of three questions: 1) What factors listed are not applicable to micromobility in Phoenix?; 2) What factors present an opportunity for future research or future phases of micromobility in the low-density city?; and 3) What factors negatively or positively affect micromobility in the low-density city? The second filter reflected on the relationship between the Actors and micromobility, narrowing the complete factor list from the perspective of the three key actors (the operator, the City of Phoenix, and the user). The Findings chapter presents the results.

Interviews

Academia portrays micromobility as a travel decision influenced by factors in the built environment or demographic data. Research in this area often draws conclusions from what can be directly seen and measured. This research design is logical, because it reflects observable mobility patterns. However, while such methods provide valuable insights, they leave significant gaps in understanding micromobility operations, specifically motivations and decisions that neither quantitative nor policy analysis can explain. Recognizing these limitations highlights the need for interviews.

14 semi-structured interviews conducted between January 2025 and May 2025 with influential decision-makers, active transportation planners, and urban planning academics in Phoenix inform this research. Interview participants were identified through local policy research or recommendations from other interviewees and were scheduled on the basis of the interviewees' direct contributions or their organization's contribution to micromobility implementation in Phoenix. Public, private, and non-profit sector stakeholders comprise the group of interviewees, including active transportation planners, active transportation consultants, current and previous government workers, business advocates, bike advocates, regional partners, micromobility operators, transit app developers, academics and professors who conduct micromobility research and who teach livable communities and design courses, American Institute of Certified Planners (AICP) professionals, and city council members. Participant names and identities are anonymized throughout.

All interviews, with the exception of two that occurred over email, occurred virtually. After introductions at the start of the conversation, interviewees granted permission for notes to be recorded during the meetings. A sample of interview questions asked include:

1. Who do you represent?
2. What areas, in your opinion, would most benefit from micromobility? (Realistically? In a perfect world?) Where would you personally want to use micromobility where it is not currently? What are the limitations preventing micromobility from existing in these spaces?
3. What factors best create an environment where micromobility is likely to thrive in low-density cities?
4. How does micromobility fit into Phoenix's current and future vision of itself as a city? How does micromobility fit into Phoenix's identity (current and future) and its goals?
5. What should the role of government be in determining where micromobility is allowed to operate?
6. Are there any other cities you try to learn from? Reference? Why?

7. How was the micromobility [geofenced] area in Phoenix decided? Why is it located where it is? Who is most likely to use micromobility in Phoenix (demographic data)?
8. Superbowl: How does this special event influence planning? Are there other special events worth studying?
9. Who else do you recommend I speak with? (such as City/agency public officials, nonprofits, advocacy groups, Lime/Spin, University students/professors, consulting companies? Neighborhood associations? Tourism groups? Etc.)
10. Any additional questions that naturally arise in conversation.

After all interviews were completed, the interview notes were coded with themes that emerged from the conversations.

Policy Review & Public Records Request

The development of Phoenix's micromobility program is reconstructed through interviews, recollections, and visions for Phoenix's transportation future. Interviews provided insights not only into individual perspectives, but also into the decision-making processes behind the program's implementation, often referencing key historical events such as public meetings and the development of formal planning documents. To contextualize and corroborate these narratives, a comprehensive review of city plans and public records was undertaken.

City plan and public records documents illustrate how public agencies formally introduced and framed micromobility initiatives to both the public and elected officials. The review encompassed a diverse range of planning instruments, including comprehensive plans, active transportation plans, budgets and capital improvement programs, safety plans, and municipal codes. In total 12 city plans and city-published public resources published before June 2025 were analyzed, as detailed in Table 1.

Table 1. Local Plans and Public Resources

Plan Name	Author
Plan PHX 2025 General Plan	City of Phoenix
Phoenix 2024-2029 Capital Improvement Program	City of Phoenix
Phoenix 2024-2025 Summary Budget	City of Phoenix
Transportation 2050 (T2050)	City of Phoenix
Key Corridors Master Plan	City of Phoenix
Active Transportation Plan	City of Phoenix
2050 Env Sustainability Goals	City of Phoenix
Road Safety Action Plan/Vision Zero	City of Phoenix
Housing Phoenix Plan	City of Phoenix
Climate Action Plan	City of Phoenix
City of Phoenix City Manager's Performance Dashboard	City of Phoenix
City of Phoenix Municipal Code	City of Phoenix

Additionally, a public records request was conducted to collect primary source materials from January 2017 to May 2025 related to the formal governance and implementation of micromobility in Phoenix. This included obtaining City Council meeting minutes, specifically, recordings of sessions in which micromobility was presented and deliberated, as well as relevant ordinances and contractual agreements with micromobility operators. The search was conducted using the keywords “Micromobility” and “Scooter” on the City of Phoenix’s online public records database, available online at https://www.phoenix.gov/administration/departments/cityclerk/programs-services/search-public-records.html. The list of public records analyzed is detailed in Table 2.

Table 2. City of Phoenix Public Records Requested and Reviewed

File Name	File Type	Date of Publication or Event
CON157713-0	Services Agreement	1/20/2023
CON157714-0	Services Agreement	1/20/2023
GEN205240	City Council Report	6/26/2019
GEN265295	Transportation, Infrastructure, and Planning Subcommittee Report	10/20/2021
GEN266014	Transportation, Infrastructure, and Planning Subcommittee Report	4/20/2022
GEN266117	City Council Report	5/11/2022
GEN278099	City Council Report	12/14/2022
GEN278606	Economic Development and Equity Subcommittee	12/13/2022
GEN279862	Transportation, Infrastructure, and Planning Subcommittee Report	5/17/2023
GEN280149	City Council Report	5/31/2023
GEN280415	Economic Development and Equity Subcommittee	6/28/2023
GEN291416	Transportation, Infrastructure, and Planning Subcommittee Report	9/20/2023
GEN312340	Transportation, Infrastructure, and Planning Subcommittee Report	1/31/2024
GEN323325	City Council Report	5/29/2024
GEN324469	Transportation, Infrastructure, and Planning Subcommittee Report	10/16/2024
GEN325321	City Council Report	12/18/2024
MIN175609	Meeting Minutes	10/20/2021
MIN174908	Meeting Minutes	2/11/2022
MIN175620	Meeting Minutes	4/20/2022
MIN174954	Meeting Minutes	4/28/2022
MIN175575	Meeting Minutes	12/13/2022
MIN175526	Meeting Minutes	5/17/2023
MIN175767	Meeting Minutes	6/28/2023
MIN175866	Meeting Minutes	9/20/2023
MIN185862	Meeting Minutes	9/28/2023
MI186165	Meeting Minutes	2/22/2024
MIN186316	Meeting Minutes	6/20/2024
ORD6602-G	Ordinance	6/26/2019
ORD49256-S	Ordinance	12/14/2022

Secondary Sources

In addition to formal secondary sources, local Reddit forums and local newspapers from January 2017 to May 2025 were referenced to inform and capture the unofficial, and occasionally anonymous, temperaments of Phoenicians at the time of micromobility deployment in Phoenix. These platforms provided valuable context for understanding how residents reacted to and engaged with the program outside of official channels. By analyzing posts and comment threads on local Reddit forums, along with articles in local news outlets, the research aimed to document the range of community responses that may not be fully reflected in formal public records or planning documents. This supplemental material helped to enrich the broader narrative of micromobility's reception in the city.

History of Micromobility in Phoenix

History of Distrust

In 2017 and 2018, venture capital-funded "dockless" bike-and-scooter sharing platforms, free from spatial constraints, pre-determined parking hubs, and government approvals, appeared in downtowns across North America. The sudden deployment of unregulated dockless electric scooters and bicycles in North America forced their way into urban landscapes in a disruptive and controversial approach that often ignored local regulations. Rather than integrating with existing transportation systems or securing municipal approvals, companies like Bird, Lime, and Spin placed their vehicles directly onto city streets, and catalyzed a widespread policy and planning response from municipal governments. Cities scrambled to regain control of public space, enforce safety, and respond to citizen concerns while responding with regulation. The early deployment of micromobility in North America was marked by what many observers described as, "typical tech arrogance" (Bhattacharjee, 2018). Companies adopted a "move fast and break things" mentality, deploying scooters and bikes without municipal permission in hopes of capitalizing on public interest and shaping regulatory outcomes retroactively.

Cities were largely unprepared for the scale and pace of private micromobility rollouts. Lacking pre-existing frameworks, the municipal response was reactive action more than proactive planning. Local governments found themselves reacting to public backlash. Incidents of injury due to improper use and scooters blocking sidewalks created serious concerns for pedestrian and wheelchair accessibility, and public safety (McDermott, 2021). City officials had to allocate resources to this response, including legal departments who drafted cease-and-desist letters, transportation planners who were forced to respond to the public and stress on existing infrastructure, and public works departments who had to retrieve improperly parked or abandoned devices (Williams, 2018). With companies operating outside existing governance systems, cities like San Francisco, Milwaukee, and Denver issued cease-and-desist orders, impounded vehicles, and levied fines (Janzen, 2018; Williams, 2018). Other cities such as Nashville, Charlotte, and Honolulu echoed similar sentiments, citing safety, legal compliance, and public nuisance concerns (Williams, 2018).

City officials expressed frustration at having to reallocate staff and resources from already stretched departments to address the influx of unregulated vehicles. In many cases, public safety, legal, and transportation departments had to respond within days. This is perhaps most pronounced for Austin city planners where Lime's uncoordinated launch of 300 to 500 devices during Austin's SXSW festival forced transportation departments to respond over the weekend during a major event (Small, 2017). Local transportation officials were left to scramble over an already intense and stressful transportation coordination period, highlighting the disconnect between tech-led micromobility startups and municipal processes.

San Francisco's experience also exemplifies this disruptive entrance. Companies placed hundreds of scooters on city sidewalks, prompting cease-and-desist letters and media coverage describing the rollout as "unlawful" and "hazardous" (Bhattacharjee, 2018). According to NBC Bay Area, companies acted despite, "legislation winding its way through the process," banking on an "asking for forgiveness rather than permission" mentality (Bhattacharjee, 2018).

This chaotic deployment of micromobility devices damaged trust between public agencies and the private tech start-up operators and disillusioned public transportation planners who might pilot and expand legitimate micromobility programs. The public sector's perception of micromobility as reckless and dismissive of local governance continues to impact the negotiation of public-private partnerships in the sector. Yet, despite the initial chaos, this micromobility deployment approach ignited a larger public discussion and created visibility for these new devices.

Micromobility in Phoenix

Phoenix was not immune from the tidal wave of floating scooters and bicycles. However, unlike some communities that were caught off guard, Phoenix had the foresight and time to respond and implement emergency ordinances that restricted shared mobility devices' use in the city. Specifically, a Phoenix city ordinance prohibited the devices from operating downtown until 2019 (Brodie, 2018; Oldham, 2019). Fourth generation shared micromobility was not Phoenix's first exposure to bike share; the City of Phoenix operated a docked bike share program, called Grid Bike Share, within the central city from 2014-2020 (City of Phoenix, 2023a, 2023b).

Despite this, fourth generation shared micromobility scooters were allowed in the neighboring cities of Tempe prior to Phoenix, and it was possible to travel between those cities and Phoenix, even though they weren't technically legal in Phoenix ("I Just Rode a Bird Scooter in Phoenix," 2018). As a professor of urban planning at Arizona State University noted, "When Ofo came into Tempe, it didn't matter that Scottsdale and Phoenix didn't allow shared bikes because people are going to use them as they will and all of a sudden, every city [in the valley] has a [scooter] problem."

In response to growing demand, the City of Phoenix's Aviation and Transportation Subcommittee approved a scooter pilot program to begin in 2019 (Brodie, 2018; Hsieh, 2019; Oldham, 2019). The pilot started in the fall of 2019. According to Devney Preuss, former executive director of the Phoenix Community Alliance, the reversal on the earlier city ordinance was a result of the changing nature of downtown Phoenix and the need for increasing modes of alternative transportation in downtown Phoenix. She noted, "People no longer want to move in and out of the city quickly after they get off work…We now have amenities that people want to experience, which the scooters can increase their access to" (Oldham, 2019). An alternate explanation, offered by the former micromobility planner for the City of Phoenix, is that the pilot program reflected the city's deliberate approach to establish clear parameters rather than rejecting the shared mobility outright.

Phoenix's first e-scooter micromobility pilot had a small, two-mile footprint in the downtown core, and was designed by a traffic engineer with the City of Phoenix. A former micromobility planner from the City of Phoenix noted, “It didn’t necessarily come from a planning side, but there was a lot of thought and good outreach behind the pilot.”

In 2021, the City of Phoenix decided to transition from a pilot program to a full-time program and hired its first full-time micromobility planner to design this program. At this time, Lime was three years old, and the infancy of this technology mirrored planners’ experience accommodating this new transportation mode into existing networks. The City of Phoenix’s first full-time micromobility planner noted that he had to learn about micromobility on the job while simultaneously developing a plan for it.

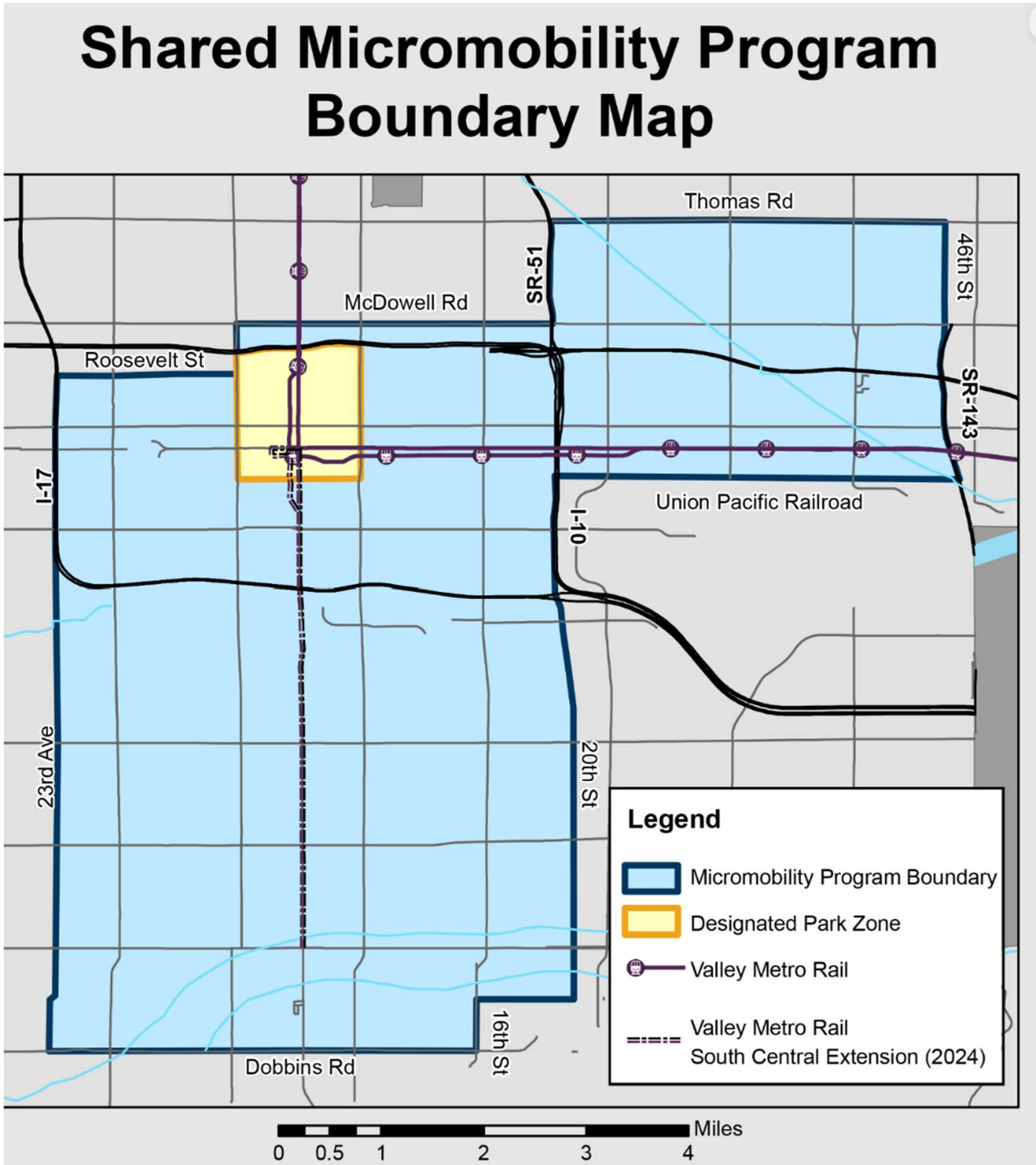
As illustrated in Table 3, during program planning and development, the City of Phoenix renewed the pilot program three times, with each pilot phase altering variables, like the maximum number of vendors allowed to operate within city bounds. Over 3.5 years, including a hiatus during COVID-19, over 300,000 trips occurred, with average trip length ranging from 12.5-16.6 minutes.

Table 3. Phoenix's Micromobility Pilot Program Statistics, 2019-2023 (City of Phoenix, 2023a, 2023b)

Phase	Dates	Maximum Number of Vendors	Total Trips	Average Trip Duration (Minutes)	Average Number of Vehicles Deployed	Size
I	Sept 2019- Mar 2020	3	102,756	12.5	339	Two miles - downtown core
COVID DELAY	Mar 2020- Sept 2020					
II	Oct 2020- Mar 2021	2	40,957	15.5	192	
III	Apr 2021- Mar 2022	2	82,008	14.2	174	
IV	Apr 2022- Mar 2023	4	79,027	16.6	623	

Eventually, the City of Phoenix released an RFP summoning potential micromobility operators to submit applications to operate in the city’s full program. According to the City’s contracts with micromobility vendors (City of Phoenix, 2023a, 2023b), the City required vendors to have: Certificate of insurance; $20,000 Surety bond to the City; E-bikes and e-scooters: no more than 1,500 vehicles and at least 500 vehicles, with the fleet having at least 20% e-bikes and traditional pedal bikes; All vehicles must have working brakes, headlights, taillights, speed limits of 15mph for e-scooters and 20 mph for e-bikes; Use a parking system in the downtown core; and a mobile app for reservations. At the time of the RFP, vendors were required to deploy 30% of fleet to equity zones (later reduced to 15% of fleet). Vendors were required to provide real-time and historical data and information to the agency, and the vendor was also required to provide a publicly accessible API that meets the requirements of the GBFS (https://github.com/NABSA/gbfs). The City of Phoenix also required vendors to provide education for users at sign-up and each time the application is opened, including: Follow local traffic laws; Riding on the sidewalk is prohibited; Riders must be 18 years old to operate a vehicle; Encourage the use of a helmet; No drunk riding; Riders should inspect vehicles prior to operation; Park in authorized areas only; and the vehicle speed is limited to 10mph for e-scooters and 15mph for e-bikes for first time riders. The City of Phoenix determined geofenced boundaries for no-ride zones, slow zones, and parking requirements. The City of Phoenix offered providers a three-year contract term, with the option of two additional years. In January of 2023, the City signed two contracts with two vendors, Lime and Spin (City of Phoenix, 2023a, 2023b), who operate in the area defined in Figure 3. City of Phoenix Shared Micromobility Program Boundary Map, 2024.

Figure 3. City of Phoenix Shared Micromobility Program Boundary Map, 2024

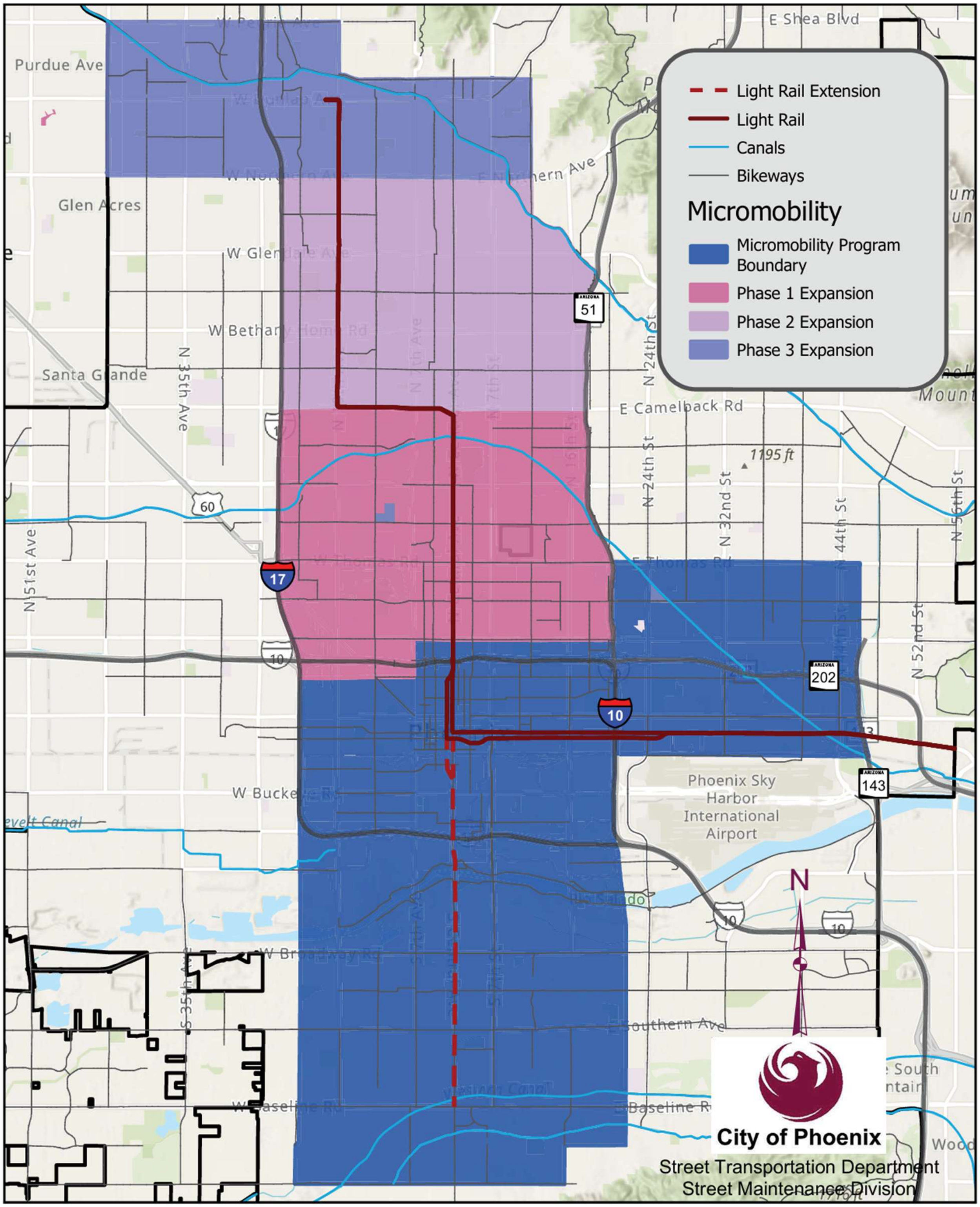


Expansion Phase

Changes to the program have been deliberately phased to build confidence among riders and residents by demonstrating sufficient ridership levels and compliance with regulations. The City of Phoenix conducted outreach to shape future boundaries and service hours of the micromobility program, ultimately proposing a service area extending two miles from the light rail corridor and 24-hour service. According to City of Phoenix active transportation planners, this proposal was met with enthusiasm from the community. The formal presentation of the program occurred on December 17, 2024, when the plan was brought before the City Council for approval (City of Phoenix City Council, 2024b). At this time, the program introduced 24-hour service.

According to City of Phoenix active transportation planners, as of May 2025, the City had plans to extend the micromobility service boundary to cover a two-mile radius around high-capacity transit, including both bus rapid transit (BRT) and light rail. Planners with the City of Phoenix described a three-phase expansion approach along the northern light rail corridor beginning with the area up to Camelback, progressing to the northern sections, and ultimately reaching the northernmost point served by the light rail, as shown in Figure 4. Additionally, planners described a southern light rail extension scheduled to open on June 7, 2025, which may prompt future expansion of the bike share geofenced boundaries to surround the southern light rail extension.

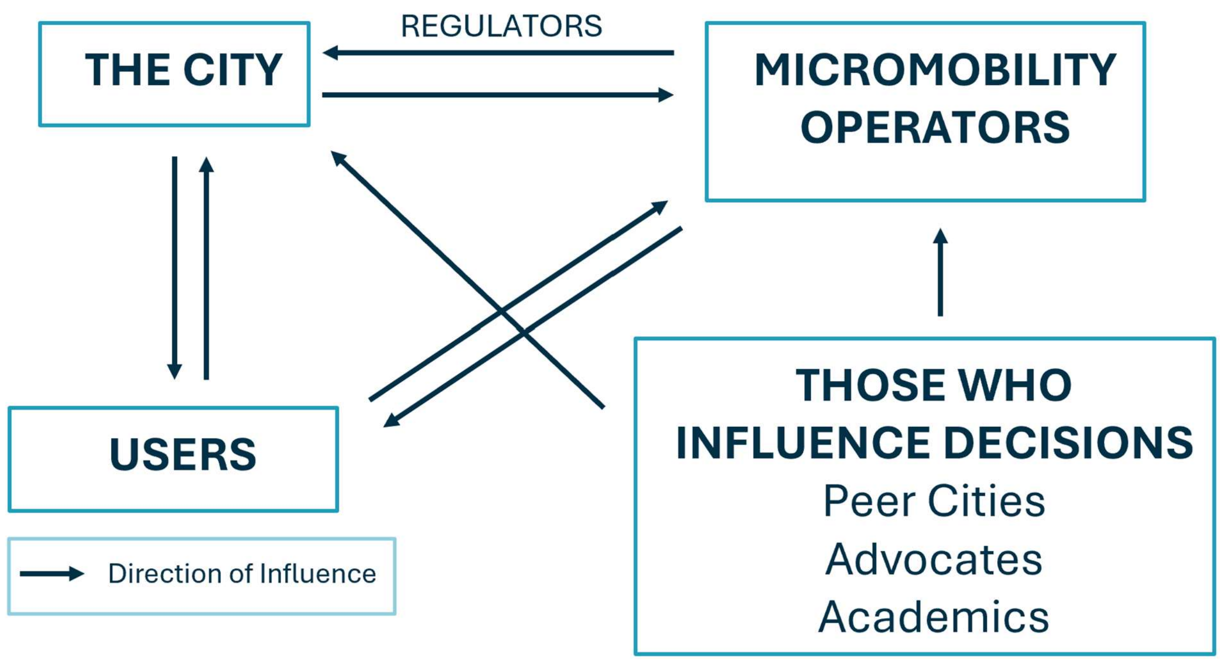
Figure 4. Phoenix's Micromobility Program Expansion, 2025 (City of Phoenix City Council, 2024b)



Actors

There are several stakeholders who influence the implementation of micromobility in Phoenix. These stakeholders are the people of Phoenix, academics, the City of Phoenix, the vendors, peer cities, and advocates. The relationship between these actors is portrayed in Figure 5 and described in the sections below.

Figure 5. Actors, Relationships and Direction of Influence in Phoenix's Micromobility Program, 2019-2025



The City

Regulators or Visionaries?

During interviews, when City of Phoenix planning staff were asked about their roles in supporting the micromobility program, many emphasized their capacity as management, over an identity as visionaries. The planners focused on ensuring that vendors meet program requirements, such as removing improperly parked scooters, enforcing parking regulations, and ensuring equitable access. Their primary goal, as they described, was to manage providers' operational capacities and "provide adequate levels of service." This functional approach highlights an important role of government, to manage and oversee the operational and programmatic aspects of micromobility. In this context, government's duty occurred behind the scenes, and it is to ensure the private vendor can scale and operate responsibly.

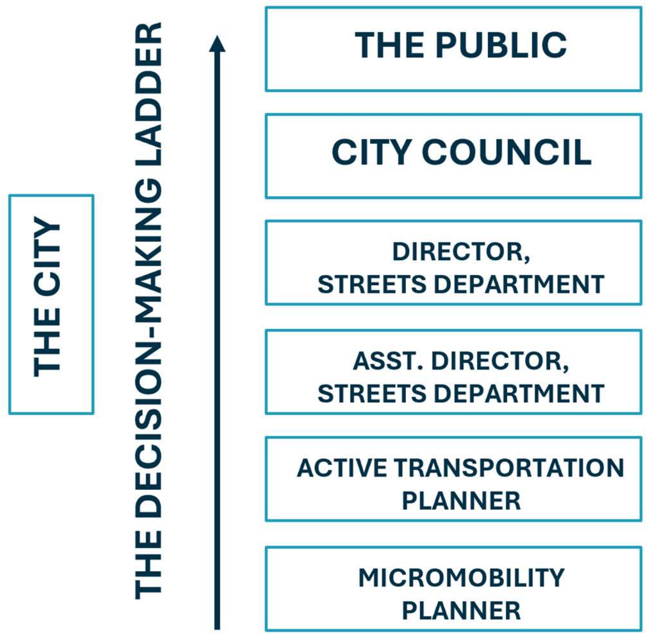
One example of the City of Phoenix's obligation to regulate occurred when vendors lobbied the City to expand the micromobility program boundary further south. From the City's perspective, operators pushed for a larger service area to collect more data to run their algorithms because vendors were making decisions based on their operations in the neighboring cities of Tempe and Scottsdale. The City responded by asking if vendors would need additional warehouse locations, more staff, more devices, and more recharge collection vans. In this instance, the city needs to act as regulators to act in the best interests of the residents and of the economy. The incentive to draw a large programmatic boundary can be negative. The program boundary is defined by an area where residents can expect to find scooters, where the city can respond to residents' concerns. The City has the onus of showing where in the built environment micromobility fits in. This includes a consistent and fair application of micromobility regulations on sidewalks, major arterials, and existing bicycle infrastructure.

However, this focus on regulation leaves little room for cities to act as innovators. An Arizona State University professor of urban planning noted that they would like to see cities identify not only as regulators but as hubs for innovation, and for cities to plan for the future they want. Specifically, they said, "Innovation also works if it's directed. Over the last 40 years we've been built to think the state can't do anything, state can't innovate. The state has no value whatsoever. But not to be trite, the state put a man on the moon. We can do things like that! But we have to support it." This highlights the potential for cities to lead and to innovate, especially within the field of transportation.

The Decision-Making Ladder

The city's dual identity as regulators and innovators affects how decision-making unfolds in political practice. The political structure within Phoenix, depicted in Figure 6, further complicates the decision-making process for micromobility. The City of Phoenix's former micromobility planner and an author of the City of Phoenix's active transportation plan lamented that, "The structure of decision making in the City of Phoenix means that while micromobility planners develop the plans and city reports, they are not in direct communication with city council"; the final micromobility reports are "filtered through" levels of the Streets Department. In Phoenix, there are five "political chokepoints" before a change to the micromobility program is released to the public. The order of these five political chokepoints is: an idea or plan revision originates with the micromobility planner. The micromobility planner submits a draft to Phoenix's active transportation planner, who adds comments and revisions before submitting to the Assistant Director of the Streets Department. According to the former micromobility planner, much of the policy is driver at this assistant director level, "an active transportation skeptic", as she is the approval authority brining policy to the director of the Streets Department, and ultimately the City Council. Each of the five filters represents a separation between the micromobility planner's proposal and what is released to the public. This structure can lead to delays and potential miscommunications between planning staff and elected officials, however, the additional reviews can also serve to align new staff's work with a format the city council is familiar with.

Figure 6. City of Phoenix's Decision-Making Ladder for Micromobility



City Council Approval

Each city council member represents different districts, and each city council member is voting with their particular constituents in mind. In the case of the micromobility program, the council districts closest to downtown were most critical to approving the micromobility program because these districts contain two traits considered the most valuable for the Phoenix micromobility program expansion: the highest population density and proximity to the light rail transit corridor.

One of the critical council districts, Council District 4, located north of downtown, expressed concerns about micromobility expansion due to safety issues, sidewalk riding, and visual clutter. The councilwoman representing this district was originally opposed to expanding micromobility into her district, expressing concern with backlash from the community, reportedly emailing photos of improperly parked micromobility devices to the micromobility planner at the time with notes asking how micromobility would function in her neighborhood. The micromobility planner at the time reported that the councilwoman requested that the city planners meet with every neighborhood district for community input (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2021b). Given her responsibility to respond to community concerns, her skepticism is warranted.

However, as an example of duplicative work, planners felt that this work had already been done, and the residents of this area had already expressed support for micromobility program expansion into their neighborhood. During the micromobility planning phase, the former micromobility planner learned from an online survey with maps of the potential program area, that Phoenix residents were mostly in favor of a larger service area, and there was little pushback from the community (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2024). However, as a result of the interaction with City Councilwoman from District 4 and this council woman's reaction to the micromobility plan, the micromobility planning team settled on "keep[ing] the program within the council districts on board". The City of Phoenix planner decided to take a conservative approach, choosing a two square mile area within Phoenix's 500 square mile footprint, stating a desire to start the first phase small, and build from there. This situation may serve as an example of why improved communication and alignment between the city planners and elected officials could ensure community concerns are addressed.

Council members from historic neighborhoods also expressed apprehension to micromobility adoption; A local policy advocate shared an anecdote of addressing fears of the unknown in these neighborhoods in order to gain City Council approval.

The City wants to do what is best for its constituents, but sometimes that can lead to City staff strategizing on how to receive City Council approval versus staff presenting what they think is best for the community. According to an Arizona State University Associate Professor of Geographical Sciences and Urban Planning, the current funding structure of the Streets Department forces planners to use strategy and forces planners into a role of advocacy for their program and for funding. A local planner noted that the Active Transportation Planner within the City of Phoenix is a politically aware decision maker, who is cautious and will push on what she has the momentum to do in her position. This hesitation materialized in the ATP, PlanPHX, and T2050 plans, which scarcely mentioned micromobility (City of Phoenix, n.d., 2024b; Maricopa Association of Governments, 2023). These documents are intended to represent visionary and practical goals for the future of the city and micromobility's brief appearance is demonstrative of its expectation to meaningfully contribute to the city's transportation goals.

Bringing Micromobility to Phoenix: City Council Methods

The City Council plays a greater role than just voting to approve micromobility in council districts; they also shape the methods city planners employ to create the micromobility regulatory environment and implementation strategies. Within the political context of Phoenix, some council districts exhibited resistance to micromobility expansion, notably District 4, where representatives demanded extensive community consultation before endorsing program growth. According to local planners, this limited initial expansion plans to council districts already supportive of micromobility.

According to a former micromobility planner with the City of Phoenix, the timeline initially communicated to them for program implementation was very compressed, with expectations for a program launch within a few months. In reality, however, program implementation took considerably longer as City Council repeatedly postponed formal approval, requiring this micromobility planner to simultaneously apply for pilot program extensions and advocate for permanent program adoption. This rushed timeline and lack of budget for micromobility did not allow for studies, such as demand assessments or feasibility analyses, that typically inform infrastructure or transportation projects' decision-making. The planner noted that unlike other corridor or active transportation projects, micromobility was driven more by a "need to make this happen" mentality than by data-driven planning.

To compensate for the absence of formal studies, the City of Phoenix's active transportation planner at the time employed two methods to inform the micromobility program creation: community outreach and peer city analysis. They worked to define the program's service area, researching the scope of comparable micromobility programs, and estimating reasonable fleet sizes. Their community engagement approach involved presenting draft maps to the public, particularly focusing on transit-adjacent zones such as light rail corridors. Through surveys and public feedback, residents expressed preferences for extending the service area to a two-mile buffer around transit stations. The city-conducted surveys that incorporated a broad range of questions to understand both users and non-users of the Phoenix Shared Micromobility Program. Participants were asked about their frequency of use, vendor preferences, satisfaction with program boundaries, and safety perceptions. Additional questions addressed awareness of local regulations, feelings of safety, and potential barriers to using micromobility. However, the planner shared that the outreach process faced challenges due to a lack of direct communication channels between micromobility planners and City Council members, resulting in repeated efforts to gather and relay public input.

While community engagement is an important criterion for decision-making, there is much the City could have learned by conducting a feasibility study, or quantitatively analyzing pricing strategies, distribution of devices, demand, and user education needs. Some cities, like the Town of Herndon, a suburb within the Metropolitan Washington Council of Governments, completed a micromobility feasibility study to, "explore the feasibility and implementation considerations around introducing micromobility into the town" (City of Herndon, 2021, p. v). This study was conducted in anticipation of the DC Metro's Silver Line Phase II expansion and after neighboring towns housed Capital Bikeshare stations prior to program creation. The Capitol Region Council of Governments (Capitol Region Council of Governments (CRCOG), 2022) and San Mateo County Micromobility Final Plan (City/County Association of Governments of San Mateo County, 2022) are other examples of municipalities that have conducted micromobility feasibility studies. The information from a study like this in Phoenix could identify the market for micromobility, the program cost, how the city could manage dockless parking, or how micromobility might influence transit ridership.

Micromobility Operators

Sitting across the table from the City, are the vendors, also known as micromobility providers and operators. These actors are the private companies responsible for raising private equity funds and bringing shared micromobility devices to a city. In Phoenix, as of May 2025, there were two vendors: Lime and Spin. These companies operate across the U.S., and as such, chose to enter Phoenix's market, bringing in their outside knowledge and experience. As previously discussed, the vendors have been criticized for the manner in which they entered the market.

Although the vendors serve a transportation need within the city, their other motives include making a profit. In an interview the CEO of Lime, Wayne Ting, discussed the costs of launching micromobility in a new city, estimating the cost is upwards of tens of millions of dollars, then scaling over time to cover the expense of the warehouse, devices, and operations staff (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.).

The margins for micromobility device companies are slim, leading to privacy over operations and data. Ting revealed that prior to his onboarding, Lime was losing money daily and unlikely to survive ("originally, the payback was never") (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.). By developing Lime's own hardware, introducing annual improvements (like swappable batteries delivered via cargo bikes and interchangeable bike and scooter batteries), and renewed attention to demand forecasting tools that predict hourly rebalancing needs by the half block, Lime recovered its investment in a year with profits occurring in five years

As of 2025, Lime is confident in its business and marketing model, with CEO Wayne Ting noting that not only does Lime have a win rate greater than 90%, but also that the biggest competitor to Lime is not another shared micromobility company, but "the car". Active transportation planners and residents of Phoenix would likely agree. According to Ting, most car trips are less than five miles, and the most common number of people in a car is one (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.).

Relationship between City and Vendors

CEO of Lime, Wayne Ting, described the process of introducing shared micromobility to cities as an "expansion playbook," a strategic sequence that begins with vendors initiating conversations with local regulators (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.). First, he described, the vendors start a conversation with the "local regulators," and explain how the vendors will solve a problem for the city. Ting noted the most pressing urban transportation issues that he uses to frame the benefits of shared micromobility are affordability, congestion, and carbon emissions. This framing is crucial in convincing cities to launch pilot programs, which then pave the way for formal requests for proposals (RFPs) and broader program implementation. Ting's use of the term "regulators" exclusively to describe municipal authorities highlights the relationship between cities and micromobility companies. One of the core tensions in the relationship between cities and micromobility vendors is the difference in how each entity perceives its role, and how each entity behaves as if it operates independently.

A local planning professor articulated this tension clearly by contrasting city planning practices with private sector approaches. Cities engage in long-term, democratically grounded planning processes that anticipate future transportation needs, reflected in comprehensive plans updated every five to ten years. In contrast, private micromobility firms enter markets rapidly and with considerable capital, often without aligning their innovations with existing "democratically established plans". According to a local planning professor, these companies act as if they have invented a revolutionary mode of transport that cities must accommodate regardless of prior planning, thereby offloading regulatory and integration challenges onto already stretched city staff. The influx of scooters requires cities to divert attention from other priorities, further exacerbating tensions between public agencies and private operators.

Despite these challenges, interviews with both public and private stakeholders reveal a more complex, interdependent relationship rather than a purely adversarial one. A planner who has worked both for the City of Phoenix and a private micromobility operator emphasized that neither cities nor micromobility operators can succeed independently; collaboration is essential. A planning professor at Arizona State University Professor reinforced this idea, acknowledging that although private firms may resist regulation, they ultimately depend on it prevent oversaturation, safety issues, and consumer distrust. Local planners cited the example of San Diego, where too many competing operators led to micromobility market oversaturation. Conversely, cities like Charleston successfully managed micromobility by limiting operators to one and controlling prices, allowing for service improvements without profit-driven fragmentation. Lime, Spin, Bird, and Superpedestrian have publicly supported limits on operator numbers, explicitly praising Phoenix's decision to cap the market at two vendors (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2024a). Ting noted that in most cities, one operator tends to dominate ("winner take most") due to customer preferences for vendor reliability and apps specific to each micromobility provider (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.).

This dynamic reveals a relationship of mutual dependency between vendors and regulators characterized by negotiation and compromise. Operators must adapt to the unique policies and goals of each city, aligning profitability with serving cities. From the city's perspective, providing innovative transportation options like micromobility is a competitive strategy to attract residents, tourists, and investment. A director with PCA shared that cities like Phoenix must actively compete with peer cities for residents, tourists, and investment. Offering cutting-edge transportation options, including micromobility becomes part of that competitive strategy. While the City is charged with regulating vendors, it can also quietly foster innovation, by demanding higher standards of sustainability, or incentives for multimodal integration within contracts. Ultimately, the private-public relationship is interdependent: vendors require regulatory approval and market access, while cities rely on private innovation and investment to expand transportation options. Each party pursues its own goals: private companies seek profitability alongside public service, and cities aim to regulate effectively while fostering innovation and serving its constituents.

Those Who Influence Decisions: Peer Cities

Peer city analysis has become a widely accepted step in micromobility program formation. Peer city analysis is the tool describing when a city surveys the implementation tactics and protocols of comparable markets before establishing their own program. The American Micromobility Panel: Part I observed that micromobility programs in the U.S. typically fall into one of two categories. The report separated results into trends emerging from "Big and Dense cities" (such as New York, Chicago, and Portland) or trends from "Other cities" (Fitch-Polse et al., 2023). However, trends pertaining to Big and Dense city programs, such as New York City's micromobility program, are difficult to replicate in metropolises like Phoenix, where sprawling land use patterns are as equal a part of the identity as the large population.

Discovering suitable cities for Phoenix's peer city analysis may benefit from thinking more creatively about Phoenix's unique attributes. One appropriate example, according to a City of Phoenix active transportation planner, could be applying land use groupings that organizations like NACTO use to distinguish dense, walkable cities like New York and Chicago from less walkable cities. Another framework for identifying appropriate peer cities is understanding the regurgitation of sprawling suburban land use patterns throughout the Sun Belt. Yet just because a city was established in the Sun Belt, does not mean it shares goals, structures, and challenges. Despite being the most proximate to Phoenix, the neighboring towns of Tempe and Scottsdale are often viewed as estranged siblings, and the City of

Phoenix's micromobility program is not integrated into Tempe's. Tempe is a peer city, but there are other cities that better complement Phoenix.

During six interviews with local planners in Phoenix, interviewees suggested Phoenix's peer cities are Austin, San Jose, Sacramento, Davis, Austin, Las Vegas, San Diego, Tulsa, and several Southern California cities. These comparisons may reveal how cities borrow programmatic elements from peer programs that are ill-fitted to their context, or out of sync with their population trajectories and urban form According to two local active transportation planners in Phoenix, Las Vegas shares common traits with Phoenix, but is not aspirational from a planning perspective. Meanwhile, more progressive cities like Denver may reflect Phoenix's ambitions, but not its current constraints. Additionally, non-planning stakeholders, such as city council members, may advocate for more ambitious, and sometimes misaligned, comparisons to cities like Chicago (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2021c). In one council meeting, officials from the Street Transportation Department were pressed to explain how Phoenix could emulate programs in cities with vastly different urban forms, such as Chicago's parking system, and present injury rates from "big cities" (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2021b). According to a former City of Phoenix micromobility planner who helped develop Phoenix's micromobility program, "I spent a whole week trying to decide what the service area should be. I looked at other cities for the size of the program, how many bikes and scooters to have, and what is a reasonable area to start with." Figure 7 illustrates seven programs the City of Phoenix formally analyzed as part of their evaluation, and how the amenities Phoenix proposed compared to those programs (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2021c). The cities demonstrate how Phoenix could choose to model its program off cities and programs that closely reflect Phoenix's current conditions, but may not represent Phoenix's long-term goals or, Phoenix could choose an aspirational pathway, modeling its program off cities with robust transit and active transportation networks and dense population centers that do not closely reflect Phoenix's current conditions.

Figure 7. Peer Cities' Micromobility Programs Referenced by the City of Phoenix

Comparison of Fleet Sizes

	Phoenix *(Proposed)*	Denver	Omaha	Boulder	Tampa	Minneapolis	Los Angeles	Chicago
Approximate Boundary Size (Sq Mi)	76	154.9	144.6	25.7	170.6	57.5	503	234
Number of Vendors	2	2	2	1	4	Not Specified	5	3
Max Fleet Size (per vendor)	1,500	1,500	1000	200	4,500 SVR* 1,000 MVR*	2,500	6,000	3,333
Total E-Scooter Fleet	3,000	3,000	2,000	200	5,500	2,500	30,000	10,000
Traditional Bike Fleet Size per vendor	>125					1,000	Combined with E-Scooter Fleet Size	Not Specified
E-Bike Fleet Size per vendor	>125	600		500	1,500 SRV* 1,000 MRV*	1,000		
Adaptive Bike Fleet Size per vendor	>50				60			
Total Bike Fleet Size	>300	600		500	2560	2,000	Not Specified	16,500

**SRV – Single Rider Vehicle, MRV – Multiple Rider Vehicle*

Denver emerged as the most frequently cited peer city for Phoenix to model its micromobility program in interviews with city planners, active transportation consultants, advocates, and academics. While Denver's transit network is more progressive and its micromobility ridership is stronger than Phoenix's, Denver's combination of a relatively dense downtown core and surrounding ring of suburban land use mirrors Phoenix's geography, making it a seemingly appropriate reference point. A City of Phoenix Active Transportation planner added that Denver's approach to micromobility, especially its equity strategies, informed Phoenix's program.

A drawback to modeling a city's program off a peer city's is that peer cities do not always provide reliable conversions and realistic lessons learned. Two local City of Phoenix planners touched partially on this question: "For some of the program formation research, you just look at whatever city is one step ahead of you in the planning process. The downside to this is that it is difficult to get contracts from other cities if there is not an open RFP." They added that cities like Austin are referenced primarily because it is a Sun Belt City, with a dense core that transitions to suburban sprawl, but "if Austin hasn't updated their micromobility program in three years, then maybe Austin is not the best example to use as a model for Phoenix." In fact, researchers conducting a similar investigation on micromobility in Austin found, "stations were centered by fiscal austerity, but the shared micromobility network was shaped by ad hoc, intuitive sense of where stations could be sited" (Stehlin & Payne, 2021, p. 1076). According to this research, planning for micromobility was less calculated, but rather, according to the micromobility planner in Austin, "We just said, 'Let's start in the CBD, why not? That's where everybody else is starting, and that's where all the short trips seem to occur. That's where the parking pain is the most" (Stehlin & Payne, 2021, p. 1077).

Moving forward, the City of Phoenix can exercise caution when adopting the policies and programs of other peer cities and better understand the contextualization and strategy that needs to translate the other city's program's results to Phoenix. As one micromobility provider noted, "Each city has a different regulatory framework. There are frameworks that work well for a city, but if it's not correct, then a [micromobility] operator may not want to come." Phoenix will need to account for this when comparing its program to other cities. For example, if another city has similar densities to Phoenix but does not have a curfew, as Phoenix's early micromobility program did, then the other city may find success in ways and at times Phoenix will not experience.

Opportunities for Peer City Analysis

However, this does present an opportunity for cities that fall outside of the American Micromobility Panel's "Big and Dense" category to form collaborative networks and share lessons learned. Phoenix active transportation planners noted that when they have a question about the micromobility program, they will reach out to all the NACTO cities, but they were not sure how many Sun Belt cities were NACTO members. As of May 2025, there were 11 full member NACTO Sun Belt cities, seven of which had privately operated dockless micromobility programs, and 26 Sun Belt city affiliate members (NACTO, 2025). There are opportunities for these cities to organize and share implementation strategies, risk factors, and barriers unique to their built environment. Such opportunities for collaboration include: fund ITDP or other reports, aggregate data like what is available on Ride Report so that they are not trying to fit into a mold of big, dense cities that is not appropriate for them. As Wayne Ting observed, smaller cities like Omaha have unexpectedly become successful micromobility markets, surprising preconceived notions that only the largest cities in the world, where density, problems of affordability, and congestion were the most acute, could support micromobility programs (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.).

In addition to expanding the program, looking to Tempe and Scottsdale can provide Phoenix with peer cities navigating similar climate and political environments. Despite cultural differences and differences in the built environment, they share climates and state political environments. Several local planners, urban planning professors, and advocates noted that locally, Tempe's program has outperformed Phoenix's in terms of ridership, owing to students and its proximity to Arizona State University, a dense urban space, more infrastructure, and walkable districts. Tempe is described by a local advocate as the "weird sibling in the Valley," because it is more bikeable and community driven. Coordinating micromobility programs across municipal boundaries would benefit both the vendors, and the user experience. According to a City of Phoenix active transportation planner, "The vendors operate in the neighboring cities, so their decisions are linked to the other cities, like Tempe and Scottsdale, and wanted the program's limits to be further south than the City decided." Expanding service boundaries and collaborating on the regulatory environment could benefit Phoenix, Tempe, and Scottsdale, as residents don't stop their lives at the boundaries between these municipalities.

Those Who Influence Decisions: Advocates

Micromobility is not driven solely by planners, policy makers or operators, but also by advocacy organizations that shape how, where, and why micromobility is implemented. In the City of Phoenix, the Phoenix Community Alliance (PCA) had a role in influencing the development and deployment of micromobility in downtown Phoenix. While PCA's motivations stem from economic interests specific to the downtown core, their impact demonstrates the power of advocacy in catalyzing access to new modes.

Additionally, neighboring bicycle advocates, the Tempe Bicycle Action Group, represent advocacy centered around extending active transportation improvements to non-traditional areas.

Planners in Phoenix largely attribute the City Council's buy-in to the micromobility program to the advocacy of the Phoenix Community Alliance. In Phoenix, the PCA has become a key figure in promoting micromobility, particularly within the downtown core. According to a director with the Phoenix Community Alliance, PCA operates under the broader umbrella of Phoenix Downtown Inc., focusing explicitly on the urban core of Phoenix – an area spanning approximately 92 square blocks. PCA is frequently described in the community as a kind of "homeowners association" for Downtown Phoenix and represents over 350 members that include businesses, neighborhood groups, and private companies. Approximately 80% of PCA's membership comes from business interests, which shapes the Alliance's primary concerns and advocacy goals. PCA serves as a coalition-building and lobbying entity that brings together powerful stakeholders in the urban core. As noted by two City of Phoenix active transportation planners, "PCA has been great cheerleaders of micromobility," emphasizing that the launch of the scooter pilot program was aided by PCA's pressure and lobbying efforts. In addition to promoting the micromobility pilot program, PCA advocated for the installation of designated scooter parking corrals to address common complaints about sidewalk clutter and improper parking.

While PCA publicly supported Phoenix's micromobility pilot program, its core motivations are rooted in economic objectives defined by a neighborhood in Phoenix. Scooter and bike share is viewed as a tool to enhance the vitality of Downtown Phoenix, encouraging longer stays, greater foot traffic, and increased spending. This reflects a broader vision to position downtown as a competitive and attractive hub for both residents and tourists, especially in comparison with peer cities such as Salt Lake City and Denver. Conventions, in particular, are seen as a vital driver of downtown vitality. PCA views micromobility as essential infrastructure that enables tourists to navigate the downtown area with ease and enjoyment. As PCA's Advocacy Director explained, PCA's support for initiatives such as stadium renovations and micromobility is closely tied to the goal of economic development. "The more people we can bring to downtown, the better." PCA's advocacy is therefore less about transforming the city's transportation culture and more about consolidating Downtown Phoenix's status as an economic and cultural anchor.

Despite PCA's success in catalyzing micromobility initiatives within the city center, their advocacy does not always align with broader public needs. For example, while PCA has supported the reintroduction of pedal bike share systems, these systems have been disappearing in peer cities, not opening. City planners expressed skepticism about the long-term viability of pedal bikes, suggesting a disconnect between PCA's advocacy and evidence-based planning.

Moreover, PCA's focus is largely centered on the needs of Downtown Phoenix rather than the broader metropolitan area. This creates an imbalance in transportation planning, including micromobility. As one planner pointed out, there are few, if any, advocacy groups pushing for micromobility access in underserved communities beyond the downtown core. The result could be a fragmented transportation network that reinforces existing inequities.

To contrast PCA's downtown-focused advocacy, the Tempe Bicycle Action Group's (TBAG) mission is to make biking a safe and enjoyable option for all residents, regardless of age or socio-economic status. According to a local TBAG representative, the Tempe Bicycle Action Group's greater mission has been, "To improve the infrastructure in the region to not only make biking an option, but a delightful choice." A director with TBAG emphasized an advocacy rooted in universal design and expanding bikeability in the region stating his goal was to improve bike access, "Whether that's an eight-year-old on their way to school or a senior headed to the grocery store."

There are advocacy groups for downtown Phoenix, who have been vocal and supportive of micromobility. There are bicycle recreation groups who are also advocates. Both have access to either capital or leisure time. But who is advocating for the transportation folks outside of downtown? Can micromobility successfully expand outward to the broader, underrepresented parts of the city without this advocacy? There are citizens who will complain about the negative aspects of micromobility that impact their daily lives, like parking, but will not strategize and advocate for ways in which micromobility can succeed.

Those Who Influence Decisions: Academia

Academic research plays an active role in influencing the micromobility landscape, as both cities and private vendors look to scholars for data-driven insights and policy justification. As local governmental decisions are scrutinized today more than ever, many cities, planners, and elected officials need the weight of an academic study behind their decisions. However, this expanding relationship between academic research, elected officials, and private practice also raises critical questions about objectivity and influence. Vendors like Spin are hiring academic researchers to deepen their understanding of micromobility trends and user behavior, which informs their profit-driven decisions. Research guided by for-profit motives may compromise the role of academics as “unbiased observers.” According to Spin's Senior Government Partnerships Manager, the company is investing in university-led research to better understand the optimum pricing of micromobility rides to and from transit. As an academic researcher in this field, an urban planning professor out of the University of California, Davis shared contributions he and other academic researchers are making to micromobility developments, but did not expand on the influence of private micromobility companies on the direction of his work. Moving forward, there is a case for academics in urban planning to better apply the position as neutral observer to create more transparent insights for cities and their residents.

People

Lastly, it is imperative to recognize the central role of Phoenix’s residents and visitors, the primary users affected by micromobility policies and programs, in shaping and responding to these transportation innovations. The population interacting with micromobility can be broadly categorized into two distinct groups: local residents and tourists. Each group occupies different spatial, social, and economic contexts within the city and may exhibit divergent travel behaviors and needs. Residents are more likely to benefit from the program’s expansion along established transit corridors such as the light rail, as these areas align with daily commuting patterns. Conversely, tourists may engage with micromobility options in ways that differ from residents, often driven by leisure or short-term transit demands.

Research and stakeholder interviews highlight that younger demographics are more inclined to adopt micromobility services. A Government Partnerships Manager from Spin and previous Micromobility Planner with City of Phoenix noted that the average user age for scooters hovers around thirty years old, indicating a predominantly young adult user base. This observation suggests that the program's growth and sustainability are closely linked to the preferences and behaviors of younger populations who are more willing to experiment with novel modes of transport.

However, this widespread adoption among younger, often less experienced riders and the marketing of micromobility devices as accessible to all users introduces safety concerns. One specific safety concern is inexperienced riders reaching high speeds. In Phoenix, first-time users may travel up to 15 miles per hour on unprotected roadways. In transportation planning, this speed and mode scenario corresponds to a Level of Traffic Stress (LTS) of 4, a level typically reserved for more experienced cyclists who gain confidence in their cycling capabilities through gradual acclimation to challenging traffic conditions (WSDOT, 2023). This suggests that shared micromobility potentially exposes inexperienced riders to unsafe conditions by bypassing traditional stages of rider acclimation. In this light, micromobility planners and policymakers in Phoenix must carefully consider the needs and behaviors of residents and tourists when establishing program regulations.

Findings

Factors

The central research question guiding this work is: *What factors best create environments where shared micromobility is likely to thrive in low-density urban contexts?* The chapter identifies which factors within the case study's environment are required to foster an environment where shared micromobility is likely to thrive. As discussed in the Methods chapter, themes emerged in interviews and policy review, establishing criterion that helps explain how and why micromobility appears in unlikely places, such as suburban-like environments, and the levers that influence the success and longevity of bike-and scooter-share programs in these settings.

Table 4. Complete Factor Table presents the raw material from interviews and policy review. It is the complete list of many factors that help explain micromobility in Phoenix, including operators' capacity, density, funding, and safety, among others. There are likely many more factors that contribute to the distribution, use and success of shared micromobility in low-density settings, but those presented below are what transpired from this study's methods. The findings can be grouped into factor categories of Built Environment (7Ds) and Additional Factors. Several of these factors have been previously acknowledged by transportation scholars. In particular, Cervero and Kockelman's publication (1997) on the three dimensions – density, diversity and design – that influence travel demand in San Francisco, maintain their relevance in a low-density city, such as Phoenix. But while Cervero and Kockelman structure their research question around the built environment, this paper contemplates additional dimensions pertinent to emerging technologies in low-density settings. Factors considered, but not deemed to have an impact, include enforcement, app-based reservations, service, user comfort and vandalism of devices.

Table 5. Secondary Filter Questions presents the secondary filter, discussed in the Methods chapter, which refined the complete factor list. This filter ran each factor from Table 5 through a series of three questions: 1) What factors listed are not applicable to micromobility in Phoenix?; 2) What factors present an opportunity for future research or future phases of micromobility in the low-density city?; and 3) What factors negatively or positively affect micromobility in the low-density city?

Table 6 illustrates the final product, illustrating how the factors that affect micromobility in Phoenix related to each stakeholder, and is discussed in the Results section below.

Table 4. Complete Factor Table

Category	Factor	Sub-Factor(s)
Built Environment	Density *"The variable of interest per unit of area" **	Population Density, Activity Centers, Effective Daytime Density
	Diversity *"Number of different land uses in a given area...wherein low values indicate single-use environments and higher values more varied land uses" **	
	Design *"Street network characteristics...vary from dense urban grids of highly interconnected, straight streets to sparse suburban networks of curving streets forming loops and lollipops" or "or other physical variables that differentiate pedestrian-oriented environments from auto-oriented ones" **	Grid
		Historic Neighborhoods
		Infrastructure (Separated Bike lanes)
	Distance to Transit *"The shortest street routes from the residences or workplaces in an area to the nearest rail station or bus stop" or "transit route density, distance between transit stops, or the number of stations per unit area" **	Transit Connectivity
	Destination Accessibility *"Ease of access to trip attractions" **	Program Footprint
	Demand Management *"Parking supply and cost" **	Parking
	Demographics	Equity
Additional Factors	Culture	
	Funding	Economics of Micromobility
		City Budget (for City)
		Subsidies (to Vendor)
	Political Environment	Political Bias
		Regulatory Environment
		Public Plans
	Education	
	Safety	
	Local Climate & Topography	
	Operators' Capacity	

* (Ewing & Cervero, 2010)

Table 5. Secondary Filter Questions

Actor	Question	Supply, Regulation, Demand
Operator	Does this factor influence an operator's decision to supply devices to a specific area or to operate within a particular city?	What factors drive supply?

The City	Is it necessary for this factor to be assessed (or present) as part of the city's approval process for micromobility implementation?	What factors represent things the City must regulate?
User	Will the user utilize micromobility because of this factor?	What factors drive demand?

Results

Micromobility in Phoenix is affected by a complex network of factors and vary significantly based on the stakeholder, whether that is the City, the operator, or the user. Each stakeholder is influenced uniquely by factors that increase their involvement in the program, challenge their involvement, minimally impact their involvement, or present an opportunity to enhance their involvement in the program. The factors that best create an environment where micromobility is likely to thrive in Phoenix are illustrated in Table 6. Additionally, a factor's relevance to a particular stakeholder (Operator, City, or User) is coded. Each factor is discussed in detail following the table. The coding attributed to each cell within the table is based on interviews with local stakeholders and document review discussed in the previous Methods chapter.

Various factors explain micromobility in Phoenix depending on the stakeholder. For operators, key considerations include population density, the regulatory environment, demographics (including equity), and culture. The City of Phoenix, including City Council members and planning staff, evaluate micromobility through transit connectivity, parking availability, demographics, city budget constraints, political bias, regulatory frameworks, public planning, safety, and operators' capacity. From the user's perspective, important elements were community diversity, street design (grid vs. cul-de-sac), bike infrastructure, the geographic footprint of the program, demographics, the affordability and economics of micromobility, and safety.

Factors that may present an upfront issue to micromobility adoption and demand, but are resolvable, also vary by stakeholder. For operators, these elements are distance to transit, city budget allocations, and the availability of subsidies. For the City of Phoenix, challenges related to historic neighborhoods presented an initial barrier, which was mitigated through community outreach and City

Council education. However, from the user's standpoint, there are no directly resolvable factors, as users typically have limited influence over the structural or policy-related aspects of micromobility systems.

There are factors that minimally impact micromobility in Phoenix. For operators, their own capacity has relatively little influence on overall micromobility outcomes. From the city's perspective, none of the factors identified on the list played a minimal or insignificant role. For users in Phoenix, local climate and topography, as well as comfort, had limited effect on their engagement with micromobility.

Several factors present opportunities to enhance micromobility across stakeholders. For operators, investments in infrastructure such as separated bike lanes and user education can significantly improve service effectiveness and adoption. The City of Phoenix decision-makers and planners can expand the footprint of micromobility programs and promote education to increase accessibility and public engagement. For users, improved transit connectivity and education about how to safely use micromobility can encourage greater participation.

Table 6. Factors that influence micromobility in Phoenix

LEGEND: Factors

Not Applicable			
Opportunity			
Result	Most Relevant	Moderate Impact	Least Relevant

Category	Factor	Sub-Factor	**Operator** *Does this factor influence an operator's decision to supply devices to a specific area or to operate within a particular city?*	**City** *Is it necessary for this factor to be assessed (or present) as part of the city's approval process for micromobility implementation?*	**User** *Will the user utilize micromobility because of this factor?*
Built Environment	**Density**	Population Density, Activity Centers, Effective Daytime Density			
	Diversity				
	Design	Grid			
		Historic Neighborhoods			
		Infrastructure (Separated Bike lanes)			
	Distance to Transit	Transit Connectivity			
	Destination Accessibility	Program Footprint			
	Demand Management	Parking			
	Demographics	Equity			
	Culture				

Additional Factors	**Funding**	Economics of Micromobility			
		City Budget (for City)			
		Subsidies (to Vendor)			
	Political Environment	Political Bias			
		Regulatory Environment			
		Public Plans			
	Education				
	Safety				
	Local Climate & Topography				
	Operators' Capacity				

* (Ewing & Cervero, 2010)

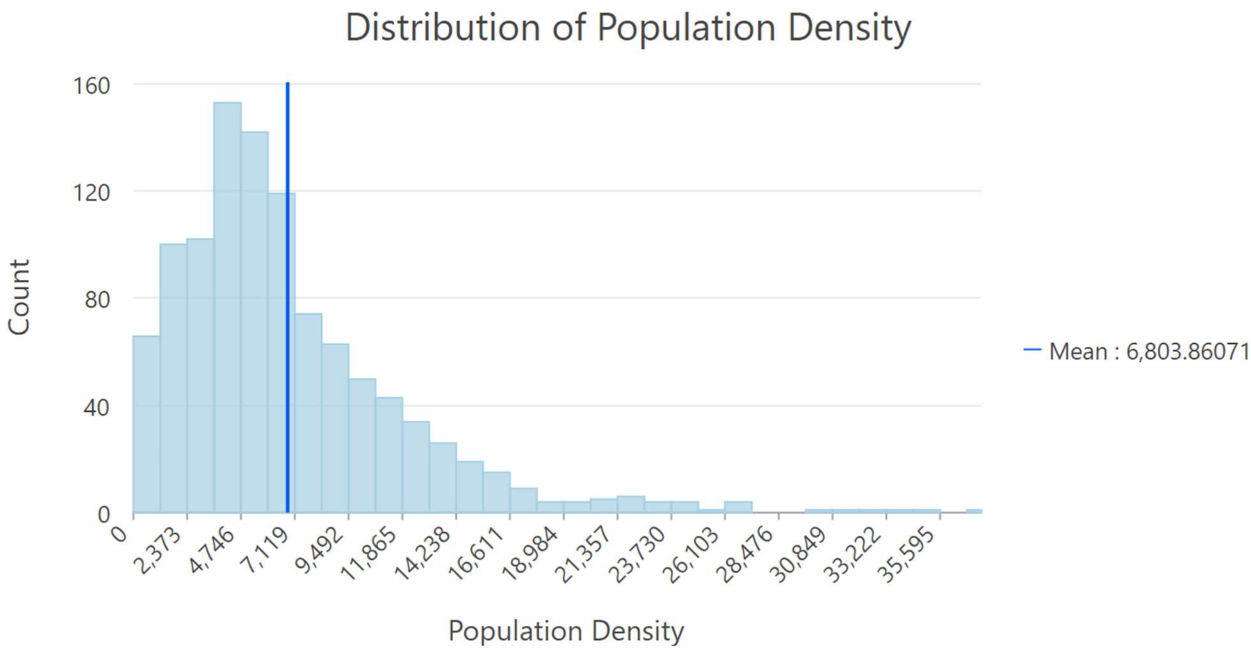
Built Environment

Density

When analyzing micromobility systems, density repeatedly emerged in planning documents and interviews as a primary determinant of program viability in interviews and planning documents. Micromobility may not require the same high and continuous population density as public transit systems, but without sufficient user density, micromobility could fail in an area.

Identifying the ideal population density to support micromobility in Phoenix was less apparent in interviews and planning documents, underscored by the range of densities across the city. A 2018 Institute for Transportation and Development (ITDP) report recommended a device density of approximately 10-30 vehicles per 1,000 residents (Institute for Transportation & Development Policy, 2018). While the quantity of vehicles per residents is important, the ITDP report did not establish a clear population density threshold necessary to sustain a micromobility program. Statistical data from Phoenix reinforces the variability of density across the city's footprint. According to the 2019 American Community Survey, Phoenix contains over 1,055 census tracts. As shown in Figure 8, the maximum tract-level population density reaches nearly 38,000 people per square mile, while the mean and median densities are 6,803 and 5,600, respectively (U.S. Census Bureau, Department of Commerce, 2021). This wide range highlights how even within a generally low-density urban fabric, localized density pockets (such as 5,600 people per square mile) can support micromobility systems. A challenge for Phoenix's micromobility planners, therefore, is not only to identify these high-density nodes, but to design linkages between them and expand their definition of density beyond residential population density.

Figure 8. Distribution of Population Density Per Census Tract in Phoenix



Traditional understandings of population density as residents per square mile may be insufficient to understand micromobility demand in low-density contexts, where dense housing is not continuous and evenly distributed. Multiple forms of density, including resident population density, activity centers, and effective daytime density, may all contribute to population density, and all three of these versions of density exist in Phoenix. Phoenix's unique form contains multiple downtowns, localized commercial hubs, and entertainment venues that drive travel demand. Two local planners observed that in Phoenix "pockets of density and pockets of activity centers drive micromobility use." Another local planner currently acting as a government relations manager for a private micromobility company agreed, "What factors best create an environment where micromobility is likely to thrive in low-density cities? Where you see activity. Where you see things to do."

Interviewees discussed how activity centers, located within or outside of low-density city centers, complement the impact of population density. These pockets of density and activity centers can include employment hubs, entertainment venues, and mixed-use centers where average trip distances fall between one to two miles, making them ideal for micromobility. Locations like stadiums, and concert venues draw large crowds, enabling temporary "flash flood" effects where demand spikes dramatically and the users' driving experience deteriorates. These are occasions where the user may consider using alternative forms, like on-demand ride-hailing services. A former employee of a micromobility company shared that in cities like Indianapolis and Nashville, whose programs experience the greatest number of trips per vehicle per day, most of the rides occur going to or departing from events.

Effective daytime density, exemplified by college campuses, is another concept critical to understanding micromobility viability. An employee of a micromobility company described college campuses as “safe bets” for where to locate micromobility programs. ZIP code 85281, according to a local advocate, which includes Arizona State University (ASU) in Tempe, sees its population swell by approximately 50,000 people during the day, dramatically increasing the effective daytime population density to levels exceeding its residential average of approximately 5,200 people per square mile to over 10,000 people per square mile in the densest areas where active micromobility rentals are occurring. This surge drives micromobility usage in a compact five-square-mile core, even though the ZIP code encompasses 13 square miles, and broader areas of Tempe remain underutilized due to their low and disconnected density. This anecdote demonstrates how daily traffic in specific areas can drive dense daytime populations that differ markedly from their residential population.

Diversity (of Land Use)

While diversity of land use is one of the original 3Ds of travel demand (Cervero & Kockelman, 1997), it did not present itself as a significant factor during data collection and analysis.

Design

Phoenix Developed Along a Grid

Despite Phoenix’s reputation for sprawling suburbs that reward driving, local planners acknowledge its historical development along a grid was important for users relying on non-auto modes of transport (City of Phoenix, 2024). The layout of a neighborhood was not discussed in interviews by micromobility operators or City decision-makers or did it appear in policy review, but it is suggested as an important component of the built environment that drives users' travel demand (Duany & Plater-Zyberk, 1991).

Historic Neighborhoods

The design of neighborhoods within Phoenix proved to be an initial barrier to micromobility program implementation. An employee from PCA shared that a City Council member representing a historic neighborhood adjacent to the micromobility program and "packed right on top of downtown" expressed concern for the new mode's potential disruption to the historic area. Once the fears in this and other historic neighborhoods were addressed, City Council members became more amenable to the micromobility program as a whole.

Infrastructure

The presence and quality of active transportation infrastructure are important to successful micromobility systems, particularly in low-density and auto-oriented cities. Quality, not just quantity, of infrastructure is a recurring concern. Davis, California is cited as a model example for bike infrastructure that drives high micromobility ridership. A professor at Arizona State University highlighted the importance of high-quality bike lanes that are not only present but are well-designed and safe to use.

Cities like Phoenix lack many of the basic elements required to make micromobility, and other active modes of transportation, safe and practical. Major arterial streets that are often six lanes wide with turn lanes, pose serious safety hazards to non-automobile users. Two local planners emphasized that this creates barriers between neighborhoods, making it difficult, for example, for people in West Phoenix to travel safely to Central Phoenix. Minimal sidewalk widths (typically 5-5.5 feet) and the absence of bike lanes on most roads exacerbate these challenges and discourage micromobility use along major roads. In Phoenix, many bike lanes are either missing entirely or situated in hostile environments, such as wide, high-speed arterials. This context deters users from opting for scooters or bicycles, particularly in suburban areas where distances might be manageable but the travel environment is perceived as unsafe.

The challenge in Phoenix is further complicated by questions of modal integration and road design. According to a professor of urban planning, there is often no clear place for micromobility devices in the built environment. In downtown areas, scooters and bikes are commonly ridden on sidewalks due to the absence of protected lanes, creating conflicts with pedestrians. As a local bicycle advocate noted, efforts to make micromobility feasible in the region should begin with, "fixing the basics," such as "protected lanes, curb ramps, safe crossings"; Without this infrastructure, "micromobility becomes just another way to get hurt." Notable exceptions within parts of Phoenix, Tempe, and Scottsdale have integrated better bike infrastructure, and these areas tend to support more successful micromobility programs. A private micromobility employee noted that in stereotypical car-dependent suburban towns like Queen Creek, children can be seen riding on the street in bike lanes, a good sign that the biking conditions are safe. The presence of well-maintained and safe infrastructure in areas like these reduces the barriers to micromobility adoption.

Change is slowly occurring, but, according to the Phoenix Active Transportation Plan, it is gaining momentum. The first proposed bike system in Phoenix was adopted by City of Phoenix Council in 1987, and not until 2014 was the City's first bicycle master plan adopted. Since then, the City has installed protected bike lanes, two-way protected bike lanes, and is designing a bike boulevard. As of 2023, the City of Phoenix had 183 miles of buffered bike lanes, eight miles of protected bike lanes, and 974 miles of traditional bike lanes (Maricopa Association of Governments, 2023).

Distance to Transit

Distance to transit is one of the "seven D's" literature attributes to travel demand, defining this metric as, "the shortest street routes from the residences or workplaces in an area to the nearest rail station or bus stop" or, "transit route density, distance between transit stops, or the number of stations per unit area" (Ewing & Cervero, 2010, p. 267). This research adapts the travel demand definition to micromobility, by seeking to understand if micromobility trips support transit and connect to transit trips.

According to the North American Bikeshare and Scootershare Association's (NABSA) 2023 Shared Micromobility State of the Industry Report, "16 percent of all shared micromobility trips were for the purpose of connecting to transit" (2023, 14). AICP planning professionals reflected that "Micromobility is not the magic bullet, but it can make transit more efficient," and expressed excitement for future opportunities to connect shared micromobility with, "transit-oriented communities and along existing and future rail lines, and the arterial BRT bus system." A City of Phoenix active transportation planner added to this sentiment noting that many cities have already linked transit with micromobility, through financial consolidation or app consolidation, such as using the same transit card or app for both light rail and micromobility.

Phoenix's current public transportation system reflects modest accessibility, with a transit score of 36 ("Some Transit", according to Walk Score. Transit Score rankings define "large cities" as cities with more than 300,000 people (Walk Score, 2025)). The city operates 71 bus lines and two light rail lines, with the light rail demonstrating "the highest levels of transit ridership in Phoenix in comparison to other bus routes in the city" (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2024a).

Patterns of public transit usage and community feedback shapes micromobility planning in Phoenix. A 2024 report to the City of Phoenix Transportation, Infrastructure, and Planning Subcommittee supported this notion: "According to the 2019 Origin and Destination study conducted by Valley Metro, 73 percent of riders access light rail stations by walking, while 14 percent of riders bike to light rail stations," and used the correlation between public transit utilization and micromobility users to argue there is an increased demand for micromobility in areas with high transit use. At the time of this report, the micromobility program connected to several bus routes and the light rail system (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2024a).

City staff emphasized that high-speed transit should direct micromobility planning, and after extensive community feedback and excitement, proposed a programmatic scooter boundary of two miles within light rail. This strategy received substantial community support and resulted in a phased micromobility expansion plan anchored by light rail and bus rapid transit stops. Planners anticipate significant demand for micromobility in equity zones, particularly those affected by the upcoming light rail extension scheduled for June 7^{th}, 2025.

Despite the city's strategic micromobility expansion anchored by the public transit system, the relationship between micromobility and public transit remains contested, with research showing mixed results on whether the two modes exhibit complementary or substitution effects. While some studies suggest that micromobility can enhance transit ridership and reduce vehicle miles traveled, their findings are mixed and not directly applicable to cities with a sprawling footprint, like Phoenix, (Fishman et al., 2014; Guo et al., 2022; Jin et al., 2019; Transport for London, 2014). National data, from the North American Bikeshare and Scootershare Association (NABSA), indicates that 13% of all transit trips are replaced by micromobility (2023), raising questions about whether such services support or undermine public transit use. One micromobility planner who lives in Phoenix but works in Seattle shared that in Seattle, "they observe how people who have just missed a bus at a stop and don't want to wait for the next bus will just take micromobility." In this anecdote, where transit is frequent, micromobility may substitute for short transit trips. In Phoenix, longer distances and lower transit frequency may encourage more complementary use, especially for first- and last-mile connections. However, the reliability of micromobility for return transit trips may affect user willingness to depend on it as part of their commute. This barrier supports the claim the CEO of Lime made, that increasing the supply of micromobility devices actually leads to an increase in utilization (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.).

Despite growing interest in aligning micromobility expansion with high-capacity transit, Phoenix's current planning decisions are driven more by practical reasoning and advocacy than by empirical evidence. City staff acknowledged that the decision to expand the micromobility program along the light rail corridor was not based on bike counts, pilot programs, or data collection. In fact, city staff admit difficulty in locating research that supported the connection between light rail systems and shared micromobility. Instead, the alignment was selected as a "defensible" boundary, or an approximation grounded in the belief that micromobility trips align with high-capacity transit and the average trip length for micromobility is one to two miles. The Phoenix Community Alliance (PCA), a vocal advocate for micromobility and light rail in Phoenix, framed the strategy as a way to enhance first- and last-mile connectivity to downtown. However, when asked about the data supporting their advocacy, a PCA director admitted it was, “more anecdotal data than empirical,” with feedback primarily derived from conventions rather than formal studies. City of Phoenix active transportation staff also noted that PCA’s continued support for pedal bicycles was increasingly out of step with trends in cities like Phoenix, where such modes are declining.

Micromobility in Phoenix and similar cities has the potential to serve first- and last-mile connections to public transit, but this relationship remains largely assumed rather than empirically validated. While commonly cited as a solution to bridge gaps in transit access, the connection between micromobility and transit is often treated more like accepted fact rather than a rigorously studied phenomenon.

Destination Accessibility

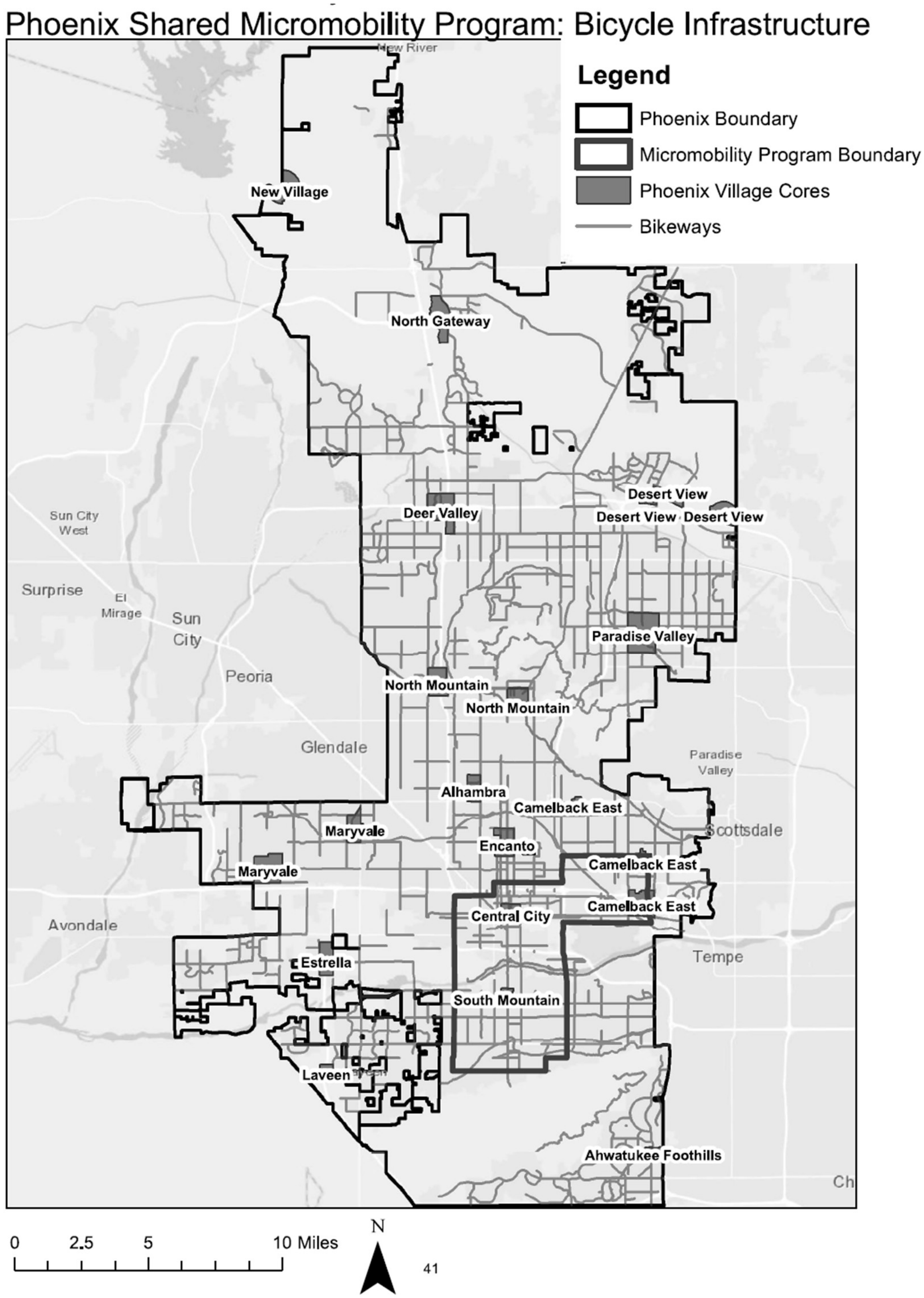
Currently in Phoenix, scooters function well in downtown areas, for entertainment, and for day trips. Challenges for shared micromobility in Phoenix arises when users need devices for round-trip commutes, such as riding a scooter home from the light rail, because a rider can’t count on having a device available for the return trip. Lime CEO, Wayne Ting, touched on reliability in his interview (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.). If car-less users depend on micromobility devices, they will need to make sure bikes are available. Lime found that providing an overabundance of bikes and devices leads to device reliability with their customers. When Lime increased the fleet, they saw the average trips per vehicle per day increase across the board, meaning utilization increases; When they incrementally grew their supply, they saw demand increase because more people can reliably ride Lime.

Program Footprint: Networks, Trail Systems, and Inter-Jurisdictions Connections

Jurisdictional boundaries, administrative in nature and politically and legally necessary, often disrupt the functional connectivity required for active transportation modes. Micromobility services often operate on a city-by-city basis, constrained by permits and agreements that rarely extend across city lines, yet users do not typically adjust their mobility patterns based on municipal boundaries. According to local planners, the triangle area, which encompasses downtown Phoenix to Tempe to old town Scottsdale, represents the most densely developed and transit-rich area of the metropolitan region, and is also where many transit investments are occurring. This region could support micromobility, yet, despite this, micromobility providers are limited in their ability to operate across city borders. As a City of Phoenix active transportation planner observed, "The City of Phoenix's program boundaries don't connect to Tempe's. Allowing Spin and Lime in both cities to cross the boundary would help. People don't stop their lives at the boundary." These limitations reduce system efficiency and ignore existing demand in high-density areas.

In addition to inter-jurisdictional connections, inaccessible active transportation systems present another opportunity to improve the micromobility experience. While the Phoenix region contains networks of off-street trails and canal paths, appealing for both safety and convenience, these existing pathways are not utilized in the current micromobility program, as shown in Figure 9. Phoenix's canal system, including the Grand Canal, was often cited in interviews as an off-street bike network that supports a pleasant and safe bicycling experience. One micromobility operator noted that while the canals near her home are ideal for walking her dog and would be safe for micromobility use, she is unable to legally ride a scooter or e-bike along them. Micromobility devices such as scooters are not permitted on many of these off-street routes, as the canals are managed by the federal Bureau of Land Management (BLM). A local planner identified this as a significant missed opportunity, given that these paths represent some of the safest and most continuous east-west connections across the metro area. The absence of infrastructure integration across jurisdictions and levels of land management agencies reduces the potential connectivity of these corridors yet represents an opportunity to improve the micromobility experience. One way to address this gap is to map active transportation routes and assess what proportion are legally accessible to micromobility users. Expanding access to these trails for shared micromobility programs would enhance regional connectivity and improve safety by directing users to existing infrastructure rather than forcing them onto dangerous arterials or narrow sidewalks.

Figure 9. Phoenix Bike Infrastructure with Micromobility (GEN312340_41, 2024)



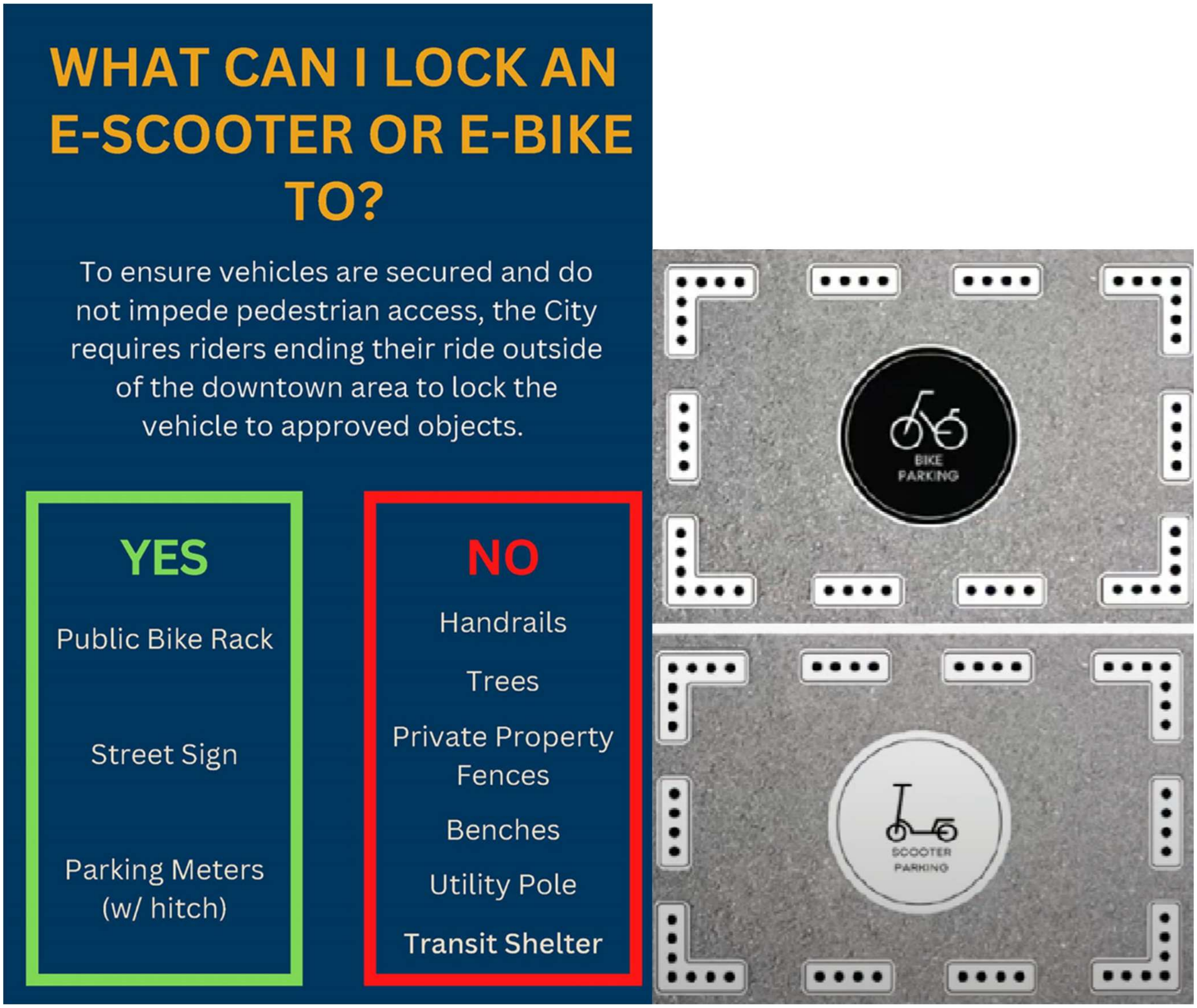
Demand Management

Parking

Much like the rise of private car ownership in the 1910s and 1920s (Shoup, The High Cost of Free Parking), the visual clutter of loose micromobility devices in the public right of way has many cities scrambling to solve the parking shortage. A local bike advocate shared that in this region, this leads to micromobility “chaos”. Micromobility devices were introduced to cities without integration into the city’s existing and forthcoming plans, meaning many cities never addressed where to store, park, and dock devices, and this responsibility, according to a local planning professor, ultimately falls into the City’s hands because “people hate the parking and insist the city do something.” This theme was present in many interviews, and also a primarily cited cause of the City Council’s delay to extend the micromobility program into districts outside the Downtown.

Parking solutions are a key factor to micromobility success in low-density cities and the City of Phoenix’s proposed parking solutions include: parking corrals and geofenced drop zones to help keep sidewalks safe and organized, reallocating wide sidewalks and street furniture to provide parking (City of Phoenix City Council, 2019; City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2023d). Phoenix’s current micromobility plan has mandatory parking corrals for certain areas per the insistence of the City Council and the advocacy of PCA, as exhibited in Figure 10. The City planned to add more mandatory parking in the downtown area in the next phase. However, areas outside of Downtown do not have much space and right of way for parking, with some neighborhoods and streets lacking sidewalks altogether, which presents a unique challenge to the City.

Figure 10. City of Phoenix Micromobility Parking Guidance, 2024



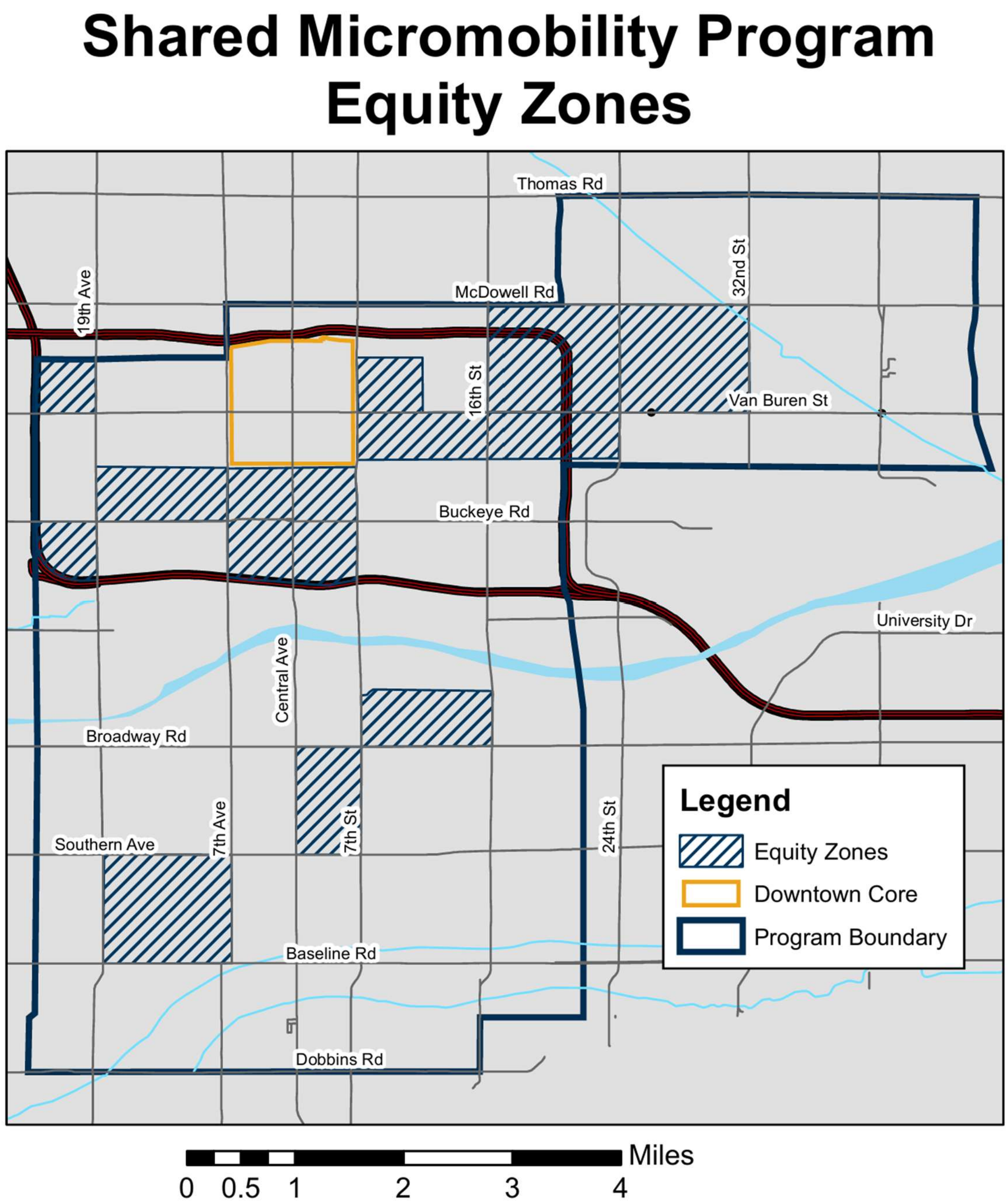
Demographics

Equity Zones

Equity was a central consideration in the development of Phoenix's micromobility program, driven by a recognition that Phoenix's scooter pilot was limited to downtown Phoenix, a relatively affluent and transit-rich area, according to City of Phoenix active transportation planners. The pilot neglected large segments of the city where transportation needs are significant and access to alternatives are more limited. To counteract this, City of Phoenix planners deliberately introduced equity zones into the full program rollout and expanded the micromobility footprint to low-income areas with less transportation infrastructure. These zones were designed using an equity index based on environmental justice indicators at the census tract level. A natural breaks analysis identified the five highest-scoring tracts, which were then designated as equity zones, as depicted in Figure 11. Although these zones have remained unchanged since their creation, City of Phoenix planners anticipate future updates, especially in areas like South Phoenix where light rail expansion is planned.

Equity Zones in Phoenix automatically discount any trips originating within equity zones, with no additional action required, according to City of Phoenix active transportation planners. Low-income users receiving federal benefits can also register for the Equity Program to access further fare reductions (typically around a 15-20% discount per ride).Vendors such as Lime also offer time-bundle discounts, incentivizing larger purchases with lower per-minute costs. Initially, the city required vendors to deploy 30% of their micromobility fleets within equity zones, but this was later reduced to 15% after pushback from operators. Nonetheless, city planners remain firm that this requirement will not be relaxed further, especially with anticipated demand increases in equity zones following the June 7th, 2025 light rail opening. Despite these measures, significant areas of Phoenix, particularly South and West Phoenix, still face limited micromobility access, raising questions about the program's current reach and effectiveness. Local active transportation planners noted that these areas often lack sidewalk and cycling infrastructure and highways physically cut off these neighborhoods from other parts of the city making active transportation unsafe and challenging.

Figure 11. 2024 Micromobility Program Equity Zones (Foley, 2023)



Additional Factors

Culture

The cultural context, or the collective values, norms, and perceptions (Hansen, 2011), of a city plays a significant role in shaping the adoption and success of micromobility systems, often influencing behavior as much as infrastructure itself. In cities like Phoenix, where auto dependence and the built environment are deeply intertwined (Phoenix has a household vehicle ownership rate of 92% (Sisson, 2024) and households in Phoenix spend on average $10,900 a year ($908 per month) on vehicle ownership costs (Maricopa Association of Governments, 2023)), cultural attitudes toward walking and cycling can either facilitate or hinder the uptake of micromobility. As local planners have noted, there remains a cultural barrier to active transportation, with resistance to on-street infrastructure stemming not from technical constraints but from perceived identity and values.

Phoenix's relatively low walkability and bikeability rankings further underscore this challenge. A low walkability score indicates a car-dependent city, where most errands require a car. As of 2025, Phoenix ranked 31st out of the 50 largest U.S. cities for walkability (Walk Score, 2025) and continues to face serious pedestrian safety issues, with the highest pedestrian fatality rate, or pedestrian deaths per 100,000 population, in the nation reported in 2017 (Retting, 2017). The City of Phoenix's Active Transportation Plan cited that the most frequently identified barrier to walking, according to its citizens, is "distances between places" (Maricopa Association of Governments, 2023, ATP-22), yet "On average, 40% of all trips we make are for a distance of two miles or less – a distance that can easily be covered by a 10 minute bicycle ride or a 30 minute walk" (2023, p. ATP-11). Mesoscale infrastructure, such as bike sharing, helps bridge the mobility gap between longer distances (Stehlin & Payne, 2021, p. 1066).

Its bike infrastructure has evolved slowly: while the city now has over 180 miles of buffered bike lanes and a growing number of protected lanes, it still received a modest People for Bikes Bike Score of 56 out of 100, based on the quality of the city's bike network. This score ranked Phoenix 699th of all cities in the U.S. (People for Bikes, n.d.). These metrics reflect not only infrastructural gaps but also decades of limited political will and public support for active transportation.

Recent investments and planning efforts, such as the 2023 Active Transportation Plan, show a shift toward more ambitious goals, including achieving Platinum Bicycle Friendly Community status (Maricopa Association of Governments, 2023). After developing the 2023 Phoenix Active Transportation Plan, the City announced investments in active transportation and a renewed interest in improving its bikeability status. Every two years the City will apply for Bicycle Friendly Community Status with the goal of achieving Platinum status (Maricopa Association of Governments, 2023, p. iii).

According to a local bike advocate, efforts to expand micromobility must include not only practical improvements but also a cultural shift. This shift encapsulates city leaders actively promoting walking, cycling, and transit as central to a city's identity. The willingness of a city to restrict car access to large events and incentivize mass transit or active modes is a reflection of these broader cultural dynamics.

Funding

Shared micromobility, while often promoted as a sustainable and flexible urban transport solution, is ultimately an expensive form of mobility, both for users and operators. From the user's perspective, rental costs can accumulate rapidly, making ownership a more economically rational option for even modest and infrequent riders.

On the operator's side, shared micromobility services also face significant cost challenges. As a micromobility operator highlighted, these systems are costly to operate, particularly in low-density cities, where achieving scale is difficult. One private micromobility provider commented in an interview that *the* factor that best creates an environment where micromobility is likely to thrive in low-density cities is public funding. Early private micromobility budgets were particularly inefficient, with Lime's average scooter only lasting 30 days and a lack of data to optimize operations (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.). Recent technological improvements, which Lime's CEO credits to swappable batteries delivered via cargo bikes and hardware ownership, have extended device lifespans and improved financial viability, with Lime reporting profitability in 2024 (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.). However, these improvements do not eliminate the underlying costs of operation. Historically, public-private partnerships, prevalent in older bike share systems, mitigated these expenses by removing the profit motive. City of Phoenix active transportation planners lamented that reintroducing public subsidies or non-profit models may be necessary to prioritize affordability and equity for users. Active transportation planners with the City of Phoenix acknowledged, "As a member of the public, you're not going to get great micromobility unless you see it as public transit, and integrate it with the public transit system. Phoenix is not there yet. That would be the future." Thus, while shared micromobility continues to evolve, its current economic model appears unsustainable for both users and providers.

The City's Budget

The funding structure of micromobility programs in Phoenix reveals a broader tension between innovation and austerity in urban transportation planning. In Phoenix, shared micromobility operates under a strict cost-recovery model, meaning it must generate enough revenue through vendor fees to fully support itself, with no financial input from the city's general fund. Phoenix is not alone in this approach; cities like Indianapolis and San Diego have adopted similar cost-neutral models. According to the City's 2022 Shared Micromobility Revenue Contract Solicitation – Request for Award, "In order for the program to remain cost neutral to the City, revenue will be used to cover the cost of staff time and resources used to manage the program. Additional revenue will go toward bike infrastructure and expansion of the program" (City of Phoenix City Council, 2022b, p. 293). The city holds contracts with private operators such as Lime and Spin, who pay a $15,000 annual permit fee, $0.15 per ride, and a $50,000 "Infrastructure Guaranty," or "capital investment offset" (City of Phoenix, 2023a, 2023b). Additionally, vendors are required to provide quarterly reports, including ridership program status, fleet status, an advertising report, and an annual audited statement of gross and net sales revenue (City of Phoenix, 2023a, 2023b). City of Phoenix active transportation planners shared that these vendor payments support the city's micromobility expenses, including data acquisition through the Ride Report platform and the micromobility planner's salary.

These budgetary constraints, namely that the program remains at no cost to the city, have critical implications for how the program is managed and developed. A former micromobility planner with the City of Phoenix expressed frustration over the cost neutral mandate. They recounted being unable to pursue improvements, such as installing bike racks to address parking concerns, without either "borrowing from other budgets" or embedding costs in vendor contracts. Similarly, a micromobility operator noted that while operators are willing to pay fees, high regulatory costs reduce their capacity to reinvest in operations. This created a feedback loop in Phoenix where the more the city relies on private operators to regulate the system, the less financial flexibility operators have to improve services or for operations. In fact, a 2023 city survey revealed that constituents are actively requesting expanded micromobility access (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2024a), but the city is unable to provide this service due to the rigid revenue neutral mandate.

Moreover, the city's limited financial commitment directly influences how planning staff allocate their time and resources, according to City of Phoenix active transportation planners. Several micromobility planners suggested the City consider in the future a bifurcated staffing model for the City's micromobility team, akin to Capital Metro's structure in Austin, to improve efficiency, with one team handling long-term planning and another focused on compliance and operations.

It is interesting to note that in Phoenix, micromobility, a transportation service, is uniquely expected to be financially self-sufficient while other transportation services like buses, light rail, and highways routinely receive public subsidies. Micromobility is often treated as an amenity rather than a legitimate piece of the mobility puzzle. As a local planner emphasized, if the city wants to be serious about micromobility, it must take ownership in committing its own resources or invest in research towards alternative funding mechanisms. Without such changes, micromobility in Phoenix risks remaining an under-resourced service, unable to fulfill its potential as a meaningful contributor to the transportation system.

Alternative funding mechanisms exist, such as Nike's sponsorship of Lyft's BIKETOWN and partnership with the Portland Bureau of Transportation (City of Portland, 2024), and financial models that blend public investment with private support, which Phoenix could explore.

Subsidies

The allocation of public resources, in this instance subsidies afforded by public funds, should reflect that the funding, or city's loss of revenue, will help the city achieve or progress towards its priority goals whether that be optimizing travel time, walkability, or freight movement. Public investment should be strategic. For example, cities with clear air quality policies do not automatically subsidize electric vehicles simply because they exist within regulatory frameworks. A new technology that operates within existing city infrastructure and regulation, whether that be micromobility or ride hailing, does not mean the city should invest in it. The City must contemplate the best use of its money. For subsidies, the operator is using public infrastructure that the city has allocated money to build and maintain, the operator uses this for free and gets to profit.

The City of Phoenix's primary transportation objective over the last four decades has been optimizing travel time. Thus, public subsidies in the City have built urban environments that prioritize automobile efficiency. The increasing frequency of extreme heat events and growing climate concerns may be shifting municipal priorities toward sustainability and alternative transportation modes.

According to Wayne Ting, Lime received $140 million in investments in 2020 and $600 million in bookings in 2024 (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.), an amount that may exceed the City of Phoenix's active transportation budget. The City of Phoenix must reflect on whether it is worth subsidizing this mode.

An effective approach for micromobility companies operating in Phoenix may be for these companies to frame their services as discounted services that help the City of Phoenix accomplish its highest priority goals. For example, this reframe could transform former complaints from operators about the cost of providing services in low demand equity zones to micromobility providers enhancing transportation access and equity in underserved communities and therefore providing a low cost solution for one of the City's strategic areas.

An advocacy director for the Phoenix Community Alliance echoed emerging discussions around low utilizations rates for micromobility devices in Phoenix and whether subsidies are justified.

Ultimately, this conversation remains unresolved and is one the city will need to weigh carefully. The city must consider whether micromobility delivers sufficient benefits to justify continued public investment or if funds might be better directed toward other transportation priorities.

Political Environment

Regulatory Environment

The regulatory environment of a market is one of the most important criteria influencing vendors' decisions to enter and operate in a city's micromobility program, according to Spin's Senior Government Partnerships Manager. Regulations concerning curfews, rider age limits, equity zones, and other restrictions directly affect the profitability and feasibility of their services. According to a manager with a micromobility company and a former City of Phoenix employee, each city requires a tailored regulatory framework suited to its unique context and what works well in one city may deter operators in another if the framework is not appropriately designed (Stoeltje et al., 2023).

Additionally, legacy regulations can pose challenges for emerging technologies, including micromobility programs. A local planning professor highlighted that many scooter laws in Phoenix are based on outdated statutes from the 1960s intended for different types of motorized scooters. Although Phoenix has a recreational law regulating scooters, it is rarely enforced, allowing micromobility vehicles to use canal paths regularly despite formal restrictions. Providers must consider and review legal frameworks designed to regulate micromobility as well as historical micromobility regulations to reflect best practices.

Political Bias

Political bias at the state, regional, or local level can shape the trajectory of micromobility programs, either enabling or obstructing their development. An advocacy director in Phoenix noted that at the state level some state legislators exhibit an ideological opposition to public transportation and safety initiatives like Vision Zero. In some cases, individual actors with authority over transportation policy can wield outsized influence, particularly when they are skeptical of or opposed to active transportation. Other local planners agreed that a key decision-maker who is not supportive of micromobility can derail efforts, regardless of broader public or departmental interest. This structural vulnerability highlights the need for institutional safeguards, such as better policies or advisory committees, which prevent one person's ideology from stalling progress on active transportation improvements.

Additionally, due to what some interviewees perceived as political bias in the city and the state against active transportation, the prioritization of micromobility projects suffered from inconsistent procedural standards. Whereas large-scale transportation projects typically receive adequate timelines and allocated funding for public surveys, feasibility studies, or transportation planning, Phoenix's micromobility initiatives were pushed forward without similar support, under rushed timelines and with limited or no dedicated budget. This discrepancy reflects deeper political biases about what constitutes legitimate or "serious" transportation infrastructure.

Planning for Micromobility in Phoenix's Formal Planning Documents

Despite its alignment with key urban planning goals, shared micromobility has not been fully integrated into Phoenix's formal planning documents, largely due to the timing and manner in which it was introduced. Micromobility caught Phoenix, and many communities, off guard, arriving before adequate policy frameworks or infrastructure could be established. While micromobility supports the broader goals of Phoenix's General Plan, Climate Action Plan, Active Transportation Plan (ATP), and the Transportation 2050 (T2050) initiative, it is often underrepresented or omitted entirely from these documents (City of Phoenix, n.d., 2021, 2024b; Maricopa Association of Governments, 2023). This omission reflects a cautious planning approach. According to authors of the ATP and other relevant transportation plans, the micromobility scooter pilot was running simultaneously to the drafting of these policies leading planners to avoid committing to specific objectives before the pilot's outcomes were fully evaluated. The same hesitation is evident in both the T2050 plan and PlanPHX (City of Phoenix, n.d., 2024b).

However, after six years of program implementation and multiple program expansions, Phoenix now has the opportunity to more intentionally embed shared micromobility into its long-range transportation and sustainability strategies. As a professor of livable communities emphasized, the success of micromobility depends not just on program design, but on "major structural changes" that support multimodal transportation systems. Re-integrating micromobility into core planning documents will be essential for aligning it with citywide goals and ensuring it is treated as a permanent component of the City's mobility.

Education

Education is important, even essential, in low-density cities, both to raise awareness that micromobility exists as a viable transportation option and to allow residents to test drive these vehicles and become familiar with their use. In Phoenix, education targeted users with varying degrees of success while garnering limited attention from decision makers, including City Council members. During the pilot, efforts were made to introduce the public to micromobility through hands-on experiences and general awareness campaigns as well as in-app user agreements. However, education extended beyond users; some attempts were made to include policymakers, albeit with mixed results. City planners at the time of implementation shared methods, including hosting demonstrations and events and inviting City Council members, a few of whom sent staffers or assistant directors to make brief appearances. Despite these efforts, the City planners questioned whether such outreach changed attitudes, suggesting that many decision-makers remained entrenched in their views. The absence of structured, ongoing education for city leadership limited their exposure to the benefits and challenges of micromobility, potentially undermining support for the program.

Furthermore, some users from the bike advocacy industry encountered safety issues early on, with incidents such as hospitalizations shaping their opinions. This underscores the need for comprehensive safety education alongside promotional efforts. Overall, while user education was a visible component of the pilot, more robust and sustained engagement, particularly with policymakers and skeptical stakeholders, is necessary to foster deeper institutional and public support for micromobility.

Safety

It is nearly impossible to separate safety from active transportation infrastructure, thus while this factor is important to stakeholders relevant to Phoenix's decision-making, it is not unique to low-density cities. Injuries, due to improper use, inebriation, or collisions with vehicles are seemingly inherent to these free floating scooters and bicycles.

Local Climate and Topography

Whereas some cities must consider topography when planning for active transportation, climate and heat was so blatantly obvious as a predictor of ridership in Phoenix, that most interviews did not mention it, or only in passing. This factor is not unique to low-density cities, but does inform programs situated in other hot, desert settings. The average annual temperature in Phoenix is 75.6 degrees Fahrenheit, with the hottest month (July) averaging 95 degrees Fahrenheit (National Weather Service, n.d.). There is an opportunity for Phoenix to collaborate with and learn from Tempe, as ridership in Tempe exceeds Phoenix despite congruent weather patterns. Electric devices alleviate some of the physical stress presented with active modes while still offering cooling effects from the breeze generated from displacing air. However, as a director with the Phoenix Community Alliance said, "How do you promote ridership when its 115 outside?"

Operators' Capacity

Another factor the city considered when drawing the boundaries of the scooter pilot, and later the micromobility program, is the operators' ability to effectively manage their operations. The vendors pushed City of Phoenix planners to create a limit further south than what the City ultimately decided, and also asked the City to consider boundaries that would facilitate their operations in neighboring cities, like Tempe and Scottsdale. However, City of Phoenix active transportation planners shared that in the sprawling low-density metropolis of Phoenix, vendors are operating out of one warehouse location. The

City evaluated if the vendors could establish additional warehouse locations, hire more staff, and acquire more rebalancing vehicles and scooters. The evaluation process determined that the City would keep its original program footprint.

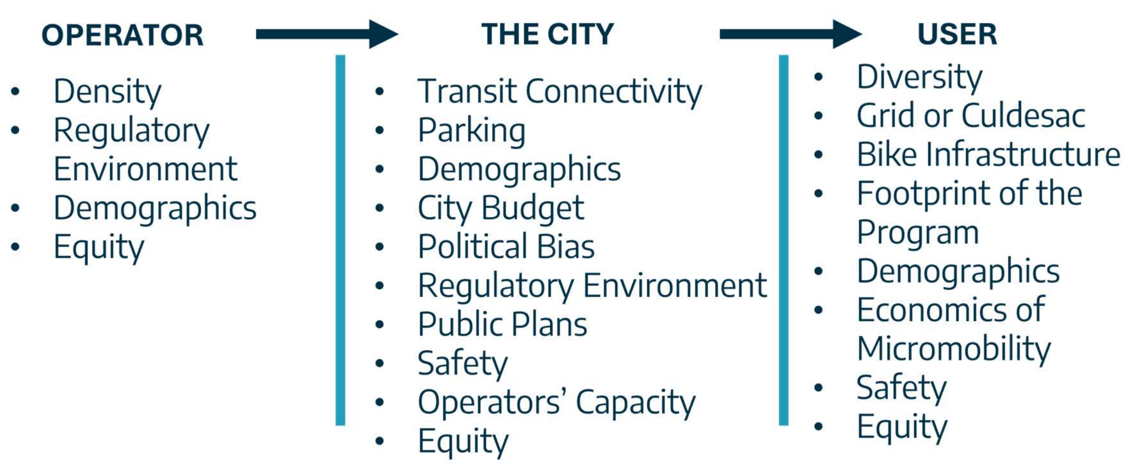
Less-Cited Factors

Vandalism, enforcement, app-based reservations, and comfort do not provide meaningful insight on the complexity of Phoenix's micromobility program, and thus were removed from the evaluation.

Placing the Factors into a Process

The resulting factors are influenced by three important decision-makers (the operator, the City, and the user) in a hierarchical process, as illustrated in Figure 12. The first level of the process begins with operators determining if they'd like to supply devices to a micromobility program. This decision rides on factors such as density, regulatory environment, demographics, and equity. Only if these factors are satisfied, will the vendor decide to supply devices. The next level in the process is the City of Phoenix. The city's approval depends on factors illustrated in Figure 12. For example, in Phoenix, if there is no parking plan or equity areas are not addressed, the devices will not be permitted. Once a program is permitted, the final factors determine if a user will utilize micromobility.

Figure 12. Process of Micromobility Factors Moving from One Actor to the Next



Discussion

Micromobility in low-density cities, particularly in the American Sun Belt, has received little attention relative to its testing and implementation in dense, urban environments. Phoenix's case study explores opportunities and limitations of micromobility in a sprawling, car-dependent context. This paper does not aim to generalize Phoenix's early micromobility experience to all low-density cities, but it does offer lessons that may apply to similar low-density landforms across the U.S., both within the Sun Belt and not.

The interviews, mapping, and policy review revealed several clear patterns of micromobility in Phoenix that may help the city plan for micromobility in the future, operators better release this technology in the future, and other cities of a similar footprint to Phoenix's plan for micromobility.

Density

Density is treated as a prerequisite for successful mobility systems. In Phoenix, density thresholds are indeed critical, acting as gatekeepers for determining the viability of a shared micromobility program. As a conceptual model, micromobility adoption can be viewed as a flowchart where density serves as the initial decision node, and once it is met, other factors can be evaluated to see if micromobility is a good fit for a place. For example, Phoenix's micromobility system was significantly affected by the political opposition of a single councilmember representing District 4, which disrupted potential connectivity across otherwise suitable areas. This kind of political veto power illustrates how micromobility in low-density cities function more like networks of dense "vertebrae"; if one dense district is removed, the system's mobility spine is compromised.

However, in low-density contexts, density appears differently than in dense, urban contexts. In Phoenix, the density threshold is not a fixed number but dependent on cultural, political, and spatial variables. Pockets of density and activity centers demonstrate the benefit of viewing density beyond population. Phoenix's ample college campuses, institutions, stadiums, and concert venues, which are sprinkled throughout the city, may be resources for the City to consider in future expansion phases.

Concentrating micromobility in these hot spots and providing clear connectivity between these locations may increase use in addition to its focus on equity zones and high-capacity transit networks.

History of Distrust Feeds into Political Chokepoints

One of the major hurdles to implementing micromobility in Phoenix has been political. An early misstep by micromobility vendors, introducing devices without coordinating with cities, created a climate of distrust. This resulted in political chokepoints where councilmembers, particularly in key districts, became resistant to further rollout. In low-density cities, this resistance has a significant impact because stakeholders in high-density neighborhoods, where ridership is concentrated, weld unequal decision-making power. Programs rely on buy-in from dense neighborhoods the city. Unlike cities like New York, Chicago, or San Francisco, where nearly every neighborhood meets the ridership threshold, Phoenix must rely on a smaller number of pockets of density, activity centers, and areas of effective density.

The role of City Council in this process cannot be understated. Councilmembers not only approve policy, but their support or opposition can determine whether micromobility thrives or does not exist. As such, stakeholder education should not be considered a supplemental task, but central to micromobility's success. City Council's questions during Transportation, Infrastructure, and Planning ("TIP") Subcommittee Council meetings revealed a level of unfamiliarity with the concepts the City Council was asked to approve and comment on (City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2021a, 2022a, 2023a, 2023c). Micromobility operators and the City Transportation department should reflect on the person presenting a concept to City Council, and if the presenter has the expertise to build trust and accurately portray micromobility to the decision-makers.

Education strategies should involve early direct engagement, including offering test rides, communicating transit connectivity benefits, and aligning messaging with the City Council's priorities (whether that be economic development, Vision Zero, or climate action). Phoenix's City Council did not say they wanted to eliminate micromobility, but rather that they did not want the deployment of these vehicles to jeopardize how others experience the city.

In cities like Phoenix, initial community outreach is important, but it should be complemented with City Council education. Public education sessions, which allow potential riders to test this technology, should be paired with quantitative analysis to see how stated preferences compare to actual behavior.

Using Funding to Benefit All

The City of Phoenix chose to not directly invest in the operations of micromobility. However, even without allocating funds to operations, the City can still play a proactive role in micromobility planning by investing in feasibility studies, quantitative analysis, and pilot programs in non-traditional places. These lower-cost, knowledge-generating efforts can provide crucial insight.

While infrastructure is important to increase micromobility ridership, not all bike infrastructure applies to micromobility. For example, the Grand Canal and canal system designed for traditional active transportation modes does not permit shared micromobility. The city can invest funds into changing access for all along these existing bike infrastructure paths instead of diverting funds to create brand-new facilities.

Take the Burden Off the Most Vulnerable Road Users

Introducing a new mode of transportation into an existing transportation system should require education for all roadway users, including drivers, pedestrians, and micromobility users. While the City of Phoenix's contracts with micromobility providers required vendors to include educational features in the mobile applications, this alone is insufficient. Education should be extended to drivers on how to behave when there is a scooter on the road. The education in the mobile micromobility application occurs at the registration phase, when riders are creating an account, and includes lessons on how users should interact with the street, such as "don't ride on the sidewalks." It would benefit all users of Phoenix's streets to receive education, so those in the largest and heaviest vehicles are aware of new, unpredictable modes on the street.

Collaborating to Re-imagine Low-Density Cities

Low-density cities, such as Phoenix, cannot simply replicate micromobility policy and implementation strategies from high-density cities. Phoenix should look to for opportunities to collaborate with peer cities across low-density cities facing similar challenges, including cities in the American Sun Belt, neighboring Tempe and Scottsdale, and NACTO member cities. A network like this could coordinate feasibility studies, share data, and test pilot programs in a mutually supportive context. Building a coalition of low-density cities could lead to innovation and create a knowledge base for micromobility planning.

User Choice: Infrastructure and safety

Many interviewees discussed the importance of active transportation infrastructure to micromobility travel demand. Yet, where and how an individual rides micromobility is a choice that only occurs after providers have supplied the devices and city council has approved the program.

Conclusion

Transportation Reform: Reframing Micromobility from Novelty to Necessity

As fall-out from the initial introduction of micromobility to cities settles and micromobility becomes an accepted travel mode, cyclist advocates, planners and micromobility operators contemplate the future of micromobility in Phoenix. Some believe the technology can provide an opportunity to bring a renewed interest to cycling and use cycling to improve quality of life, while others align the service the mode offers with transit benefits. To the former point, a bike advocate from the Tempe Bicycle Action Group said, "I think the future of Tempe is interconnected, people-first, and climate-conscious. If we do it right, cycling will be one of the defining features of our identity — not just as a mode of transport, but as a signal that we care about health, equity, and quality of life."

In Phoenix, addressing constraints in the local bicycle network to allow micromobility greater access is practical in the more immediate future. Currently, electric devices are not allowed to travel on

Phoenix's canals, which provide safe, interconnected active transportation travel lanes. Two local planners commented on this, saying, "It's not something we can change now, but in the future, we can change this."

An Arizona State University professor of planning critiqued Phoenix's street design, saying, "A street design is a 'statement of values' that reveals the optimization problem a city is trying to solve. In Phoenix, traffic lanes, unprotected crosswalks, and a lack of bicycle lanes convey the city's prioritization of vehicle flow over safety and accessibility." According to one micromobility advocate, the goal should be to transition from a city where cycling and scooting are merely possible, to one where they are "delightfully inevitable."

In Phoenix, the deployment of micromobility has not been taken seriously relative to other transportation modes, and micromobility is occasionally considered a recreational alternative instead of a legitimate form of transportation. Planners in Phoenix note how unlike traditional corridor or active transportation projects, the city launched its micromobility program without baseline data, studies, or a dedicated budget. An Arizona State University professor within the School of Geographical Sciences and Urban Planning argued that this stems from a "motor-normative" paradigm in transportation planning, which prioritizes traffic flow and cost-efficiency over accessibility and multimodal integration.

Shared micromobility challenges the foundational principles of transportation engineering by advocating for slower, more expensive, and less space-efficient travel, yet it fills mobility gaps that cars and transit cannot. Micromobility riders pay more to go slower, demonstrating that there is a transportation need not captured by the car. This pushes transportation planners into an unfamiliar realm where they lack experience, and challenges the core tenets of transportation engineering.

Stakeholders across the Phoenix region argue that micromobility must be better integrated with public transit to serve as a true mobility solution. Several experts noted that micromobility is not a "magic bullet" but a tool that can enhance transit systems by improving access to and from stations, particularly in areas underserved by bus or rail. This perspective aligns micromobility with equity goals, particularly for communities that lack reliable public transit access. Similar to public transit, shared micromobility offers public service benefits, and may require subsidies in some areas. This integration can occur on technological platforms, like payment and trip planning apps TransitGo or Valley Metro, as well as through physical infrastructure and policy. According to a planner in service delivery for TransitApp, Phoenix can look to ongoing efforts in cities like Seattle to embed micromobility within multimodal trip planning tools.

Coexistence of Private and Shared Micromobility Ownership Models

Phoenix's annual growth rate, 80,000 to 100,000 new residents per year, raises important questions about how much existing dense development can realistically accommodate this population growth. According to a local planning professor, if half of the new residents were to live in high-density areas, the absolute numbers would still be insufficient to justify new transit lines. Over the span of 20 years, the population unable to find housing in the dense development areas will move to less dense areas, reinforcing the low-density spatial patterns that have plagued the city. Small-scale, flexible transportation options will be as important a component of Phoenix's transportation future as private vehicles.

Some local pundits posit that micromobility in the city will largely trend towards privately owned devices, but there will likely remain strong demand for shared micromobility. While privately owned devices are more economical with long-term use, shared systems offer advantages such as reduced upfront cost, protection against theft, and convenience for one-way or infrequent trips (Faghih-Imani et al., 2014), benefits that cement their relevance. They also serve tourists, residents without secure bike storage, and lower-income individuals who may use shared devices and transitional tools before purchasing their own (U.S. Department of Transportation, 2025). Phoenix should plan to accommodate both private and public micromobility, ensuring infrastructure and policy applies to both.

Directions for Future Research

There are five avenues for future research into micromobility in low-density cities, specifically Phoenix, which emerged from this body of work. First, understanding the relationship between transit and micromobility in Phoenix could inform how the two modes complement or compete with each other.

Second, pilot program locations could be chosen strategically to explore unknown variables. Third, the broader impact of multi-modal transportation investments should be explored, including whether investments in multi-modal infrastructure reduce insurance liability, and in a similar vein, if multi-modal infrastructure creates "safe havens" for micromobility and active transportation use. Fourth, it is important to investigate whether the presence of micromobility users on shared paths discourages use by traditional cyclists or pedestrians. Lastly, future research could explore how residents of low-density urban environments and tourists use micromobility differently.

The General Bikeshare Feed Specification (GBFS) data did not provide maps that fostered meaningful insight. The micromobility program, at the time of this research, had a small area, so device locations appeared somewhat consistently across the map. In reviewing the data, histograms of current fuel percentages were used to infer supply and usage patterns, but the findings were ultimately outside the scope of this research.

Transit & Micromobility's Compatibility

In larger, denser cities with well-connected transit access, several studies have shown that micromobility can actually lead to a decrease in public transit ridership (Fishman et al., 2014; Jin et al., 2019; Transport for London, 2014). This substitution effect may arise because micromobility offers a faster, on-demand, and more direct point-to-point travel experience, eliminating wait times associated with transit. When users are able to reach their destination in the same amount of time, or less, by micromobility than by transit, they may be incentivized to choose the more convenient mode, especially for short trips.

However, the dynamics in Phoenix differ due to its sprawling nature and nascent transit infrastructure. The average micromobility trip length is about 1.3 miles (North American Bikeshare and Scootershare Association (NABSA), 2024). This distance could make micromobility an unlikely substitute for transit in Phoenix, where travel distances to get across town are longer. Instead, micromobility in Phoenix has the potential to function as a complement to transit, helping to bridge the "first and last mile" gap for residents traveling to and from light rail stations.

The City of Phoenix has structured its micromobility expansion strategy around transit as a critical factor. The current program expansion is designed to align closely with transit access, concentrating the micromobility program within a two-mile radius of existing light rail stations. Additionally, while private operators have expressed concerns about equity zone requirements, citing low demand, a City of Phoenix planner countered that ongoing transit expansion will increase usage and demand in these areas. The City's planning approach assumes that transit infrastructure will increase micromobility adoption, especially in neighborhoods where access to transportation has historically been limited. Future iterations of this work could evaluate the substitution factor and better understand how micromobility interacts with transit in Phoenix.

Rethinking Pilot Design and Placement

Phoenix's 2019-2023 micromobility pilot was established in the dense, commercially-driven center of the metropolis (City of Phoenix City Council, 2019; City of Phoenix Transportation, Infrastructure, and Planning Subcommittee, 2022a). In part, the pilot was constrained because there was no funding for the program outside of the position vehicle relocation, which is later written into the contract of the micromobility providers. Additionally, the downtown area had strong advocates, like PCA, while the other neighborhoods within Phoenix did not have strong advocates. While the pilot was successful in that area, the City of Phoenix did not gain an understanding of how micromobility would operate in its greater idiosyncratic urban form.

Because of these constraints, the pilot program and the program was not able to serve the community in the same way that light rail can. The constraints around downtown represent one trip purpose. Future research could suggest a pilot in locations that are more unique to Phoenix to see if it is likely to survive in those areas. If micromobility struggles, what are their struggles and why did they occur?

Liability & Multi-Modal Investments

Currently, the program operates on a neutral budget, meaning the micromobility program does not impact the city's budget, yet a shift toward financial support from the city may be considered, according to a director with PCA. Subsidies for private micromobility solutions are not new yet they remain controversial as the cost of investing those resources in private companies versus a natural solution artificially influences the market, according to a planning professor from Arizona State University. For example, a former micromobility operator shared that the City of Charleston partnered with a private sponsor to subsidize the entire program, leaving the vendor only responsible for the location and placement of devices versus competing and bringing in the highest revenue.

Future research can seek to better understand the downstream impacts, namely insurance premium changes and active transportation ridership, of investing in active transportation infrastructure, particularly as the impacts relate to micromobility. City of Phoenix planners and micromobility operators revealed in interviews that high insurance premiums and costs of liability insurance were major barriers to micromobility operators, especially for smaller non-profits. Future research could investigate if multimodal infrastructure investments, including improved bike lanes, safer intersections, and better parking infrastructure reduce injury rates, and therefore decrease insurance premiums for operators. Additionally, future research could look to see what the return on investment for such infrastructure would be for cities or private operators. If active transportation infrastructure can reduce liability exposure, it may both benefit public safety and improve the micromobility financial model.

Another research opportunity is the effect of active transportation infrastructure investments on overall ridership across active transportation modes, including micromobility. It is often assumed that improved infrastructure encourages more people to bike or use scooters, but the nature of this relationship has not been studied in the low-density context. Additionally, in Phoenix, many of the safest, most continuous, separated bicycle lanes, such as those within the canal system, are closed to electric micromobility. This suggests infrastructure investments do not equally improve the riding experience across all modes. Research could analyze whether bike lane expansions and other improvements cause mode shifts. This is relevant to micromobility in low-density cities, to see if new infrastructure leads to increases in micromobility ridership due to perceptions of safety, and whether dense clusters of micromobility activity then encourage other active transportation users. Conversely, it is also worth exploring whether the influx of fast-moving, inexperienced micromobility users on shared paths deters traditional cyclists or pedestrians.

Limitations

This research did not include interviews with micromobility users. Although surveys and travel diaries made available from the American Micromobility Panel were intended to inform user perspectives, the results did not contain sufficient data or meaningful insights. Additionally, the research did not distinguish users between Phoenicians and visitors.

There are many additional influential decision-makers who were not interviewed in this process. Multiple Lime employees were contacted with a request for an interview via email introduction from one of their colleagues, LinkedIn, or cold emails. Despite some messaging correspondence, a Lime representative was not available to sit for an interview. Several secondhand sources, like Lime CEO, Wayne Ting's, interview with The 20 Minute VC (*Wayne Ting, CEO @ Lime: From Losing $3 on Every $1 to $90M in EBITDA*, n.d.) were reviewed to better understand Lime's approach and perspective.

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