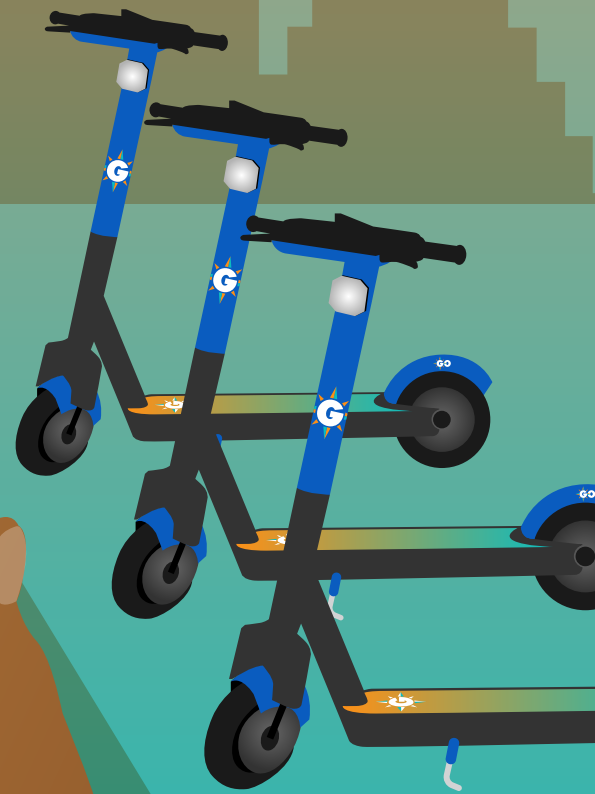


Understanding and Tackling Micromobility: Transportation's New Disruptor



Contributors

This publication was researched and written by **Pam Shadel Fischer**, GHSA's Senior Director of External Engagement. The publication was prepared with the assistance of an expert panel:

Jonathan Adkins

*Executive Director, Governors Highway Safety Association
Washington, DC*

Ruth Esteban*

*Highway Safety Specialist, National Highway Traffic Safety Administration
Washington, DC*

Dr. Staci Hoff

*Research Director, Washington Traffic Safety Commission
Olympia, WA*

Colin Hughes

*Senior Policy Manager, New Mobility, Lyft
Washington, DC*

Ken McLeod

*Policy Director, League of American Bicyclists
Washington, DC*

**Served in advisory capacity*

Jason JonMichael

*Assistant Director, Austin Transportation Department
Austin, TX*

Nicole Paine

*Program Manager, National Association of City Transportation Officials
New York City, NY*

Tamara Redmon*

*Pedestrian Safety Program Manager, Federal Highway Administration
Washington, DC*

Steve Roberson

*Senior Research System Analyst, State Farm®
Bloomington, IL*

Sharada Strasmore

*Shared Micromobility Planner, District Department of Transportation
Washington, DC*

Russ Martin, Senior Director of Policy and Government Relations, GHSA, reviewed and edited the publication. Creative by **Brad Amburn**.

*Cover: Designed by Brad Amburn. Please note **GO** is a fictional micromobility provider.*

This publication is primarily directed to Governors Highway Safety Association (GHSA) members, who consist of the state and territorial Highway Safety Offices, which are tasked with addressing the behavioral safety issues that plague the nation's roadways and contribute to the vast majority of traffic crashes. It is not intended to be inclusive of all policies or programs, nor does inclusion of a policy or program imply endorsement by GHSA, State Farm® or the expert panel. Rather it is intended to foster discussion and action that advances the safety of all roadway users. While SHSOs are the primary audience, advocates, educators, elected officials, micromobility providers and system operators, and planning and transportation professionals will also find it instructive.

Why State Highway Safety Offices and Their Partners Should Read This Publication

Micromobility is a new and emerging issue that merits your attention as people who use this mode have a right to the road. But just like other modes of transportation, micromobility is not without its challenges. This publication, which is funded by State Farm®, explores six of those challenges — oversight, funding, data collection, enforcement, infrastructure and education — and the role your State Highway Safety Office (SHSOs) and partners can play to help address them.

GHSA consulted with an expert panel of federal, state and local highway safety officials, bicycle and rideshare advocates, and micromobility providers as well as public health professionals and others working in this arena to gain a better understanding of the challenges and potential solutions discussed in this publication. Several months into these discussions, COVID-19 erupted in the U.S., impacting the mobility of every segment of society. The pandemic has forced us to rethink transportation, particularly in cities where many people rely on mass transit to get around. Therefore, the pandemic along with expert insights, survey results and online research informed this work.

Introduction

Disruptive—problematic, destructive, radical change sparked by innovation

More than a century ago, mass production of the Model T **disrupted** the nation's economic and social character as the assembly line ushered in a new era of mobility for all. The smartphone is this century's disruptor making possible a new form of **shared mobility** that includes not only cars, but also pedal-powered and electric bicycles (e-bikes), standing and seated electric scooters (e-scooters), and electric skateboards and skates. These bicycles, scooters and other small devices are part of an evolving class of vehicles referred to as **micromobility** or **personal transportation devices** (PTDs). They're typically low speed (under 30 mph), light weight (less than 100 pounds) and partially or fully motorized and may be personally owned or part of a shared fleet (Pedestrian and Bicycle Information Center & Society of Automotive Engineers as cited in Goodman et al., 2019). (See the chart on page 19.)



The smartphone is this century's disruptor, enabling greater shared mobility. (Please note GO is a fictional micromobility provider.)

Interestingly, *disruptive* is the term frequently used by urban transportation and planning officials to describe micromobility. However, electric bicycles are hardly disruptive or new. The first e-bike patents were awarded in the late 19th century. But the first commercially successful models would not appear until 1997, with worldwide mass production following several years later. Electric powered scooters, skateboards and skates, previously unpowered children's toys, have been transformed into adult conveyances, with e-scooters becoming a preferred mode of travel for many 18–34-year-old urbanites and college students.

In the U.S., pedal-powered rather than e-bikes and scooters heralded the start of shared mobility when the first docked (or station-based) bike system launched in Tulsa, OK in 2007. More than a dozen years later, there are 190 systems across the country, including New York City's Citi Bike, the nation's largest. Launched in 2013, Citi Bike set a single day record of 100,000 rides in September 2019 and achieved its 100 millionth ride in July (Change, 2020; City of New York, 2020).

E-scooters, which began appearing overnight on city streets in 2018, may seem child-like in their appearance. But these dockless vehicles (unlike docked vehicles, these do not have a fixed home location and may be dropped off and picked up from arbitrary locations) quickly overtook station-based bike share and established micromobility as a legitimate, albeit controversial, transportation mode. As a result, some bike share systems have gone dockless — and electric. Currently, more than 40 U.S. bike-share programs now have electric fleets (Lee et al., 2019), with that number expected to grow.

40+
The number of U.S. bike-share programs with electric fleets.

The Pandemic's Impact on Micromobility

When the World Health Organization declared coronavirus a worldwide pandemic on March 11, 2020, and states began putting shelter-in-place orders into effect, travel all but stopped. People, however, still had to go out for groceries and check on loved ones, while those deemed essential needed to get to work. As the virus quickly spread, use of mass transit fell to historic lows as people, who could, refrained from riding buses, trains and subways to avoid being in close quarters with others. Some systems also reduced service hours and/or routes forcing those who could not work from home to find other commuting options.

Many people in cities turned to micromobility. In New York, bikeshare ridership jumped 67 percent in mid-March compared to 2019, while bike check-outs on Chicago's Divvy program more than doubled the first two weeks of March compared to last year. However, once lockdowns and mandatory shelter-in-place orders took effect, micromobility use dropped and some systems shut down (Shared-Use Mobility Center, 2020). Those providers that continued to operate, instituted extra cleaning and disinfecting measures. Many systems offered free rides to essential workers or deeply discounted rates to provide open-air, socially distant transportation, while systems in Kansas City, Detroit, Memphis and the Big Island of Hawaii, for example, offered unlimited free rides for all. Some systems partnered with restaurants and food delivery services to help them fulfill orders, with one provider, Wheels, offering e-bikes equipped with self-cleaning handlebars and brake levers.



67%
the uptick
in Citi Bike
ridership in
March 2020
compared to
last year.

As cities have reopened, micromobility providers are hopeful the continued need to social distance will result in far greater demand for service. An April 2020 survey of 25,000 Americans found that of those who regularly ride mass transit, 20 percent would no longer do so, while another 28 percent would do so less often (IBM, 2020). A month later, micromobility providers in Columbus, OH, Oklahoma City, OK, and Washington, DC were reporting the length of e-scooter rides was increasing, suggesting "riders [were] making their full commutes on the vehicles rather than for first-mile, last-mile trips" as had been the norm before the pandemic (Lazo, 2020). Meanwhile, Chicago officials announced they would partner with three e-scooter vendors to conduct another four-month pilot program starting this July that would make 10,000 scooters (up from 2,500) available throughout much of the city (Wisniewski, 2020).

Use of these devices may go beyond shared systems as sales of on-road bicycles, including e-bikes, surged during the pandemic, with one New York City retailer recording sales of 600 percent compared to last year (Goldbaum, 2020). A recent study commissioned by Deloitte predicted use of e-bikes worldwide will grow 50 percent by 2023 (Lee et al., 2020). Most e-bikes will travel at least 25 miles or farther depending on the level of power assist the rider engages. They can also be used to haul gear and transport packages and food to customers. In March, New York City's comptroller released a report encouraging the city to subsidize frontline workers who may be interested in purchasing e-bikes to hasten their travel time (Hawkins & Ricker, 2020). Then

on April 1, New York state's ban on e-bikes and scooters was rescinded giving communities the ability to allow and regulate them (Hawkins, 2020).

During the height of the pandemic, some cities closed streets to cars and opened them exclusively to pedal and e-bicycles, e-scooters and pedestrians. Oakland, CA was the first to do this launching its [Slow Streets](#) program on April 11. By early June, over 20 miles of slow streets had been installed along 19 corridors throughout the city (City of Oakland, 2020). Seattle also closed 20 miles of roads — dubbed [Stay Healthy Streets](#) — that had limited open space, low rates of car ownership and were along routes to essential services including takeout meals. Those closures became permanent in May, making Seattle the first U.S. city to commit to such a measure. The city is also accelerating efforts to install biking infrastructure including greenways and protected bike lanes (Portfield, 2020; Zipper, 2020). Across the nation, micromobility providers and pedestrian and bicycling advocates have been urging other cities to follow suit.

Micromobility: Far from a Passing Craze

There is no doubt that COVID-19 negatively impacted micromobility, as many providers slashed their workforce and removed bikes and scooters from cities either voluntarily or under government order. But industry watchers are predicting that until there is a treatment and/or vaccine for the virus, people will remain hesitant about being in crowds and continue to seek other forms of transportation (Nicklesburg, 2020). Micromobility can help fill that need now and well into the future. Before addressing the challenges, however, it is important for SHSOs to understand that micromobility is far from a passing craze.

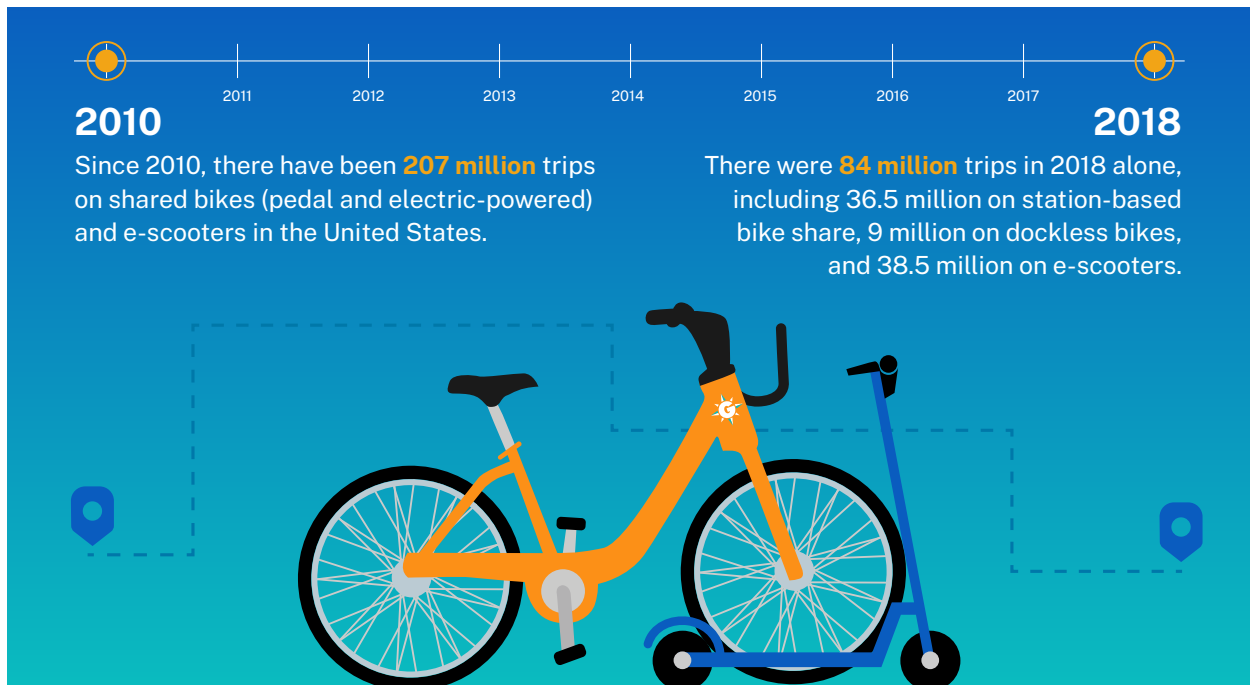
Ridership Growth

Since 2010, there have been 207 million trips on shared bikes (pedal and electric-powered) and e-scooters in the United States. A total of 84 million of those trips occurred in 2018 (the latest year for which data is available), double the number taken the previous year. Those 84 million trips included 36.5 million on station-based bike share, 9 million on dockless bikes and 38.5 million on e-scooters (National Association of City Transportation Officials [NACTO], 2019).

Of the three micromobility modes, e-scooters overtook bikes as the preferred vehicle for dockless providers and by the end of 2018 there were approximately 85,000 scooters operating in nearly 100 U.S. cities. Three metropolitan areas — Los Angeles, San Diego and Austin — accounted for the largest concentration of all e-scooter trips (40 percent) in that year (NACTO, 2019).

85,000
scooters were
operating in nearly
100 U.S. cities in 2018.

Station-based bike share systems also expanded their fleets by 9 percent in 2018 (57,000 bikes), sparking upticks in ridership. For example, Ford GoBike grew 10-fold in the San Francisco Bay Area increasing ridership by 260 percent, while Honolulu's Biki grew 30 percent and rides jumped 200 percent. Boston's Bluebikes not only expanded by 40 percent and gained 30 percent more riders, but also increased its coverage area. By the end of 2018, 85 percent of all city residents lived within a five to seven-minute walk of a Bluebikes station, up 67 percent from 2017 (NACTO, 2019).



While pedal-powered bikes accounted for the greatest share of station-based system rides in 2018 at 30 million, station-based e-bikes (6.5 million) had double the usage of their non-electric counterparts. Madison, WI converted its entire bike share fleet to electric in 2019 and found that e-bikes generated “up to five times as many trips as standard bikes,” while usage declined in cities where e-bikes were removed from their systems’ fleets (Anzilotti, 2019b). As a result, San Francisco, Minneapolis and New York are just a few of the cities transitioning all or a portion of their fleets from pedal to electric bikes in collaboration with providers (NACTO, 2019).

In 2018 the average bike share trip covered 2.5 miles and lasted just under 25 minutes, while the average e-scooter trip traversed 1.5 miles and lasted approximately 17 minutes. The largest bike share systems were more heavily used, on a per-bike basis, than smaller systems. The opposite holds true for e-scooter systems as the largest fleets were used less than once per day, while smaller fleets were used more than four times per day. The greatest use of station-based bikes occurred during traditional rush hours, while scooter trips were dispersed throughout the day, with the most ridership on Fridays and weekends. Surveys of riders in cities across the U.S., found station-based bike share users are more likely to ride to get to and from work and to connect to transit. The opposite is true for e-scooter riders who are more apt to use the device for social, shopping and recreational purposes (NACTO, 2019), with tourists accounting for a significant share of ridership in some major cities (Gauquelin & Chamussy, 2020).

Although 2019 micromobility trip data is not yet available, all indications are that the number continued to grow. Atlanta’s system, for example, logged 3 million rides between January and September. Austin recorded 5.3 million rides in 2019 (City of Austin, 2020a) and Los Angeles had one million scooter and dockless bike rides per month last year. And Lime, which was operating micromobility fleets worldwide, marked a milestone in September 2019 — its 100 millionth ride (Schneider, 2020).

A Viable Transportation Alternative

Micromobility — unlike trains, buses and subways — allows for social distancing. But in a pre-pandemic world, some people without the means, ability or desire to own a vehicle choose to get around via e-bikes and scooters. And they likely recognize and appreciate micromobility's value even more since the pandemic.



Car travel speeds in cities had been getting slower pre-pandemic, making micromobility a faster alternative. In midtown Manhattan, for example, cars traveled an average of 4.7 miles per hour in 2017 (Agrawal as cited in Lee et al., 2019). Shared e-bikes and e-scooters typically have a top-speed of 20 and 15 mph, respectively, making them a faster alternative. Speed of travel is important to riders. In Copenhagen, where 62 percent of the population bikes to work or school, more said getting there faster (49 percent) — rather than health benefits, cost savings or the environment — is their primary motive for cycling (Lee et al., 2019). Then there's gridlock and parking; unlike cars and trucks, bike and scooter riders take up less space and do not have to circle the block to find a place to park — or pay for the privilege.

E-bikes and scooters can not only make getting to a destination faster, but also enable the rider to do so without breaking a sweat. Both devices — unlike pedal bikes — require less or no output on the part of the rider. E-bikes are especially convenient for older adults and people with limited mobility, as the rider can pedal a little or a lot. Proponents of e-bikes also point to the device's health benefit, suggesting that riding one “isn't cheating,” as users get additional exercise because they ride more often and for longer distances (Krug, 2020). Having access to an e-bike might also prompt someone to pick up their bike helmet rather than their car keys to run an errand or commute to work.

Scooters, on the other hand, require a bit more physical prowess, which is why these devices are evolving to accommodate different body types and comfort levels. In Portland, OR micromobility providers Razor and Shared offer e-scooters with seats for people with disabilities. The seated e-scooters also have larger wheels and wider

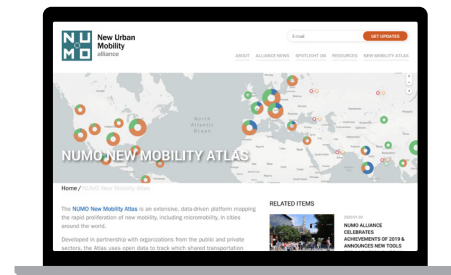


Detroit's Adaptive MoGo program meets a wide range of rider needs.

tires than stand-up scooters. Meanwhile, Detroit's Adaptive MoGo (bikeshare) program had begun offering 13 different cycles including recumbent, upright cargo, hand and tandem tricycles to accommodate a wide range of rider needs in 2018. However, the program is currently postponed due to the pandemic (MoGo, 2020).

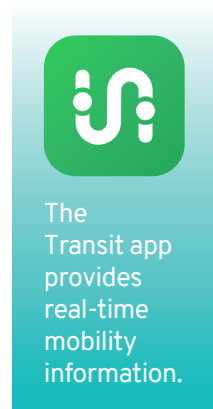
Concerns about locating a micromobility system (either docked or dockless) and whether a device is available are also being addressed. Provider apps, for example, can pinpoint the location of available devices and their prices as measured by range. Google Maps displays the location of bike sharing stations and how many bikes are available in 24 cities around the world including Chicago, Los Angeles, New York and San Francisco. The app also provides the location of Lime scooters in many U.S. cities and directions to and from the closest bike sharing stations in ten cities including Chicago, New York, San Francisco and Washington, DC (Smith, 2020).

The New Urban Mobility Alliance launched an online platform, [New Mobility Atlas](#), in late 2019 to map the growth of new mobility in cities. It uses open data to track the availability of shared transportation options including dockless scooters, bikes and mopeds. In response to the pandemic, the North American Bikeshare Association (NABSA) created a [COVID-19 Tracker](#) that identifies micromobility shared services for each state/city and whether each is operating, offering free or reduced prices and additional services such as support to health care facilities and delivery services.



The New Mobility Atlas tracks shared transportation options in cities.

Potential riders can also get help from the U.S. Department of Transportation's (U.S. DOT) Bureau of Transportation Statistics' (BTS) [interactive bikeshare and e-scooter map](#), which shows, by city, the name of the system serving the area (the site is current as of November 2019). For cities with a docked bike share system, the map allows users to zoom in on the location of a docking station at street level. Bike share systems with fixed docking stations are also included in the BTS' Intermodal Passenger Connectivity Database (IPCD), which includes information about passenger transportation facilities. According to the IPCD, 71 percent of all bike share docking stations are located within one block of another public transportation mode such as a bus or train, while 13 percent are within two blocks (U.S. DOT, 2019). That is why transit aggregator apps like [Transit](#) are gaining popularity with micromobility users. The app provides real-time information for buses, trains, bikes, e-scooters, car share and ride hail services in 188 cities/regions in the U.S., giving riders the ability to easily mix and match modes to help them get where they want to go (Transit, 2020).



Finally, micromobility providers recognize the public's pandemic-driven concern about hygiene. While e-bikes and e-scooters have a built-in social distancing mechanism — one-rider-only — ensuring they are disinfected between riders is an issue. As noted earlier, Wheels has partnered with NanoSeptic to cover its devices' cover grips and brake levers with a self-cleaning material designed to reduce transmission of the virus (Gauquelin & Chamussy, 2020). To prevent the spread of COVID-19 in Austin, on March 17, 2020, the City's Transportation Department required

all providers to reduce their fleets by 10 percent due to the decrease in ridership, remove all non-operational devices and institute sanitation measures for those devices remaining in operation on the city's right-of-way (J. JonMichael, personal conversation, July 1, 2020).

Meanwhile, PTD providers Pony, Spin and Wheels have found a way to eliminate the need to disinfect their vehicles between riders. They have changed their business model from casual users to regulars by testing long-term rentals for shared bikes and scooters. Micromobility proponents call this a “good try before you buy option,” with Wheels and Pony (the latter is dubbed Adopt-A-Pony) now selling devices directly to the public (Gauquelin & Chamussy, 2020).

The Safety of Micromobility

Micromobility generated significant press coverage in 2018 and 2019 due mostly to the proliferation of e-scooters, which (as discussed earlier) began appearing on local streets as an adult conveyance rather than a children's toy. The news stories typically focused on concerns about scooters being operated and parked on sidewalks, as well as the potential for riders to be seriously injured or killed. The latter was sparked by a series of research studies that examined medical records and emergency room data related to e-scooter incidents. Just like other transportation modes, the research confirms e-scooters and e-bikes are involved in crashes and people are injured and killed. However, research conducted by e-scooter provider, Bird, contends that “more people are injured by motor vehicles in three hours in the U.S. than are injured by e-scooters in a year” (Bird, 2019a). According to the International Transport Forum (ITF), “e-scooter riders do not face significantly higher risk of road traffic death or injury than cyclists” and roads would be “safer if e-scooter and bicycle trips replace travel by car or motorcycle” (2020).

E-Scooters

Using data from the National Electronic Injury Surveillance System (NEISS), one study found that between 2014 and 2018 the number of e-scooter injuries and hospital admissions in the U.S. increased 222 percent and 365 percent, respectively. During the same time period, the rate of scooter crashes increased from six per 100,000 people to 19 per 100,000 with fractures, contusions/abrasions and lacerations the most prevalent injuries. The researchers also noted there was a large increase in injuries between 2017 and 2018, rising from 8,016 to 14,651 (2018 marked the unofficial start of e-scooter programs in many locales), and the rate of head trauma for scooter riders was double that of bicyclists (Namiri et al., 2020). It is important to note that the researchers were not able to distinguish between standing and seated scooters or to account for ridership exposure. The explosion in the number of e-scooters beginning in 2018 must be also taken in account when reviewing crash and injury data. According to the National Association of City Transportation Officials (NACTO), between 2010 and 2016 there were 88 million shared mobility trips in the U.S. However, those trips were taken on bike share, not e-scooters (NACTO, 2020).

222–365%

the jump in hospital admissions for e-scooter injuries between 2014 and 2018.



These injury and head trauma rates mirror findings of an Austin study conducted by the city's Public Health (APH) Department, with support from the Centers for Disease Control and Prevention (CDC). Researchers identified 271 people with potential scooter crash-related injuries and interviewed slightly more than half. They learned that 45 percent of the crashes involved head injuries, with 15 percent suffering traumatic brain injuries. Less than one percent of the riders were wearing a helmet. Unlike the NEISS study, however, the APH had access to exposure data (number of trips, miles and hours ridden) and found that for every 100,000 trips taken, 20 individuals were injured (APH, 2019).

These studies along with several others also examined causation factors. Most scooter injuries were the result of falls, collisions with objects such as light poles, manhole covers or curbs or crashes involving motor vehicles. However, the latter were not as prevalent as might be expected. In the Austin study, for example, 16 percent of the incidents involved a rider either "colliding and swerving, stopping or jumping off a scooter to avoid a collision" with a motor vehicle, while 10 percent of injured riders actually collided with a motor vehicle. (The latter, however, were more likely to result in significant injuries.) Instead, the roadway condition—potholes, cracks in the pavement—played a much larger role (50 percent), with a third of riders injured on sidewalks and slightly more than half in the street (APH, 2019).

Other factors identified in the studies included inexperience, alcohol and speed. In Austin one-third of those injured were first-time riders, while more than 60 percent had ridden nine times or less (APH, 2019). In Southern California, where researchers examined medical records from two urban emergency departments, five percent of injured riders tested positive for alcohol, while in Austin 29 percent had consumed alcohol in the 12 hours preceding their injuries (Trivedi et al., 2019; APH, 2019).

Another study involving 103 male scooter riders treated at trauma centers in San Diego and Austin, found 79 percent tested for alcohol and 48 percent of those individuals were over the legal limit (0.08). Additionally, 60 percent were screened for drugs, with slightly more than half (52 percent) testing positive (Kobayashi et al., 2019). And 37 percent of people in the CDC/APH study, said that "excessive scooter speed contributed to their injury" (APH, 2019).

1/3
of those injured
in Austin were
first-time
scooter riders.

Several studies also found e-scooters pose a risk to pedestrians. In the South California study cited above, 52 percent of the pedestrians seeking treatment had been hit by a scooter and 24 percent tripped over a device that was parked on the sidewalk (Trivedi et al., 2019). This has prompted some cities to ban sidewalk riding to prevent injuries and reduce liability claims. However, micromobility providers and advocates worry that prohibiting sidewalk riding poses risks to scooter riders who would be forced to operate on high-speed and/or high-volume roadways that are unlikely to have separate or protected infrastructure (more on that on page 14).

When it comes to gender and age, male e-scooters riders were more likely to be injured than females and the average age ranged from 29 to 39. However, people of all ages were represented in the studies. That said, the Southern California study found that nearly 11 percent of e-scooter injuries involved patients under 18 years of age, despite state law requiring riders to be at least 16 (and 18 years of age per provider rental agreements) (Trivedi et al., 2019). In addition, 60 percent of the riders injured in Austin were residents, while a third either lived out of town, in other states or other countries.

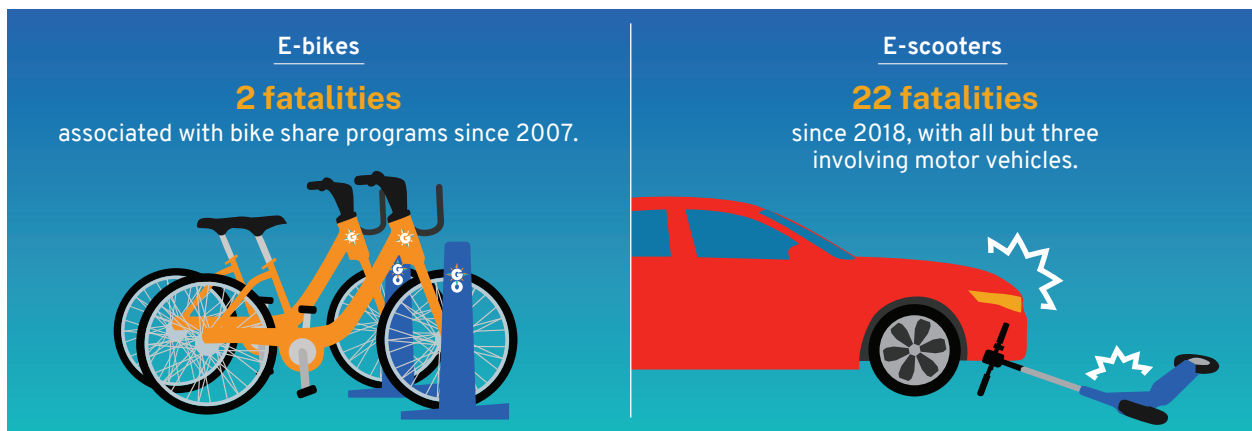
E-bicycles

Using NEISS data from 2000 to 2017, an analysis of injury patterns and trends associated with e-bikes found there were 3,075 injuries accounting for 0.13 injuries per 10,000 total U.S. emergency department injuries (EDIs). (This compares to 130,797 powered scooter injuries at a rate of 5.3 injuries per 10,000 EDIs.) The average age of a person injured on an e-bike was 31.9, with riders 18-44 and 45-65 accounting for 41 percent and 28 percent of all injuries, respectively. Males were more likely than females to be injured (83 percent) (DiMaggio et al., 2019). It merits noting the average age of an injured e-bike user increased from 22.8 before 2013 to 37.7 after 2013, likely the result of an increase in the device's use for commercial deliveries in urban settings and possibly by older persons seeking a power-assisted transportation device (Tan, Nadkarni & Wong as cited in DiMaggio et al., 2019).

Unlike e-scooter injuries, e-bike-related injuries were nearly three times more likely to be the result of a collision with a motor vehicle and to be severe enough to necessitate hospitalization due to internal injuries. E-bike injuries were also three times more likely than e-scooter injuries to involve a collision with a pedestrian. (This may be due to the disparity in weight and speed between a traditional bicycle and an e-bike and the fact that e-bikes, unlike motor vehicles, are quiet.) E-bike riders, on the other hand, were more likely than e-scooter riders to have been wearing a helmet at the time of their injury (DiMaggio et al., 2019). The researchers involved in many of these studies pointed out that the prevalence of e-bike and e-scooter related injuries were likely underestimated.

3x
more likely that e-bike injuries are the result of a collision with a motor vehicle or pedestrian compared to e-scooters.

As for fatalities, limitations with the data make it difficult to report the numbers. E-bikes are typically identified as bicycles in crash reports and medical records, while e-scooters may not be identified at all (see page 19). The 2017 GHSA report, [A Right to the Road](#), pointed out that despite unprecedented growth in U.S. bike share there had been only two deaths associated with these programs since 2007. As for e-scooters, according to a database maintained by researchers at the University of North Carolina's Collaborative Sciences Center for Road Safety, there have been 22 fatalities in the U.S. since 2018, with the most recent occurring last December in Elizabeth, NJ. The key takeaway from these crashes is that 19 of the fatalities involved a motor vehicle. The three other fatalities were the result of a rider crashing into a tree, a collision between two e-scooters and head trauma resulting from a scooter fall (Harmon, 2020). All but two of the fatally injured scooter riders were male. The deceased riders ranged in age from 5 to 53, with an average age of 28.8 years (PBIC, 2020).



SHSO Involvement in Micromobility

GHSA surveyed the 54 State and Territorial Highway Safety Offices to better understand what, if any role, they are currently playing in micromobility at the state and/or local level. The survey asked if their state has laws addressing micromobility (e.g., maximum speed, where the devices may be ridden, minimum rider age, helmet use) and local micromobility programs/pilots. The SHSOs were also asked if they were working with local programs (if one or more existed in their state) or on micromobility at a statewide level and if they were not, why. Finally, SHSOs were asked if a staff member had been specifically tasked with addressing micromobility.

Thirty states (60 percent) responded to the survey. Seventeen reported having state laws addressing some aspect of micromobility, with most focusing on e-scooters. Sixteen SHSOs indicated there are micromobility programs/pilots in their state, but only nine are working with them in some capacity (typically education). Six SHSOs indicated they are working on micromobility at a statewide level, with activities ranging from educating riders and drivers and providing grant funds (for education and enforcement of bicycle and pedestrian issues rather than expressly for micromobility) to serving on a commission tasked with reviewing legislation and potential pilot sites.

When asked why they were not working with an existing program or on any statewide activities, several SHSOs responded they were not asked and/or there was no data to support their involvement. One explained they “have no jurisdiction [since the devices] are not classified as a motor vehicle,” while several other SHSOs said micromobility is a “local issue” (GHSA, 2020a).

All SHSOs are encouraged to identify where micromobility has established a foothold in their state or has the potential to do so. While the U.S. DOT BTS bike share map shows programs exclusively in urban areas and busy suburban corridors, micromobility is popular on many college and university campuses and could (if it is not already) begin appearing on small town streets. Getting ahead of and supporting this mode means taking inventory of micromobility programs and laws/ordinances in your state and determining what data, if any, your state is currently collecting. Once you have done that, carefully review the remainder of this publication — it outlines a game plan for helping your SHSO become an *active participant* in the micromobility arena.

Getting ahead of and supporting this mode means taking inventory of micromobility programs and laws/ordinances in your state and determining what data, if any, your state is currently collecting.

Addressing Micromobility’s Challenges

Contrary to news reports and public perception, COVID-19 has not been a death knell for shared mobility. Rather it has established e-bikes and e-scooters as a viable and convenient mode of transportation. (Just ask any essential worker who has been using one to get to and from work during the pandemic!) (Spivak, 2020). And if device providers begin pivoting from rent by the ride to rent by the month or try and buy, e-bikes and scooters have the potential to become a preferred or more frequent mode of travel for city dwellers and college students, as well as people living in the suburbs and small towns across America.

Recognizing micromobility’s potential and the fact that these devices are sharing the road (or sidewalks) with motor vehicles, traditional bicycles and pedestrians, there are inherent safety issues. For that reason, SHSOs cannot afford to remain on the sidelines. Waiting to be invited in or taking the position that micromobility is a local issue is short-sighted and fails to consider the critical role SHSOs can play in addressing the following six challenges, all of which have statewide implications:

Oversight

The Challenge: The statutes and regulations governing PTDs vary from state to state and/or locality to locality, making it difficult for riders and other road users to know what is allowed and for law enforcement officials to address unsafe behaviors.



Consistent, simple, and easy-to-understand rules promote safety and offer clear guidance for riders.

Since states have oversight of traffic laws and vehicles, the responsibility rests with state legislatures to address this problem. *What is needed are consistent, simple and easy-to-understand rules that promote safety and balance the needs of all road users. At the same time, the rules must be flexible enough to accommodate new devices that are likely to appear in the future.* As these shared systems and/or personal PTD use grows, a statewide law provides guidance and ensures that regardless of jurisdiction, riders know what they can and cannot do. This becomes even more important if a local government does not have its own rules. Plus, a strong state rule reduces the burden on local governments to enact their own regulations (Fang et al., 2019).

The consensus among micromobility providers, local transportation and law enforcement officials and advocates is that *state legislatures are the appropriate entity to establish regulations for PTDs, but state laws must grant local governments the ability to limit the devices’ based on local conditions* (Fang et al., 2019). For example, there may be certain streets in a city that are simply too narrow or congested to support mixed modes. Or sidewalks with heavy pedestrian traffic may not be appropriate for e-scooters or necessitate lower riding speeds during certain times of the day and/or days of the week. Communities might also need to implement PTD riding and parking restrictions during special events and observances.

There is also agreement that *PTDs should be regulated as a class, not device by device since they share similar operational characteristics (e.g., low speed, fully or partially motorized)*. This makes rule making less reactionary and ensures the rights and responsibilities are clear the moment a new device appears on the road. Even more importantly, regulating PTDs as a class makes it easier for the public and law enforcement to remember one set of rules (Fang et al., 2019).

Most concur that, where appropriate, *PTD rules should mimic bicycle rules*. Proponents point to the value of applying bicycle rules, which not only riders, but also other road users and law enforcement can remember. It also ensures fairness, since PTDs function much like bicycles due to their speed and size (Fang et al., 2019). Which begs the question — should PTDs be allowed on sidewalks?

Proponents say PTD rules should mimic bicycle rules, which leads to questions over sidewalk use.

Micromobility proponents and public health experts stress banning sidewalk riding sets up PTD riders (especially those on e-scooters) to break the law – particularly in areas where they do not feel safe riding in the street. Banning PTDs on sidewalks is also inconsistent with how bicycles are currently regulated, as few states have language in their vehicle codes that prohibit sidewalk riding. The League of American Bicyclists (LAB) argues there should be clear rules for sidewalk riding, so it is clear how all road users should interact with each other. LAB recommends that bicyclists ride on the road if they can do safely. Sidewalk riding can create conflicts with pedestrians, it is also a leading cause of crashes involving cyclists being struck by turning motorists (Butcher, 2014; LAB, 2018).

Sidewalks are designed to be safe spaces for pedestrians; therefore, priority must be given to people on foot. However, the case can be made for not enacting PTD sidewalk bans. *Instead, states legislatures should develop policy that promotes the safety and unrestricted movement of all modes, with the caveat that communities may impose sidewalk and other infrastructure-related bans as well as speed limit caps where warranted* (Fang et al., 2019).

A case in point is Arlington County, VA, which piloted a micromobility program in October 2018 and subsequently passed an ordinance allowing the use of e-bikes and e-scooters on its streets a year later. (Arlington County is part of the Washington, DC metropolitan area, which is also served by the regional Capital Bikeshare program.) Virginia’s motor vehicle code defines the devices and where they may be operated (among other restrictions) but gives local governing bodies the right to enact ordinances prohibiting the use of PTDs and other devices on sidewalks (Virginia Law Library, 2020). In early 2020, the County instituted a ban on sidewalk riding where there is a protected bike lane “available in the same direction of travel” (Arlington County Government, 2020). Signage prohibiting sidewalk riding has been installed adjacent to the bike lanes. Where PTD sidewalk riding is permitted, the maximum speed limit is 6-mph.



Signage posted in Arlington, VA, limits sidewalk riding.

What About E-bikes?

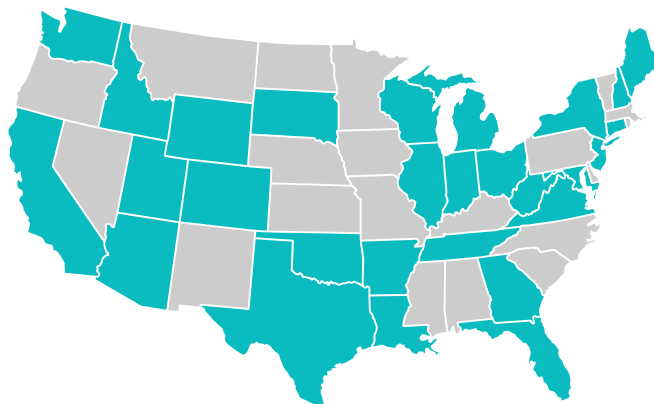
Aren’t they already regulated – particularly when it comes to where they may be ridden? Federal law ([U.S.C. Title 14 Section 2085](#)) defines what an e-bike is for the purpose of Federal regulation of consumer products (see the box) and directs that these vehicles must comply with Consumer Product Safety Commission standards. But the law is silent on when and where they may be operated. As a result, some states identify an e-bike as a moped or other motor vehicle, require that the device be registered and the rider licensed, and/or ban its use on bicycle-specific infrastructure.

What is an e-bike?

According to the U.S. Government, it is a two or three-wheeled vehicle with fully operable pedals and an electric motor of less than 750 watts (1 h.p.), 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 good news is state legislatures are making progress in adopting a standard definition for e-bikes. As of August 2020, [28 states](#) have adopted a 3-tiered classification system:

- » **Class 1** bikes provide electrical motor assistance only when the rider pedals and cuts off when reaching 20 mph.
- » **Class 2** bikes have a throttle-activated motor that can be used without the pedals and cuts off when reaching 20 mph.
- » **Class 3** bikes provide electrical or throttle-activated motor assistance only when pedaling and cut off when reaching 28 mph.



According to PeopleForBikes, the 28 states in green have enacted model legislation regulating three classes of e-bikes.

The laws also have similar defining language along with safety and operation requirements. This effort has largely been led by PeopleForBikes, a national advocacy group that promotes the use of Class 1 and Class 2 e-bikes wherever pedal-powered bikes are allowed and Class 3 e-bikes on roadways only (Exponent, 2019; Yobbi, 2020).

Finally, a review of state/territorial, local and university regulations governing PTD operation found that all addressed one or more of four explicit behaviors: *required* such as wearing helmets; *allowed* and *prohibited*, with a focus on sidewalk riding; and *exempted* such as not needing a license or registration. The most common user behaviors explicitly *required* address helmet use (typically for riders under 18 years of age), minimum rider age, braking, lights and reflectors, safety guides, yielding to pedestrians, number of riders, riding abreast, parking, speed of streets, rights and penalties (Fang et al., 2019).

The Role for SHSOs

- ✔ Task a staff member, ideally a program coordinator or manager working in pedestrian and bicyclist safety, with the responsibility of becoming your SHSO's expert on micromobility. If PTDs are not explicitly banned in your state, this individual is encouraged to work with local jurisdictions that may already have micromobility operations to harmonize regulation.
- ✔ Include micromobility (if it is not explicitly addressed) in your state's pedestrian and bicycle safety task force, advisory group, commission or other relevant body's charter and expand the membership to include representatives from this mode.
- ✔ Work with the task force to review how PTDs are addressed in state laws and regulations to identify confusing language, gaps and deficiencies.
- ✔ Work with task force members — and others with an interest in micromobility, such as providers and sellers, local ride share program administrators, and insurers, to educate policymakers and the media about what PTDs are and are not and how to effectively regulate their use ensuring that mobility and safety are not compromised.

Funding

The Challenge: The current U.S. surface transportation funding law — the FAST Act — does not include dedicated funding for micromobility, despite a decade of steady growth.

Currently there are shared micromobility systems in 47 states and Washington, DC. The mode is expected to continue to grow over the next decade, with management consultant, McKinsey predicting it could generate anywhere from \$300 to \$800 billion by 2030 (Heineke et al., 2019). The pandemic's effect on those projections is unknown, but not the public's appetite for transportation modes that promote social distancing. When the average length of household trips is factored into the discussion — the majority (59 percent) are less than six miles and three-quarter are ten miles or less (Federal Highway Administration, 2018) — the use of shared and/or owned PTDs becomes even more viable and cost-effective (particularly for those who do not have the means or desire to travel by motor vehicle).

At present, the cost of owning and operating a shared micromobility system falls on local governments, device providers and/or non-profits. Some bikeshare systems are government-owned, such as those operating in the DC metropolitan area, while others are government-endorsed. Citi Bike in New York, for example, is the latter and uses money from corporate sponsors rather than public dollars to purchase and maintain vehicles (DuPois, Greiss & Klein, 2019). San Francisco's bikeshare program, Bay Wheels, is administered by the Mass Transit Authority (SFMTA) and operated by Motivate, which has undertaken a major expansion with sponsorship from Ford. Once complete, the system will cover approximately half the city — at no expense to taxpayers (SFMTA, 2020). (Motivate is owned by Lyft and operates many bikeshare programs across the United States.)

The introduction of dockless bikes, however, created a new set of challenges for government agencies, prompting cities to institute permitting processes that include the collection of fees to help cover administrative and other costs (much to the dismay of providers). San Francisco was one of the first to do this, charging each provider an application and annual permit fee as well as a \$10,000 endowment. Seattle enacted a \$250,000 free-floating bike share program fee in 2018 that annually allows four dockless providers to each operate up to 5,000 bikes on the Department of Transportation's (SDOT) right-of-way. If there are three or fewer vendors, the fee is \$50 per permitted bicycle or other device, prorated by month. SDOT uses the fee to cover permit costs, program administration and for public-realm accommodations such as signage and designated bike share parking areas (SDOT, 2018). (Seattle currently does not allow e-scooters.)

Fees help, said those government and non-profit officials interviewed for this publication, but they do not begin to cover all administrative costs. Nor do they address the need to educate riders and other road and sidewalk users about how to safely operate together. Many communities encourage or require micromobility providers to invest in education and rider training that includes promoting helmet use, but consistent and widespread outreach is needed. Funding is also needed to train officers to understand and enforce PTD laws. There is also agreement among city and community officials, providers and advocates that more protected infrastructure is needed, as it is the preferred and safest place to ride. All these things take money.



At present, the cost of owning and operating a shared micromobility system falls on local governments, device providers, and/or non-profits.

Micromobility & Reauthorization

The NABSA, which advocates for shared micromobility, is calling on Congress to include micromobility in the next surface transportation reauthorization bill. Infrastructure is a key theme of NABSA's platform, which includes incorporating Complete Streets into project design, expanding the Transportation Alternatives Program to include shared micromobility and placing greater emphasis on using Highway Safety Improvement Program funds to address vulnerable road user safety. The association is also urging Congress to reauthorize and increase funds for direct investment in micromobility systems and allow monies to be used to study and support the industry's growth. That provision, coupled with reinstating the bicycle commuter tax benefit and expanding it to include shared micromobility, could result in more e-bikes and e-scooters on the road (NABSA, 2020).

SHSOs may fund some micromobility safety programs using federal funding from Section 402 or possibly Section 405(h) (Non-motorized Safety) of the National Priority Safety Program. A state is eligible for Section 405(h) funding if its combined statewide pedestrian and bicyclist fatalities account for more than 15 percent of its total traffic deaths based on the most recent Fatal Analysis Reporting System (FARS) data.

However, SHSOs may use these funds only to train law enforcement officials on pedestrian and bicyclist safety laws and for enforcement mobilizations, campaigns and road user public education and awareness programs that address these laws (GHSA, 2020b). Ensuring law enforcement and all road users understand these laws is critical. However, this restriction has hampered states from fully expending 405(h) monies. Therefore, GHSA urges Congress to expand this program to allow federal funds to be used for a wider range of programs that address vulnerable users. States should also explore how these funds can be used to advance micromobility safety.

GHSA urges Congress to expand the 405(h) program to allow federal funds to be used for a wider range of programs that address vulnerable users.

The use of alcohol and other drugs by PTD riders, as well as bicyclists and pedestrians, is also problematic, just as it is for motorists. As discussed previously (see page 10), researchers examining the medical records of PTD riders treated at hospitals found significant alcohol and drug use. At the same time, one-third of fatally injured pedestrians in 2018 and 20 percent of bicyclists ages 16 and older, in 2019, with known test results had a BAC of 0.08 or higher [Retting, 2020; NHTSA as cited in Insurance Institute for Highway Safety, 2019]). Under the FAST Act, slightly more than half of Section 405 funds are earmarked for impaired driving incentive grants (GHSA, 2020b). However, the use of alcohol and/or drugs by all road users means they have diminished faculties that could impact judgement, decision-making and reaction time and put them at risk for injury and/or death. Therefore, Congress should expand the use of Section 405(d) funds to include countermeasures addressing alcohol and drug use by drivers, riders, pedestrians and bicyclists.

Helmet Use

For PTD riders, reinforcing the importance of wearing a helmet is critical as the majority of shared bike and scooter riders do not wear helmets and are significantly less likely to do so compared to cyclists who own their bicycles (Fischer et al., as cited in Graves et al., 2014). Micromobility providers urge riders via their apps and websites to wear helmets but they do not typically provide them at the time of rental. (See the rare exceptions in the sidebar.) An evaluation of the barriers

These PTDs Come with a Helmet

Getting shared PTD riders to wear helmets is a big problem for providers. Wheels provides riders a free helmet that is locked to the rear of their e-bikes operating in six U.S. cities. The helmet is unlocked via the Wheels app and comes with a peel-off biodegradable headliner. A magnetic sensor in the bike recognizes when the helmet is being used (Hawkins, 2019a).

In Europe, 5,000 Tier scooters are equipped with a foldable helmet that is locked inside a compartment located below the handlebars (accessible via the app). The helmets meet European safety standards, are checked after every fifth ride and disinfected as part of the company's COVID-19 safety precautions (Porter, 2020).

and facilitators to helmet use among bikeshare riders in Australia, where helmet use is mandatory, found that 61 percent cited helmet inaccessibility or the desire not to wear one as the main barriers to using the mode (Fishman et al., as cited in Graves et al., 2014).

Providers, however, do not advocate for helmet laws as the requirement could impact a rider's spur-of-the-moment ability to use a shared device. It was e-scooter operator, Bird, that sponsored the bill in California that rescinded the state's helmet requirement for all riders 18 and older (Kerr, 2018). At the same time, e-bike and scooter provider, Lime, gives a helmet to all learn to ride event participants and partners with a leading helmet manufacturer to offer riders discounts on helmet purchases. During the pandemic, helmet manufacturer, Thousand, launched its Courier Care program to give free helmets to bicycle couriers doing essential work (Thousand, 2020). To address the disparity in helmet use among shared PTD users, Congress is encouraged to include competitive funding in the next federal transportation bill to spur development of collapsible helmets or helmets designed for shared use.



Development of collapsible and shareable helmets could encourage use among riders.

The Role for SHSOs

- ✔ Educate your state's Congressional delegation about:
 - » what micromobility is (referring to the SAE Taxonomy discussed on page X can be helpful) and how it has and continues to grow, the behavioral safety issues that put riders and other road/sidewalk users at risk and the need to authorize funding for micromobility safety in the next federal surface transportation funding bill.
 - » why expanding the 405(d) program is necessary to fully address the impact of alcohol and other drugs on road safety.
 - » why expanding the 405(h) program is necessary to fully address the safety of ALL vulnerable road users.
 - » the disparity in helmet use among PTD riders, the dangers of riding without a helmet, the societal costs associated with head/brain injury and the need for innovative approaches to increase helmet use.

Data

The Challenge: Micromobility-involved crashes and injuries are likely underreported due to the lack of a universal reporting standard.



SHSOs are dependent on crash and other aggregated, de-identified data sets for problem identification and resource allocation. Data is also critical for making sound policy-decisions. The current lack of a standardized reporting mechanism for PTD-related crashes coupled with underreporting on the part of law enforcement and providers makes it difficult for SHSOs and their partners to understand micromobility’s impact on traffic safety. This should not be construed as the fault of either party, as a rider may choose not to report a crash, the crash may not involve a motor vehicle or meet the state’s reportable standard or it could have been misclassified. If reference is made to a PTD on a crash report, it is typically included in the narrative (Goodman et al., 2019).

To collect reliable micromobility crash data, state crash reporting systems should include a unique field element with attributes for all PTDs currently permitted to operate on state and local roadways. A micromobility element for non-motorists has been proposed for the next update to the Model Minimum and Uniform Crash Criteria (MMUCC) scheduled for publication in 2022. The proposed element follows the framework laid out by the Society of Automotive Engineers (SAE) in their publication, [Taxonomy and Classification of Powered Micromobility Vehicles](#) (J3194). The graphic below and associated narrative are included in a [summary document](#) to J3194 and present the most user-friendly avenue to increase data capture of these mobility types without sacrificing data quality and integrity.

POWERED MICROMOBILITY VEHICLE

A wheeled vehicle that must:

- Be fully or partially powered
- Have a curb weight ≤ 500 lb (227 kg)
- Have a top speed ≤ 30 mph (48 km/h)

Scope of J3194™

- Only includes vehicles that are primarily designed for human transport and to be used on paved roadways and paths
- Excludes solely human-powered vehicles

TYPES OF POWERED MICROMOBILITY VEHICLES¹

	Powered Bicycle	Powered Standing Scooter	Powered Seated Scooter	Powered Self-Balancing Board	Powered Non-Self-Balancing Board	Powered Skates
Center column	Y	Y	Y	Possible	N	N
Seat	Y	N	Y	N	N	N
Operable pedals	Y	N	N	N	N	N
Floorboard / foot pegs	Possible	Y	Y	Y	Y	Y
Self-balancing ²	N	N	N	Y	N	Possible

¹All vehicles typically designed for one person, except for those specifically designed to accommodate additional passenger(s)
²Self-balancing refers to dynamic stabilization achieved via a combination of sensors and gyroscopes contained in/on the vehicle

Source: Society of Automotive Engineers

What about FARS?

Fatal Analysis Reporting System (FARS) coding for *Person on Personal Conveyance* was modified in 2020 to indicate whether the personal conveyance was *motorized*, *non-motorized* or *unknown*. This new coding does not include motorized bicycles, but the definitions align with the ANSI D-16 definition. It is important to point out, however, that FARS data can only be accurately coded if specific information such as *scooter motorized* or *scooter non-motorized* is recorded on the state crash report. Until this detail is captured on state crash forms, the change to FARS will not be fully realized.

What States Are Doing

Georgia follows the [ANSI D16.1](#) definition for a personal conveyance — “a device, other than a transport device, used by a pedestrian for personal mobility assistance or recreation... that can be motorized or human powered, but not pedaled” (American National Standards Institute, Inc., 2017). Officers are [instructed](#) to use the [pedestrian identifier](#) when completing a [crash report](#) involving an e-scooter and a motor vehicle and to note the *scooter brand* under *vehicle make* and *scooter* under *model*. If the incident, however, involved an e-scooter and a pedestrian or two e-scooters, no crash report would be filed because no motor vehicle was involved. By defining e-scooters as pedestrians, however, the state is not getting a complete picture of how these devices are impacting the safety of riders and other road users.

Boise Amends E-Scooter Law Despite Lack of Data

The importance of having micromobility crash data cannot be overstated — especially when it comes to making sound policy decisions. But a lack of crash and other data did not stop city officials in Boise, ID, from amending its e-scooter ordinance in July 2019, after the program had been operating for nine months and logged nearly half a million trip miles. Instead, the change was made based on “anecdotal reports of risk-taking and misbehavior.” The safety-related revisions address slowing scooters down from 15 mph to 5 mph in congested areas and public places and assigning an ID number to each scooter to help the public report reckless riders to local authorities (Capron, 2019). Both are reasonable provisions that have been instituted in other cities. However, several Boise micromobility officials interviewed for this report indicated they were not aware of any citations being used for dangerous scooter riding.

In North Carolina, officers in Charlotte have received training on how to document the role of e-scooters in the narrative of the crash report to help track e-scooter crashes and compare them to other modes (Goodman et al., 2019). This is helpful if the crash forms are captured electronically and allow for keyword queries. Otherwise, obtaining this information would require manually reviewing all crash reports.

Several state crash reporting forms were or are being updated to address micromobility but none to the extent suggested by the MMUCC proposal. For example, Pennsylvania added *Bicycle-Electric Assist* under *vehicle type* in its crash reporting system and began collecting information about e-bike crashes on January 1, 2020. The California Highway Patrol (CHP) is adding an *operator* box to its 555 Crash Reporting Form to indicate that a micromobility device was involved, but it will

not distinguish the device type (i.e., e-scooter, e-bike or e-skateboard). The form, which is used by enforcement agencies throughout the state, has separate boxes for *pedestrian* and *bicyclist*. A new non-motorist attribute, *Pedestrian Using an Electronic Scooter*, is being added to the Tennessee Traffic Analysis Network (TITAN) electronic crash reporting system used by all law enforcement agencies statewide. Without this identifier, the system would have to query the narrative for scooter in combination with the non-motorist code, *Pedestrian Using a Personal Conveyance*.

Using Hospital Data

At present, hospital data is considered the best source of local PTD-related crash, injury and fatality data (Goodman et al., 2019). But this data also can be problematic, since it is dependent on hospital personnel properly coding the rider's/patient's injuries. For researchers and others interested in studying micromobility, there is no consistent terminology or easy way to search for PTD-related injuries. That prompted two epidemiologists in Atlanta to launch the Scooter Crash and Trauma CoHort or SCRATCH injury registry in June 2018. Currently, the registry has information about 800 micromobility-related events that have occurred through the end of 2019. Obtaining this data, however, has been challenging since health care providers are using a myriad of cause codes for these injuries (J. Rupp, personal conversation, May 6, 2020).

There is no consistent terminology or easy way to search for PTD-related injuries.

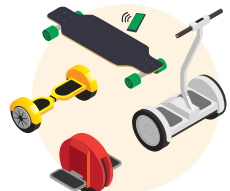
To address this problem, the National Center for Health Statistics approved the use of new ICD-10-CM (International Classification of Diseases, 10th Revision, Clinical Modification) [external cause codes](#) beginning October 2020. This will provide health care practitioners the means to differentiate PTD-related injuries (referred to as pedestrian conveyance accidents) by device (i.e., e-scooter, e-skateboard, hoverboard) and cause (i.e., collision with a pedestrian, pedal cycle, two or three-wheeled motor vehicle, car, pick-up, van, heavy transport vehicle, bus; fall from a device; collision with a stationary object). The intention is to code to the greatest level of granularity possible. The group that pressed for approval of the new cause codes pointed to the critical importance of accurate injury surveillance for successfully developing, implementing and evaluating prevention initiatives (McConnell-Lampthey & Schuerer, 2019).

Training on the use of the new ICD-10-CM codes is planned. This is key, along with engaging the medical record companies providing clinical software systems used by physicians, nurses, emergency personnel and others. A poster designed for display in clinical and administrative settings where micromobility-related injuries are triaged, described and coded has been developed by the North Carolina Department of Health and Human Services and may be reproduced and posted without permission by states and their partners.

New Modes, New Codes!
Categorizing injuries related to emerging micromobility transportation.



e-Scooters
Keyword for Chief Complaint:
e-scooter + Brand
(Bird, Gotcha, Jump, Lime, Spin, Razor, etc.)




Other Devices
Keywords for Chief Complaint:
e-skateboard, e-hoverboard,
Segway®, e-unicycle

ICD-10-CM Codes

V00.09 Pedestrian on foot injured in collision with other pedestrian conveyance
V00.181, V00.182, V00.188 Accident on other rolling type pedestrian conveyance
V01-V06 (.09, .19, .99) Pedestrian with other conveyance injured in transportation collision

NOT considered e-scooters
These devices are not considered e-scooters and have their own set of ICD-10-CM codes.

 mobility scooters
 mopeds
 motor scooters

Department of Transportation
ROAD SAFETY
Questions? Contact BeInjuryFreeNC@dhhs.nc.gov
NC DEPARTMENT OF HEALTH AND HUMAN SERVICES
Division of Public Health

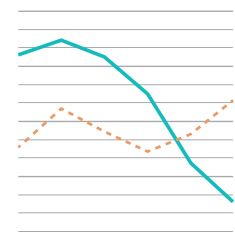
North Carolina's poster on micromobility-related injury codes, which may be reproduced without permission.

Linking crash and medical data can help SHSOs and their partners develop a better understanding of safety issues associated with micromobility. But being able to look at trip or exposure data (i.e., origin-destination, time of day, day of week) would provide a more robust picture and ensure crash and injury/fatality data are not examined in a vacuum. This data is often lacking for those who walk and bike, but not so for shared micromobility (more on that below). By having access to this data, traffic safety and public health professionals can more accurately compare crash trends and injury rates across all modes and better allocate resources for maximum impact.

Micromobility Provider Data

Shared e-bikes and scooters generate a lot of vehicle data, which are collected and maintained by the micromobility providers. These data can be used by communities with shared mobility programs to help them make better management and planning decisions — including bolstering safety. The challenge though is to receive the data from different providers in a standardized format. Los Angeles recognized this early and responded by developing an open source [Mobility Data Specification](#) (MDS) administered by the Open Mobility Foundation and currently used by 80 communities including Austin, Seattle, San Jose, Providence, and Louisville (Zipper, 2019).

MDS enables cities to obtain de-identified, dockless trip information in real-time. But it does not collect crash data. As pointed out earlier, the provider must rely on the rider to report an incident. Some do, especially if the PTD is damaged, but it is not common practice. As part of their agreement with providers, some cities require them to report collisions, injuries, and property damage on ongoing basis. Atlanta uses provider-supplied data to post a monthly [Shareable Dockless Mobility Device](#) report that includes trip, parking violation and safety data presented in a graph or chart. The latter (a chart) shows total trips, crashes and injuries (only those reported to providers) and fatalities by month. This information is extracted from an excel spreadsheet that requires the provider to provide the date and a description of the incident, the PTD and incident (crash/fall/other) type, the time the customer reported the incident, the time of report resolution and a description of that resolution.



Some cities, such as Atlanta, use provider data to produce reports on micromobility usage and safety.

Michigan State University, one of many colleges/universities with micromobility programs, also requires its e-scooter provider, Gotcha, to share crash incident data that it receives from riders via its app. Mobility researchers at MSU want to use this and other data to gain insights for “develop[ing] technology solutions that encourage good social behavior, from safe driving practices to alleviating accessibility hazards” (MSU, 2019). An MSU official acknowledged, however, that incidents are likely not captured as there were only two reported in 2019. One was the result of an unrepaired roadway and the other was rider error; neither warranted medical attention. Efforts to obtain micromobility injury data from local hospitals and urgent care clinics also have not been successful due to the inability to distinguish between crashes involving e-scooters, mopeds and e-skateboards and shared and personally owned devices (B. Nelson, email conversation, May 2020).

The micromobility providers interviewed for this publication acknowledged there are gaps in crash and injury data and expressed interest in working with SHSOs and their partners to identify how best to bridge them. This includes meeting with Traffic Records Coordinating Committees to explain what data they collect and learn what states specifically want and need.

Crowdsourced Data

Micromobility providers and others interviewed for this publication also suggested using crowdsourced data — data collected and reported via technology by a user community — to better understand what is occurring in an area and where interventions (i.e., enforcement, outreach, infrastructure improvements) might be helpful. Crowdsourced data is a convenience sample, so there is the potential for sampling bias. However, when it is combined with other data sources, it can provide a deeper and more nuanced understanding of an issue or problem (Ray & Sussman, 2019).

Is crowdsourced data reliable? Using the How's My Driving app (recently rebranded as [OurStreets](#)), volunteers spread out across Crystal City, Rosslyn, and Ballston (part of the DC metropolitan area) on an October day in 2019 to capture how many motorists blocked or parked in bicycle lanes. Over a five-hour period, they reported more than 300 violations and collected a wealth of information about each including location, time of day, duration of the violation, vehicle type and what it was doing (loading, standing, parked). By looking beyond the number of violations and pulling in crowdsourced information, local officials were able to understand why a bike lane was not working and make more informed decisions about how to fix it (Sussman, 2019).

Officials in Northern Virginia were able to use crowdsourced data to understand why a bike lane was not working.

The app developers stressed OurStreets is “not about demonizing drivers, it’s about understanding why these behaviors are happening... the geographic and date/time context, and how [a community] can make changes to mitigate these problems.” It is a way to use crash, citation and “all these other layers” to tell “a more contextualized story about what’s actually happening on our streets” (Machosky, 2020).

OurStreets can be used anywhere in the United States. [Street Story](#), developed by the Safe Transportation Research & Education Center (Safe TREC) at the University of California-Berkeley, is a free, community engagement tool that allows residents, community groups and agencies throughout California to collect information about collisions, near-misses, general hazards and safe locations to travel. While people submitting information about collisions are not required to provide their name, they must select their mode of travel from a pull down menu that includes PTDs (e-bike, e-scooter, other), indicate the date, whether it occurred during the day or at night, who was involved, if there were any injuries or fatalities, the cause (infrastructure, environment, behavioral with specific examples) and what would make the placers safer. SafeTREC recognizes community members have a wealth of information about transportation safety and want not only to collect it, but also make it publicly accessible (SafeTREC, 2020).

The Role for SHSOs

- ✔ Work with the appropriate agency(ies) to update your state’s crash report to include a micromobility field and/or identifiers that capture crashes by device and train officers to use it.
- ✔ Partner with your State Department of Health; Hospital, Emergency Medical Physicians, Trauma Nurses and EMS/First Aid Associations; and other health care-related groups to promote awareness (i.e., distribute the UNC poster) and widespread use of the new ICD-10-CM external cause codes for micromobility.

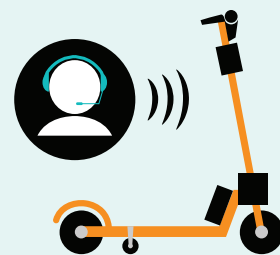
- ✓ Meet with city/community officials who administer shared micromobility programs to learn what safety-related data they collect and from whom, how they use and what they need.
- ✓ Invite micromobility providers working in your state to attend a Traffic Records Coordinating Committee meeting to begin a dialogue on data collection, sharing and needs.
- ✓ Include a micromobility representative on your Traffic Records Coordinating Committee.
- ✓ Link micromobility exposure, crash and injury data to fully understand the devices' safety impacts and make more informed resource allocation and policy decisions.
- ✓ Partner with a community to pilot the use of crowdsourced data to gain a deeper understanding of a traffic safety problem and the best countermeasures for effectively addressing it.

Infrastructure

The Challenge: Separating transportation modes is the most effective way to reduce crashes. If separate infrastructure does not exist, micromobility riders will go where they feel safe and innovate based on what is available.

Many of the complaints about micromobility — and scooters, in particular — center around sidewalk parking and riding. Advocates argue if space is built to safely park and ride PTDs, these conflicts can be avoided along with the need for complicated laws and enforcement (Kyrouz, 2020). Because dockless vehicles can be left anywhere, concerns about vehicles blocking the right of way (a significant problem for people with physical, visual and cognitive impairments) and not being parked upright garnered significant media attention the past couple of years. Since then, many cities have taken steps to address the parking problem from posting signage and using [stencils](#) to demarcate parking spaces to developing apps to report improperly parked bikes and establishing PTD parking corrals. Regarding the latter, these are often the last parking space or the curb side (if local laws permit), no-parking area adjacent to crosswalks and stops, referred to as [daylighting](#) (Ramboll, 2020; AmericaWalks, 2020).

In 2018, Santa Monica (the unofficial birthplace of e-scooters) created 107 on-street and sidewalk parking zones and required providers to offer parking incentives



Self-Driving Scooters Roll into Georgia

An Atlanta suburb is partnering with scooter providers, Go X and Tortoise, to address the city's parking problem by launching self-driving vehicles. Peachtree Corners passed an ordinance requiring all shared micromobility devices to automatically reposition themselves as way to increase scooter accessibility and reduce sidewalk clutter. Riders use the Hail the Scooter app to summon a device to their location. After they've completed their trip, the scooter drives itself — at 5 mph — back to a home base, where it is disinfected. The scooters aren't really driving themselves; they're piloted by remote teleoperators located in Mexico (Anderson, 2020).

to encourage rider use. The incentives have helped, but city officials acknowledged that more education, in-app messages, incentives and disincentives and drop zones are needed (City of Santa Monica, 2019). The DC Department of Transportation (DDOT) began installing off-sidewalk parking corrals for both private and shared dockless vehicles citywide in February 2020 and is taking [requests](#) from residents for additional corrals. Where there are no corrals, riders are reminded to park in the furniture zone — the first five feet of the curb, where there are typically public benches or trees — placing one wheel on the curb and the other in the street to ensure there is adequate space for pedestrians (DDOT, 2020). In June, Austin partnered with Swiftmile to launch a 6-month pilot to determine if free access to the latter’s scooter parking and charging stations will “influence user behavior in managing sidewalk organization” and “increase access to fully charged scooters” (City of Austin, 2020b).



DDOT dockless vehicle parking video

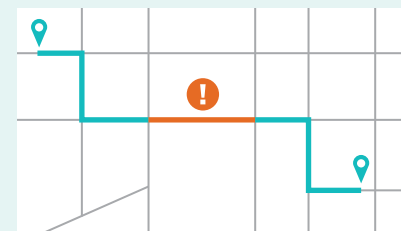
Sidewalk Riding

When it comes to addressing sidewalk riding, infrastructure is the fix. But funding and building it is not that simple. PTDs make some pedestrians feel unsafe because they move at a higher rate of speed. (Maximum speeds for these devices range from 15 to 20 mph, but riders generally travel at much lower speeds or are required to do so by city or county ordinance.) But for those PTD riders that do not feel safe on the adjacent street due to road conditions (i.e., uneven pavement, potholes, gravel, grates, sewer covers), traffic volumes and/or motor vehicle speeds, the sidewalk is often the best option. That is why organizations such as NACTO and NABSA are calling for more bike lanes and paths, bikeways and other clearly marked, comfortable and safe places to ride (NACTO, 2019; NABSA, 2020).

Micromobility users concur. In Austin, which operates 76 bike share stations and launched its dockless bike and scooter program in 2018 (the latter generated 1.8 million trips the first year), the Department of Transportation surveyed community members and found on a scale of one (very uncomfortable) to five (very comfortable) e-scooter and bike riders were most comfortable on protected bike lanes (4.11), followed by paved urban trails (3.87), painted bike lanes (3.64) and residential streets with no marked traffic lanes, bike lanes or sidewalks (3.3). Sidewalks on busy, multi-lane roads (2.62) were less comfortable than natural surface trails (2.91), but more

Can Sensors Keep Bikes Off Sidewalks?

Using sensors and an AI-based statistical model that predicts the likelihood of a user riding on the sidewalk and for how long, Lime is sending a push notification to San Jose, CA riders when more than half of their trip occurs on the sidewalk. They may also receive an image showing exactly where the sidewalk riding occurred and an email with the same warning. Lime also sees the potential for sharing the data with city officials to advocate for more protected bike lanes (Sawers, 2020).



comfortable than multi-lane streets with marked traffic lanes but no bicycle lanes or sidewalks (2.09) (City of Austin, 2018). Feeling comfortable is key. When researchers set out to learn why male e-bike and e-scooter riders outnumbered females riders two to one, it was not fear of the devices but lack of fully separated and protected lanes that alienated women (Krizek & McGuckin, 2019).

Separate Infrastructure

The evidence is clear that providing infrastructure that separates riders — bicyclists, e-bikes, and e-scooters — from motorists is the most effective countermeasure for preventing crashes. Cycle tracks, on-street bicycle lanes that are physically separated from motor vehicles by barriers such as curbs or bollards, are 89 percent safer than streets with parked cars and no cycling facilities (Teschke et al., 2012). When physical separation is not possible, reducing the distance or time bicycles (pedal-powered and/or motorized) are exposed to risk is essential (Ragland as cited in Williams, 2015). This can be done through marked bike lanes, bicycle boulevards or greenways, bike boxes (pavement marking that features a stop line closer to the intersection to give bicyclist and PTD riders a head-start when the light turns green) and specially marked traffic lights that provide an advance green signal for riders.

89%

Separated on-street bicycle lanes offer significantly more rider safety compared to streets with no physical separation.

But separate paths and bike lanes also make communities safer for drivers, not just riders. Researchers analyzed 13 years of crash and street design data from 12 large U.S. cities to understand what makes some safer than others and found those with protected bike lanes had lower fatality and injury rates. Cities with an abundance of cycle tracks, saw their fatal crash rates decline by 44 percent and their injury rates cut in half compared to cities with an average amount of protected infrastructure. Bicyclists also benefited from painted and fully separated bike lanes. However, what generated the greatest safety gains for riders — and drivers — were bike lanes separated with bollards, planters or other devices (Bliss, 2019).

But separate paths and bike lanes also make communities safer for drivers, not just riders.

Making infrastructure improvements is not the responsibility of the SHSOs. But they can educate law enforcement, elected officials, and the public about infrastructure needs and how particular countermeasures improve safety for all road users. As a member of a statewide pedestrian and bicyclist task force or working group, a SHSO can also join with state and local DOTs, safety partners and advocates to review crash, injury and other data, such as near misses collected through crowdsourcing (discussed previously), to identify, prioritize and select appropriate countermeasures for locations posing a high risk for vulnerable road users. States are encouraged to take a systemic approach to safety which involves implementing improvements based on high-risk roadway features correlated with specific severe crash types. Unlike the approach used to address hot spots, the systemic approach considers multiple locations with similar risk characteristics and selects the most appropriate and affordable countermeasure(s) for widespread implementation (FHWA, 2020).

Reviewing origin and destination data collected by micromobility providers is also another potential source of information for identifying potential hot spots on roadways where no crashes have occurred — yet. For instance, the data may reveal many riders are ending their trip at a location that is not adjacent to a major business, retail or transportation hub. Does the speed limit or number of traffic lanes increase at that point or on adjacent roads? If there is marked or protected

infrastructure for cyclists, does it end there? Getting the answer to these and other questions could help prevent future crashes and save lives.

The Role for SHSOs

- ✔ Invite micromobility providers operating in your state to join the statewide pedestrian and bicyclist safety task force or advisory group.
 - ✔ Work with micromobility providers and/or community officials to obtain and analyze trip (origin and destination) and other data to identify potential high-risk areas for riders. Use the findings along with crash, injury and other data to take a systemic approach to reducing and preventing fatal and serious injuries.
 - ✔ Partner with communities with dockless micromobility programs to fund research to better understand why sidewalk conflicts occur and how best to address them.
 - ✔ Conduct a general session or workshop at your annual statewide safety conference to educate law enforcement and other behavioral safety partners about bicycle infrastructure (e.g., cycle tracks, bike lanes, bike boxes) and its effectiveness in reducing crashes for all road users — bicyclists, PTD riders, pedestrians and motorists.
 - ✔ Educate state and local elected officials and the media about bicycle infrastructure and its effectiveness in reducing crashes for all road users — bicyclists, PTD riders, pedestrians and motorists.
 - ✔ Partner with statewide and local bicycle and pedestrian safety groups to educate the public about bicycle infrastructure and its effectiveness in reducing crashes for all road users — bicyclists, PTD riders, pedestrians and motorists.
 - ✔ Include information on your website about how bicycle infrastructure works and its effectiveness in reducing crashes for all road users — bicyclists, PTD riders, pedestrians and motorists.
-

Enforcement

The Challenge: Most cities require providers to inform riders about safe operating rules, but enforcement of those rules is the responsibility of local law enforcement officials. That effort, however, may be hampered by the lack of a state micromobility statute and/or local ordinance and little or no officer training.

As previously discussed in the oversight section of this publication, states should establish PTD regulations, with the caveat that local governments can enact additional rules based on local conditions. Local ordinances are often enacted after, rather than before, shared devices appear on city streets and sidewalks and in response to public complaints. Typically, they address where a PTD may and may not be operated, underage riding,



speed limits, helmet and/or cell phone use and other safety issues. Most cities require providers to inform riders about the rules through their apps, but enforcement of these rules ultimately falls to police and municipal code enforcement officers. That is why it is essential for law enforcement to be at the table when micromobility ordinances are developed.

It is essential for law enforcement to be at the table when micromobility ordinances are developed.

In Austin, the Transportation and Police Departments collaborated to develop a micromobility ordinance, after more than 5,000 e-scooters appeared on its streets. “They were literally thrust on the city and it was disruptive,” said an APD Commander. “Riders were in the middle of the street, going the wrong way, parking anywhere and blocking sidewalks. We didn’t have a state law or city ordinance; we were literally flying blind” (E. Miesse, personal conversation, May 11, 2020). The issue came to a head when an intoxicated e-scooter rider, traveling the wrong way on a city street, was struck and killed by a motorist in February 2019.

To address the problem, two chapters in the Austin City Code — traffic regulation and administration and bicycles — were amended to include the operation of micromobility devices and bicycles on sidewalks and roadways. The former is defined as a “scooter, skateboard or other compact device designed for personal micromobility, either privately owned or part of a shared... service” (City of Austin, 2019b). Because PTDs are similar in movement to bicycles and Austin has a robust system of bike lanes and paths, the APD Commander explained that it made sense to enforce them like bicycles. As a result, the ordinance expressly states that a PTD rider — like a pedestrian or bicyclist — is a vulnerable road user.

The ordinance allows on-road (in adherence with vehicle traffic rules and traffic-control devices) and sidewalk riding “in a reasonable and prudent manner” but also requires PTDs and bicycles to yield the right-of-way to pedestrians (City of Austin, 2019b). It prohibits the use of portable electronic devices and double-riding and outlines where scooters and bikes may and may not park. There is no rider age restriction, however, a person under 18 years of age must wear a helmet. An offense is deemed a Class C misdemeanor punishable by a fine not to exceed \$20 for a first conviction and \$40 for a second and subsequent conviction. The court may dismiss a helmet offense up to 30 days after a citation is issued, if the defendant can show proof of purchase (City of Austin, 2019b). No information was available on the number of citations issued since the ordinance took effect. However, the APD Commander indicated that police and municipal code officers have written tickets.

Austin’s ordinance does not address impaired riding, which has been a problem in this city and others. A rider can be arrested for public intoxication and subsequently released to a friend, but the APD Commander pointed out a state micromobility law addressing this and other concerns is needed. Texas does not currently have such a law. California, on the other hand, does. [Section 2122.15](#) of the State Vehicle Code prohibits operating a motorized scooter on a highway while under the influence of alcohol, drugs or a combination of the two. While there is a per se BAC limit of 0.08 under California’s DUI statutes, there is no per se law for intoxicated scootering. BAC can be a consideration but is not necessary to determine if the operator has violated the law. The offense is a misdemeanor punishable by a fine of up to \$250 and does not count against a person’s driving record (California Legislature, 2020).



California prohibits operating a motorized scooter under the influence, but there is no per se BAC limit.

Officer Training, Resources & Support

In addition to having an ordinance that clearly defines the rights and responsibilities of micromobility users, law enforcement officials also need training. The latter is essential for ensuring officers understand the rules and enforce them fairly and equitably. They also need a primer in PTD typology and how these devices operate; how to identify them in crash reports, especially if there is no unique identifier for PTDs; safe riding practices; and how can they help educate riders, drivers and pedestrians about safely sharing the road. Every officer tasked with enforcing Austin's ordinance received training that included riding a standing and seated scooter, vital for creating empathy. The APD also issued a training bulletin addressing how to enforce the city's micromobility ordinance.

Training Providers to Be Responsible Partners

Micromobility providers in Austin are also expected to help reinforce the city's ordinance. When the Texas School for the Blind and Visually Impaired complained to Austin transportation officials about problems with e-scooters on their downtown campus, providers were required to participate in experiential training. That, however, did not involve riding a scooter. Instead, provider staff members were blindfolded and led by hand down busy urban sidewalks. The training, coupled with monthly (now quarterly) meetings, has resulted in the deployment of strategies that are positively impacting compliance and safety. The training has since been expanded to address ADA (Americans With Disabilities Act) concerns and is helping to make providers more responsible partners (J. JonMichael, personal conversation, April 9, 2020).

Baltimore, MD, launched a six-month e-scooter pilot program in August 2019 that was made permanent in early 2020. The Baltimore Police Department's Training Unit recommended officers give warnings to riders, rather than tickets during the first year. To ensure officers were fully versed in the city's scooter laws and new bicycle infrastructure, information was included in one of the BPD's monthly online service trainings. Patrol officers must click through a series of slides and pass an online quiz, with the results recorded to ensure completion by all personnel. The BPD also developed a business card-sized educational piece that patrol officers can easily carry and use to start a conversation with riders (M. Young, personal conversation, July 6, 2020).

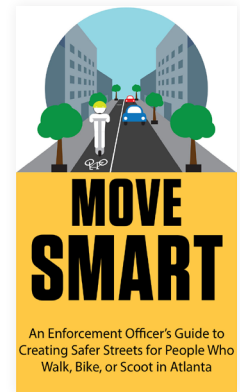


Baltimore's business card-sized resource for officers.

Some cities have developed reference guides to help officers cite the appropriate statute or ordinance associated with a micromobility violation. Oregon's [pocket guide](#), which addresses seven devices including e-scooters and e-bikes, was originally developed in 2002 by the SHSO and state licensing agency and is updated whenever there is a legislative change or a new device is added. It lists the applicable State Vehicle Code for easy reference along with the minimum operator age; license, registration, insurance, helmet and lighting requirements; maximum capable and allowable

speeds; where it may be ridden (sidewalk, bike path, crosswalk); and if passengers are permitted and a DUII (Driving Under the Influence of Intoxicants) charge is possible. While it is designed for law enforcement, the handy reference is also used by the courts, legislators, community advocates, and city council members, and frequently cited by the media.

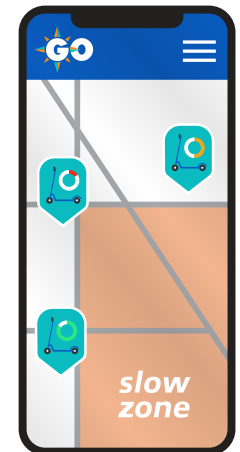
Atlanta’s ordinance regulating shareable dockless mobility devices (e-bikes and scooters) was passed by the City Council in January 2019. [Move Smart: An Enforcement Officer’s Guide to Creating Safer Streets for People Who Walk, Bike or Scoot in Atlanta](#) was developed to help officers enforce the new ordinance along with other state and city codes applicable to vulnerable road users (pedestrians, bicyclists and PTD users). In addition to listing the applicable ordinance or code for violations and allowed actions, the three-panel brochure provides guidance for properly identifying and coding scooters, pedal and e-bikes and pedestrians on crash reports.



Atlanta PD resource for enforcing micromobility ordinances

Geofencing

In some communities, shared PTDs are prohibited from riding and/or parking in certain zones or their top speed is restricted. Large fleets can make it difficult for police officers to address these violations. More and more cities are requiring providers to use geofencing — a software feature that uses global positioning system (GPS) or radio frequency identification (RFID) to establish geographic boundaries — to supplement traditional enforcement. Using the PTDs’ location, which is already monitored by GPS, providers can set triggers to alert riders when they enter or exit a slow zone or restricted area.



Geofencing helps enforce slow zones and restricted areas for shared PTDs.

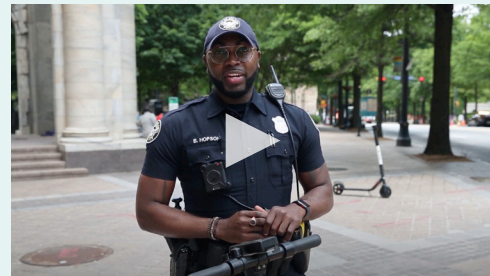
Santa Monica was one of the first cities to require providers to use geofencing to address parking, safety and oversaturation problems. The city and providers set up a deactivation zone around the beach area (City of Santa Monica, 2019). As a PTD approaches, the device begins to slow down and eventually stop. Geofencing is also used in Washington, DC to alert PTD users that sidewalk riding is prohibited in the Central Business District, due to its high volume of pedestrians. Other cities with designated slow zones and restricted areas require it of providers as well.

It is important, however, for law enforcement (and the city officials that establish PTD speed limit caps) to understand that the maximum speed (as specified by the manufacturer) a PTD can achieve is not the speed riders are typically traveling. Research funded by the Transportation Research Board and Federal Highway Administration (FHWA) found that on average e-skaters and skateboarders traveled 10 mph, while e-scooters were going 7.5 mph (Birriel et al., 2001, Fang & Handy, 2017, & FHWA, 2004, as cited in Fang et al., 2018). Another study of e-scooter riders in San Jose, CA, found they were going an average of 11 mph on streets, and slightly slower — 10 mph on mix-used paths and 9 mph on sidewalks — on facilities where there were pedestrians (Fang et al., 2018). The bottom line is that PTD riders are “generally two to three times faster than the average pedestrian and slightly slower than bicyclists” and “on sidewalks and mix-used paths [they] are typically slower than bicyclists” (Fang, et al., 2018).

Educating Riders, Enlisting the Public's Help

Law enforcement officials in some cities also play an active role in educating micromobility users about local ordinances as well as safe riding practices. Both roles are especially important when shared mobility programs first get underway. When Santa Monica launched its dockless pilot program in 2017, sidewalk riding was a prevalent issue as riders learned new behaviors and walkers and motorists adjusted to the new mode. The Santa Monica Police Department (SMPD) conducted enforcement based on key community complaints. They issued citations but also gave warnings to violators, conveyed information via digital messaging boards and posted on social media. Between June 2017 and September 2019, SMPD issued 1,006 citations to shared bike and e-scooter riders, with 61 percent of the tickets issued to riders under 16 years of age for not wearing a helmet (the law was amended in 2019 to require helmet use by riders under 18). Riding on sidewalks and running red lights accounted for 13 percent and 7 percent of the tickets, respectively. Ticketing peaked in July 2018 at 250 citations and had dropped to an average of 50 per month in 2019, as riders gained skill and greater awareness of the local laws (City of Santa Monica, 2019).

The Atlanta Police Department (APD) filmed a [Public Service Announcement](#) to help the public understand the city's new scooter ordinance. APD Officer Benjamin Hopson hosts the 90-second PSA that covers no sidewalk riding or cellphone use, riding with traffic and following traffic laws, giving pedestrians the right-of-way and parking do's and don'ts. Helmet use is recommended (but not required) and the PSA closes with a reminder to *move to the street if you're not using your feet*. The city also created *Never Ride on Sidewalks* and *Park Here* stickers to help reinforce two key provisions in the ordinance that often generate significant complaints when programs first get underway.



Officer Hopson hosts APD's scooter safety PSA

Finally, some communities expand the enforcement net by asking the public to report PTD violations or unsafe riding practices. In addition to providing information about how to use e-bikes and e-scooters in Boise, ID, the city's website includes a [form](#) the public can complete and submit to report violations. These are routed to a Compliance Officer for investigation.

The Role for SHSOs

- ✔ Work with local law enforcement officials in cities with micromobility programs to identify gaps and deficiencies in state laws that hamper their ability to address unsafe riding behaviors (i.e., impaired riding).
- ✔ Work with your state's pedestrian and bicyclist task force—and others with an interest in micromobility—to educate policymakers and the media about gaps and deficiencies in state laws that compromise safety for PTDs riders and other road users.
- ✔ Convene a meeting between micromobility providers operating in your state and local and

state law enforcement leadership to begin a dialogue that will result in the identification and implementation of strategies that will foster safe mobility.

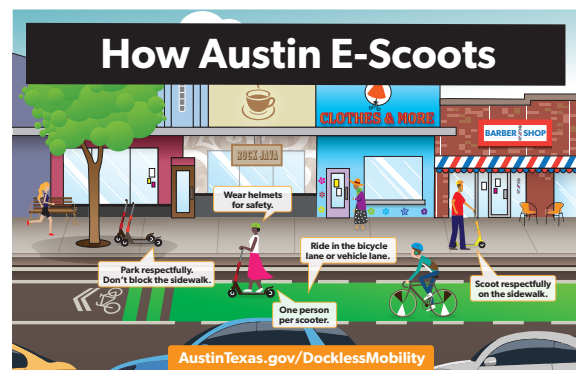
- ✓ Host micromobility training for law enforcement officials that includes a PTD typology and operation primer (with an on-road component); crash reporting guidance; safe riding practices; and techniques for effectively engaging with riders, drivers and pedestrians to promote safely sharing the road.
- ✓ Develop and distribute a micromobility quick reference guide for use by law enforcement and other interested parties and make it available to the public and media via your SHSO and partner websites.
- ✓ Fund a pilot to evaluate the effectiveness of police officers using e-bikes and/or e-scooters to conduct community policing.

Education

The Challenge: Education is essential for ensuring micromobility users operate devices safely and respectfully and other road and sidewalk users are accepting of this mode. But public outreach is resource intensive and cannot be the sole responsibility of cities and/or providers. Other partners must be tapped to help foster widespread public engagement.

To create a culture where all modes are accepted and safety is paramount, cities, providers and public, private and non-profit organizations must partner to educate **all** road users. When it comes to micromobility, education is predominantly user-focused with little or no information directed to other road users. The city or community agency responsible for overseeing the shared mobility program typically maintains a website or webpages where visitors can find general information (often in the form of frequently asked questions) as well as safe operating tips, how to **ride** and **park** videos and links to rules and/or local ordinances. Some cities, such as [Austin](#), [Portland](#), and [Chicago](#) have developed colorful posters, in multiple languages, to illustrate the do's and don'ts of safely e-scooter. Most educational materials address a handful of tips such as conducting a pre-ride check, following the rules, yielding to pedestrians, wearing a helmet and parking properly.

One exception is Arlington, VA, which uses a [multi-modal campaign](#) (which predates the introduction of e-scooters) to encourage everyone to be a PAL — predictable, alert and lawful. Predictability is especially important since PTD riders are likely to innovate based on infrastructure, traffic volumes, skill level and familiarity with the area. This speaks to



Many cities, like Austin, have developed engaging graphics on e-scooter safety.



the need to educate motorists (novice and seasoned), pedestrians and bicyclists about how these devices work and why riders may switch from the sidewalk to the street to a protected bike lane (i.e., poor pavement conditions, local restrictions, preference) all in the same trip. At the same time, educating PTD riders about the importance of being predictable, so other modes have a better idea of what they are going to do next and can react accordingly, is essential.

Educating Drivers

Communities with micromobility programs are encouraged to take a page from Arlington’s play book and promote predictability, which is a key tenant of injury prevention. State licensing agencies can also help. A 2019 American Association of Motor Vehicle Administrators (AAMVA) white paper calls on providers to educate “everyone who will be in the environment” about the rules e-scooters most follow. However, including information about the PTDs currently allowed to operate on local and state roadways and what motorists can do to safely share the road by slowing down and giving them space should also be added to new driver manuals. Adding PTD-related questions to the written test is also encouraged to gauge new driver understanding of the mode. In addition, including micromobility information on agency websites with safety and/or safely sharing the road pages is also encouraged.

Driver education programs, including those offered to seasoned and older drivers for insurance and/or point reduction (i.e., AAA, National Safety Council, AARP), should also include a discussion about PTDs either as a stand-alone topic or in conjunction with lessons focused on pedestrians, bicyclists and other vulnerable road users. The American Driver and Traffic Safety Education Association (ADTSEA) recently released a revised driver education classroom curriculum (version 3.0) but there is no mention of micromobility. What new drivers and their experienced counterparts need to understand is what these devices are and how they operate; the disparity in size and weight between PTDs, motor vehicles and others on and near the road; and the danger of speeding and impairment caused by alcohol, and other drugs, drowsiness and distraction. Crash data indicate that speed, alcohol and distraction are common causation factors in crashes involving motor vehicles and vulnerable road users. Most micromobility injuries are single vehicle (i.e., the rider fell, collided with a fixed object) but 90 percent of fatalities are the result of a collision between a motor vehicle and a PTD (K. Harmon, personal conversation, March 17, 2020).

Should Children Ride PTDs?

The American Academy of Pediatrics (AAP) recommends that children under 16 — who are too young to have a driver’s license — should not operate or ride on electric or motorized scooters. Nor should they ride with an adult since these devices are designed for single rider use only.

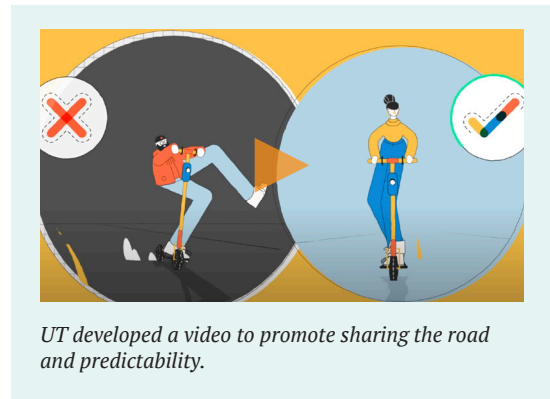
E-scooters, however, are easily accessible to minors — they can sign up on an app without parental consent — and most cities do not have a way to verify a user’s age. Therefore, the AAP recommends that children know the rules and their parents’ expectations and that parents check their child’s phone if they have concerns. Parents with college-aged children are also encouraged to talk with them about the dangers of operating a scooter while texting, listening to music or under the influence of alcohol or other drugs (Morgan, 2019).

Most micromobility injuries are single vehicle, but 90 percent of fatalities are the result of a collision between a motor vehicle and a PTD.

Uber is working with the League of American Bicyclists (League) to retool the latter’s 90-minute Bicycle Friendly Driver Education Program for online delivery to rideshare drivers. Uber and the League were also working on a short curriculum to be directed to people using Uber’s JUMP shared e-bikes. The training would be made available via the Uber app and delivered in local communities by League Certified Cycling Instructors. However, the JUMP education did not launch because Uber sold its bike and scooter business to Lime.

Educating Out-of-Towners & Tourists

SHSOs can also help educate road users and several are doing so. In Utah, the Departments of Public Safety and Transportation partnered to create a video directed to motorists and scooter riders that speaks to the importance of sharing the road and predictability. The video also reminds scooter riders to familiarize themselves with local laws since they can change from one city to another. This is a key point since shared mobility programs are frequently used by out-of-towners and/or tourists.



Santa Monica, CA, for example, found nearly 30 percent of the people using its micromobility program lived outside the county, making it challenging to convey the rules of the road and safety information (City of Santa Monica, 2019). Nashville faced a similar challenge, as it hosted a record 16.1 million visitors in 2019 (Nashville Convention & Visitors Bureau, 2020). While city officials suspended the latter’s e-scooter program in late 2019, work is underway to relaunch it. Once the devices are back on Nashville streets, riders will need to know that it is illegal to scoot drunk. When the program was operating, the Tennessee SHSO used social media to warn riders about the danger and consequences for riding impaired. Both examples point to the need for partnerships between SHSOs, cities, providers, local travel and tourism groups and their members to ensure this and other critical information are delivered.

Cities can also convey safety tips and information about where not to ride to visitors and locals through on-device and on-street messaging. Panels affixed to the baskets on Boise’s shared bikes, for example, advise riders about pricing as well as safe riding practices and where to ride. Street signage, sidewalk decals, digital message boards and billboards are also likely to be seen by out-of-towners, while blog posts, community emails and social media notifications can be used to reach residents. These tactics have been employed in Santa Monica, where a survey found that



Boise conveys safety tips and information on panels affixed to bike share baskets.

85 percent of riders and 90 percent of the public said they were aware of the shared mobility program's parking and riding rules. The city also conducted more than 100 engagement activities during the pilot phase of its program that included tabling at events and helmet distribution (City of Santa Monica, 2019). Other cities have partnered with providers, elected officials and/or local organizations to conduct outreach and education events such block parties along transit routes, learn to ride events in conjunction with health fairs and street festivals, and other activities.

Bolstering On-Device Training

The importance of learn to ride events coupled with ongoing practice cannot be overstated. Just like novice drivers, new micromobility users need to build skill through behind the handlebar practice. The APH/CDC study of injured scooter riders in Austin, discussed earlier, found that only 10 percent of those injured had ridden ten or more times before crashing (APH, 2019). That does not mean that all novice PTD riders are or will crash. But training and practice can help reduce that risk.

10%
of injured Austin riders had ridden a scooter 10 or more times – indicating training and practice can help reduce risk.

Some cities such as Chicago and Washington, DC use ambassadors to engage with riders and the public. The DC Bike Ambassadors, funded through a partnership with the city's DOT, interact with residents and visitors on street corners and adjacent to transit stations and at street fairs and community events. Their goal is to encourage more people to try bicycling and micromobility; educate them about safe road, sidewalk and trail use; provide resources to make non-motoring travel easy and safe; and model safe and respectful road use behavior. They also offer group rides (Washington Area Bicyclist Association, 2020).

Provider Sponsored Education

The micromobility providers' role in delivering safety training and information cannot be overstated. Cities recognize it, expect it and are awarding permits to those providers with strong education and public outreach plans. Providers understand the impact concerns about safety have on mass adoption of the mode and have been taking steps to address rider inexperience and behavior. In addition to establishing safety advisory boards in 2019, both Bird and Lime were engaged in extensive rider education initiatives prior to the pandemic. Bird kicked off a 100 city [Safe Streets S.H.A.R.E.](#) (see the sidebar) tour last June in San Jose that was designed to bring neighborhoods together to learn about micromobility, the importance of helmet use (including free fittings), rules of the road, parking best practices, sober riding and how to share the road with all modes (Bird, 2019b).

Like Bird, Lime was partnering with communities to provide opportunities for people 18 and older to learn about the mode and how to ride and park safely through its free

What Does it Mean to S.H.A.R.E.?

Safe Riding. Navigate traffic and bike lanes with care.

Heighted awareness. Anticipate what others might do.

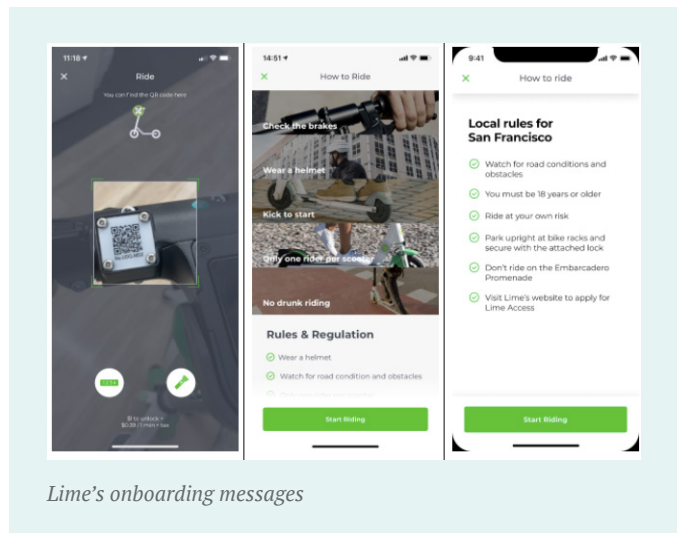
Always alert. Save the selfies and music for after the ride.

Respect pedestrians. Yield and always keep walkways accessible.

Every voice matters. Get involved to help your city reshape its streets (Bird, 2019).

First Ride Academy. The inaugural event was held in July 2019 in partnership with the Los Angeles Police Department (LAPD) and included an on-road ride with LAPD officers, a free helmet and a coffee voucher courtesy of a local sponsor. The training was subsequently delivered in many other cities, on college campuses and to groups such as the DC Bar and Restaurant Workers Alliance (DCBRWA), whose members need access to alternative late-night transportation options when transit is not running (Lime 2019a). If, and when, these events will start up again is unknown.

All providers require riders to review onboarding messages (i.e., safety tips, localized rules and restrictions) on their apps before gaining access to a vehicle. (This is often required by the agencies that regulate them.) Providers also use their apps to address impairment, helmet use and safe routes. To prevent drinking and riding, Lime (in certain locations and at specific times) requires users to verify they are safe to ride before unlocking one of their e-scooters (Lime, 2019b). Lyft added protected bike lanes and bike-friendly routes, designated by dark green and dotted green lines, respectively, to its app to encourage their use (Hawkins, 2019b). Bird updated its app to invite riders to submit photos (at the end of their trip) showing themselves wearing a helmet to earn incentives such as ride credits (Hawkins, 2019c). And when Chicago's 2020 e-scooter pilot rolls out this summer, all new riders will be required to complete an in-app safety quiz before starting their first trip (Wisniewski, 2020).



This information is also addressed on provider websites, which frequently have safe riding and parking instructional videos, and initiatives designed to bolster **responsible riding** and helmet use. Some have partnered with cities to conduct public outreach campaigns that use outdoor advertising to alert motorists to slow down and be on the lookout for PTDs and remind riders to wear helmets and highly visible clothing. But these efforts should not be a substitute for hands-on training and education for riders and motorists, which likely will not happen until there is a COVID-19 vaccine or providers can institute hygiene measures that reassure the public.

The Role for SHSOs

- ✓ Partner with cities, providers, law enforcement and public health officials, and others (i.e., tourism bureaus, chambers of commerce, large employers, hotel chains) to use crash, injury and other data to develop and disseminate educational materials, segmented by road user group (i.e., new and seasoned motorists, tourists and other out-of-towners, pedestrians, bicyclists, first-time and experienced PTD riders), that conveys what they can do to safely share the road. House this information on your SHSO website and include downloadable PDFs.

- ✓ Work with your state driver education association, department of education and providers to develop and distribute a micromobility lesson plan that includes an optional PTD ride.
- ✓ Work with your state licensing agency to include micromobility information in the new driver manual and on its website, and micromobility questions on the licensing exam.
- ✓ Work with your state licensing agency and defensive driving program providers to incorporate micromobility information into their approved curriculums.
- ✓ Convene a meeting with cities, universities, providers and pedestrian and bicycle education and advocacy organizations in your state to identify and implement strategies for restarting and expanding community and campus learn-to-ride and practice riding events in a post-pandemic world.
- ✓ Provide grants to help cities, colleges/universities and local organizations amplify their micromobility education, training and outreach efforts.
- ✓ Partner with a provider in your state to pilot GDL-like onboarding messages emphasizing what new riders should and can do to protect themselves as they gain experience and build skill. Once riders safely complete ten rides, the app sends a congratulatory message and future onboarding messages are shorter but continue to reinforce key safety practices.

Final Thoughts

When automobiles first appeared on city streets more than a century ago, they added even more chaos to a mix of pedestrians, bicyclists, children at play, horses, and streetcars. The U.S. is now experiencing another transformative moment in transportation. Today, a new micro mode — electric and motorized bicycles, scooters and other personal transportation devices, that some consider a god send and others a menace — have joined the mix. Regardless, micromobility is here and likely to stay. The mode's tremendous growth over the past couple of years — fueled by people seeking a more efficient, less costly and, in some cases, fun transportation alternative — cannot be ignored. And despite the pandemic's impact on travel that forced many shared systems to shut down, micromobility proved to be a lifesaver for essential workers in urban centers. The devices' utility even resulted in one state ending a long-held ban.

Micromobility is likely here to stay. The mode's tremendous growth cannot be ignored, and it has proven to be a lifesaver for essential workers in urban centers during the pandemic.

The SHSOs have a role to play in helping to bring order to today's transportation chaos. Just like other modes, PTD riders are crashing. But are personal conveyance devices like e-bikes and scooters less safe? Limited data make it difficult to determine their overall impact on safety. SHSO officials can and should partner with city officials, micromobility providers, law enforcement and public health officials and others working in traffic safety and injury prevention to collect and analyze all available data, so there is a more complete picture of the devices' safety impact. Without robust data, it is impossible to make informed decisions about how this mode should be

regulated, where to make infrastructure improvements and deploy enforcement or how best to engage with **all** road users to ensure they safely share the road.

GHSA will also play a role in addressing micromobility. In addition to this publication, the association is working with State Farm® to provide resources agents can use to educate their policyholders about safely riding and sharing the road with PTDs. GHSA is working to secure funding to develop and pilot law enforcement training that will be delivered in a train-the-trainer format. Meetings will be convened with national partners to discuss adding micromobility to existing driver education and training programs and to advocate for its inclusion in the next federal surface transportation funding bill.

References

- American National Standards Institute, Inc. (2017, December 18). Manual on classification of motor vehicle traffic crashes, 8th edition. Mechanicsville, VA: Association of Transportation Safety Information Professionals.
- AmericaWalks. (2020). Planning urban design, Daylighting [Web page]. <https://americawalks.org/daylighting/>
- Anderson, B. (2020, May 20). All hail the world's first self-driving e-scooter fleet coming to Georgia city [Web article]. Carscoops. <https://www.carscoops.com/2020/05/city-in-georgia-to-get-autonomous-e-scooters-as-part-of-six-month-pilot/>
- Anzilotti, E. (2019a, April 25). Turns out, people really miss e-bikes when they're taken away. Fast Company. <https://www.fastcompany.com/90339750/turns-out-people-really-miss-e-bikes-when-theyre-taken-away>
- Anzilotti, E. (2019b, June 18). Madison is the first city to go 100% electric for its bike share. Fast Company. <https://www.fastcompany.com/90365265/madison-is-the-first-city-to-go-100-electric-for-its-bike-share>
- Arlington County Government (2020, February 10). New rules for shared e-scooters and e-bikes in Arlington [Press Release]. <https://newsroom.arlingtonva.us/release/new-rules-scooters-e-bikes/>
- Austin Public Health. (2019). Dockless electric scooter-related injuries study, Austin, Texas, September – November 2018. Austin, TX: Epidemiology and Disease Surveillance Unit, Epidemiology and Public Health Preparedness Division. https://www.austintexas.gov/sites/default/files/files/Health/Epidemiology/APH_Dockless_Electric_Scooter_Study_5-2-19.pdf
- Bird. (2019a, April). A look at e-scooter safety; Examining risks, reviewing responsibilities and prioritizing prevention. <https://www.bird.co/wo-content/uploads/2019/12/Bird-Safety-Report-April-2019.pdf>
- Bird. (2019b, June 26). Bird kicks off 100 city s.h.a.r.e. tour to make streets safer for all [Press release]. <https://www.bird.co/press/bird-kicks-off-100-city-s-h-a-r-e-tour-to-make-streets-safer-for-all/>
- Bliss, L. (2019, June 3). Protected bikes are safer for drivers, too. CityLab. <https://www.citylab.com/transportation/2019/06/protected-bike-lanes-safe-street-design-bicycle-road-safety/590722/>
- Butcher, K. (2014). Myth: Riders are safer on the sidewalk [Blog]. PeopleForBikes Foundation. <https://peopleforbikes.org/blog/bike-myths-debunked/>
- California Legislature. (2020). Vehicle Code – VEH Division 11. Rules of the road [21000 -23336]; Division 11 enacted by Stats. 1959, Ch. 3. [Web page]. https://leginfo.ca.gov/faces/codes_displaySection.xhtml?lawCode=VEH§ionNum=21221.5
- Capron, M. (2019, July 25). Boise, Idaho, changes e-scooter laws to increase safety [Web article]. *The Idaho Statesman*. <https://www.govtech.com/fs/Boise-Idaho-Changes-EScooter-Laws-to-Increase-Safety.html>
- Chang, S. (2020, May 31). Citi Bike promises to add “thousands” of e-bikes this summer as NYC reopens [Web article]. Gothamist. <https://gothamist.com/news/citi-bike-promises-to-add-thousands-of-e-bikes-this-summer-as-nyc-reopens>
- City of Austin. (2019a). Dockless mobility community survey report. Austin, TX: Transportation Department. https://austintexas.gov/sites/default/files/files/Transportation/Dockless_Mobility_Community_Survey_Report_2-28-19.pdf
- City of Austin. (2019b). Ordinance No. 20190523-059. https://library.municode.com/tx/austin/ordinances/code_of_ordinances?nodlld=964446
- City of Austin. (2020a). Shared micromobility transportation data and performance hub [Web tool]. <https://data.mobility.austin.gov/micromobility-data/>
- City of Austin. (2020b). Smart mobility, Swiftmile electric scooter parking and charging station pilot program [Web press release]. <https://www.austintexas.gov/department/smart-mobility>
- City of New York. (2020, July). Mayor de Blasio, Department of Transportation, Lyft celebrate 100 millionth Citi Bike ride [Press release]. <https://www.nyc.gov/office-of-the-mayor/news/530-20/mayor-de-blasio-department-transportation-lyft-celebrate-100-millionth-citi-bike-ride>

City of Oakland. (2020). Oakland slow streets [Web page]. <https://www.oaklandca.gov/projects/oakland-slow-streets>

City of Santa Monica. (2019, November). Shared mobility pilot program summary report. https://www.smgov.net/uploadedFiles/Departments/PCD/Transportation/SantaMonicaSharedMobilityEvaluation_Final_110419.pdf

DiMaggio, C. J., Bukur, M., Wall, S. P., Frango, S. G., & Wen, A. Y. (2019). Injuries associated with electric-powered-bikes and scooters: Analysis of U.S. consumer product data. *Injury Prevention*, doi:10.1135/injuryprev-2019-043418

District Department of Transportation. (2020). Bike and scooter corrals [Web page]. Washington, DC. <https://ddot.dc.gov/page/bike-and-scooter-corrals>

DuPuis, N., Greiss, J., & Klein, C. (2019). Micromobility in cities : A history and policy overview. Washington, DC: National League of Cities. <https://www.nlc.org/resource/micromobility-in-cities-a-history-and-policy-overview>

Exponent. (2019, August 16). Summary of regulations and standards; Domestic municipal, state and federal regulations of e-bicycles, rental bicycles, and e-scooters; Review of organizations engaged in developing rental bicycle and e-scooter standards. Tempe, AZ: State Farm Labs.

Fang, K., Agrawal, A. W., & Hooper, A. M. (2019). How and where should I ride this thing? Rules of the road for personal transportation devices. San Jose, CA: Mineta Transportation Institute. https://transweb.sjsu.edu/sites/default/files/1713-Fang-Agrawal-Hooper-Rules-Personal-Transportation-Devices_0.pdf

Federal Highway Administration. (2018). National Household Travel Survey (2017), Explore vehicle trips data [Web page]. Washington, DC: U.S. Department of Transportation. <https://nhts.ornl.gov/vehicle-trips>

Federal Highway Administration. (2020). A systemic approach to safety—Using risk to drive action [Web page]. Washington, DC: U.S. Department of Transportation. <https://safety.fhwa.dot.gov/systemic/>

Gauquelin, A., & Chamussy, J. (2020, May 27). Shared mobility rebooted [Blog]. The Urban Mobility Daily. <https://urbanmobilitydaily.com/shared-mobility-rebooted/>

Goldbuam, C. (2020, May 18). Thinking of buying a bike? Get ready for a very long wait [Web article]. *The New York Times*. <https://nytimes.com/2020/05/18/nyregion/bike-shortage-coronavirus.html>

Goodman, D., Witte, A., Stark R-L., & Frackelton, A. (2019). E-scooter practices in mid-sized cities in the United States. Chapel Hill, NC: Pedestrian and Bicycle Information Center.

Governors Highway Safety Association. (2020a). Micromobility survey of State Highway Safety Offices, results. Washington, DC.

Governors Highway Safety Association. (2020b). Section 405 National Safety Priority Program [Web page]. <https://www.ghsa.org/about/federal-grant-programs/405>

Graves, J. M., Pless, B., Moore, L, Nathens, A. B., Hunte, G., & Rivara, F. P. (2014). Public bicycle share programs and head injuries. *American Journal of Public Health*, 104(8). <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4103224/pdf/AJPH.2014.302012.pdf>

Harmon, K. (2020, March 26). List of e-scooter fatalities. Chapel Hill, NC: Collaborative Sciences Center for Road Safety. https://www.roadsafety.unc.edu/wp-content/uploads/2020/03/E-scooter_fatalities_vMar_20_2020.pdf

Hawkins, A., & Ricker, T (2020, March 27). Now is a great time to buy an e-bike, social distances over greater distances [Web article]. The Verge. <https://www.theverge.com/2020/3/27/21195561/ebike-coronavirus-social-distance-reasons-to-buy-traffic>

Hawkins, A. J. (2019a, December 10). Wheels redesigns its shareable e-bikes to include a helmet, biodegradable headliner included [Web article]. The Verge. <https://www.theverge.com/2019/12/10/21003734/wheels-electric-bike-bikeshare-helmet-redesign-included>

Hawkins, A. J. (2019b, September 19). Lyft is adding bike lanes to its app to encourage safer riding [Web article]. The Verge. <https://www.theverge.com/2019/9/19/20874032/lyft-add-bike-lane-app-cities-bike>

Hawkins, A. J. (2019c, November 19). Bird will give free scooter rides if you take a selfie while wearing helmet [Web article]. The Verge. <https://www.theverge.com/2019/11/19/20972447/bird-free-scooter-rides-selfie-wearing-helmet>

Hawkins, A. J. (2020, April 2). New York finally legalizes electric bikes and scooters, A huge win for immigrant delivery workers [Web article]. *The Verge*. <https://www.theverge.com/2020/4/2/21204232/new-york-legalizes-electric-bikes-scooters>

Heineke, K., Kloss, B., Scurtu, D., & Weig, F. (2019, January 29). Micromobility's 15,000-mile checkup. McKinsey & Co. <https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/micromobilitys-15000-mile-checkup>

Hu, W. (2020, March 14). A surge in biking to avoid crowded trains [Web article]. *The New York Times*. <https://www.nytimes.com/2020/03/14/nyregion/coronavirus-nyc-bike-commute.html>

IBM. (2020, May 1). COVID-19 is significantly altering U.S. consumer behavior and plans post-crisis; personal mobility, retail shopping, and event attendance are among the areas most impacted [Web press release]. https://newsroom.ibm.com/2020-05-01-IBM-Study-COVID-19-Is-Significantly-Altering-U-S-Consumer-Behavior-and-Plans-Post-Crisis?mod=article_inline

Insurance Institute for Highway Safety. (2019). Fatality facts 2018 bicycles [Web page]. <https://www.iihs.org/topics/fatality-statistics/detail/bicyclists>

International Transport Forum. (2020). Safe micromobility. Paris, France. https://www.itf-oecd.org/sites/default/files/docs/safe-micromobility_1.pdf

Kerr, D. (2018, July 16). Bird goes after helmet laws for electric scooters; The e-scooter rental company quietly sponsors a bill to get rid of some California safety rules [Web article]. *cnet*. <https://www.cnet.com/news/bird-goes-after-helmet-laws-for-electric-scooters/>

Kobayashi, L. M., Williams, E., Brown, C. V., Emigh, B. J., Bansal, V., Badiee, J., Checchi, K. D., Castillo, E. M., & Doucet, J. (2019). The e-merging e-pidemic of e-scooters. *Trauma Surgery & Acute Care Open*. <https://tsaco.bmj.com/content/4/1/e000337>

Krizek, K. J., & McGuckin, N. (2019, November 18). Shedding NTHS light on the use of little vehicles in urban areas, Transport Findings. <https://doi.org/10.32866/10777>

Krug, F. (2020). Electric bikes vs. regular bikes: What's the real difference no one talks about [Blog]. *Evelo Electric Bikes*. <https://www.evelo.com/blog/electric-bikes-vs-regular-bikes/>

Kyrouz, M. (2020, April 8). How to reboot micromobility in cities and make shared scooters a sustainable business [Web article]. *The Startup*, Medium. <https://medium.com/swlh/how-to-reboot-micromobility-in-cities-b8ed2eb11b0f>

Lazo, L. (2020, May 18). Bike-share and e-scooter companies, hit hard by the pandemic, may come back stronger [Web article]. *The Washington Post*. <https://www.washingtonpost.com/local/trafficandcommuting/why-bike-and-e-scooter-companies-hit-hard-by-the-pandemic-may-come-back-stronger/2020/05/16/07632900-95d5-11ea-91d7-cf4423d47683>

League of American Bicyclists. (2018). Bicycle friendly state, Sidewalk riding laws [Web page]. https://bikeleague.org/sites/default/files/SidewalkRiding_8_2018.pdf

Lee, P., Loucks, J., Stewart, D., Jarvis, D., & Arkenberg, C. (2019). Telecommunications, media, and technology predictions, 2020. *Deloitte*. https://www2.deloitte.com/content/dam/insights/us/articles/722835_tmt-predictions-2020/DI_TMT-Prediction-2020.pdf

Lime. (2019a, December 19). First ride safety event helps bar, restaurant workers navigate at night [Web article]. *Second Street/Lime*. <https://www.li.me/second-street/first-ride-safety-event-helps-bar-restaurant-workers-navigate-night>

Lime. (2019b, August 29). Lime promotes back-to-school-safety with first ride campus events [Web article]. *Second Street/Lime*. <https://www.li.me/second-street/lime-promotes-school-scooter-safety-with-first-ride-campus-events>

Machosky, M. (2020, January 13). Want to report dangerous driving? Now you can with OurStreets app [Web article]. *Next Pittsburgh*. <https://nextpittsburgh.com/city-design/want-to-report-dangerous-driving-now-you-can-with-ourstreets-app/>

McConnell-Lamprey, S., & Schuerer, D. J. E. (2019, September 10-11). Electric scooter and other micromobility devices. Presentation at the 2019 ICD-10 Coordination & Maintenance Committee Meeting, Hyattsville, MD. <https://www.cdc.gov/nchs/data/icd/Topic-packet-Sept-2019-Part2.pdf>

Michigan State University. (2019, September 20). MSU expands mobility research opportunities with e-scooter partner [Web article]. East Lansing, MI. <https://msutoday.msu.edu/news/2019/msu-expands-mobility-research-opportunities-with-e-scooter-partner/>

MoGo. (2020). Adaptive MoGo relaunch postponed due to COVID-19 [Web page]. City of Detroit. <https://mogodetroit.org/mogo-for-all/adaptive-mogo/>

Morgan, A. (2019). E-scooters aren't for kids: AAP urges safety rules [Blog]. American Academy of Pediatrics. <https://www.healthychildren.org/English/Safety-prevention/on-the-go/Pages/E-scooters.aspx>

National Association of City Transportation Officials. (2019). Shared micromobility in the U.S.: 2018, NACTO bike share and shared micromobility initiative [Web page]. <https://nacto.org/shared-micromobility-2018/>

National Association of City Transportation Officials. (2020). Bike share in the U.S.: 2010-2016 [Web page]. <https://nacto.org/bike-share-statistics-2016/>

Namiri, N. K., Lui, H., Tangney, T., Allen, I. E., Cohen, A. J., & Breyer, B. N. (2020). Letter: Electric scooter injuries and hospital admissions in the United States, 2014-2018. *JAMA Surgery*, January 8.

Nashville Convention and Visitors Center. (2020). Statistics & facts [Web page]. Nashville, TN. <https://www.visitmusiccity.com/explore-nashville/about/statistics>

Nicklesburg, M. (2020, May 14). Pandemic spells uncertain future for bikes and scooters as mobility services confront new realities [Web article]. Geekwire. <https://www.geekwire.com/2020/pandemic-spells-uncertain-future-bikes-scooters-mobility-services-confront-new-realities/>

North American Bikeshare Association. (2020). Recommendations for a surface transportation reauthorization bill [Web page]. <https://nabsa.net/wp-content/uploads/2020/NABSA-022-One-Sheet.pdf>

Porter, J. (2020, May 20). Tier's shared electric scooters will soon come with foldable helmets, safely stowed in a dedicated compartment [Web article]. The Verge. <https://www.theverge.com/2020/5/20/21264672/tier-electric-scooters-sharing-helmet-compartments-built-in>

Portfield, C. (2020, May 8). Seattle permanently closes streets to cars as U.S. cities create more open spaces during Coronavirus [Web article]. *Forbes*. <https://www.forbes.com/sites/carlieporterfield/2020/05/08/seattle-permanently-closes-streets-to-cars-as-us-cities-create-more-open-spaces-during-coronavirus/#1ecb59eb3f05>

Rambol. (2020). Achieving sustainable micro-mobility, Green paper April 2020. Arlington, VA. https://se.ramboll.com/-/media/files/rgr/documents/markets/transport/m/ramboll_micro-mobility_greenpaper_a4_0320_lowres.pdf?la=sv

Ray, A., & Sussman, M. (2019). Traffic Safety Facts, Traffic Tech: Using crowdsourced data to improve pedestrian and bicyclist safety: A case study [Unpublished]. Washington, DC: National Highway Traffic Safety Administration.

Retting, R. (2020). Pedestrian traffic fatalities by state, 2019 preliminary data. Washington, DC: Governors Highway Safety Association. <https://www.ghsa.org/sites/default/files/2020-02/GHSA-Pedestrian-Spotlight-FINAL-rev2.pdf>

SafeTREC. (2020). Street Story: A platform for community engagement [Web page]. University of California-Berkeley. <https://safetrec.berkeley.edu/tools/street-story-platform-community-engagement>

Sam Schwartz. (2020). Shifting gears: Divvy bikeshare + ride hailing in Chicago during Covid-19 [Web article]. <https://www.samschwartz.com/staff-reflections/2020/6/16/shifting-gears-divvy-bikeshare-ride-hailing-in-chicago-during-covid-19>

San Francisco Mass Transit Authority. (2020). Bikeshare, the city's bikeshare network is expanding [Web page]. <https://www.sfmta.com/getting-around/bike-bike-share>

Sawers, P. (2020, January 28). Lime uses sensor data to keep scooters off sidewalks [Web article]. Venture Beat. <https://venturebeat.com/2020/01/28/lime-uses-sensor-data-to-keep-scooters-off-sidewalks/>

Schneider, B. (2020, April 27). There's something about scooters, Dockless scooters seemed at first like a sidewalk scourge, but they're changing city streets for better [Web article]. Slate. <https://slate.com/technology/2020/04/dockless-scooters-cities-safer-better.html>

Seattle Department of Transportation. (2018). Free-floating bike share program permit requirements for the 2018-2019 permit cycle, Version 2.1–November 16, 2018. https://www.seattle.gov/Documents/Departments/SDOT/BikeProgram/Seattle_Bike_Share_Permit_Requirements_v2.1_20181219.pdf

Smith, C. (2020, July 20). Google Maps just got a great new feature for cyclists [Web article]. BGR. <https://bgr.com/2020/07/20/google-maps-directions-docked-bike-sharing-navigation>

Spivak, C. (2020, April 29). Citi Bike rolls out expansion to the Bronx, upper Manhattan amid pandemic [Web article]. Curbed New York. <https://ny.curbed.com/2020/4/29/21241426/citi-bike-expansion-coronavirus-bronx-upper-manhattan-biking>

Sussman, M. (2019, October 30). In just 5 hours, volunteers collected over 300 bike lane violations in Arlington [Web article]. Greater Washington. <https://ggwash.org/view/74501/hows-my-driving-in-arlington-virginia-bike-lane>

Teschke, K., Harris, M. A., Reynolds, C. O., Winter, M., Babul, S., Chipman, M. (2012). Route infrastructure and the risk of injuries to bicyclists: A case-crossover study. *American Journal of Public Health*. 102, 2336-2343.

Thousand. (2020, March 30). We're giving bike couriers delivering essential supplies a free helmet [Blog]. <https://www.explorethousand.com/blogs/journal/were-giving-bike-couriers-delivering-essential-supplies-a-free-helmet>

Transit. (2020). Transit [Web page]. <https://transitapp.com/>

Trivedi, T. K., Liu, C., Antonio, A. M., Wheaton, N., Kreger, V., Yap, A., Schriger, D., & Elmore, J. G. (2019). Injuries associated with standing electric scooter use. *Jama Network Open*, 2(1):e187381. doi:10.1001/jamanetworkopen.2018.7381

U.S. Department of Transportation. (2019). New BTS interactive map shows growth of urban bikeshare/e-scooter systems. <https://content.govdelivery.com/accounts/USDOT/bulletins/261c1f9>

Virginia Law Library. (2020). Code of Virginia: Title 46.2, Motor vehicles. <https://law.lis.virginia.gov/vacode/title46.2/chapter1/>

Washington Area Bicyclist Association. (2020). DC Bike Ambassador [Web page]. <https://waba.org/programs/d-c-bike-ambassador/>

Williams. A. (2015). Spotlight on highway safety, Bicyclist safety. Washington, DC: Governors Highway Safety Association.

Wisniewski, M. (2020, June 12). Scooters will return to Chicago streets this summer as the city launches an even larger pilot program [Web article]. *The Chicago Tribune*. <https://www.chicagotribune.com/business/transportation/ct-biz-scooters-entire-city-summer-pilot-lakefront-606-20200612-vcooq43wif-ganagmpwzwlw6cy-story.html>

Yobbi, D. (2020, March 11). Industry making steady progress on state e-bike legislation [Web article]. Bicycle Retailer and Industry News. https://www.bicycleretailer.com/industry_news/2020/02/26/industry-making-steady-progress-state-e-bikes-legislation#.Xmo3SEBFW2X

Zipper, D. (2019, April 2). Cities can see where you're taking that scooter; Thanks to technology developed by Los Angeles (and opposed by Uber), they know more about the movement of dockless vehicles than ever before [Web article]. Slate. <https://slate.com/business/2019/04/scooter-data-cities-mds-uber-lyft-los-angeles.html>

Zipper, D. (2020, May 14). Cities have a small window to save themselves from cars. Everyone is reconsidering their transportation mode right now. Automobiles don't have to win. [Web article]. Slate. <https://slate.com/technology/2020/05/cities-cars-bicycles-scooters-feet.html>



www.ghsa.org

The Governors Highway Safety Association (GHSA) is a nonprofit association representing the highway safety offices of states, territories, the District of Columbia and Puerto Rico. GHSA provides leadership and representation for the states and territories to improve traffic safety, influence national policy, enhance program management and promote best practices. Its members are appointed by their Governors to administer federal and state highway safety funds and implement state highway safety plans.

