



ITS DEPLOYMENT EVALUATION

Executive Briefing



Micromobility

Introduction

Micromobility is a term referring to “any small, low-speed, human or electric-powered transportation device, including bicycles, scooters, electric-assist bicycles (e-bikes), electric scooters (e-scooters), and other small, lightweight, wheeled conveyances [1],” as defined by the FHWA. Additionally, the Society of Automotive Engineers classifies powered micromobility vehicles as those with a top speed of less than 30 mph and a curb weight of less than 500 pounds [1]. Shared micromobility refers to the communal use of micromobility devices, usually deployed by private companies in urban areas.

In the last decade, micromobility use has surged tremendously, especially in urban environments. The COVID-19 pandemic 2020 reversed micromobility usage trends as overall transit ridership fell sharply, and travelers had less need to get to and from transit hubs. However, since 2021 micromobility popularity and utilization is back on the rise. According to the National Association of City Transportation Officials (NACTO) 2023 report on Shared Micromobility, trips taken in 2023 on shared bike and scooter systems reached an all-time high of 157 million trips in the U.S. and Canada [2]. As of 2022, 158 communities were served by shared e-scooters, 35 were served by dockless bikeshare, and 61 by docked bikeshare systems in the U.S. [3]. Shared micromobility systems have become integral to many urban and suburban areas across the country due to their ability to help users navigate traffic congestion in a cost effective and flexible way. Partnerships between municipalities and micromobility companies have also been growing, aiding in regulating the public and safe integration of shared micromobility in these areas.

Personal ownership of micromobility devices has also increased. This is important for cities to keep in mind as they develop regulations and infrastructure to facilitate micromobility usage, including parking areas, micromobility use lanes, public charging for electric micromobility, and more.

Highlights

- Micromobility utilization is on the rise since the COVID-19 pandemic, with 2023 experiencing the highest usage rates ever of shared micromobility.
- Shared micromobility deployments help solve critical transportation challenges including first mile/last mile connection, greenhouse gas emissions, and increased automobile use.
- The NYC Cargo Bike Pilot was largely successful in reducing congestion and enhancing safety of last mile delivery.

This brief is based on past evaluation data contained in the ITS Databases at: www.itskrs.its.dot.gov. The databases are maintained by the U.S. DOT's ITS JPO Evaluation Program to support informed decision making regarding ITS investments. The brief presents benefits, costs and best practices from past evaluations of ITS projects.



Benefits

The rise of micromobility has transformed many urban landscapes by facilitating in first mile/last mile connections, decreasing automobile usage, and decreasing greenhouse gas (GHG) emissions.

Micromobility appeals to urban areas as a solution to vehicle and pedestrian congestion issues. An analytical study of e-scooter use in Texas revealed that the deployment of e-scooters reduced vehicle use by 47 percent. In the same study, results showed that personal vehicles were used much less often e-scooter use by 50 percent of the respondents ([2024-B01893](#)). Similarly in California, results from a

shared micromobility pilot in showed that 49 percent of trips used during the introduction of a private dockless e-bike and e-scooter program displaced car trips ([2021-B01547](#)). In Shanghai, the launch of a bike sharing program increased the proportion of cyclists commuting by 9 percent ([2024-B01827](#)). In dense urban areas, micromobility can also decrease sidewalk crowding. This is demonstrated in a simulation study in Indiana which demonstrated that 44 percent of e-scooter trips could likely replace walking ([2023-1802](#)).

Increased micromobility use has proven to be beneficial for environmental sustainability by replacing automobile usage and decreasing emissions, energy consumption, and vehicle miles traveled (VMT). An analysis of survey data from three e-bike rebate programs in California estimated that e-bikes replaces at 35 to 44 percent of VMT, thus reducing 12 to 44 kg of CO₂ emissions per person each month ([2023-1755](#)). Cargo bikes in New York City each have the potential to save seven tons of CO₂ emissions per year, equating to over 100 trees planted, or 15,436 passenger car miles traveled. These bikes also increase delivery service productivity, serving as last-mile delivery vehicles without taking up curb-space ([2024-B01859](#)). A Colorado bike sharing company estimated that their annual CO₂ emission reductions was 36.56 metric tons ([2021-B01561](#)). The implementation of the Citi Bike Program in New York saved 9,368,455 VMT, resulting in a 1.77 percent decrease in Particulate Matter (2.5 concentration) ([2024-B01856](#)). Similarly, an environmental impact assessment based on survey responses in Wisconsin revealed that an electric bike share program decreased energy consumption (kJ/mile) by 15.78 percent ([2023-B01710](#)). This proven impact on GHG emissions provides a solution to many issues in sustainability and public health.

The increased popularity of shared mobility systems has brought concerns about accessibility to the forefront. The U.S. DOT E-Mobility toolkit reports increased mobility for older adults and individuals with disabilities as a benefit of electric micromobility, due to the ease of riding compared to traditional micromobility. The toolkit also reports that electric micromobility expands mobility for underserved communities with considerably lower upfront and operating costs compared to traditional vehicles, as well

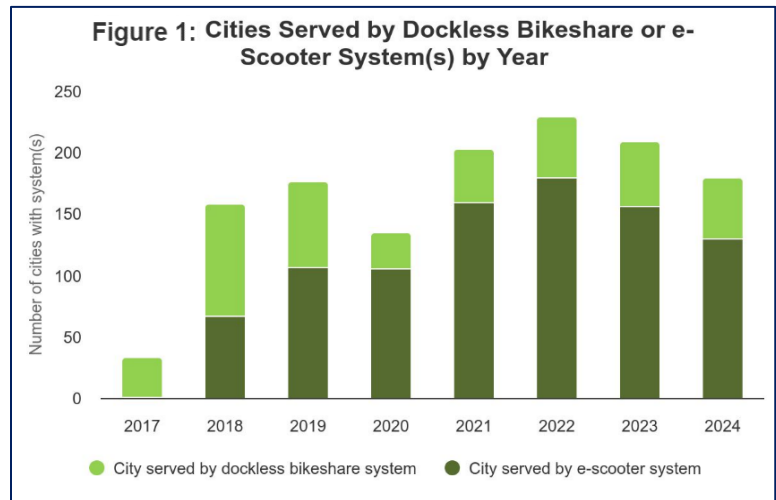


Figure 1: Cities served by dockless Bikeshare or e-Scooter System(s) by Year, from the Bureau of Transportation Statistics [4].



as discounted fare structures, credit-free access, and non-smartphone access for lower income and unbanked individuals. [5] The California study on e-bike rebate programs correlates this with results that showed that participants with lower incomes replaced car trips with e-bikes more frequently ([2023-1755](#)). Additionally, a study using a Geographic Information System (GIS)-based gap analysis created a population-density-normalized index to evaluate the impact of a planned 20-station expansion of the Baltimore bike share system. Researchers found that the expansion would lead to a 36 percent increase in the index, indicating improved access to micromobility ([2023-B01805](#)).

Agencies have moved to adapt their infrastructure to encourage micromobility usage by creating a safer environment for users using ITS. Oregon DOT spent two years testing the addition of a blue light bicycle detection system to traffic signals, and 81 percent of cyclists surveyed indicated that the devices improved their waiting experience. Over 90 percent of respondents agreed that having information about bicycles in the intersection was useful ([2021-B01586](#)). Similarly, in Washington, a camera-based Collision Avoidance Warning System installed on transit vehicles was predicted to bring an estimated \$13.1 million reduction in vehicle damage claims and \$6.9 million reduction in pedestrian injury claims, totaling \$20.0 million reduction in potential insurance payout costs. This system used cameras to provide drivers with visuals of blind zones, where vulnerable road users (VRUs) may be hidden. Buses equipped with this system saw 43 percent less pedestrian collision warnings and pedestrian zone alerts ([2023-B01799](#)). When paired with effective lane and curb management strategies, the integration of micromobility infrastructure allows for regions to offer a variety of mobility modes to all its users. Our [Curbside Management](#) executive briefing provides more insight on how to implement these strategies.

Costs

Costs for implementing shared micromobility systems vary depending on types of system installed, such as counters, shared hubs, parking zones, lockers, micromobility traffic signals, etc. These systems can vary by type of micromobility offered (i.e. bikes, scooters, skateboards), whether they are docked or dockless, electric or traditional etc. The table below lists relevant costs for previous deployments of shared micromobility systems and related technologies.

Table 1: Costs Associated with Shared Micromobility Deployments

System/Technology	Cost	Location
Smart Mobility Hub – Bike Share	Costs for the deployment and operations of bike sharing stations within the hub were \$272,452 (2023-SC00525).	Columbus, Ohio
Pedestrian and Bike Counters	A passive infrared and inductive loop pedestrian and bike counters can cost \$11K - \$25K in the first year, with an estimated annual cost of up to \$3,400 (2022-SC00529).	Raleigh, North Carolina



System/Technology	Cost	Location
Integrated Corridor Management Bike Share System	A 300-bicycle initial deployment was estimated to incur a capital cost of \$2,400,000 and an estimated annual operating cost of \$600,000 (2021-SC00496).	Des Moines, Iowa
Shared Dockless E-scooter Pilot	The system cost a total of \$287,282 on the program. \$212,077 of these costs were offset by the revenue from the program (2019-SC00417).	Portland, Oregon

Best Practices

Deployments of shared micromobility systems and infrastructure are still relatively new. There are currently several financial and integration challenges to consider when deploying. Consider these recommended practices to make the deployment process more effective, safe, profitable, and equitable.

Provide more protected bike lanes and bike parking to improve safety and support the integration of public transit and micromobility.

Based on survey results from the Bay Area's Rapid Transit System's (BART) study on the integration of micromobility and public transit, having more protected bike lanes was ranked as the top strategy needed to improve safety and micromobility experience. However, these bike lanes must be consistent and well-marked across the region to enable easier interpretation and navigation for riders to feel entirely safe making use of them. There is presently a lack of accessible and affordable secure shared micromobility parking. BART's purchase and installation of "old wave style" bike racks outside stations have addressed many complaints about inappropriate and hazardous vehicle parking. However, limited above-ground space at the transit stations may be an issue, leading to conflicting ideas regarding the optimal solution for shared micromobility parking ([2023-L01182](#)).

Thorough analyses of the needs of the area, gaps in service, cost analysis, and community education campaigns are vital to the successful integration of shared micromobility systems.

Gather both shared and personal micromobility data for better decision making. In the same California study, city managers relied on costly micromobility dashboards, despite personal micromobility outnumbering shared usage by nearly ten times in the surveyed area. Therefore, integrating bicycle and pedestrian counters with shared micromobility dashboards is recommended for informed infrastructure investment planning. Additionally, collecting data on bikes or scooters carried on the train or in the stations could help justify investment in improved racks and signage ([2023-L01182](#)).

Explore models for public-personal partnerships to provide cost-effective rebalancing of micromobility vehicles at transit stations. Sufficient rebalancing of vehicles at transit stations were observed because of the high costs of rebalancing and battery charging. Models for public-personal partnerships are needed to plan effective vehicle rebalancing, targeting transit stations during rush hour, and supporting peripheral communities to ensure comprehensive coverage ([2023-L01182](#)).

To promote accessibility, offer discounts to remove cost barriers and provide cash payment options. Cost is often a barrier to using bike sharing systems for lower income individuals. In Philadelphia, lower income residents are offered an approximately 60 percent discount on bike sharing passes to reduce cost barriers. Some travelers do not have credit or debit cards. Philadelphia offers travelers a cash payment option to remove this barrier to bike share use ([2022-L01084](#)).

Organize educational and awareness campaigns for the technology. Multiple deployments emphasized the need for educating communities about the new technologies for successful adoption. This is helpful in building general trust of the new system ([2022-L01084](#)). This outreach should be for all people: micromobility users, drivers, and transit operators. This includes an increase in marketing ([2024-L01208](#)) as well as surveys to assess comprehension rates ([2021-L01047](#)).

Accommodate new and emerging technologies with flexible deployment plans. Many emerging technologies, such as e-scooters, e-bikes, and car-sharing may enter and leave the market quickly, meaning that vendors may leave a project or partnership with little to no notice. Accommodating emerging transportation modes requires flexibility during the project development and design process and accounting for plan changes as final locations, permitting, and power access may also change and affect the implementation of these technologies ([2022-L01161](#)).

Success Story: NYC DOT Commercial Cargo Bike Deployment

In December 2019, the New York City DOT launched a two-year Commercial Cargo Bike Program. This pilot program featured 100 cargo bikes that would be used by three global commercial package delivery companies. These bikes were anticipated to help meet last-mile delivery needs in a safer and more sustainable way [6].

This program had three main goals. First, the program aims to reduce congestion by replacing trucks and vans with cargo bikes, and to reduce illegal and double parking. Second, it seeks to enhance safety by using more context-appropriate vehicles for last mile deliveries in high-density areas, thus creating fewer turning conflicts from oversized delivery vehicles. And, finally, the program intends to cut GHG emissions by reducing truck VMT in favor of low-power electric bicycles. The design of cargo bikes meets all these goals without negatively impacting commercial



Figure 2: NYC DOT pedal-assist e-cargo bicycle (Source: NYC DOT).



delivery operations, helping to prove that private companies could collaborate with the city to decrease the impact that traditional last-mile truck deliveries have on the streetscape.

The program was managed by NYC DOT Freight Mobility and coordinated with the New York Police Department, NYC DOT Parking, Commercial Bicycles Unit, and Safety Education teams. Bike operators had to complete required training and share GPS data for their vehicles. Cargo bike corrals were implemented to be designated loading/unloading areas. All bikes were expected to comply with both New York State and New York City laws. This requirement caused conflict during the pilot as some bikes were deemed noncompliant with an April 2020 State legal ruling that “bikes” cannot be more than 36 inches wide.

This pilot was largely successful. Between May 2020 and January 2021, the number of cargo bike deliveries increased 109 percent with no reported crashes. During the COVID-19 pandemic, the cargo bikes were used to make grocery deliveries and decrease crowding in grocery stores. The study reported that cargo bike miles displaced van and box truck miles at a 1-to-1 rate, resulting in a per-bike CO₂ savings of approx. 7 tons/year—equivalent to over 100 planted trees or more than 15,000 passenger car miles traveled. The success of the program led to an expansion to over 350 cargo e-bikes, including three additional delivery companies. A lesson learned to increase usage by major delivery companies and small businesses is to create further incentivization through innovative street design and curb management tools, and by developing business-friendly legislation and rulemaking for a permanent commercial cargo bike program.

In 2024, the NYC DOT has officially authorized the use of cargo bikes and finalized standards for usage [7]. They also released their own electric cargo bikes with the intention of using them for infrastructure maintenance. Cargo bike deliveries have increased significantly in New York City. In 2022, cargo bikes made more than 130,000 trips, delivering over five million packages, resulting in the reduction of over 650,000 metric tons of CO₂ emissions, the equivalent of emissions generated by 1.6 billion passenger car miles. In addition to these environmental benefits, this micromobility technology has improved safety, curb space management, and last mile delivery in the country’s most densely populated city, helping to establish micromobility as a long-term mobility solution.

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