From Trikes to Seated Scooters:

Increasing Access to Micromobility through Vehicle Design

Focus groups and rider surveys inform recommendations for cities and micromobility providers

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veo

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Contributors

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Community Collaborators

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Finally, we would like to express our gratitude to the readers and stakeholders who will engage with this report. It is our hope that the findings and recommendations presented here will inspire further dialogue, inform decision-making, and foster collaborative efforts to create more equitable and inclusive mobility systems.

Key Terms

Acoustic bike: A non-motorized bicycle that relies solely on human power for propulsion.

Class 1 e-bike: A type of electric bike that is equipped with a motor that assists the rider only when they pedal. Class 1 e-bikes are also often referred to as "pedal-assist" e-bikes because the motor engages when the rider pedals. Most e-bikes offered in shared micromobility fleets today are class 1 e-bikes.

Class 2 e-bike: A type of electric bike that has a motor that engages when a rider holds down a throttle. The motor of a class 2 e-bike is controlled by the rider's throttle, moving the bike forward even when the rider is not pedaling.

Micromobility providers: Organizations or companies that offer shared micromobility services, including the deployment and management of vehicles like electric scooters and bicycles for public use.

Throttle-assist vehicles: Electric micromobility vehicles that feature a throttle for acceleration and do not require pedaling.

Shared micromobility: A transportation program in which small, lightweight vehicles such as electric scooters and e-bikes are made available to the public for shared use. Individuals rent these vehicles for short-distance travel through service provided by companies or organizations.

Underrepresented riders: Individuals or groups who are not well-represented among current micromobility riders, often due to barriers or challenges related to accessibility, safety, or infrastructure.

Executive Summary

Shared micromobility offers a convenient solution for short urban trips and, when widely adopted, holds promise to make major strides in sustainable urban mobility. However, not everyone is benefiting equally from existing micromobility systems. Ridership data reveals significant disparities, with adults aged 45+, women, people of color, and people with low incomes underrepresented.[1] Meanwhile, people with disabilities and nonbinary riders are often unaccounted for in micromobility ridership surveys.

In May 2023, Veo convened focus groups with 49 individuals in Seattle, Washington. The goal of this research effort was to identify strategies for broadening access to shared micromobility. Focus group participants represented a diverse cohort of underrepresented and intersecting identities, including riders aged 45+, people with disabilities, people with low incomes, people of color, nonbinary riders, women, and members of the LGBTQ+ community. Researchers combined qualitative data from these focus groups with quantitative data from Veo ridership surveys to identify ways to increase access.

The outcome of this research effort materialized into a series of white papers dedicated to increasing access. **This first white paper delves into how vehicle design can enhance access among underrepresented riders.**

Although extensive research has been conducted on the impact of bike lane design on micromobility access, there remains a noticeable gap in understanding how vehicle design influences accessibility.[2] Leveraging qualitative data from focus groups and community discussions at a Cinco de Mayo event, alongside quantitative analysis from Veo's 2023 Rider Survey Report, this paper illuminates pathways to enhance micromobility access through vehicle design.

This research effort identifies riders aged 45 and above and people with disabilities as groups that stand to benefit significantly from the integration of more accessible vehicle types into shared micromobility fleets. This report proposes ten recommendations to enhance accessibility for these groups.

1 4th Annual Shared Micromobility State of the Industry Report." North American Bikeshare and Scootershare Association. August 10, 2023. Accessed March 12, 2024, 12. https://nabsa.net/2023/08/10/2022industryreport/

2 MacArthur, J., McNeil, N., Cummings, A., & Broach, J. "Adaptive Bike Share: Expanding Bike Share to People with Disabilities and Older Adults." Transportation Research Record 2674, no. 8 (2020): 556-565. https://doi.org/10.1177/0361198120925079

Summary of Report Recommendations

The below ten recommendations summarize the key findings of this white paper

Observation	Example	Recommendation	Decision Maker(s)
Specific vehicle features increase access for adults aged 45+ and riders with disabilities	The following vehicle features increase access for adults aged 45+ and people with disabilities: **Throttles** allow riders who cannot physically pedal a means to propel themselves forward **Seats** provide access to riders who cannot stand for extended periods of time **A low center of gravity** increases feelings of balance, control, and comfort **Large tires** offer a more comfortable ride for navigating common street conditions like potholes, rocks, and uneven surfaces	**Offer vehicles with accessible features to increase access** Seated, throttle-assist vehicles with large tires and a low center of gravity increase access for riders aged 45+ and riders with disabilities.	Micromobility providers
Micromobility vehicles currently available for shared use do not fully meet the access needs of adults aged 45+ and people with disabilities	Feedback from adults aged 45+ and people with disabilities indicates that vehicles with three or four wheels and vehicles with seats that have back support would increase access for them.	**Innovate for a more accessible future** Micromobility providers should prioritize innovation and community engagement on the topic of accessible vehicle design to deploy new vehicle types that enhance accessibility.	Micromobility providers
Riders prefer specific vehicle types for a variety of reasons ranging from ease of use, to safety, to personal preference	The majority of riders have a preference when it comes to vehicle type: About half (53%) of riders will choose an alternative transportation option if their preferred vehicle is not available.[3] While some riders prefer a standing scooter because it's lightweight and has a low key profile, others prefer a seated vehicle that doesn't require pedaling.	**Offer mixed fleets of vehicles to accommodate communities with diverse needs** Micromobility providers should ensure that their fleets offer a diverse range of vehicle types to cater to the varied needs and preferences of community members.	Micromobility providers
Communities are unique – what works in one community may not work in another	Vehicle preferences within a community may vary based on factors such as demographics, weather, topography, bike infrastructure, and more.	**Use data to guide fleet composition** City decision makers and micromobility providers should track ridership trends by vehicle type and adjust fleet composition based on demand.	City decision makers Micromobility providers

3 "2023 Rider Survey: Building for a New Era." Veo. November 15, 2023, 17. https://www.veoride.com/wp-content/uploads/2023/11/Veo-2023-Rider-Survey-Report.pdf

Observation	Example	Recommendation	Decision Maker(s)
Micromobility policies can influence access	Cities that are leveraging policy to increase access with more accessible vehicle types include New York City, NY; Milwaukee, WI; Berkeley, CA; Newark, NJ; and Washington, DC (see details on page 21).	**Incentivize mixed fleets with accessible vehicles** Cities should require micromobility providers to offer mixed fleets, with a guarantee that a meaningful mix of seated and standing vehicles with accessible features will be available to the community at all times.	City decision makers
	Overly-stringent regulations regarding vehicle type can inadvertently exclude new and innovative vehicle types from deployment. For example, a rule that requires vehicles to have two wheels only or weigh a maximum of 50 lbs precludes the possibility of including more accessible, self-balancing vehicles like trikes into a community's fleet.	**Make regulations that prioritize access but remain flexible** City regulations on micromobility types must evolve with the pace of innovation to accommodate vehicles that broaden access to a wider range of riders.	City decision makers
Prioritizing "active transportation" in micromobility programs can limit access for older adults and riders with disabilities	Focusing solely on vehicles that require pedaling restricts access for riders who are unable to pedal or are uncomfortable pedaling.	**Choose access over active transportation** To enhance accessibility, city stakeholders should prioritize vehicle types that maximize access, rather than exclusively focusing on pedal-powered options.	City decision makers
Addressing vehicle access alone isn't enough to increase access among older adults and riders with disabilities	Affordability challenges can impede access.	**Incorporate discounts for people with disabilities and older adults** Micromobility programs should offer discounts for people with disabilities and older adults to encourage and increase access.	City decision makers Micromobility providers
	Not everyone perceives micromobility as inclusive to their needs, owns a smartphone, or is comfortable using smartphone apps.	**Conduct community outreach to adults aged 45+ and people with disabilities** These efforts should raise awareness about accessible vehicle options and offer guidance on smartphone use and access methods for those without smartphones.	City decision makers Micromobility providers
	The parking and riding of micromobility vehicles on the sidewalk can impede transportation access for people with disabilities who are not using micromobility.	**Clear the sidewalks of micromobility vehicles** Cities and micromobility providers must work together to upgrade micromobility infrastructure (eg. adding on-street parking corrals and protected bike lanes) to clear the sidewalks of shared vehicles so people with disabilities can travel comfortably and safely in the pedestrian right of way.	City decision makers Micromobility providers

Introduction

Shared micromobility offers a convenient solution for short urban trips and, when widely adopted, holds promise to make major strides in sustainable urban mobility. However, not everyone is benefiting equally from today's micromobility systems. Ridership data reveals significant disparities, with adults aged 45+, women, people of color, and people with low incomes underrepresented.[4] Meanwhile, people with disabilities and nonbinary riders are often unaccounted for in micromobility ridership surveys.

On the topic of increasing access to micromobility, there has been extensivve research focused on how protected bike lanes are key to increasing ridership among underrepresented riders.[5][6][7] This research has found that unprotected bike lanes favor only the most confident riders, who tend to be adult men.[8] In order to make riding feel safer for a wider range of people, transportation experts recommend that cities upgrade their streets with safer bike lane designs to better serve riders of "all ages and abilities." [9]

While there has been substantial research into how bike lane design affects access, there remains a notable gap in understanding the influence of vehicle design on micromobility access.[10] Current research on this topic is limited but suggests that micromobility vehicle types often cater to specific demographic groups. For instance, Veo's 2023 Rider Survey Report outlines how adults aged 45+ and people with disabilities are nearly twice as likely to prefer seated, throttle-assist vehicles over standing scooters.[11]

The Importance of Affordable and Accessible Transportation for People with Disabilities and Older Adults

Transportation access is crucial for older adults and people with disabilities to lead fulfilling lives. Affordable transportation can be a lifeline, helping individuals stay independent by providing access to grocery shopping, medical appointments, friends and family, and more. Without adequate transportation, older adults and people with disabilities can become isolated and struggle to meet daily needs. [12]

4 "4th Annual Shared Micromobility State of the Industry Report." North American Bikeshare and Scootershare Association. August 10, 2023. Accessed March 12, 2024, 12. https://nabsa.net/2023/08/10/2022industryreport/

5 Jennifer Dill and Nathan McNeil, "Four Types of Cyclists? Testing a Typology to Better Understand Bicycling Behavior and Potential." Transportation Research Record, 2387 no. 1, 129-138. https://doi.org/10.3141/2387-15

6 "Designing for All Ages & Abilities." National Association of City Transportation Officials. December 2017, 3-4. https://nacto.org/wp-content/uploads/2017/12/NACTO_Designing-for-All-Ages-Abilities.pdf

7 "Equitable Bike Share Means Building Better Places for People to Ride." National Association of City Transportation Officials. July 2016. https://nacto.org/wp-content/uploads/2016/07/NACTO_Equitable_Bikeshare_Means_Bike_Lanes.pdf

8 "Designing for All Ages & Abilities." National Association of City Transportation Officials. December 2017. Accessed March 12, 2024, 3. https://nacto.org/wp-content/uploads/2017/12/NACTO_Designing-for-All-Ages-Abilities.pdf

9 ibid

10 MacArthur, J., McNeil, N., Cummings, A., & Broach, J. "Adaptive Bike Share: Expanding Bike Share to People with Disabilities and Older Adults." Transportation Research Record 2674, no. 8 (2020): 556-565. https://doi.org/10.1177/0361198120925079

11 "2023 Rider Survey: Building for a New Era." Veo. November 15, 2023. Accessed March 12, 2024, 18-19. https://www.veoride.com/wp-content/uploads/2023/11/Veo-2023-Rider-Survey-Report.pdf

12 "The Role of Transportation in Addressing Social Isolation in Older Adults." National Center for Mobility Management. July 2020, 8. https://nationalcenterformobilitymanagement.org/wp-content/uploads/2020/06/FINAL_CONDENSED_SOCIAL-ISOLATION-RESEARCH-PAPER.pdf.

As the U.S. population ages, the need for transportation access for older adults and people with disabilities is becoming even more pronounced. By 2050, the number of Americans aged 65+ is projected to increase 47%.[13] Approximately 2 in 5 of these individuals will have a disability.[14]

Ensuring transportation access for these groups is vital; however, they continue to be underserved in existing transportation systems. This includes shared micromobility, with many older adults and people with disabilities feeling excluded due to physical limitations.[15] More research is needed to uncover the specific barriers that these groups face when it comes to using micromobility.[16]

Micromobility Fleet Composition in the U.S.

The North American shared mobility market is still in its early stages of vehicle development, with the majority of vehicles requiring riders to pedal or stand using class 1 pedal-assist e-bikes and stand-up scooters. Shared micromobility providers have begun to introduce new vehicle types into their fleets, including seated scooters, class 2 throttle-assist e-bikes, and a limited number of adaptive bicycles. Some providers offer adaptive wheelchair devices, designed to convert human-powered wheelchairs into electric wheelchairs. However, these devices get little to no use.

There is potential for a variety of new vehicle types, such as three-wheeled trikes, multi-passenger vehicles, cargo bikes, and all-weather riding vehicles, to open up micromobility to new riders. Understanding how these new vehicle types can increase accessibility may lead to more inclusive designs tailored to the needs of underrepresented groups.

13 "2023 National Population Projections Tables: Main Series." United States Census Bureau. Accessed March 12, 2024. https://www.census.gov/data/tables/2023/demo/popproj/2023-summary-tables.html.

14 "Prevalence of Disabilities and Health Care Access by Disability Status and Type Among Adults — United States." Centers for Disease Control and Prevention. Accessed March 12, 2024. https://www.cdc.gov/ncbddd/disabilityandhealth/features/kf-adult-prevalence-disabilities.html

15 MacArthur, J., McNeil, N., Cummings, A., & Broach, J. "Adaptive Bike Share: Expanding Bike Share to People with Disabilities and Older Adults." Transportation Research Record 2674, no. 8 (2020): 556-565. https://doi.org/10.1177/0361198120925079

16 ibid

Focus Groups in Seattle, Washington

In an endeavor to foster a more inclusive future for the industry, Veo conducted a set of four focus groups in Seattle in May 2023. Through conversations with 49 members of the community, the researchers sought to learn how to increase access to micromobility among underrepresented and historically underserved groups, including adults aged 45+, people with disabilities, nonbinary riders, women, people of color, and people with low incomes.[17]

Seattle was an ideal location to host these focus groups. The researchers chose a city where micromobility is thriving and shared mobility is part of the transportation culture. Micromobility usage in Seattle is at record high, reaching more than 5 million rides in 2023.[18] Seattle has also been recognized as one of the most bikeable cities in the U.S., ranking in the 95th percentile of People for Bikes 2023 City Rankings.[19] Furthermore, more than 500 people in Seattle took Veo's latest rider survey, providing a wealth of information on needs and preferences among Seattle's broad rider base.

17 "4th Annual Shared Micromobility State of the Industry Report." North American Bikeshare and Scootershare Association. August 10, 2023. Accessed March 12, 2024, 12. https://nabsa.net/2023/08/10/2022industryreport/

18 "Scooter and Bike Share - Data and Permit Information." Seattle Department of Transportation. June 12, 2023. https://www.seattle.gov/transportation/projects-and-programs/programs/new-mobility-program/scooter-bike-share-data

19 "Seattle Washington, United States." People for Bikes. Accessed March 12, 2024. https://cityratings.peopleforbikes.org/cities/seattle-wa

Findings

Vehicle Preference by Comfort Level and Trip Type

A significant portion of the focus group sessions was spent gathering feedback about vehicle types. A total of 34 focus group members participated in vehicle test rides and completed feedback booklets about each vehicle. 94% of participants identified as being part of one or more groups considered underrepresented or underserved in micromobility. Approximately 38% of participants identified as having a disability, and 27% were aged 45 or older.[20] While participants were able to provide feedback on each vehicle, they were not obligated to test ride all vehicles.

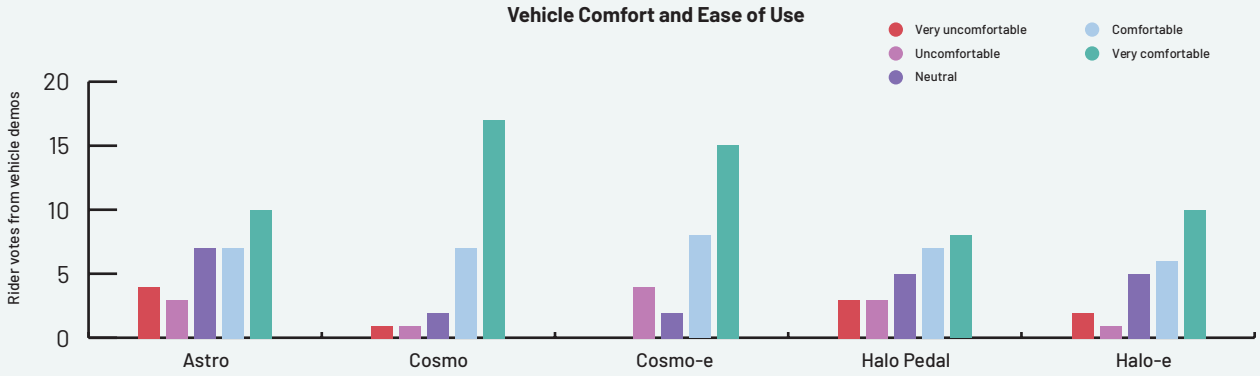
Table 1. Test rides: Vehicle Preference by Comfort Level and Trip Type

Vehicle comfort/ease of use: Ratings represent net comfort votes in rider booklets (total "comfortable" votes minus "uncomfortable" votes).
Trip type: Trip type is featured if the vehicle received 10 or more votes in rider booklets. Feature is in bold if an item received 20 or more votes.

20 Focus group participants responded "yes" if they had any of the following disabilities: Mobility (Difficulty walking or climbing stairs), Independent Living (Difficulty doing errands alone), Cognitive (Difficulty concentrating, remembering, or making decisions), Sensory (Difficulty hearing and/or seeing), or Personal Care (Difficulty dressing or bathing).

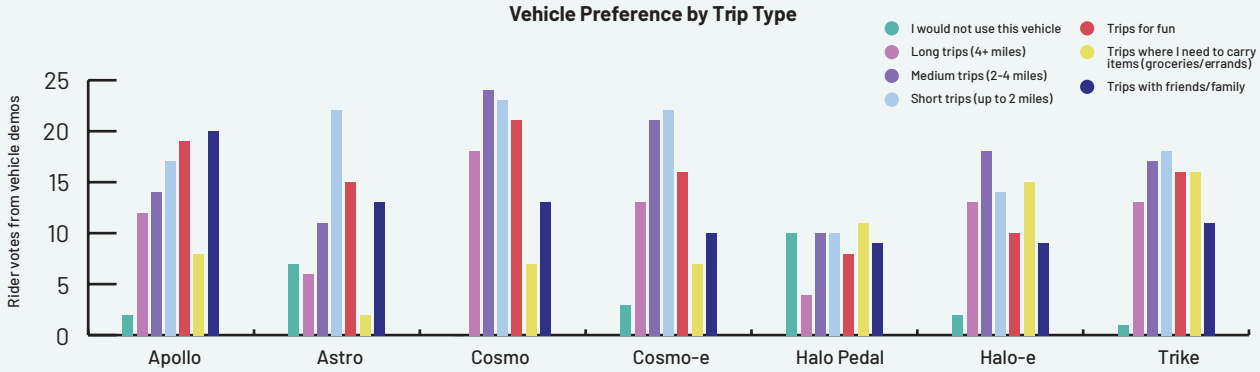
	Vehicle Name & Description	Comfort / Ease of Use *Green= Comfortable (> 15 votes)* *Yellow= Somewhat comfortable: (10-15 votes)* *Red= Uncomfortable: (< 10 votes)* *Empty= Vehicle not available for demo*	Trip Type *Short trips (up to 2 miles)* *Medium trips (2-4 miles)* *Long trips (4+ miles)* *Trips for fun* *Trips to carry items (eg. groceries)* *Trips with friends/family*
	**Apollo** Two-seated throttle-assist e-bike	Not available for demo	✓Short trips (up to 2 miles) ✓Medium trips (2-4 miles) ✓Long trips (4+ miles) Trips ✓for fun ✓**Trips with friends/family**
	**Astro** Classic throttle-assist standing e-scooter	Somewhat comfortable	✓**Short trips (up to 2 miles)** ✓Medium trips (2-4 miles) ✓Trips for fun ✓Trips with friends/family

	Vehicle Name & Description	Vehicle Comfort / Ease of Use	Trip Type
	**Cosmo** Throttle-assist seated e-scooter with foot rest	Comfortable	✓**Short trips (up to 2 miles)** ✓**Medium trips (2-4 miles)** ✓Long trips (4+ miles) ✓**Trips for fun** ✓Trips with friends/family
	**Cosmo-e** Throttle-assist class 2 e-bike with pedals - riders can use throttle or pedals to propel themselves forward	Comfortable	✓**Short trips (up to 2 miles)** ✓**Medium trips (2-4 miles)** ✓Long trips (4+ miles) ✓Trips for fun ✓Trips with friends/family
	**Halo pedal bike** Classic bike with pedals (non-electric)	Uncomfortable	✓Short trips (up to 2 miles) ✓Medium trips (2-4 miles) ✓Trips to carry items (eg. groceries)
	**Halo e-bike** Electric assist class 1 e-bike	Somewhat comfortable	✓Short trips (up to 2 miles) ✓Medium trips (2-4 miles) ✓Long trips (4+ miles) ✓Trips for fun ✓Trips to carry items (eg. groceries)
	**Trike** Two-seated throttle-assist e-scooter	Not available for demo	✓Short trips (up to 2 miles) ✓Medium trips (2-4 miles) ✓Long trips (4+ miles) ✓Trips for fun ✓Trips to carry items (eg. groceries) ✓Trips with friends/family



Seated, throttle-assist vehicles (Cosmo and Cosmo-e) were rated most comfortable across all vehicle types that were available in the demo.

Focus group participants did not rank the Apollo or Trike as these vehicles were not available in demos



Workshop participants tended to choose seated, throttle-assist vehicles (Cosmo and Cosmo-e) for longer trips. Vehicles with baskets (Trike, Halo, Halo-e) were ranked high for trips where riders need to carry items. The two-seated Apollo ranked highest for trips with family and friends.

Supporting longer trips

Workshop participants tended to choose seated, throttle-assist vehicles (Cosmo and Cosmo-e) for longer trips. This feedback aligns with Veo ridership data that shows riders travel on average one mile longer on the seated Cosmo than when using standing scooters. Making it easier for riders to use micromobility to travel longer distances is particularly important in enabling riders to replace more car trips with micromobility. Vehicles that support longer trips can also be helpful for traveling longer distances at night and on weekends, when bus service may be less frequent or not operating at all.

Most comfortable: Seated, throttle-assist vehicles with large tires

The seated Cosmo and Cosmo-e were rated most comfortable across all vehicle types during the focus group demos. These vehicles have large tires, a lower center of gravity, and allow riders to propel themselves forward with a hand-powered throttle. Rider feedback from the focus groups indicates the ability to sit and lack of a requirement to pedal provides a more comfortable and more accessible ride. Multiple participants also said that the throttle is beneficial for navigating Seattle's hilly terrain, and that the Cosmo's larger tires make them feel safer when riding, especially over potholes and uneven surfaces. This feedback is consistent with findings from Veo's 2023 Rider Survey Report, which found that the Cosmo is the most popular vehicle type, with older riders, riders with disabilities, nonbinary riders, and women having a stronger preference for this vehicle type.[21]

Mixed reviews: Stand-up scooters and class 1 pedal-assist e-bikes

The Astro standing scooter received the most mixed reviews. While focus group participants gave this vehicle the most "uncomfortable" votes, others ranked it highly for comfort and a preferred vehicle for short trips.

Conversations with riders shed some light on these mixed reviews: Multiple people said they like the Astro because it's lightweight and has a low-key profile. For example, one rider in the Chinatown International District focus group said standing scooters feel smaller and more agile, which results in safety and maneuverability benefits. Several people suggested the stand-up Astro may be more popular for younger riders. However, some riders expressed a strong reluctance to use the vehicle, citing concerns about safety. For instance, one individual at the Cinco de Mayo tabling event stated, "I would never use a standing scooter - it feels unsafe."

Similarly, the Halo class 1 e-bike, which requires riders to engage the e-assist by pedaling, received mixed reviews. This vehicle is often less favored than the Cosmo and Cosmo-e because some riders are unable or unwilling to pedal during their journeys.

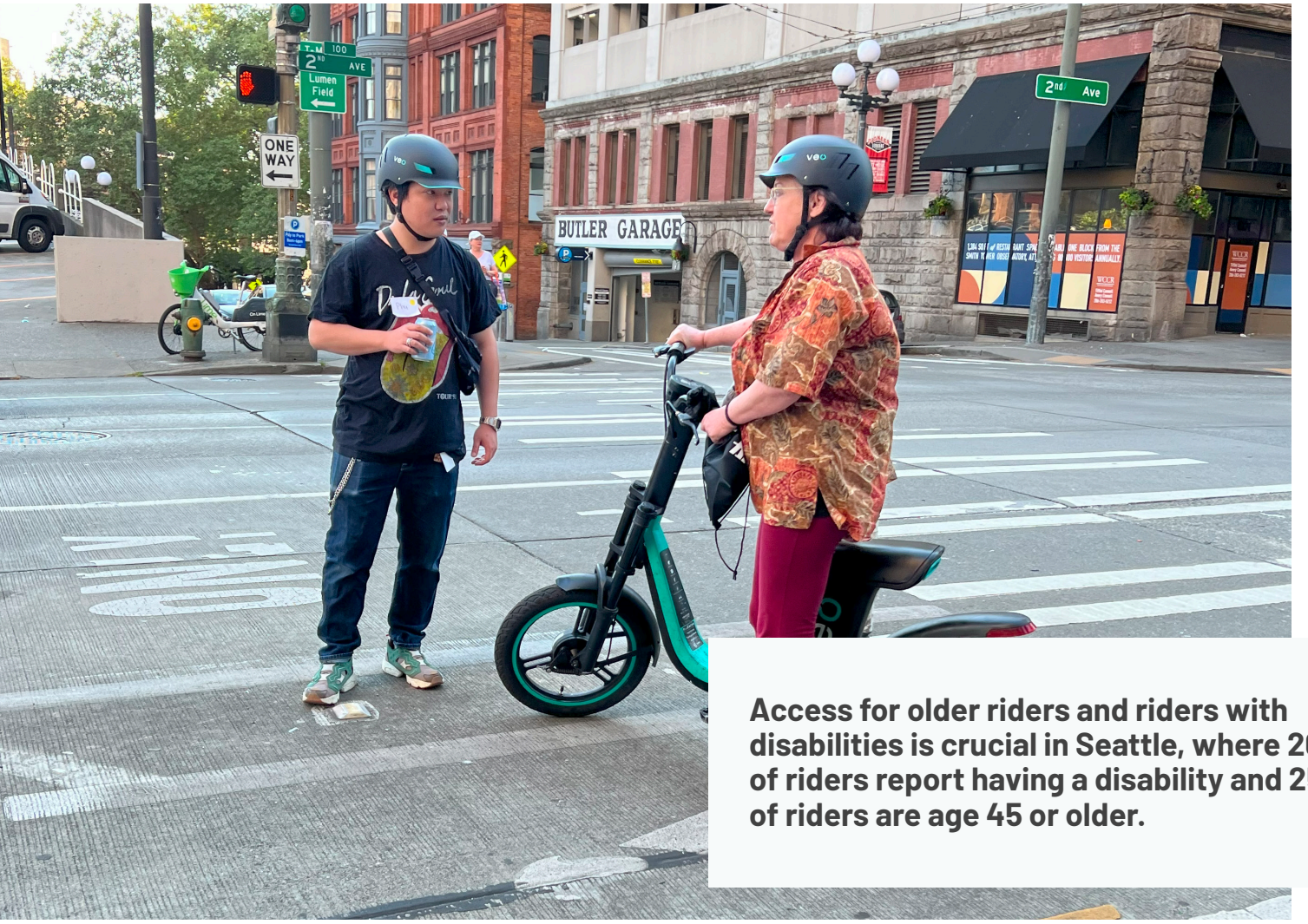
21 "2023 Rider Survey: Building for a New Era." Veo. November 15, 2023. Accessed March 12, 2024, 20. https://www.veoride.com/wp-content/uploads/2023/11/Veo-2023-Rider-Survey-Report.pdf

Least comfortable: Pedal-only "acoustic" bikes

The Halo pedal bike, which requires riders to pedal with no e-assist, emerged as the least comfortable vehicle option, with the highest number of riders checking the box for "I would not ride this vehicle." A community member at the Cinco de Mayo tabling event put it simply, stating "I don't want to pedal." Overall feedback from the focus groups and Veo's rider survey indicates that when more physical effort is required, fewer people are inclined to ride.

Vehicle features that support convenience, safety, and versatility

Many focus group participants shared how baskets and phone holders would improve the rider experience. Participants shared that baskets provide added carrying capacity for grocery shopping and running errands, making micromobility a versatile choice for everyday needs. Phone holders are another feature focus group participants requested. Participants shared how giving riders the hands-free ability to view a map on their phones can be particularly helpful for tourists and riders who are new to navigating their city from the bike lane.



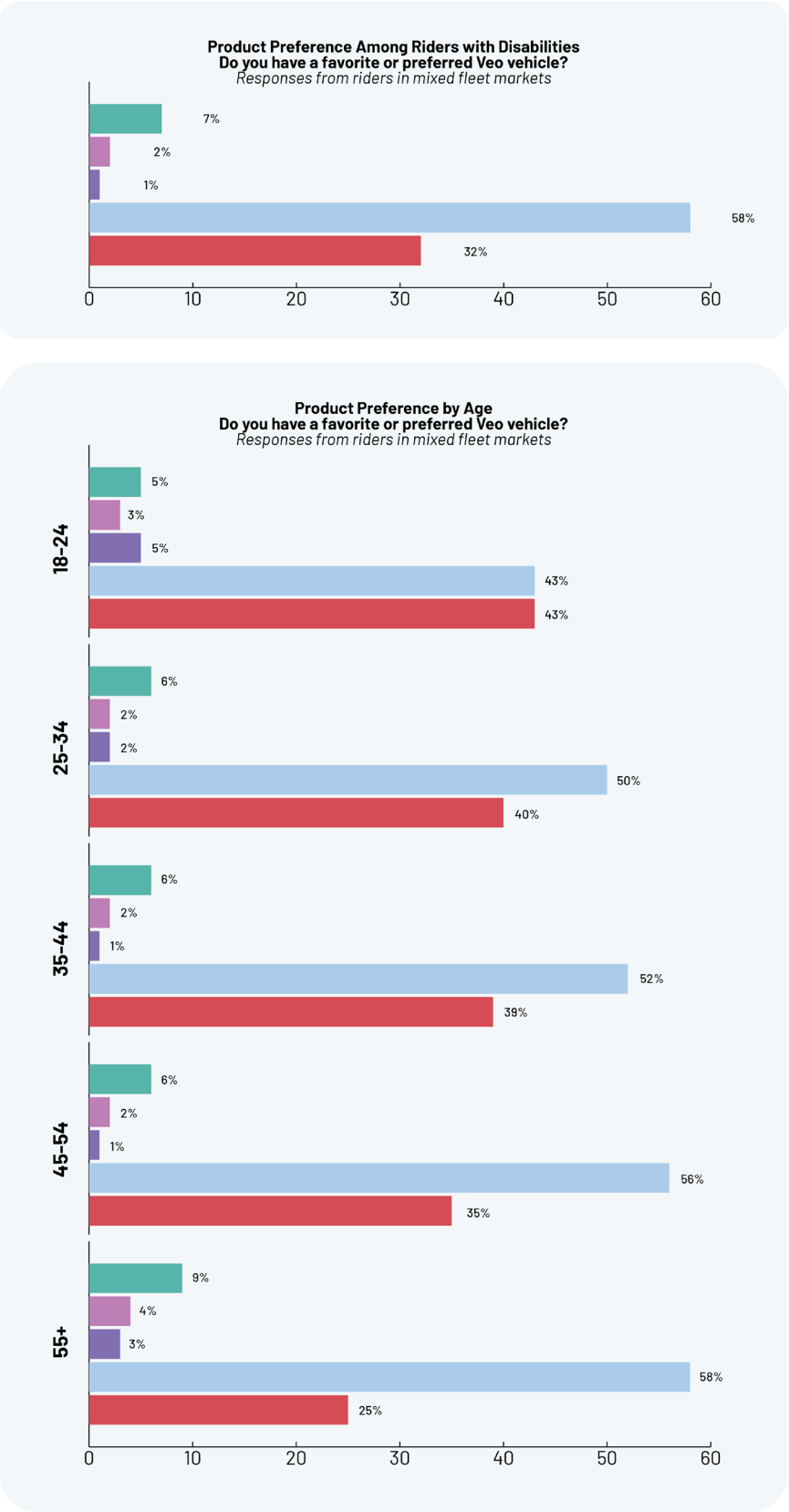
Access for older riders and riders with disabilities is crucial in Seattle, where 20% of riders report having a disability and 25% of riders are age 45 or older.

Seated, Throttle-Assist Vehicles Increase Access for Riders Age 45+ and People with Disabilities

For some riders, the presence of a seat and a throttle can determine whether or not they are willing or able to use micromobility. Feedback from the focus groups indicated that seated, throttle-assist vehicles can significantly increase access for older adults and people with disabilities. These findings align with Veo's 2023 rider survey, which found that riders aged 45+, riders with disabilities, nonbinary riders, and women tend to favor the Cosmo and Cosmo-e models.[22]

22 "2023 Rider Survey: Building for a New Era." Veo. November 15, 2023. Accessed March 12, 2024, 18- 20. https://www.veoride.com/wp-content/uploads/2023/11/Veo-2023-Rider-Survey-Report.pdf

Veo 2023 Rider Survey Report Data



Riders in Seattle

"The seated [bike] is the only vehicle I can use. Before Veo, I had no way to leave my house."

A rider in the Veo rider focus group who is paralyzed in his right leg and cannot pedal or stand commenting on the Cosmo-e

"I'm low vision; but I have enough vision to ride around Seattle via Veo....Veo has made getting to my doctors easier. Their clinic is located on a very high hill, 4 miles from my apartment."

Rider aged 55+ who uses the Cosmo-e and participated in the Veo rider focus group

"The [vehicle with a] seat is better when my strength is lower."

Rider in the Chinatown International District focus group who has a disability

"I have a mobility issue and can only use the seated vehicle."

Rider in the Seattle LGBTQ+ Center focus group who has a foot injury and said that they cannot stand for long periods of time

"Not having to pedal is huge for people like me."

Community member feedback from Cinco de Mayo event tabling event

"I'm disabled and I lost my foot in the army so the bikes you don't have to pedal are amazing."

Feedback from a Seattle rider in Veo's 2023 rider survey

"Having an e-bike around makes my life as a disabled youth much easier and frees me from being stuck at home."

Feedback from a Seattle rider in Veo's 2023 rider survey

"Not having to pedal is better for my hurt knee."

Community member feedback from Cinco de Mayo event tabling event

Continued Innovation with Three-and Four-wheeled Vehicles

Demand for a three-wheeled trike

Many participants expressed interest in a self-balancing three-wheeled trike. Although this vehicle is a prototype not yet available in Veo markets, the idea of a trike garnered significant attention and sparked extensive discussions during focus groups and at the Cinco de Mayo tabling event.

Four-wheeled vehicles could increase access further

In addition to the trike, participants explored creative ideas for vehicle types that could further increase access. More than half of participants in the Disability Mobility Initiative focus group had not previously ridden shared scooters or bikes, and shared that most vehicle types currently available do not cater to their accessibility needs. Participants in this focus group highlighted the importance of added stability that four wheels could provide, and some suggested the inclusion of back support for added comfort and safety. Participants explored creative ideas for vehicle types that could further increase access. These ideas included mobility scooters akin to those used in grocery stores, as well as autonomous scooters designed to transport riders to their destinations safely and efficiently.

The Need to Address Barriers Beyond Vehicle Type

In addition to challenges related to vehicle access, participants in the Disability Mobility Initiative focus group highlighted other barriers to micromobility, such as the prohibitive cost of rides and the necessity of owning and using a smartphone to access the service. Much of the discussion in this focus group revolved around participants' negative experiences with micromobility, including instances of scooters obstructing sidewalks and riders impeding pedestrian pathways, particularly for people who are blind or have low vision and for people using wheelchairs. One participant shared, "It never occurred to me to be excited about micromobility or to ask for vehicles that would work for me... If there were something for me, I'd be a lot more excited about it."

Looking forward, enhancing access for adults aged 45+ and people with disabilities will require increased collaboration to address real issues related to vehicle access, affordability, and inclusivity. This includes the need to address challenges with micromobility vehicles being ridden and parked on sidewalks so people with disabilities can travel comfortably and safely in the pedestrian right of way.

Feedback on the trike from the Cinco de Mayo tabling event

"The trike looks more balanced - a better ride for older folks."

"I am older - a three-wheeled vehicle feels more balanced. I think a lot of older people would like that."

"The trike feels more relaxed and enjoyable, especially if you are older."

"Three wheels would be more comfortable. I don't need to lean to one side at stop lights."

"[The trike] seems safer for tipping and riding on uneven surfaces, especially as we get older."

Recomendations

Recommendations for Micromobility Providers

1. Offer vehicles with accessible features to increase access

Micromobility providers should prioritize vehicles with accessible features to better accommodate adults aged 45+ and riders with disabilities. Features that increase access include:

Throttles to allow riders who cannot physically pedal a means to propel themselves forward

Seats to provide access to riders who cannot stand for extended periods of time

A low center of gravity to increase feelings of balance, control, and comfort

Large tires to offer a more comfortable ride for navigating common street conditions like potholes, rocks, and uneven surfaces

Vehicles with these accessible features were rated most comfortable across all vehicle types during the focus group demos. Rider feedback in the focus groups indicates the ability to sit and lack of a requirement to pedal provides a more comfortable and more accessible ride. This feedback is consistent with findings from Veo's 2023 Rider Survey Report, which found that riders aged 45+ and riders with disabilities are nearly twice as likely to prefer seated vehicles to standing vehicles.[23]

2. Innovate for a more accessible future

Micromobility vehicles currently available for shared use do not fully meet the access needs of adults aged 45+ and people with disabilities. Micromobility providers should prioritize ongoing innovation in vehicle design and development to introduce new types of vehicles that further enhance accessibility such as trikes and four-wheeled vehicles. Variations of these self-balancing vehicles could incorporate features such as back support, larger tires for enhanced comfort and stability, and cargo-hauling to accommodate various use cases and preferences. Micromobility providers should collaborate with underrepresented riders to curate vehicle designs to their specific needs.

3. Offer mixed fleets of vehicles to accommodate communities with diverse needs

Riders prefer specific vehicle types for a variety of reasons ranging from ease of use, to safety, to personal preference. This is why micromobility providers should provide fleets with a diverse range of vehicle types to cater to the varied needs and preferences of community members. Veo's 2023 Rider Survey Report found that about half (53%) of riders nationwide consider the type of vehicle available as a significant factor in deciding whether to use micromobility for their trip.[24] Offering mixed fleets of vehicles will not only enhance accessibility but can also increase ridership: Veo data indicates that markets with mixed fleets of vehicles see 10% more rides than in markets with a single vehicle type.

23 Seated, throttle-assist vehicles were rated most comfortable across all vehicle types during the focus group demos. Rider feedback in the focus groups indicates the ability to sit and lack of a requirement to pedal provides a more comfortable and more accessible ride. This feedback is consistent with findings from Veo's 2023 Rider Survey Report, which found that the Cosmo is the most popular vehicle type, with older riders, riders with disabilities, and women and nonbinary riders having a more defined preference for this vehicle type.

24 "2023 Rider Survey: Building for a New Era." Veo. November 15, 2023. Accessed March 12, 2024, 17. https://www.veoride.com/wp-content/uploads/2023/11/Veo-2023-Rider-Survey-Report.pdf

Recommendations for City Policymakers

4. Incentivize mixed fleets with a accessible vehicle types in micromobility application processes

To increase access, cities should require micromobility providers to offer mixed fleets featuring quality seated and standing vehicles with accessible features. City stakeholders should personally demo vehicle types and ask members of their community to join them and share feedback to ensure micromobility remains an attractive and accessible option for community members with a range of needs and preferences.

Some cities are already leveraging program regulations to increase access:

- **New York City, NY:** The New York City Department of Transportation coordinated with the Mayor's Office for People with Disabilities to require all vendors permitted in their system to participate in an accessible design competition as a condition of their permit.
- **Milwaukee, WI:** The City's Shared Mobility Program requires operators to provide an "accessible" vehicle type including but not limited to scooters with seats and wider wheels.
- **Berkeley, CA:** The City stipulated the need for an operator with a seated option in their micromobility permit requirements.
- **Newark, NJ:** In Newark, regulations incentivize mixed vehicle fleets by offering micromobility providers a larger fleet cap if they incorporate a variety of vehicle types.
- **Washington, DC:** The nation's capital boasts a diverse fleet of approximately 20,000 vehicles, proactively including a mixed vehicle fleet of standing scooters, pedal-only bikes, class 1 pedal-assist e-bikes, and class 2 throttle-assist e-bikes.

5. Make regulations that prioritize access but remain flexible

Overly-stringent regulations regarding vehicle type can inadvertently exclude new and innovative vehicle types from deployment. For example, a rule that requires vehicles to have two wheels only or weigh a maximum of 50 lbs precludes the possibility of incorporating certain accessible vehicle types such as self-balancing trikes into a community's fleet.

City regulations governing micromobility must evolve in tandem with the pace of innovation to accommodate

vehicles that broaden access for a wider range of riders. Prioritizing only essential criteria such as compatibility with bike lanes, speed limitations of 15 mph or lower, adherence to safety standards, and durability for shared use will help ensure that regulations remain relevant and supportive of new vehicle types.

6. Choose access over active transportation

To enhance accessibility and broaden micromobility ridership, city stakeholders should prioritize vehicle types that maximize access, rather than exclusively emphasizing pedal-powered options. While promoting physical health outcomes is one aspect of micromobility, solely focusing on so-called "healthy" travel options limits transportation choices for people who cannot or do not want to pedal.

Increasing overall transportation access offers additional health benefits. By increasing mobility through more accessible micromobility programs, community members will have more options to access important destinations like healthcare facilities, grocery stores, and opportunities for social connection.

Recommendations for Micromobility Providers and City Stakeholders

7. Use data to guide fleet composition

Communities are unique, and what works in one community may not work in another. Vehicle preferences within a community may vary based on factors such as demographics, weather, topography, bike infrastructure, and more. For this reason, city decision makers and micromobility providers should track ridership trends by vehicle type and adjust fleet composition based on demand.

Addressing vehicle access alone isn't enough to increase access among riders aged 45+ and people with disabilities. The below recommendations offer additional actions cities and micromobility providers should take to increase access.

8. Incorporate discounts for people with disabilities and older adults

During the focus groups, it became clear that affordability challenges can impede access for older adults and riders with disabilities. Most micromobility programs offer income-based discounts to ensure access for riders with low incomes. Such discounts should be extended to people with disabilities and older adults to encourage and increase access. Cities and micromobility providers should take proactive steps to inform and engage older adults and riders with disabilities about the availability of these discount programs, ensuring that all individuals have equal opportunities to benefit from affordable transportation options.

9. Conduct community outreach to older adults and people with disabilities

Not everyone perceives micromobility as inclusive to their needs, owns a smartphone, or is comfortable using smartphone apps. To bridge these gaps, cities and micromobility providers should conduct targeted outreach tailored to people aged 45+ and people with disabilities. These efforts should prioritize raising awareness about accessible vehicle options and offering guidance on smartphone use and access methods for those without smartphones.

By providing clear information and support, cities and micromobility providers can empower underrepresented individuals to embrace micromobility as a viable option.

10. Clear the sidewalks of micromobility vehicles

Micromobility vehicles being parked and ridden in the pedestrian right of way can pose significant challenges, especially for individuals who are blind, have low vision, or use wheelchairs.

Sidewalk crowding often indicates a need for improved infrastructure. Cities and micromobility providers must collaborate to identify solutions, including but not limited to:

- **Adding designated on-street parking corrals** to clear the sidewalk of parked vehicles.
- **Installing protected bike lanes** to offer a safe space place for micromobility riders to travel. According to Veo's 2023 Rider Survey, the majority of people who ride on the sidewalk say they do so because of unsafe streets and lack of bike lanes. Most sidewalk riders (73%) said they would stop riding on the sidewalk if a protected bike lane was available.

By clearing the sidewalks of shared vehicles, cities and micromobility providers can ensure that people with disabilities can travel comfortably and safely in the pedestrian right of way, fostering a more accessible and inclusive urban environment.

Opportunities for Future Research

More comprehensive and inclusive research
Future research endeavors in Seattle and beyond could benefit from broader inclusion, particularly by soliciting additional feedback from Seattle's Black, Latinx, and Indigenous communities and facilitating focus groups conducted in languages spoken by Chinese and Spanish-speaking communities. Although in-language flyers were utilized for outreach in the Chinatown International District focus group, the absence of requests for participation in language suggests the need for more extensive outreach efforts to gain feedback from Seattle's Chinese-speaking community. Further research, especially when conducted in language, could yield valuable insights.

Expanding research beyond Seattle to encompass other cities would provide a broader understanding of how to increase micromobility access through vehicle innovation. Engaging in more extensive conversations with older adults and individuals with disabilities in diverse riding environments could deepen comprehension and inform future initiatives.

Seat design considerations
Future research endeavors should explore improvements in seat design. Feedback from the Seattle LGBTQ+ group highlighted discomfort experienced by some trans men and trans-masculine riders while using the Cosmo's seat, particularly those who utilize packers. Members of this focus group also shared concerns and thoughts around transfemmes and trans women who have undergone gender affirming surgery who may also experience discomfort with harder seats. Anecdotal input from other Veo riders has also underscored the desire for an adjustable seat. This underscores the importance of exploring seat design modifications to enhance comfort for riders of diverse genders and body types.

Exploring additional benefits of seated vehicles
Further research should explore other benefits associated with seated vehicles beyond accessibility. For instance, riders using Veo's Cosmo series of class 2 e-bikes and seated scooters tend to travel approximately one mile longer per trip compared to riders using stand-up scooters. Moreover, while micromobility has demonstrated a predominantly safe track record over the past five years, with approximately 99.99% of all trips completed without incident, Veo data suggests that vehicle type can influence safety outcomes. Ridership data indicates that Veo's seated Cosmo vehicles experience approximately 62% fewer crashes than standing scooters. Future research could explore how vehicle design can affect rider safety and behavior, trip length, and more.

Appendix I

Methodology

Overview

This white paper utilizes a combination of qualitative and quantitative approaches to examine the impact of vehicle type on rider accessibility. The qualitative component incorporates insights gathered from four focus groups held in Seattle in May 2023, as well as feedback obtained from attendees at a neighborhood Cinco de Mayo event. Supplementing this qualitative data are findings from Veo's 2023 Rider Survey Report, which collected input from nearly 10,000 riders nationwide, including over 500 respondents from Seattle. Learnings from the focus groups provide a granular understanding of vehicle access at the individual level, while the survey data is used to understand how feedback from the focus groups correlates with larger industry trends.

Focus Groups

This research effort focused on feedback received during four workshop-style focus groups in Seattle. Three of the focus groups were held in partnership with community-based organizations: Chinatown International District Block Party, the Seattle LGBTQ+ Center, and Disability Mobility Initiative. A fourth focus group with Veo riders was held at Arup's Seattle office. See Appendix II for focus group participant demographics.

The researchers adopted an equitable approach to community engagement, drawing inspiration from organizations like the International Association for Public Participation to ensure that their engagement with the community prioritized equity. This approach involved key elements such as fostering partnerships with community organizations, centering community voices, and providing compensation to community members and partners for their valuable time and expertise.

Focus Group	Number of Participants
Chinatown International District Block Party	13
Disability Mobility Initiative	14
Seattle LGBTQ+ Center	9
Veo Riders	13
Total	**49**

Partnering with the community

Veo co-hosted the focus groups in partnership with leaders from three community-based organizations: Chinatown International District Block Party, the Seattle LGBTQ+ Center, and Disability Mobility Initiative. These community leaders recruited focus group participants, co-hosted the events, and provided insight on ways to foster a welcoming and inclusive environment for members of their community. Seattle-based Yes Segura of Smash the Box provided insight on the overall project approach and helped the researchers liaise with the community.

Compensation

In order to recognize community stakeholders for their time and lived expertise, over 80% of the project budget was dedicated to direct compensation to community members and community-based organizations. This included hiring Community Advisor Yes Segura, compensating community-based leaders to co-host focus groups, and compensating participants for their time.

Accommodations

The researchers sent each participant a survey ahead of the focus group in order to ensure the focus group was accessible to them. Participants were invited to share their pronouns and chosen name, dietary preferences, and whether they had accessibility needs (eg. scent-free room, large print, preferred front row seat, virtual access to the focus group). Due to high demand for both virtual and in-person participation from participants in the Disability Mobility Initiative focus group, the event was held with a hybrid approach (both virtual and in person). Food was served from a local restaurant recommended by each focus group co-host.

2023 Veo Rider Survey Report[25]

This white paper draws upon insights gleaned from Veo's 2023 Rider Survey Report, which summarizes findings from a Veo rider survey conducted during the winter of 2022. Nationally, the survey captured responses from 9,587 individuals, with 566 respondents specifically from Seattle. The survey gathered data regarding vehicle preferences and accessibility, among other topics. Through analysis of this survey data, the survey report provides valuable insights into rider needs and preferences, with a particular emphasis on promoting inclusivity and accessibility when it comes to vehicle type.

Cinco de Mayo Tabling Event

This white paper leverages qualitative feedback from conversations with the Latinx community during a Cinco de Mayo 2023 event hosted by El Centro de la Raza at their Centilla Cultural Center located in the Southeast Seattle neighborhood Beacon Hill. Veo tabled alongside community organization Smash the Box, holding conversations with members of the community about whether they use micromobility and whether infrastructure improvements or specific vehicle types would make them feel safer or more comfortable using shared scooters or bikes.

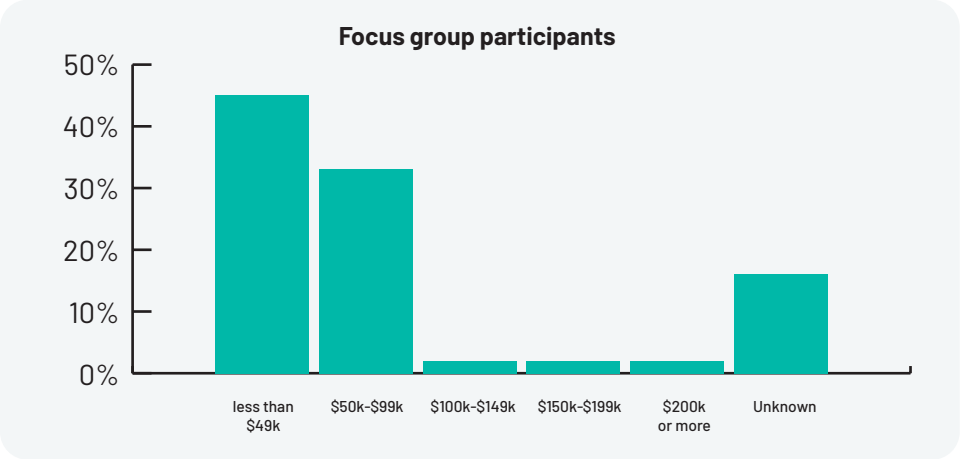
25 "2023 Rider Survey: Building for a New Era." Veo. November 15, 2023. https://www.veoride.com/wp-content/uploads/2023/11/Veo-2023-Rider-Survey-Report.pdf

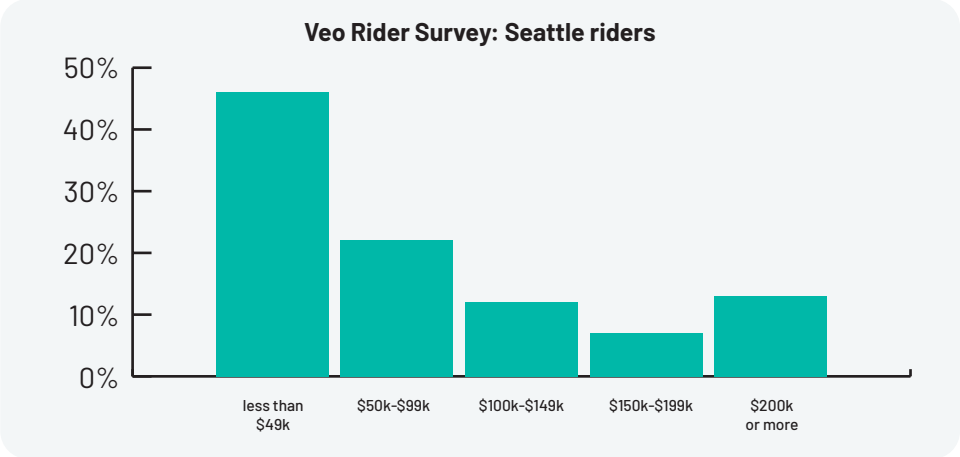
Appendix II

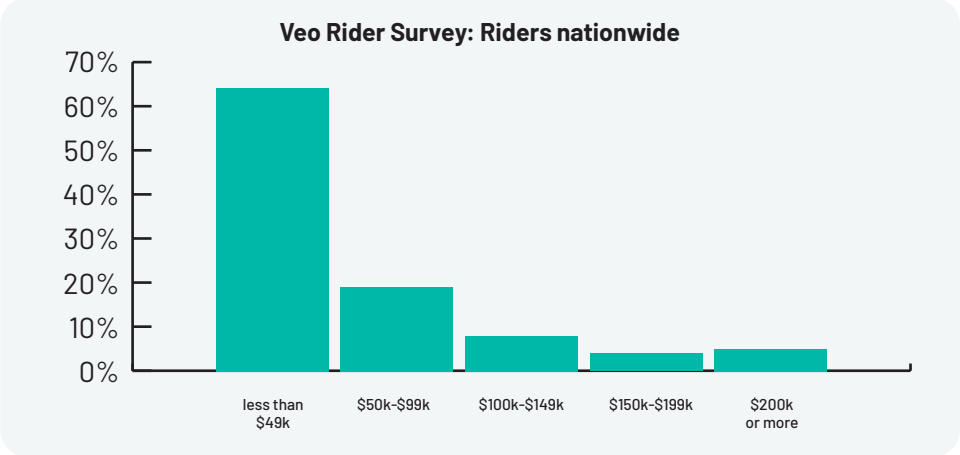
Demographics

Source	Number of participants
Focus Group* Chinatown International District Block Party (13 participants) Disability Mobility Initiative (14 participants) Seattle LGBTQ+ Center (9 participants) Veo Riders (13 participants) ** "Unknown" categories reflect focus group participants who did not provide demographic information*	**49**
Veo Annual Rider Survey - Seattle riders	**566**
Veo Annual Rider Survey - National respondents	**9,587**

Household Income



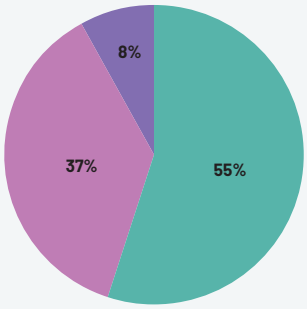




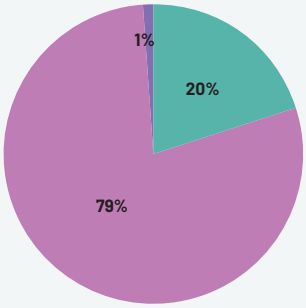
Disability Status

Do you have any conditions that limit your ability to participate in life activities?
For example:
Mobility (Difficulty walking or climbing stairs)
Independent Living (Difficulty doing errands alone)
Cognitive (Difficulty concentrating, remembering, or making decisions)
Sensory (Difficulty hearing and/or seeing)
Personal Care (Difficulty dressing or bathing)

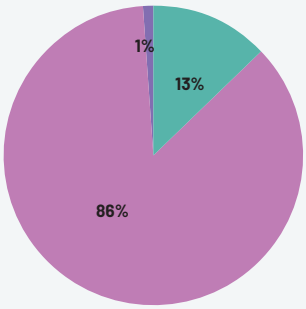
Focus group participants



Veo Rider Survey: Seattle riders

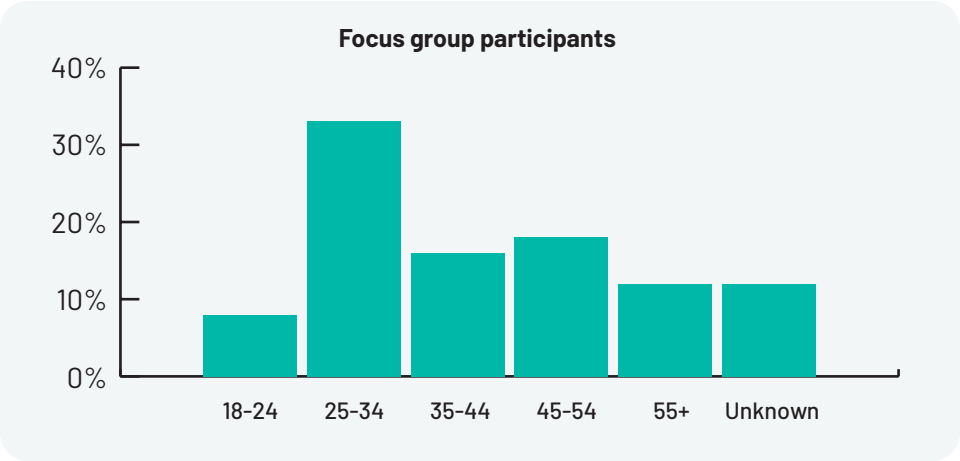


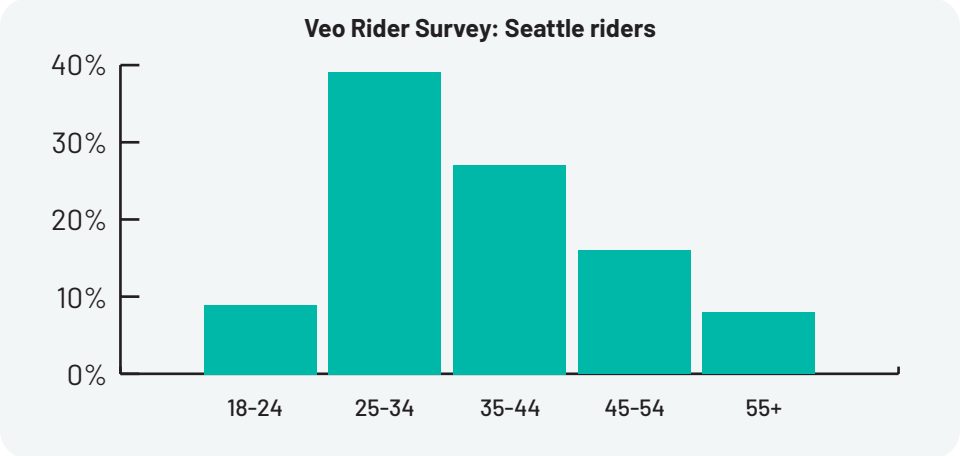
Veo Rider Survey: Riders nationwide

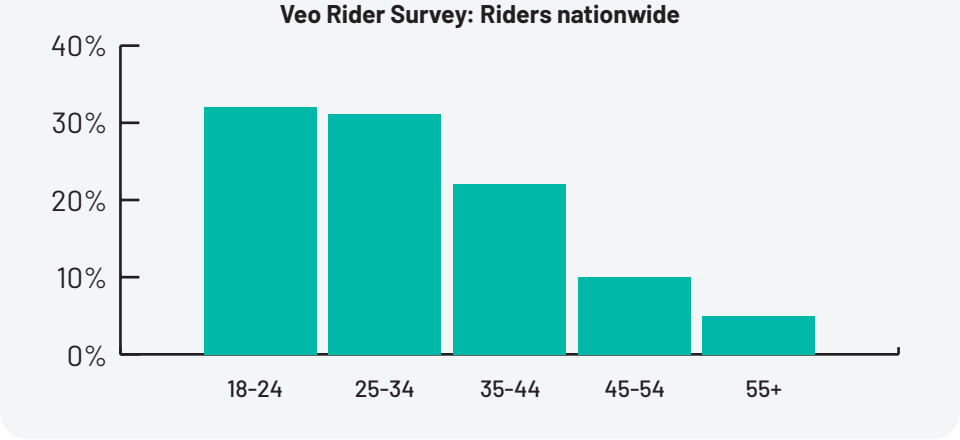


Yes No Don't know

Age

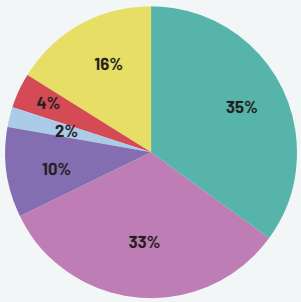

Focus group participants
40%
30%
20%
10%
0%
18-24
25-34
35-44
45-54
55+
Unknown


Veo Rider Survey: Seattle riders
40%
30%
20%
10%
0%
18-24
25-34
35-44
45-54
55+

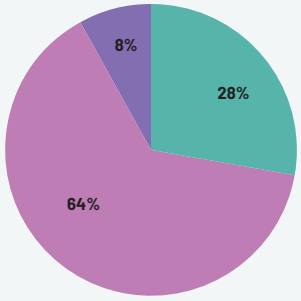

Veo Rider Survey: Riders nationwide
40%
30%
20%
10%
0%
18-24
25-34
35-44
45-54
55+

Gender

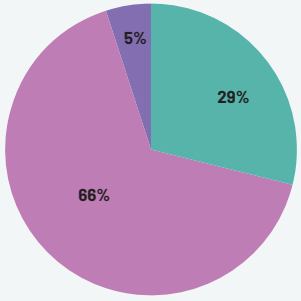
Focus group participants

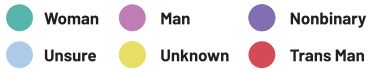


Veo Rider Survey: Seattle riders

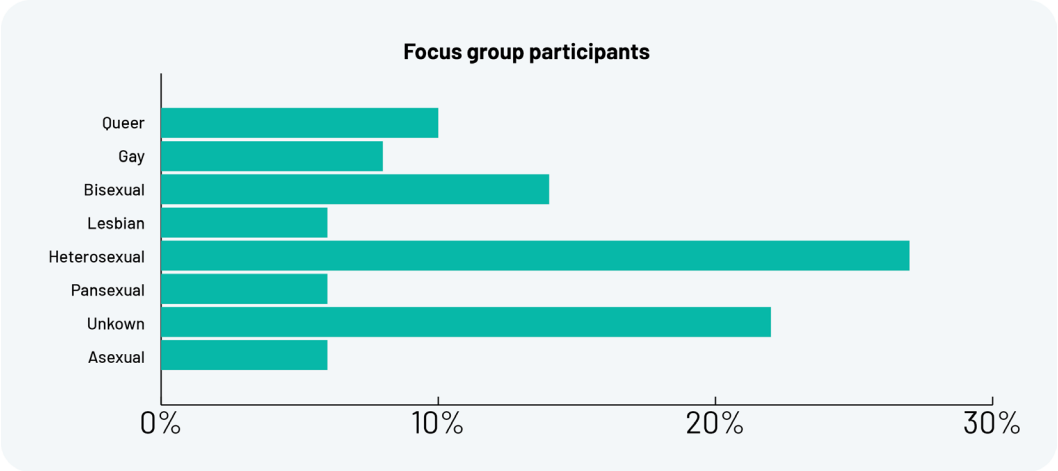


Veo Rider Survey: Riders nationwide

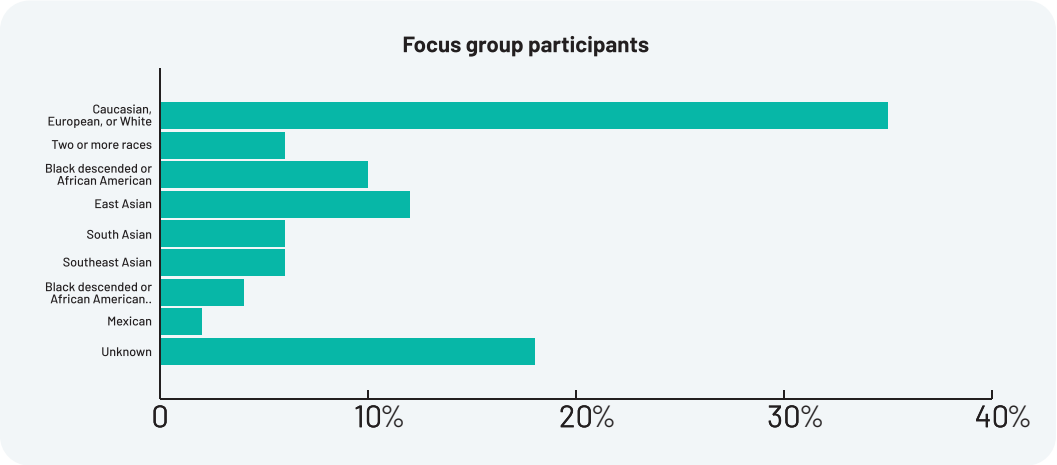


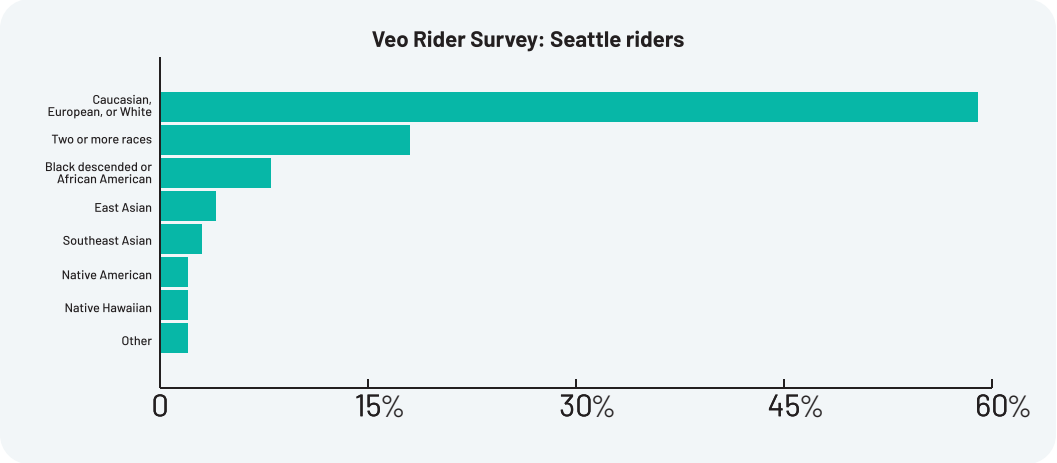


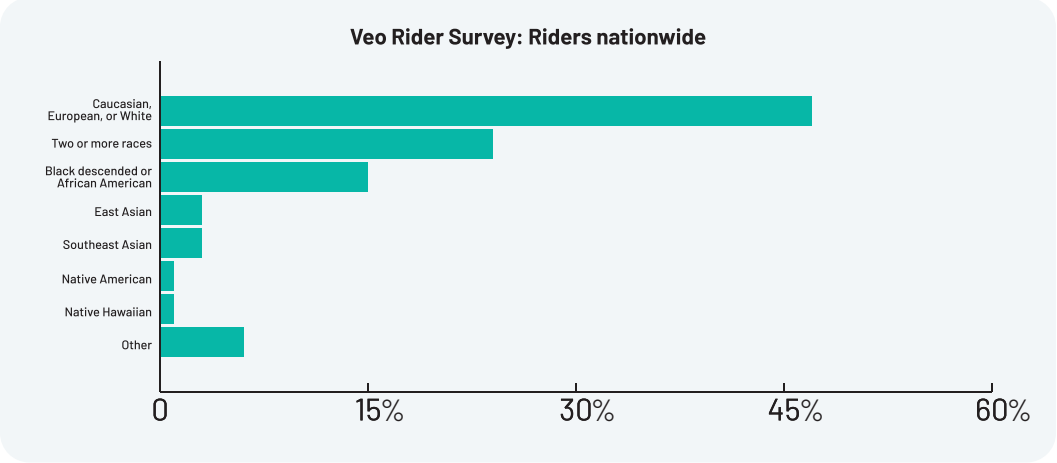
Sexuality


Focus group participants
Queer
Gay
Bisexual
Lesbian
Heterosexual
Pansexual
Unkown
Asexual
0%
10%
20%
30%

Race

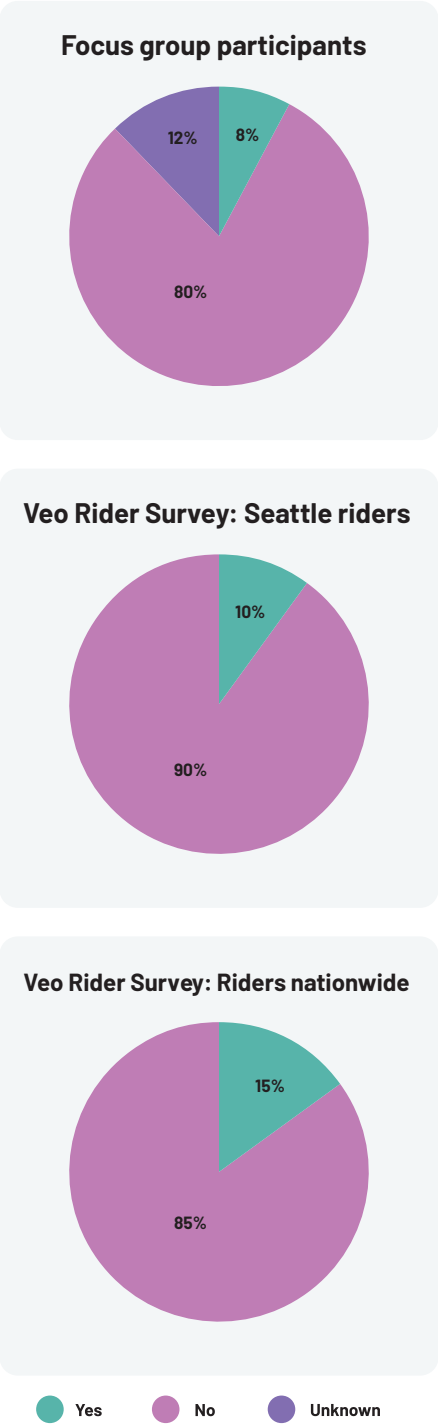

Focus group participants
Caucasian, European, or White
Two or more races
Black descended or African American
East Asian
South Asian
Southeast Asian
Black descended or African American..
Mexican
Unknown
0
10%
20%
30%
40%


Veo Rider Survey: Seattle riders
Caucasian, European, or White
Two or more races
Black descended or African American
East Asian
Southeast Asian
Native American
Native Hawaiian
Other
0
15%
30%
45%
60%


Veo Rider Survey: Riders nationwide
Caucasian, European, or White
Two or more races
Black descended or African American
East Asian
Southeast Asian
Native American
Native Hawaiian
Other
0
15%
30%
45%
60%

Ethnicity

Do you identify yourself as Hispanic, Latino, or Latinx?



About Veo

Veo is on a mission to end car dependency by making clean transportation accessible to all. We have provided millions of shared bike and scooter rides in 50+ cities and universities across North America – and we're just getting started.

Veo operates from a set of values that distinguish us in the industry. We are grounded in financial responsibility: Veo partnered with select cities to achieve profitability before scaling. We're constantly innovating, leveraging our in-house design and manufacturing process to provide cities with the safest, most accessible fleet of shared electric bikes and scooters on the market. We believe that long-term partnerships with cities and universities are crucial to success, enabling us to work together toward a sustainable, safe, and equitable transportation future. Learn more at www.veoride.com