Electric Micromobility in Oregon

A TEINA Supplemental Report

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Oregon Department of Transportation

Final Report

Electric Micromobility in Oregon

A TEINA Supplemental Report

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Contents

Foreword

This report was produced by the Oregon Department of Transportation's Climate Office under the guidance and direction of Jillian DiMedio, senior transportation electrification analyst; Suzanne Carlson, Climate Office director; and Mary Brazell, transportation electrification program manager.

The consultant project team that helped produce this report included representatives from Kittelson & Associates and Forth: from Kittelson, Wayne Kittelson, project manager, and Susan Mah, senior graphic designer and from Forth, Barrett Brown and Jeff Allen. They were joined by John MacArthur, sustainable transportation program manager at the Transportation Research and Education Center (TREC) at Portland State University.

The project team would like to thank the Portland Bureau of Transportation for its generous feedback and helpful suggestions for this report. Please note that the bureau was not asked to and has not formally endorsed the content of this report.

Executive Summary

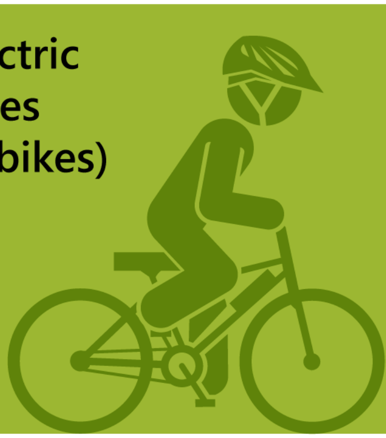
About this Report

This report provides actionable strategies and best practices for the Oregon Department of Transportation (ODOT) to facilitate e-micromobility growth. It extends ODOT's work on the 2021 Transportation Electrification Infrastructure Needs Analysis (TEINA) project, which reported on electric vehicle charging infrastructure needs for light-duty, medium-duty, and heavy-duty vehicles in Oregon through 2035. (For more on TEINA, visit https://www.oregon.gov/odot/Programs/Pages/TEINA.aspx.)

What is E-Micromobility?

Electric micromobility, or e-micromobility, refers to small mobility devices that can travel up to 30 mph and are powered (at least in part) by electric drive trains. E-micromobility devices can serve a wide range of user needs, from commuting to freight delivery. This report classifies e-micromobility devices by three categories:

Electric bikes (e-bikes)



Electric scooters (e-scooters)

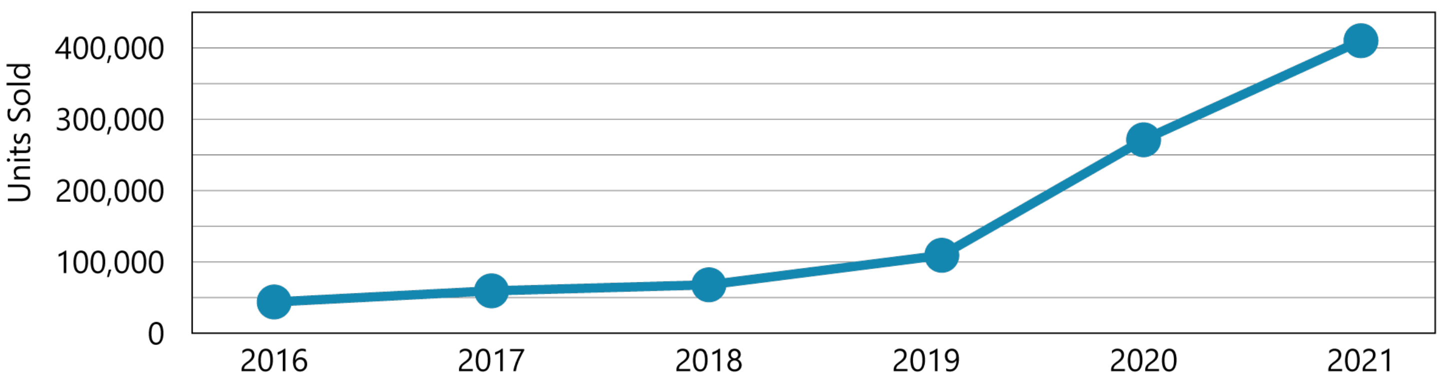
Other micromobility devices

E-micromobility devices can be privately owned or rented through sharing programs. Although they can take many forms, shared programs are typically a fleet of e-micromobility devices available for public use and accessible within the right-of-way.

E-Micromobility Today & Tomorrow

The e- micromobility industry has grown and evolved dramatically over the past ten years. In 2021, the US e-bike market was valued at $800 million, and economists expect it to grow to $1.62 billion by 2027. In 2021, it was reported that over 400,000 e-bikes were sold in the United States (see Figure 1). That figure likely represents roughly one third of all units sold in the United States. The remainder of sales not represented in this data are through online independent bicycle dealers, third party online sales, or direct-to-consumer sales (Mordor Intelligence, n.d.). On 2021 unit sales alone, e-bikes outsold electric cars (Boudway, 2021). These trends suggest a large market for e-bikes as they shift from a novelty or recreational vehicle to a viable and reliable mode for regular travel.

Figure 1. Recent Growth of E-Bike Use



Source: NPD Group, 2022

Benefits

E-micromobility can offer numerous benefits to individuals and communities by:

Overcoming Barriers to Adoption

While e-micromobility use is increasing rapidly, it still faces many barriers. The major barriers are related to safe infrastructure, education and awareness, cost, data, equity, and administration and policy.

Infrastructure

The largest barrier to e-micromobility (and all forms of micromobility) is the lack of safe and connected infrastructure, including travel lanes and facilities; secure parking; charging facilities; and integration into the broader transportation system.

How Oregon Can Prepare

- Revisit current standards and guidelines for allocating right of way for different road users.
- Increase secure parking by setting minimum standards for new private developments and by developing secure public parking facilities near transit hubs.
- Promote charging access by developing public charging at mobility and delivery hubs and alongside electric car charging installations where applicable.
- Promote coordination and integration between shared e-micromobility systems and transit agencies.

Cost

Purchasing or renting an e-micromobility device can cost less than a personal vehicle, but costs are often high enough that they remain a barrier for many consumers. Rebates, financing, and other financial incentives can make e-micromobility more accessible.

How Oregon Can Prepare

- Create a rebate or similar purchase incentive for e-micromobility devices that is graduated based on vehicle cost and household income.
- Create a purchase incentive for businesses that buy e-cargo bikes and trikes for delivering goods or services.
- Consider offering a comprehensive suite of incentives for residents with lower incomes who replace an older car with an e-micromobility device, transit ridership, or membership to combined services such as e-bike share, transit and car share.
- Help ensure that shared e-micromobility companies provide reduced subscription rates for historically underserved customers, and that they promote those plans in culturally competent ways that go beyond system apps.

Education & Awareness

Many people do not know or have misgivings about the availability and capabilities of e-micromobility devices. Some consumers may think of these devices are a fun weekend ride but do not see them as viable options for everyday travel.

How Oregon Can Prepare

- Support brand-neutral and culturally-competent opportunities for outreach, engagement, education, safety, and test rides. This should be based on feedback from communities directly to properly prioritize their needs.
- Fund and promote e-micromobility device lending libraries.

Data

To evaluate and improve e-micromobility services, government agencies and system operators need to access and use the rich data generated by shared e-micromobility systems. In using this data, agencies and operators must protect system users' privacy.

How Oregon Can Prepare

- Ensure that shared e-micromobility providers share key data (and do so utilizing open source standards) with local governments, agencies, and regulators.
- Establish, publish, and follow clear standards to ensure that all users' personally identifiable information is protected.

Equity

E-micromobility has the potential to expand equitable mobility access for historically underserved communities. But the barriers to expanding use of this technology are generally even greater for these community members. To ensure equitable access to e-micromobility, agency and operator interventions must be intentional and targeted.

How Oregon Can Prepare

- Take a "targeted universalism" approach by designing programs and policies around those with the greatest barriers to e-micromobility access.
- Design incentives for operating shared e-micromobility systems to align with equity outcomes by setting clearly-defined program goals, targeting data collection, and evaluating programs with transparency.
- Include micromobility in universal basic mobility programs.
- Implement system designs that do not create access barriers, such as those related to age, mobility limitations, smartphone and credit card requirements, or language.

Administrative & Policy Issues

E-micromobility is a new and rapidly evolving transportation mode. Legal and regulatory definitions vary widely, and this inconsistency creates confusion and uncertainty among consumers. Small and mid-sized cities often lack the resources, information, and expertise necessary to plan, coordinate, launch, and manage successful and equitable shared e-micromobility programs at scale. Funding shared e-micromobility systems is also a major challenge.

How Oregon Can Prepare

- Clarify vehicle definitions and categories, and consider joining other states in adopting the three-class classification system for e-bikes.
- Develop a clear definition and approach for commercial electric cargo bicycles that is flexible enough to allow the use of specialty vehicles (e.g., form factors, configurations, and motor capabilities), such as e-trikes.
- Pursue and leverage federal funding for shared e-micromobility programs through existing programs, and advocate for dedicated funding streams.
- Work with a non-profit operator such as Cascadia Mobility to help communities such as Corvallis, Gresham, Bend, Eugene, and Salem develop and implement coordinated shared e-micromobility equipment, operations, and financial plans.
- Use pilot programs to create and test zero-emission delivery zones

Introduction

Transportation accounts for about 40% of Oregon's greenhouse gas emissions. The state has set aggressive science-based goals to reduce greenhouse gas pollution. By 2050, Oregon aims to reduce emissions to 80% below 1990 levels. Reaching these critical goals will require significant changes to the transportation sector.[1]

Oregon is already rapidly electrifying its transportation network. Agencies and communities statewide are encouraging travelers to choose modes other than single-occupancy internal combustion vehicles and working to prioritize zero-emission modes like bicycling and walking.

More than ever before, Oregonians are using electric micromobility vehicles to get around. These e-micromobility devices include electric bicycles (e-bikes), electric scooters (e-scooters), electric skateboards, and other small devices powered in full or in part by electricity.

People use e-micromobility to commute, exercise, meet up with friends, reach transit connections, and even to move goods and freight. **With such diverse uses, e-micromobility devices will play an important and growing role in serving communities' transportation needs.**

More e-micromobility use can help the State's efforts to reduce emissions from transportation and improve community health, economic activity, and roadway congestion. **This report provides actionable strategies and best practices to facilitate the growth of e-micromobility.**

This report extends ODOT's work on the 2021 Transportation Electrification Infrastructure Needs Analysis (TEINA) project, which reported on electric vehicle charging infrastructure needs for light-duty, medium-duty, and heavy-duty vehicles in Oregon through 2035. The TEINA report found that although some public charging would help e-micromobility users, further analysis was needed to identify additional strategies for expanding the use of this mode.

Report Structure

This document is divided into four major sections:

1. **Overview of e-micromobility and its definitions**
2. **Current e-micromobility landscapes, both in the US and abroad**
3. **E-micromobility in Oregon, including challenges and barriers**
4. **Best practices, recommendations, and strategies to accelerate e-micromobility adoption statewide**

[1] *Oregon's climate goals, originally established in 2007 by House Bill 3543, were updated by Governor Brown through Executive Order 20-04 and include greenhouse gas emissions reduction of 45% below 1990 levels by 2035 and 80% below 1990 levels by 2050.*

Centering Equity

The recommendations in this report center equity and use a targeted universalism approach. Targeted universalism takes a broad goal—such as access to e-micromobility—and focuses interventions in communities with the greatest barriers to achieving intended outcomes. (For more on targeted universalism, visit https://belonging.berkeley.edu/sites/default/files/targeted_universalism_primer.pdf?file=1&force=1.)

Equality and equity have distinct meanings. **Equality** applies the same treatment to all people. **Equity** recognizes that people come with different histories and circumstances and treats them accordingly.

Consider Figure 2. Here, four people receive a standard-size bicycle that is equal: all residents get the same bicycle. But differences in age, mobility, and body size mean that not everyone benefits in the same way. When the same concept is applied equitably, everyone receives the bike that they need.

In Oregon, some neighborhoods do not have safe bicycle facilities due to a history of redlining, public disinvestment and a focus on a single mode. Targeted investment in these kinds of communities can help ensure e-micromobility access in Oregon is both safe and equitable.

Centering equity in transportation also means listening to the people most impacted by transportation inequities. This project held listening sessions with diverse e-micromobility stakeholders in Oregon and used those conversations to inform the report's findings and recommendations.

Figure 2. Visualizing Equality and Equity

Equality

Equity

Graphic inspired by Robert Wood Johnson Foundation, 2017.

Overview of E-Micromobility

Definitions

Agencies and government bodies have yet to agree on a single definition for micromobility or e-micromobility. For example:

- The Society of Automotive Engineers defines an e-micromobility device as "a wheeled vehicle that must be fully or partially powered by an electric motor, have a curb weight of less than or equal to 500 lbs. and have a maximum speed of equal to or less than 30 mph/48 kph" (SAE International, 2019).
- The Federal Highway Administration (FHWA) defines micromobility more broadly as "any small, low-speed, human- or electric-powered transportation device, including bicycles, scooters, electric-assist bicycles, electric scooters (e-scooters), and other small, lightweight, wheeled conveyances" (Price, Blackshear, Blount, Jr., & Sandt, 2021).
- Oregon DOT has its own vehicle taxonomy, illustrated in the reference card at https://www.oregon.gov/odot/forms/dmv/6619.pdf.

This report uses the term e-micromobility but focuses primarily on e-bikes and e-scooters, which are the most common vehicles used today. This approach should be reviewed and updated often, as innovation and new technology in these vehicles moves swiftly.

A Brief History

Electric bikes first exploded in popularity in China in the late 1990s. The population of e-bikes and e-bike users grew from near zero to hundreds of millions due to technology and policy developments (Cherry C., 2013).

The bikes brought many advantages, but they also brought familiar challenges, such as safety concerns and sidewalk clutter. Some Chinese cities responded to the boom and its problems—which were especially apparent with delivery services—with bans and aggressive enforcement. New York responded similarly when its e-bike population grew exponentially (Singer, 2018). In Europe, e-bikes were also gaining ground: by 2020, the majority of all bicycles sold in the Netherlands were e-bikes.

In many cities, shared scooter services soon followed, often with few regulations. Complaints about safety, sidewalk clutter, and conflicts with pedestrians spurred local governments to set stronger regulations and enforcement practices for these shared services. Despite the challenges and friction, the demand for e-micromobility continues to grow. Even partial bans and use restrictions have not overshadowed the mode's versatility and value.

Today, lithium-ion batteries and GPS technology have made e-micromobility vehicles stronger and more appealing than ever. External factors, such as the COVID-19 pandemic and human-caused climate change have further fueled the e-micromobility industry's expansion.

Figure 3. A corral for e-micromobility vehicles helps keep vehicles out of the pedestrian walking area.

Such exponential growth and potential for change has made policymakers and government officials take a closer look at these devices and their potential. Many communities have created policies and strategies that better integrate e-micromobility devices into the streetscape (see Figure 3).

Device Dictionary

To understand the potential benefits of the many e-micromobility devices available, it's helpful to review major types and their specifications.

Electric Bikes

An electric bicycle, or e-bike, has an electric motor that provides pedaling assistance or directly propels the vehicle and rider. Typically, a removable and rechargeable battery powers the motor. E-bikes are different from electric motorcycles and mopeds because the bicycles can always be pedaled by the rider—even off-road e-bikes with speed and power capabilities exceeding those of electric mopeds.

A **low-speed electric bicycle** has a federal definition, according to 15 *United States Code* § 2085: "a two- or three-wheeled vehicle with fully operable pedals and an electric motor of less than 750 watts (1 horsepower), whose maximum speed on a paved level surface, when powered solely by such a motor while ridden by an operator who weighs 170 pounds, is less than 20 mph." The federal definition permits e-bikes to be powered by the motor alone (called a *throttle-assist*) or by a combination of motor and human power (called a *pedal-assist*). The federal definition only applies to the manufacturing and the first sale of an e-bike and is regulated by the Consumer Product Safety Commission (CPSC).

At the state and local levels, e-bikes are defined and regulated by code and vary between states. In 2014, 28 states did not regulate e-bike use or had problematic definitions for devices (MacArthur & Kobel, 2014).

As of September 2022, 39 states—not including Oregon—have adopted a three-class classification system for e-bikes based on power and speed capabilities (see Figure 4) (People for Bikes, n.d.) (Seaward, 2022).

Figure 4. Power and Speed Capabilities of E-Bikes by Class

Class of E-Bikes	Pedal Assist	Throttle	Top Assisted Speed
Class 1 Pedal-assist only, with no throttle, and a maximum motor-assisted speed of 20 mph. The motor engages only when the rider is pedaling and otherwise offers no assistance.	Yes	No	SPEED LIMIT 20
Class 2 Both pedal-assist and throttle-assist with a maximum motor-assisted speed of 20 mph. The motor engages when the rider uses either the pedals or the throttle and stops assisting at 20 mph.	Yes	Yes	SPEED LIMIT 20
Class 3 Pedal-assist only, has a speedometer but no throttle and a maximum motor-assisted speed of 28 mph. The motor engages only when the rider uses the pedals and stops assisting at 28 mph.	Yes	No	SPEED LIMIT 28

Oregon's definition of an electric bicycle is similar to the federal one. According to *Oregon Revised Statues* § 801.258, an electric bicycle is a vehicle with no more than three wheels that is equipped with a motor not exceeding 1,000 watts and designed with a maximum speed of 20 mph. The *Oregon Vehicle Code* considers e-bikes as bicycles, and people can ride them on any roadway, lane, or path approved for bicycles. However, there are some exceptions: many park agencies, including Oregon State Parks, treat e-bikes as motorized vehicles and prohibit them from many areas in which bicycles are allowed.

Some e-bikes are capable of hauling cargo. People can use them for personal tasks, like picking up groceries or taking children to school. And businesses can use them instead of standard vans to deliver goods or services.

Electric freight bikes built specifically for hauling are called **cargo e-bikes and e-trikes**. These bikes and trikes are becoming more common, but many states' laws do not account for their use. Some e-cargo bikes have three or more wheels and are powered by motors that provide up to 1,000 watts, but many state laws limit e-bike electric motor power to no more than 750 watts. Cargo e-bikes often need more wattage to account for the extra weight of the cargo. States that set lower e-bike wattage and vehicle size limits may create technology constraints and legal issues for cargo e-bikes. This is not an issue in Oregon, where an e-bike can be powered by a motor that provides up to 1,000 watts.

Electric Scooters

There is no formal, widely-accepted definition of an electric scooter, or e-scooter, among state governments. The Society of Automotive Engineers has produced one taxonomy (SAE International Publishes Industry's First Standard for Classification and Definition of Powered Micromobility Vehicles, 2019). Typically, **an e-scooter** is a battery-powered two-wheeled vehicle with handlebars and a floorboard that can be stood upon while riding (see Figure 5). Different manufacturers include different features like suspension systems, turn signals, and seats.

Likewise, e-scooter laws vary, depending on whether the state defines an e-scooter as a motorized vehicle or a mobility device. California uses the definition referenced above and has some of the most comprehensive e-scooter laws in the country, including a requirement for an operating license (Fang, Weinstein Agrawal, & Hooper, 2019).

According to *Oregon Revised Statues* § 801.348, and electric scooter or "motor assisted scooter" meets the following criteria: (1) has no more than four wheels, (2) has a foot support or seat, (3) is human or motor powered, (4) has a maximum speed of 24 miles per hour, and (5) has a maximum power output of 1,000 watts.[2]

The *Oregon Vehicle Code* also regulates e-scooters. These devices cannot be operated on sidewalks, riders must be 16 or older, and riders must wear helmets.

Local jurisdictions may also add e-scooter rules. For example, Portland code prohibits scooter use on multiuse paths in its parks, such as along the Waterfront River Trail, Eastbank Esplanade, and Springwater Corridor.[3]

Figure 5. A Typical E-Scooter

[2] *See Oregon Revised Statutes, 2001 c.749 §2; 2018 c.3 §1.*

[3] *See Oregon Vehicle Code, 20.12.170–Use of Certain Devices or Equipment.*

Other Electric Micromobility Devices

Advances in electric batteries over the past decade have expanded the diversity of single-rider devices in the e-micromobility industry (see Figure 6) (Pedestrian and Bicycle Information Center, n.d.). Available devices now include:

- **electric skateboards and self-balancing boards**, known commonly as hoverboards and Onewheels
- **electric personal assistive mobility devices**, for example Segways
- **electric unicycles**

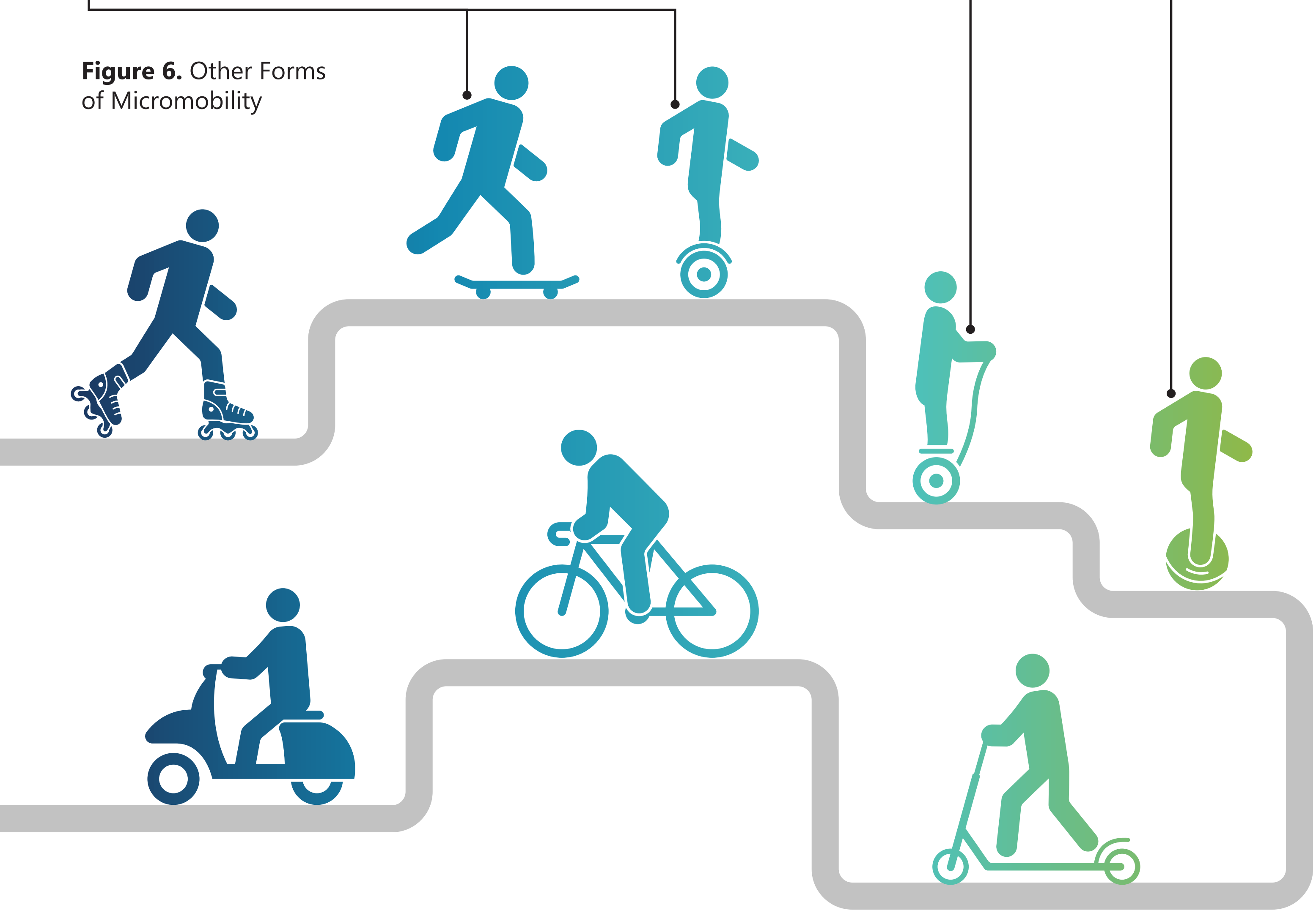


Figure 6. Other Forms of Micromobility

In a 2018 report, the Mineta Transportation Institute documented and analyzed existing personal transportation device regulations in all 50 states, 5 U.S. territories, and 101 U.S. cities. The findings reveal a murky regulatory environment, with rules often poorly defined, contradictory, or altogether absent. The laws are especially unclear for emerging low-speed vehicles (Fang, Weinstein Agrawal, & Hooper, 2019).

Oregon Revised Statutes § 801.259 considers at least some of these other e-micromobility devices to be "electric personal assistive mobility devices" (Thomas, Coon, Newton & Frost, n.d.). But Oregon law is silent on some forms of e- micromobility, such as hoverboards and Onewheels. Moving forward, Oregon will need to revise its definitions to accommodate emerging modes of e-micromobility.

Uses & Services

E- micromobility devices may be privately owned or available through shared- or rental fleet operations. Shared systems take many forms, but typically they are a fleet of devices available for public use and accessible within the right-of-way. Riders can access devices directly from a station or dock or find devices anywhere within a service area using a smartphone app. There are four main shared system types:

- **Bikeshare**.
  A well-established and often municipally-controlled mode, bikeshare is generally concentrated in denser areas, often near transit or downtown neighborhoods. Systems may include conventional bikes, e-bikes, or a mix of both. Bikeshare systems may be docked, dockless, or hybrid.

- **Shared E-Scooters**.
  Typically rented using a smartphone app, shared e-scooters are most often dockless. Vehicles may be parked within the public right-of-way instead of being left at a defined docking location. These systems are frequently branded by an operator that retains revenues but pays fees to local governments, which regulate and provide oversight.

- **E-Bike Lending Libraries**.
  At e-bike libraries, community members can borrow products without committing to purchase. Lending libraries often partner with local retailers who can provide maintenance, purchase incentives, or discounts. Libraries may be operated by retailers, traditional libraries, or nonprofit organizations.

- **Freight or Urban Delivery**.
  Commercially-owned and operated cargo e-bikes, such as the one in Figure 7, can be highly efficient urban delivery vehicles. When used in place of standard delivery vans, cargo e-bikes can dramatically reduce carbon emissions.

Figure 7. B-line uses cargo e-bikes to deliver throughout Portland.

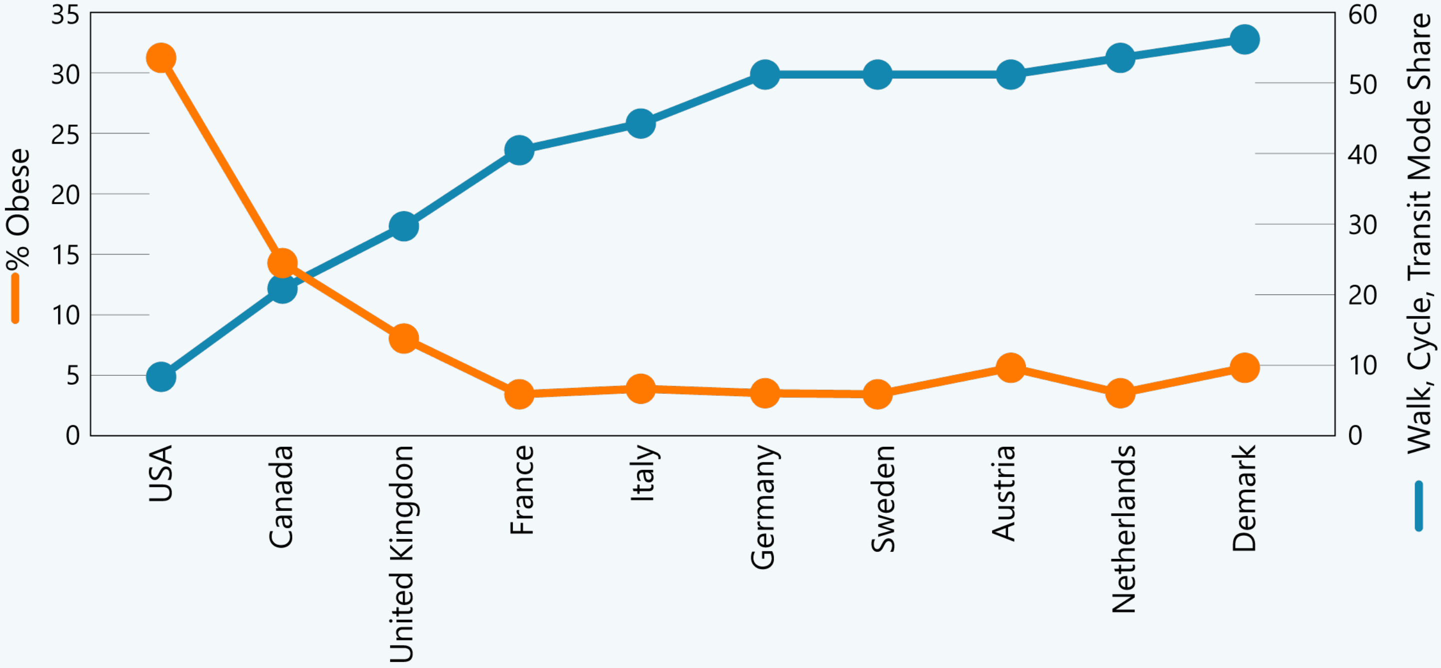
E-Micromobility Benefits

Increased e-micromobility use can benefit individuals and communities. Like other forms of active transportation, e-micromobility can improve personal health, have a positive impact on the environment and climate change, offer enhanced equity across socioeconomic groups, and reduce driving. Because the electric assist appeals to more users and can accommodate more applications (when compared to non-electric micromobility), e-micromobility has the potential to replace more car trips and have an even greater impact.

Encouraging Healthy Movement

E-biking offers many of the same health benefits as traditional biking. (The Ohio State University, n.d.). E- bikes may also improve mental health simply by getting riders to spend more time outdoors. And these benefits may be particularly important for low-income and underserved communities, which typically experience higher rates of public health problems that stem from a lack of access to nutritious food, quality healthcare, employment, and education (Steer, 2021). Figure 8 illustrates the health benefits of greater emphasis on active transportation modes.

Figure 8. Health Benefits from Shifting Modal Share



Reducing Vehicle Miles Traveled

E-micromobility has the potential to reduce automobile vehicle miles traveled (VMT). Reducing VMT reduces traffic congestion, decreases emissions, and reduces the need for car parking infrastructure. One North American survey found that 34% of e-bike owners used their devices for commuting and 29% used them for errands. The survey also found that without the e-bikes, nearly half of those commutes would have been made in private cars (MacArthur, Cherry, Harpool, & Scheppke, 2018).

Some of the top reported motivations for getting an e-bike were to overcome typical barriers to cycling, such as carrying loads, strenuousness, hills and trip distances all of which have an oversized effect on commuters not wishing to arrive sweaty to work. In this way, e-bikes expand the potential for cycling. Studies in Austria, Sweden, Denmark, and Norway point to significant decreases in VMT following e-bike deployment (Fitch, 2019).

In some cities, evidence points to shared e-scooters facilitating access to transit. Both PBOT's 2019–2020 e-scooter report and BIKETOWN's 2022 multimodal report indicate that many users combine the use of e-micromobility with other travel modes such as transit (Portland Bureau of Transportation, 2019) (Lyft, 2022). Data from Portland shows that about 40% of e-scooter users say they are driving, using taxis, and ridehailing less. Over time, users appear to be riding e-scooters more for utilitarian purposes and to access transit (Portland Bureau of Transportation, 2019). A recent review of research found that 25–40% of e-scooter trips were replacing car trips.

Reducing Emissions

E-micromobility devices produce zero tailpipe emissions. When these vehicles replace trips that would otherwise have been taken by car, they have the potential to dramatically reduce air pollution and greenhouse gas emissions (U.S. Department of Energy, 2020). For example, shifting 15% of trips from conventional single-occupancy vehicles to e-bikes would reduce Portland's carbon dioxide emissions by 12%—that's over 900 metric tons per day (McQueen M. M., 2020).

Cargo e-bikes offer even greater air quality benefits, because they replace heavier, more polluting vehicles. The BiciCarga Pilot in Bogotá, Colombia demonstrated that 16 tons of car emissions per day could be avoided by utilizing e-cargo bikes for last-mile deliveries (Newton, 2021). The Commercial Cargo Bicycle Pilot project, which began in 2019 in New York City, replaces box trucks with e-cargo bikes. The project documented a reduction of approximately 7 tons of carbon dioxide per bike per year. Each of its e-cargo bikes covers an average of 20 service miles per day, roughly the same amount that each box truck had covered (New York City Department of Transportation, 2021).

Increasing Access and Mobility Opportunities

For most people, transportation costs are generally the second greatest household expense. One Harvard University study found that commute time is the single strongest predictor of whether a person will escape poverty (Chetty & Hendren, 2015).

E-micromobility devices have the potential to advance equity because they provide faster and more affordable transportation options. Both private and shared e-micromobility options can lower costs for users and shorten travel times compared to private cars, ridehailing, and sometimes even transit. And e-micromobility generally does not require special operating licenses or certifications, which can also increase access.

Research conducted by Portland State University shows that e-bikes may increase cycling among people with mobility limitations and older people and that these vehicles may help close the bicycling gender gap. According to the study, many e-bike owners purchased an e-bike because medical conditions limited their ability to ride a conventional bike. Researchers also found that the ability to carry cargo and children on an e-bike is particularly attractive for women and that women who own e-bikes feel significantly safer riding an e-bike compared to a standard bicycle (McNeil et. al., 2018).

Due to historic redlining and other race-based policies, communities of color are far more likely to live near busy roads and suffer from higher air pollution levels. The emission-reduction benefits of e-micromobility may help improve air quality in these traditionally underserved communities (Warner, Mandy, 2020).

International & Domestic Landscape

Growth & Sales Projections

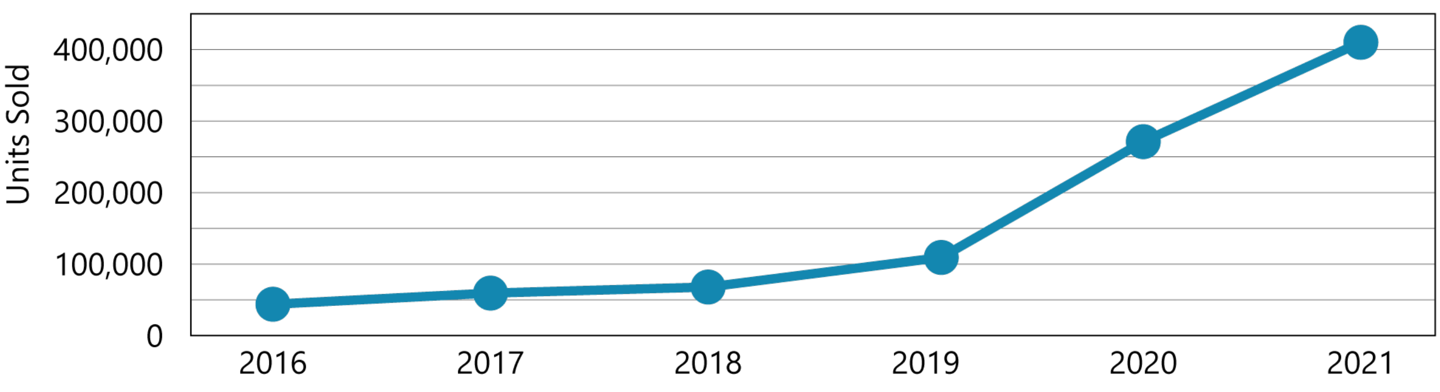
There is little data on the total number of micromobility vehicles sold and used in the United States. The best use data is collected by shared micromobility systems. As of 2021, there were 298 shared micromobility systems, including docked and dockless bike share and e-scooter systems, in North America. The largest of these shared systems has several thousand micromobility devices (North American Bikeshare Association, 2022). The North American Bikeshare Association estimates that there were 128 million unique trips on shared micromobility vehicles in 2021, nearly half of which were on shared e-scooters. E-bikes were used twice as often as their non-electric counterparts, and freight delivery services increasingly use e-micromobility devices.

Data on owning and using personal micromobility vehicles is also scant, largely because bicycles, e-bikes, and other micromobility vehicles are considered consumer products. These vehicles do not require registration, and the industry does not track sales at the state or local level.

The best data on personal ownership of e-micromobility devices is for e-bikes. The global e-bike market was valued at $27.2 billion, and economists expect it to grow to $54.4 billion by 2027 (Mordor Intelligence, n.d.). Another analysis estimates that the combined North American and European markets reached 6.4 million annual e-bike unit sales in 2021, and that in China alone, 30 million e-bike units are sold each year (Stewart & Ramchandran, 2022).

For the past few years in the United States, the conventional bicycle market has sold about 45 million units per year. In 2021, the U.S. e-bike market increased by more than 50% and likely exceeded the one-million-units-per-year mark although data is absent from online independent dealers, third party online sales and direct to consumer sales. (NPD Group, 2022). On unit sales alone that year, e-bikes outsold electric cars (Boudway, 2021). These trends suggest a large market for e-bikes as they shift from a novelty or recreational vehicle to a viable and reliable mode for regular travel. Market specialists estimate that there are likely more than 3 million e-bikes in U.S. households today (see Figure 9) (Bennett, MacArthur, Cherry, & Jones, 2022).

Figure 9. Unit Sales of E-Bikes in the United States, 2016–2021



Source: NPD Group, 2022. Bicycle Sales Market Data.

This graph is generated from data collected by independent bicycle dealers and rest of market sales, which includes sporting goods specialty, mass market, and online retailers. These data likely represent roughly one third of all units sold in the United States. The remainder of sales not represented in this data are through online independent bicycle dealers, third-party online sales, or direct-to-consumer sales.

Policies & Financial Assistance Programs

Providing funding for incentives—including rebates, tax credits, and car swap programs—is a common and effective way to accelerate e-micromobility adoption.

Purchase Incentives

Rebates and similar purchase incentives provide an incentive either at the point of purchase or after, once the purchase has been verified. Incentives may provide a flat discount or take a percentage off the total cost.

Purchase incentives can be effective in getting more people using e-bikes (Transportation Research and Education Center, 2022). While e-bikes are much less expensive than a car, prices still range from $1,000 to $5,500 and can be even higher for cargo-style e-bikes. Portland State University has reviewed e-bike incentive programs in North America and developed guidance on how to design and implement such incentives (Bennett, MacArthur, Cherry, & Jones, 2022).

As of July 2022, 65 localities in the United States offered some form of rebate toward purchasing an e-bike. Most programs were operated by electric utilities, and programs vary substantially in incentive amount and eligibility requirements. Portland State University's Transportation Research and Education Center maintains an up-to-date tracker of all domestic rebate programs (Bennett C., n.d.). Two programs are especially noteworthy due to their size and impact:

- **Denver, Colorado** administers a popular point-of-sale income-qualified rebate program that offers a maximum incentive of $1,200 for qualifying applicants and an additional $500 for e-cargo bikes.
- **The Equitable Commute Project**—a consortium of New York City-based non-governmental organizations, community development organizations, academics, and companies—is a three-year pilot program that offers a 50% e-bike discount to 5,000 qualifying essential workers with low incomes (Equitable Commute Project, n.d.). This program also tracks participants' trip data to better evaluate e- bike travel patterns for future projects.

Similar incentives are also available in many other international countries and cities, including Sweden; Paris, France; and Saanich, British Columbia (eBikesHQ, n.d.).

A tax credit is another way to incentivize e-micromobility device purchases. Tax credits can be less effective because there is a long delay between purchase and credit and because purchasers must have sufficient tax liability to benefit. However, tax credits can be designed to be fully refundable so that taxpayers without high tax liabilities still receive a refund. The proposed but not passed federal *E-Bike Act* would have created such a refundable tax credit of up to 30% or $1,500 off a new e-bike that costs less than $8,000 (117th Congress (S.2420), 2021). Although Congress did not pass this bill, it provides a useful template for future legislation.

Car Swap Programs

Car swap programs incentivize replacing a gas-powered vehicle with an e-bike. For example, California's Clean Cars for All program allows income-qualifying residents to scrap an older car and receive up to $7,500 for a cleaner car, an e-bike, bike accessories, or public transit fares. Recipients can combine these mobility options to best suit their needs (ClimateActionCenter, n.d.). Similar programs exist in a number of countries and regions including British Columbia, France, and Lithuania (eBikesHQ, n.d.) (Toll, 2021).

Infrastructure

Lack of adequate infrastructure often stands in the way of widespread adoption of e-micromobility. Innovative programs and strategies, including safe travel lanes, secure parking, and access to charging can help address these critical infrastructure gaps.

Safe Travel Lanes

Providing defined and delineated travel areas for e-micromobility devices will help increase their adoption rate (Penney, 2021). Globally, many jurisdictions are doing just that. In fall 2021, the City of Paris announced plans to make the city 100% cyclable by 2026. To do so, the City will provide 180 kilometers of fully-separated micromobility lanes (AccessWire, 2021). The City of Milan plans to have constructed 750 kilometers of fully-separated micromobility infrastructure by the end of 2035 (Green, 2022). New York City recently added hundreds of miles of bike lanes and found that in areas in with improved micromobility infrastructure, injury rates for all road users (including drivers, pedestrians, and micromobility users) fell by 40–50% (Wolfson, 2011).

Secure Parking

In December 2021, The European Commission proposed mandatory micromobility parking in all new and renovated non-residential developments (Delrive, 2021).

The Netherlands has certified micromobility parking infrastructure based on 30 individual requirements since 1999. Requirements include ease of access (with specific requirements for children and people with limited mobility); security; durability; and pricing (Oldaker, 2020). Utrecht has the largest dedicated micromobility parking facility in the world (see Figure 10). With 12,500 spaces, the facility is accessible 24/7 via a standardized public transit card and hosts a public bikeshare station (City of Utrecht, n.d.). The City expects demand for this parking facility to exceed its availability by 2025 and is already planning additional infrastructure.

Figure 10. Utrecht Bicycle Facility

Some American jurisdictions provide secure bike parking, including Oregon's TriMet, which provides bike lockers, and Go By Bike in Portland, which is the largest valet bike parking program in North America. However, facility supply continues to lag. Several startups have taken notice and launched parking services. For example, Oonee launched in New York City in 2018 and offers a modular parking system in various sizes plus optional electrical charging ports. The company has expanded to areas throughout the New York City region and has partnerships with local governments, transit agencies, nonprofits, and architecture firms (Oonee, n.d.).

Charging Access

Privately owned e-micromobility devices can generally be charged overnight at home if space and infrastructure allows. Shared devices usually have charging facilities or systems built into their design. Providing public charging for e-micromobility devices can help encourage and promote their use, especially for longer trips. Public charging also helps serve users, such as people living in apartments, who have difficulty charging at home. For example, Oregon has begun adding 110 outlets for e-micromobility device charging at West Coast Electric Highway car charging locations.

The UK and Europe also have service providers that offer public charging stations for e-micromobility:

Bike-Energy has been operating since 2011 and offers stations throughout Europe that allow any type of e-bike to be charged with the purchase of an appropriate adaptor. The company leases charging stations to businesses, communities, and local governments. They offer two station sizes, which can accommodate two to eight e-bikes. (Bike Energy, n.d.).

Bosch has initiated a pilot program in and around Switzerland with proprietary charging stations for all e-bikes that have Bosch mid-drive motor systems. Each station provides a secure locker for the battery during the charging process at no cost (Bosch, n.d.).

The City of Utrecht in the Netherlands provides stops for recreational cyclists at tourist attractions and restaurants that include parking facilities, e-bike charging, information, and basic repair tools (Steer, 2021).

Education & Awareness

Increased education and awareness of e-micromobility as a viable transportation option can help accelerate the mode's adoption and make travelers feel comfortable and confident using the technology.

E-bike lending libraries are an effective education strategy because they give community members an opportunity to test devices before purchasing. Organizations and municipalities across the US have started e-bike lending libraries.

The Colorado Energy Office launched the Can Do Colorado e-Bike Program at affordable housing developments throughout the Denver metropolitan area in spring 2021 (Colorado Energy Office, n.d.). The program now lends 181 e-bikes and 50 e-bikeshare memberships. In exchange for their membership, program participants must download an app to log rides that are then used to study e bike travel patterns (NREL, n.d.).

The City of Santa Monica partnered with Safe Routes to School to offer parents of children enrolled in eligible schools the use of e-cargo bikes for one week at no cost (The Bike Center, n.d.).

Local Motion in Burlington, Vermont, operates several e-bike lending libraries throughout the state, including one that travels to different rural communities. Local Motion offers free e-bike purchase consultations to help consumers take advantage of state and local utility rebates (Local Motion, n.d.).

Oregon's E-Micromobility Landscape

Oregon is an micromobility leader, and Portland ranks in the top 25 U.S. cities with the most bicycle commuters (Geier, 2021). This section describes the current state of e-micromobility in Oregon, focusing on different use models (personal, shared, and freight), key stakeholders, infrastructure, and current challenges to accelerating adoption.

Personally-Owned E-Micromobility

Many retailers in Oregon offer e-micromobility devices for private purchase. Some retailers exclusively sell e-micromobility products; others also offer non-electric micromobility devices. Although no state-wide incentive is available, utilities and economic development organizations throughout Oregon offer rebates for people purchasing e-micromobility devices:

- **Ashland Electric** offers a post-purchase rebate of up to $300 for an e-bike and up to $600 for an e-cargo bike (City of Ashland OR, n.d.).
- **Pacific Power** and **Corvallis-Benton County Economic Development Office** offer a limited number of income-qualified, point-of-sale rebates of up to $1,200 toward the purchase of an e-bike (City of Corvallis OR, n.d.).
- **Eugene Water & Electric Board** administers a post-purchase rebate of up to $300 for the purchase of an e-bike (Eugene Water & Electric Board, n.d.).

Shared E-Micromobility

Oregon has service providers that own, manage, and maintain shared e-bike and e-scooter fleets. **BIKETOWN** operates 1,500 e-bikes and over 180 stations in Portland and has plans to increase this number soon. **Cascadia Mobility** helps Oregon cities outside the Portland metropolitan area launch and operate equitable shared-mobility programs at scale. The organization currently operates **PeaceHealth Rides** in Eugene, which operates a fleet of non-electric bikes, and is working with the City to develop an e-scooter program.

Oregon also has had shared e-scooter programs, including ones operating in Portland, Albany, Tualatin, Bend, Milwaukie, and Eugene. However, many of these programs are no longer operational.

Data

Because e-micromobility services often rely on GPS and smartphones, localities now have new opportunities to access and understand e-micromobility travel data. Many cities in Oregon and around the world use open-source data sharing standards, like the Global Bikeshare Feed Specification and the Mobility Data Specification, to collect this micromobility travel data. ODOT's Shared Mobility Data Primer identifies key data sources and opportunities that Oregon communities can use to make data-driven decisions about where and how to deploy shared e-micromobility (Trillium Solutions, Inc., 2020).

Lending Libraries

Oregon does not currently have any e-bike lending libraries, but some retail locations offer e-micromobility test rides and rentals. Some retailers will put the cost of the rental toward a purchase (E-Bike Rentals, n.d.). The Portland nonprofit Forth has proposed creating e-bike lending libraries and was recently funded to launch such a program for houseless residents at the Bybee Lakes Hope Center in Portland (Maus, 2022).

Freight

Oregon has two freight companies that use e-cargo bikes to make deliveries. **B-line** has used e-cargo bikes to serve the Portland metropolitan area for several years. In 2021, B-line made over 41,000 deliveries and reduced VMT by more than 320,200 miles (B-Line, n.d.). **Pedalers Express** serves parts of Eugene and Springfield with electric-assisted three-wheeled cargo bikes that can transport up to 1,000 lbs (Pedalers Express, n.d.) Studies show that although they have higher labor costs and overall expenses, these operations can yield significant environmental benefits (Cherry, Azad, Rose, & MacArthur, 2019).

Other large logistics companies—including UPS and the United States Postal Service—have conducted pilot projects for three-wheeled cargo e-trikes in Oregon. Some of those vehicles are even manufactured in Oregon (Baker, 2019).

Key Oregon E-Micromobility Stakeholders

Oregon's e-micromobility landscape includes a diverse range of stakeholders, including manufacturers, retailers, operators, nonprofits, and others. Specific stakeholders include:

E-Micromobility Manufacturers	Vvolt (Beaverton) Bike Friday (Eugene) Truck Trike (Portland)
For-Profit E-Micromobility Providers	Bird B-line Lime Lyft Spin
Nonprofit E-Micromobility Providers	Cascadia Mobility[4]
Educational Organizations	Transportation Research and Education Center (TREC) at Portland State University Urbanism Next at the University of Oregon
E-Micromobility Retailers	E-Bike Store, Splendid Cycles, and Cynergy Cycles (Portland) Oregon E-Bikes (Hood River) Bend Electric Bikes (Bend)
Nonprofit Interest Groups	ABC Portland—Andando en Bicicletas y Caminando Bike About Bike Loud Black Girls Do Bike Forth Go By Bike Oregon Environmental Council The Community Cycling Center The Street Trust Electric Bikes for All coalition
Media	BikePortland

[4] *ODOT provided seed funding to Cascadia Mobility.*

Listening Sessions

In March 2022, the project team held two listening sessions with stakeholders from public agencies, academic institutions, shared service providers, freight delivery services, and non-governmental organizations. Participants discussed specific barriers to e-micromobility in Oregon today and policies and projects that can help overcome those barriers in the future.

The first listening session focused on freight and shared services. The second session focused on personal use cases and invited perspectives, insights, and expertise from key stakeholders in the personal e-micromobility space. In both sessions, participants called for updated infrastructure plans to accommodate new needs and underscored the importance of state-level rebates.

There were several key takeaways from the listening sessions:

- Setting a comprehensive and standard definition for e-bikes is an ongoing challenge because a patchwork of laws and polices makes it difficult for the industry to grow within a specific regulatory framework. This places the burden of research on the consumer to find out what can be legally used and where.
- Inadequate funding access constrains e-micromobility adoption and use.
- Bikeshare systems that include e-bikes provide better and more equitable service to individuals with certain physical disabilities.
- Hubs and corrals are most effective when integrated into both the e-micromobility system and into the larger transportation network.
- Opportunities to test drive various e-micromobility devices before purchase will accelerate the adoption curve.
- Available and reliable secure parking is a prerequisite to any e-micromobility purchase.

Expansion & Adoption Challenges

Oregon faces significant challenges to promoting the further use of e-micromobility. Such challenges relate to infrastructure, education and awareness, cost, data, and administration issues.

Infrastructure

By far the largest barrier to e-micromobility is the lack of safe and connected infrastructure.

Right-of-Way Allocation

The Oregon Bicycle and Pedestrian Design Guide and ODOT's Highway Design Manual specify that bike lanes and multiuse paths must be at least 4 feet and 10 feet wide, respectively. Neither document mentions e-micromobility devices (Oregon Department of Transportation, 2011) (Oregon Department of Transportation , 2023). Because they are often wider than standard bicycles, e-cargo bikes have trouble operating within these standards.

Standards may not allow for safe passing opportunities.

In areas with limited space, the wider footprints and faster speeds associated with some e-micromobility devices can also cause safety and operational conflicts with other modes. Since e-cargo bikes can be as wide as 4 feet, Oregon's minimum width standards for bike lanes and multiuse paths may not allow for safe passing opportunities.

Secure Parking

Publicly-accessible secure parking for e-micromobility devices is not uniformly available. Because many e-micromobility devices have larger footprints than their non-electric equivalents, storage can be challenging for renters or people with limited physical space. Because such devices are often more expensive and may have removable batteries, concerns about theft may be even greater than with conventional bikes or scooters.

For public shared systems, a lack of dedicated parking can lead to sidewalk clutter and access issues, particularly for those with mobility challenges. Portland State University research found that compliance with e-scooter parking rules was much higher on blocks with designated parking areas and that providing space for these vehicles can solve many of the complaints related to sidewalk accessibility (Hemphill, et al., 2022).

In private homes, apartments, and workplaces, bicycle parking areas may need design changes to accommodate e-micromobility devices. For example, facilities may need additional electrical outlets for charging and more ground racks (rather than vertical hanging racks) for heavier e-bikes. Affordable housing may lack elevators or secure bike parking, which forces e-bike users to carry bikes upstairs (Forth, 2018).

Charging Access

Privately-owned e-micromobility devices can generally be charged overnight at home, or their batteries can be removed for charging. Shared systems usually have charging facilities built into their design. But not everyone can easily charge their device at home. People who make longer trips or use their e-bikes more frequently may also need access to public charging.

Transportation System Integration

Most shared e-micromobility systems are not well integrated with public transit. This is both from an infrastructure perspective (lack of shared micromobility hubs along transit corridors) and from a stand point of fare integration, making it overly complex to transfer from one mode to another.

Cost

Cost—both real and perceived—remains a significant barrier for many consumers particularly where there is a lack of incentives or rebates. Depending on their size, purpose, and capabilities, e-micromobility devices can range from $1,000 to $10,000 or more. Although significantly cheaper than an automobile, they are generally more expensive to purchase than a comparable non-electric bike or scooter.

Education & Awareness

Many people remain unaware of the availability and capabilities of e-micromobility devices. Others hold misperceptions. For example, consumers may think these devices are just for a fun weekend recreational ride and not a viable option for everyday utilitarian travel. The fast pace at which this industry has developed and the lack of standardization throughout it has further contributed to this barrier.

Data

Data collection and use limits the expansion of shared e-micromobility systems in two different ways. First, to evaluate and improve services, government agencies and system operators need the ability to monitor e-micromobility use through data. However, for such a large volume of data to be useful, agencies and providers need that data to be readily accessible, efficiently archived, and easily filtered and examined for important trends and characteristics.

Researchers and operators have several available data sources:

- **MITRE** provides links to datasets, dashboards, and reports containing raw data on e-scooter use characteristics and community survey results (MITRE Corporation, n.d.).
- **Portland State University** maintains several web-accessible databases that track important e-micromobility characteristics (Portland State University, 2022), (Seaward, 2022), (Bennett C. a., n.d.)
- **Ride Report** in Portland offers cities data-driven program management, compliance, and invoicing of shared mobility programs. More than 70 cities worldwide use this database including The City of Portland. (Ride Report, n.d.).

The second data challenge is that users must feel confident that their privacy is protected. Shared systems outline their data policies in their terms and conditions, which are typically similar to transit system data policies. Generally, cities that collect data disaggregate their data or have a third party like Ride Report or Populus house the data. Disaggregation or external housing ensures that trip data is not linked to any specific individual. Nevertheless, concerns about privacy may be a barrier, particularly for undocumented riders or people with heightened privacy concerns (Golub, Serritella, Satterfield, & Singh, 2018).

Equity

There are valid concerns that e-micromobility may not be expanding access equitably. Most research on bikeshare finds that users are more likely to be men, identify as white, be young, and have higher-incomes. Most e-scooter research has similar findings, though there is some limited evidence that e-scooters might better serve people with low incomes than bikeshare (Dill & McNeil, 2021), (Wang, et al., 2002).

Most of the challenges and barriers to expanding use of e-micromobility are even greater for historically underserved communities, communities of color, and those with mobility limitations. These communities also face unique barriers.

While generally cheaper than cars, private e-bikes remain out of reach for many residents with low or middle incomes. The average e-bike costs about $2,600, whereas most current incentive programs only provide $200–$600 in assistance, if they are available at all. According to researchers at Portland State University, only 25% of financial assistance programs provide additional support for people with low incomes (Allen, 2022).

Typically, users access shared services through smartphone apps. Because they are generally only offered in English and require a credit card and data plan to function, these apps create additional barriers. Ironically, many apps advertise low-income and cash payment options in the app itself, which keeps the services underutilized by those who would benefit the most. In 2019, the Portland Bureau of Transportation (PBOT) found that nearly 60% of respondents with low incomes did not know about available payment plans and only 38% were aware of a cash payment option (Portland Bureau of Transportation, 2019).

Shared micromobility providers tend to place hubs, corrals, and devices in high demand areas and areas with existing bicycle infrastructure, where demand and ridership is higher. This is understandable, since they typically operate without public subsidy and struggle for profitability. However, these areas are typically affluent neighborhoods, and central core areas. Such placement limits access for historically underserved or marginalized communities and reinforces inequities caused by past planning, zoning, and infrastructure investment decisions.

As noted earlier, e-bikes may increase cycling among women and those with mobility challenges. However, particularly for shared micromobility systems, younger people and people with disabilities may face greater barriers to access. In order to comply with Oregon's vehicle code, these systems must prohibit use of e-scooters by youth under 16. Very few systems have requirements for adaptive vehicles so they are searching for models that expand adaptive vehicles to be more inclusive for all riders.

Administrative & Policy Issues

E-micromobility is a new and rapidly evolving mode of transportation. Small and mid-sized cities often lack the resources, information, and expertise necessary to plan, coordinate, launch, and manage successful and equitable shared e-micromobility programs at scale. Communication and coordination with traditional transit agencies is also challenging. When transit agencies are not involved or interested in funding, planning, or integrating shared e-micromobility programs, system outcomes are less ideal.

For-profit system operators may not see enough economic opportunity in smaller communities. Even if they do, the communities may not be well equipped to effectively negotiate contracts. Even larger cities have struggled to negotiate and manage effective working relationships with for-profit operators.

Funding for shared e-micromobility systems is also a major challenge. There is no single clear federal funding stream for this mode of transportation. Systems depend on a hodgepodge of state and federal funding programs for planning, equipment, and operations, each of which comes with its own restrictions and timelines. Most of these funding sources require e-micromobility systems to compete or partner with other transportation needs and modes. Such competitive funding programs also make it difficult to efficiently plan for long term operations.

Best Practices & Recommendations

This section presents best practices, recommendations, and strategies that will enhance existing e-micromobility use, mitigate its challenges, and accelerate its adoption in Oregon.

Infrastructure

Right-of-Way Allocation

Research shows that the presence of bike lanes correlates with lower rates of e-scooter riders on sidewalks and that simply prohibiting sidewalk riding is not effective (Currans, Ewing, & Iroz-Elardo, 2022). In addition to continuing investments in bicycle and pedestrian infrastructure, Oregon should revisit current standards and guidelines for allocating available right-of-way width for different road users, including e-micromobility. In doing so, it will be important to consider the surrounding urban context and the trip purposes being served.

Secure Parking

Transit corridors should prioritize secure parking facilities for privately owned e-micromobility devices. Areas with adequate electrical infrastructure, such as housing developments and shopping centers, should consider infrastructure that supports storage and charging needs. Minimum parking standards for e-micromobility vehicles tied to building and occupancy permits can help support growing e-micromobility demand. Secure parking will be especially important for those who live in apartments and those with lower incomes and fewer transportation options.

Transportation System Integration

To foster a multimodal transportation system, e-micromobility should be integrated with local and regional transit services. Research shows that shared e-micromobility systems can provide more travel options to individuals using transit and provide first-and-last-mile connections to transit. Key integration strategies include the following:

- Maximizing the number of in-service vehicles within the system.
- Siting shared-service mobility hubs and secure parking facilities with transit in mind.
- Integrating shared systems with transit trip planning and payment. Ideally, riders should be able to transfer between transit and e-micromobility with a single ticket or app.
- Well-funded and coordinated low-income programs for both transit and e-micromobility.

Purposeful collaboration between local entities responsible for e-micromobility oversight and infrastructure and transit agencies will enhance the accessibility and value of this integrated system. This might include investing public transit funding to support improvements that increase transit network access.

Charging Access

Oregon should consider and evaluate public e-micromobility charging pilot programs in areas with access to dense e-micromobility infrastructure—especially those integrated with delivery or mobility hubs. Results from evaluations should inform future efforts. The state should also ensure that new bicycle parking facilities have adequate electrical charging access for e-micromobility devices.

Oregon should also continue to install 110v outlets for e-micromobility users at electric vehicle charging stations, where appropriate. Locations near bicycle facilities, tourist destinations, or areas with dense e-micromobility infrastructure and use should be top priorities.

Cost

Rebates, financing assistance, and other financial incentives can make e-micromobility more accessible. However, these incentives must be carefully designed and account for the wide range of device prices. When designing and tracking an incentive program, government agencies and municipalities should use Portland State University's Transportation Research and Education Center's extensive research on e-micromobility incentives (Portland State University, 2022).

Oregon should create an e-bike incentive program with graduated incentives based on bike type, bike cost, and household income such as those in Colorado. A similar incentive could be given to businesses that use e-cargo bikes for delivering goods or services. Oregon should also consider offering a more comprehensive suite of incentives (like the California car swap programs) for residents with low incomes who replace older model cars.

Shared systems should also provide reduced subscription rates for people in designated underserved communities (ITS Joint Program Office, 2021).

Education & Awareness

Places where community members can test different e-micromobility devices without pressure to purchase can help people better understand and feel more comfortable with e-micromobility as a viable alternative mode of travel. Oregon should support such opportunities, including brand-neutral and culturally competent outreach, education, and test ride opportunities; e-micromobility lending libraries; and similar strategies in partnership with trusted community partners. Major employment sites and affordable housing developments are ideal locations for these programs. These approaches will be even more effective if paired with financial incentives.

E-micromobility lending libraries can help potential users determine which device best meets their unique transportation needs. Lending library surveys in Vermont and Australia (both of which also offer financial incentives) showed that 17% and 39%, respectively, of users purchased an e-bike within 12 months of using the program (Bliss, 2021).

Data

Regulating agencies should collect key data from shared systems, including trip level data using open-source standards; permit infraction data; and crash and injury data. For crash and injury data, it's important that local hospitals follow Center for Disease Control and Prevention (CDC) guidance to collect injury data related to e-micromobility accidents. Regulators should ensure data is used to assess system performance and improvement and to promote equitable access. Finally, regulators should ensure that users' personally identifiable information is protected.

Equity

A recent study found that 62% of micromobility programs have at least one equity requirement (Brown, Howell, & Creger, 2021). While more research is needed to fully evaluate the effectiveness of these requirements, the National Institute for Transportation and Communities report identifies several key approaches:

- Linking operational incentives to desired equity outcomes.
- Dedicating staff time and resources to manage shared micromobility programs.
- Matching each program requirement with targeted data collection.
- Conducting transparent evaluations.
- Defining program goals and agreeing on a shared definition of equity.
- Moving toward a model of community empowerment.

Surveys of residents in traditionally underserved neighborhoods have found that the top three changes that would increase bikeshare use according to residents were: (1) discounted bike share memberships; (2) free transfers between public transit and bikeshare; and (3) more membership options with shorter terms (McNeil, Dill, MacArthur, Broach, & Howland, 2017).

Including micromobility in universal basic mobility programs may also increase access and mobility options for low-income communities. These programs provide financial resources to people with low incomes to use on transportation services. Researchers at Portland State University evaluated a small pilot program for affordable housing residents in Portland and found interest in using financial resources for bikeshare and e-scooter share, particularly in neighborhoods where regular transit service was less frequent (Tan, McNeil, MacArthur, & Rodgers, 2021).

Local governments should work with system operators to implement systems that have been designed to overcome the specific barriers faced largely by historically underserved communities. Key access barriers of this nature include age, mobility limitations, smartphone and credit card requirements, and English-only apps.

To truly advance equitable mobility, cities must pair program-specific efforts with broader efforts. Even the most accessible shared micromobility programs cannot fully compensate for missing infrastructure, unsafe streets, or inadequate services.

Administrative & Policy Issues

Administration & Funding

Communities could consider partnering with a single entity for all shared e-micromobility services in their jurisdiction. Single operator systems typically enhance coordination, operational efficiency, and transparency. Ideally, operational management activities should be separated from equipment acquisition. The system operator could contract with more than one vendor, if necessary, but that operator should coordinate overall operations. This approach also helps to ensure communities have a choice of equipment providers and can sustain consistent long-term operations even if equipment vendors need to change.

The system operator could be for profit, or a transit agency; however, there are significant advantages to having a system operator that is a nonprofit organization. Nonprofit operators ensure better mission alignment with the local community and other partners, such as transit systems. They provide greater financial transparency and ensure that all profits are reinvested in communities. These operators can also increase access to grant and sponsorship revenue streams. A nonprofit operator across several communities can share resources and information, optimizing long term programmatic and financial outcomes, regardless of the various business models or modes offered by equipment providers. Over the past year, ODOT provided seed funding to research, design, and launch just such a nonprofit system operator - Cascadia Mobility. Cascadia Mobility was designed to serve all Oregon communities, and is currently operating programs in the Eugene area. Initially incubated by Forth Mobility, Cascadia Mobility will be a fully independent nonprofit by January 2023.

Oregon should continue its work to help bring shared e-micromobility services to communities not typically prioritized by for profit systems. Oregon should also pursue and leverage federal funding, including the new programs being created through the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, to help its communities support shared e-micromobility systems. The state should also advocate for the creation of dedicated funding streams for e-micromobility.

Vehicle Definitions

When e-bike definitions and laws governing their use differ by state and locality, it creates confusion for riders, retailers, suppliers, and regulators. Rules should be clear and consistent, so that people know when and how they can ride these devices. Clear definitions and operation rules will reduce confusion and ultimately help increase adoption. Oregon should consider joining the majority of the other states and adopting the three-class definitions for e-bikes.

Future legislation should accommodate cargo e-bikes' unique power, torque, and dimensional requirements. Freight operators have the best understanding of these devices' complicated and diverse landscape and should be directly involved in setting appropriate definitions and requirements for these vehicles.

Zero-Emission Zones

In zero-emission zones, vehicles with no emissions (like bicycles and e-bikes) and pedestrians have either exclusive or prioritized access to roadways and parking. General zero-emission zones apply to all vehicle types, but zero-emission delivery zones focus specifically on first- and last-mile freight deliveries and pickups.

Oregon should consider establishing and operating zero-emission delivery zones because they can reduce congestion and emissions. Pilot programs should vary in size and scope to accommodate different communities' needs.

Next Steps

E-micromobility is an important mode of transportation with a very small carbon footprint. It can improve personal mobility, health, and quality of life across all socioeconomic classes. It has seen significant growth over the past two decades and has great future potential. But substantial barriers remain.

It will take focused attention to overcome these barriers and maintain Oregon's leadership in the transportation industry. In addition to the short-term measures below, Oregon should regularly revisit its approach to this fast-moving mobility sector to ensure equitable access and maximum benefits for all Oregonians now and in the future.

Barrier	Key Recommendations
Infrastructure	• Revisit current standards and guidelines for allocating right of way for different road users. • Increase secure parking through minimum standards for new private developments and by developing secure public parking facilities near transit hubs. • Promote charging access by developing public charging at mobility and delivery hubs and in conjunction with electric car charging installations where appropriate. • Promote coordination and integration between shared e-micromobility systems and transit agencies.
Cost	• Create a rebate or similar purchase incentive that is graduated based on vehicle cost and household income for consumers to purchase e-micromobility devices. • Create a purchase incentive for businesses that acquire e-cargo bikes for delivering goods or services. • Consider offering a comprehensive suite of incentives for lower-income residents who replace older cars with a combination of e-micromobility, transit, or eligible cleaner vehicles. • Ensure that shared e-micromobility systems provide reduced subscription rates for historically underserved customers and promote those plans in culturally competent ways beyond system apps.
Education and Awareness	• Support brand-neutral and culturally competent outreach, education, safety, and test ride opportunities. • Fund and promote lending libraries for e-micromobility devices.

Barrier	Key Recommendations
Data	• Ensure shared e-micromobility system providers are sharing key data using open source standards and in useful forms with local governments and regulators. • Establish, publish, and follow clear standards to ensure that users' personally identifiable information is protected.
Equity	• Take a targeted universalism approach by designing programs and policies around communities with the greatest barriers to accessing e-micromobility. • Link operational incentives for shared e-micromobility systems to desired equity outcomes, with clearly defined program goals, targeted data collection, and transparent evaluations. • Include micromobility in universal basic mobility programs. • Implement specific system designs to overcome barriers to access, such as age, mobility limitations, smartphone and credit card requirements, and English-only apps.
Administrative and Policy Issues	• Clarify vehicle definitions and categorizations, and consider joining other states in adopting the three-class definitions for e-bikes. • Develop a clear definition and approach for commercial electric cargo bicycles that is flexible enough to allow the use of specialty vehicles (e.g., form factors, configurations, and motor capabilities), such as e-trikes. • Pursue and leverage federal funding for shared e-micromobility programs through existing programs, and advocate for the creation of dedicated funding streams. • Work with a non-profit operator to help smaller communities such as Corvallis, Bend, Eugene, and Salem develop and implement coordinated shared micromobility equipment, operations, and financial plans. • Use pilot programs to establish and test zero-emission delivery zones.

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