



Shared E-Scooters: Paving the Road Ahead

Policy Recommendations for Local Government



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01 | Introduction

With the passage of the Small Electric Vehicles Act (eKfV), e-scooters were declared street-legal in Germany as of 15 June 2019.¹ E-scooter companies, already active around the world, moved quickly to enter the German market. By late August, shared scooters were on the streets of over 20 cities across the country.² Particularly in light of the sometimes rocky rollout of dockless shared bicycles in the past,³ this rapid expansion has prompted a number of questions on the part of cities and towns:

What are the impacts of e-scooters on the environment, the climate, and transportation systems? How can e-scooters be operated in a manner that supports the needs of the municipality and its residents, or at least does not have negative impacts? And what are appropriate mechanisms to regulate e-scooters?

To aid in answering these questions, this report provides a synthesis of the first, primarily international, experiences with shared e-scooters, describes the opportunities and challenges they bring with them, and offers recommendations for e-scooter planning and regulation in cities and towns both in Germany and beyond. The goal is not only to provide a basis for compromise that incorporates the interests of local governments, e-scooter companies, and community members, but also to contribute to sober, thoughtful discussion of this new form of transportation based on the latest data and best practices. In developing this paper, the authors engaged diverse stakeholders in conversation: city staff, advocacy groups, e-scooter companies, and investors. The paper was originally published in German; this translation provides additional context and brings the discussion in Germany to an international audience.

Unlike in some other countries, the extent of German cities' regulatory authority over shared e-scooter systems is not entirely clear. Nevertheless, several cities have already developed rules and signed agreements with shared scooter companies to promote the orderly

and collaborative development of e-scooter services. Additionally, in August 2019 the Association of German Cities (DST) and the Association of German Cities and Municipalities (DStGB) developed a Memorandum of Understanding with locally active shared scooter companies, *"Strengthening the short-distance mobility together,"* which outlines key elements of any cooperation between scooter companies and local communities.⁴

This document builds upon that effort, as well as on a joint 2018 publication that contains recommendations for dockless bikesharing systems.⁵ It focuses exclusively on shared e-scooters (also referred to in this paper simply as scooters) as permitted in Germany: electric vehicles with handlebars, no seat (unless self-balancing), a maximum speed of 20 km/h, and other requirements as described in Section 1.1. Other micromobility vehicles, such as hoverboards, e-bicycles, and mopeds, are not considered.

1.1 The Small Electric Vehicles Act (eKfV)

The eKfV, in effect since 15 June 2019, modified several aspects of existing traffic laws and permitted compliant scooters to be ridden on public roads for the first time. Segways, which were already legal on public streets, are also covered by the new regulations.

As shown in Figure 1, the law addresses technical requirements for the vehicles, who is permitted to ride them, which road surfaces they may use, driver behavior, and parking regulations. For cities and towns, the most relevant aspects of the eKfV pertain to use of transportation infrastructure, safety, parking, and vehicle type designation.

The law requires e-scooters to use bicycle infrastructure whenever present – whether it is a bike lane, a shared bicycling and walking path, or a bicycle boulevard. This requirement deviates slightly from that for bicycle riders, who may generally choose to ride on the street with

1 Elektrokleinstfahrzeugeverordnung, in German. eKfV (2019).

2 As of 26 August 2019, based on e-scooter apps and websites.

3 In Munich, for example, 7,000 shared bicycles were rolled out quickly and without any consultation with the community; the bicycles were abandoned on city streets when the provider withdrew from the market not long thereafter.

4 DST; DStGB (2019).

5 "Bikesharing im Wandel – Handlungsempfehlungen für deutsche Städte und Gemeinden zum Umgang mit stationlosen Systemen," Agora Verkehrswende (2018).

car traffic even if bike lanes or other off-street bicycle infrastructure is present. If no bicycle infrastructure is present, scooters must be ridden in the road, and never on sidewalks.⁶ Off-road locations, such as pedestrian areas, may be opened to scooter traffic by municipalities on a case by case basis, and must be designated via signage (see Figure 1).⁷ Any person riding in prohibited loca-

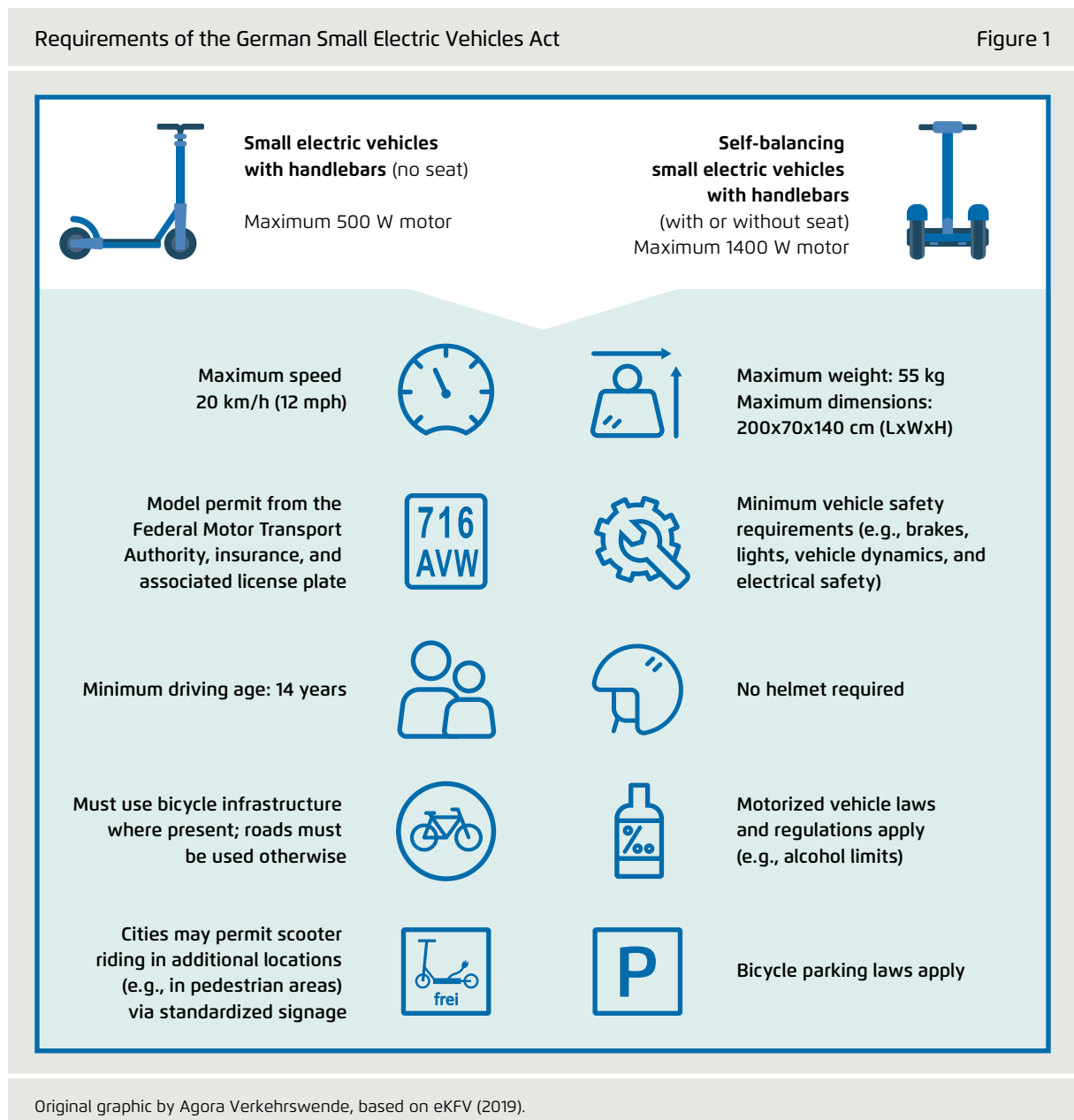
tions (e.g., on the sidewalk) is subject to a €15 fine, which may increase if the behavior hinders (€20) or endangers (€25) others, or if it causes damage (€30).⁸ These fines are relatively low compared to other locations internationally. In France, for example, fines for traffic violations are €35, but the fine for sidewalk riding is €135.⁹

6 eKFV (2019).

7 Ibid.

8 GebOSt (2011).

9 6-t (2019).



Despite mandated use of bicycle infrastructure, e-scooters are nevertheless designated as motorized vehicles and must otherwise follow the standard regulations for such vehicles (e.g., riders are subject to the same alcohol limits as when driving a car). However, there is an important additional exception: the applicable parking regulations are those for bicycles, and not those for motorized vehicles. This categorization of e-scooters has important implications for the operation and regulation of dockless shared scooter systems, as described in Sections 3.2 and 4.6.

The law also calls for an evaluation by the Federal Ministry of Transport and Digital Infrastructure (BMVI) to address e-scooter safety, performance relative to policy goals, and other impacts. This evaluation is to be completed by September 2023, and will include recommendations for any modifications to the eKFV that may be warranted.¹⁰ This evaluation will be essential to understanding the middle and long term impacts of e-scooters, as any observations to date are necessarily preliminary. It can also aid communities in better understanding how to integrate e-scooters, and micromobility in general, into their long-term mobility strategies. To support that effort, it is important that the evaluation include a rigorous consideration of the traffic and transportation system impacts of both private and shared e-scooters.

1.2 Driving the sharing market

Since the first scooter sharing system was launched in Santa Monica, California in Fall 2017,¹¹ the e-scooter market has shattered product growth records. Numerous e-scooter companies, including German companies, have received vast amounts of venture capital funding and rapidly spread to cities worldwide. The shared micromobility market is now measured in the billions.¹² Two scooter companies have already achieved “unicorn” status (valuation of \$1 billion or more), with one of them breaking the record for fastest ever rise to unicorn status.¹³

Today, shared e-scooters can be rented in cities across Asia, the Americas, Europe, and Australia. Fifteen companies are recruiting staff to serve the German market alone, with four of these launching almost immediately after the eKFV went into effect (see Figure 2).¹⁴ Growth outpaces even that of ride-hailing (e.g., Uber and Lyft) and dockless bikeshare. And yet the parallels to both these industries are unmistakable. As in other fast-growing markets, a dramatic consolidation is to be expected; tough competition will force some companies to withdraw from the market, and some to merge with other mobility providers. The first signs of this consolidation are already appearing, for example in Bird’s recent acquisition of its smaller competitor Scoot.¹⁵

10 eKFV (2019).

11 Santa Monica Daily Press (2017).

12 McKinsey & Company forecasts that the market size for shared micromobility in China, Europe, and the US could reach \$500 billion USD by 2030. McKinsey & Company (2019).

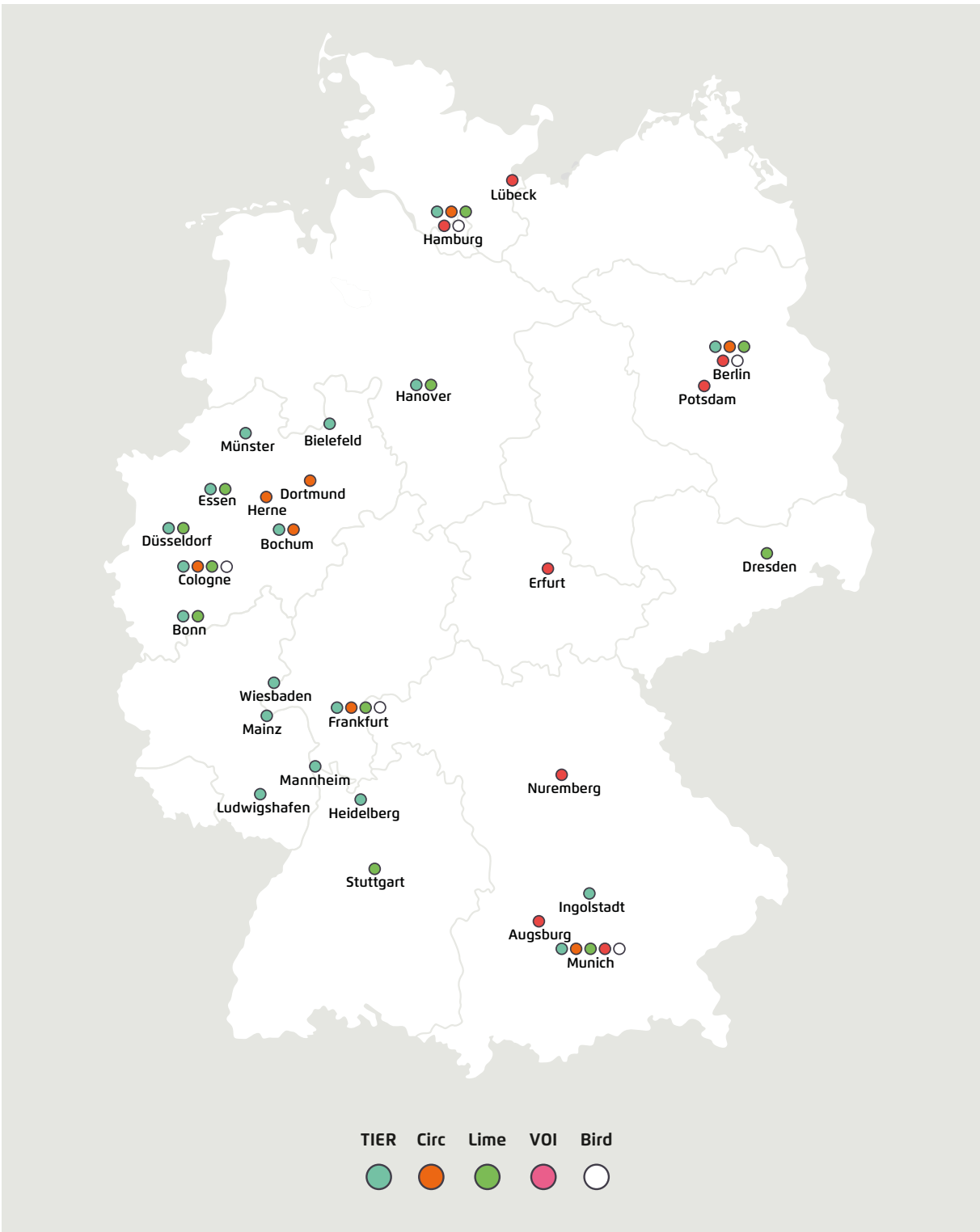
13 Silicon Valley Business Journal (2018).

14 Radforschung (2019).

15 Bird (2019 a).

Shared e-scooters in Germany (as of 10 September 2019)

Figure 2



Original graphic by Agora Verkehrswende, incorporating data from e-scooter company websites and apps.

02 | Environmental, climate, transportation and public space impacts

In drafting the Small Electric Vehicles Act, the German government specifically referenced the sustainability of e-scooters, noting their ability to increase both rural and urban mobility, as well as their potential to bridge the distance to and from public transportation. Small electric vehicles are thus expected to serve as an incentive to switch to public transportation, and to contribute to improvements in local air quality.¹⁶

Shared e-scooter companies also emphasize their potential to serve as a central element of a shift to sustainable transportation systems. Yet how great this potential is, and how exactly it can be best facilitated, remains to be seen. Some e-scooter companies have made efforts to systematically measure and calculate their climate and environmental impacts. However, a complete analysis is challenging, particularly when considering the indirect impacts of shared scooter systems.

For example, if a scooter substitutes for public transit and reduces crowding during rush hour, might that then encourage a car commuter to switch to public transit? Or on the other hand, if a car commuter switches to using an e-scooter, does the car simply end up being driven by another household member? And just as important as modal choices on specific trips, does the exposure to fun and convenient car-free electric mobility persuade riders to make other lifestyle changes, such as purchasing their own scooter or electric car, or supporting reallocation of public space in ways that promote decarbonization? At this early stage of the market, such indirect and long term effects cannot yet be reliably determined.

Nevertheless, achieving insight into e-scooters' environmental, climate, transportation system, and public space impacts is of great importance to communities. Ultimately, these impacts will determine the future of dockless shared e-scooter systems in cities and towns, and inform rules and regulations as the market matures. The following preliminary assessment and review of international experiences to date can thus serve as an initial orientation, as stakeholders navigate e-scooter impacts in their own communities.

¹⁶ Bundesrat (2019).

2.1 Energy efficiency

The primary advantages of e-scooters are plainly visible: they are electric and small. Limited to 55 kilograms according to German law, and typically much lighter, e-scooters' low weight makes them particularly efficient compared to other motorized vehicles. For example, with a single kilowatt hour (kWh) of energy, a typical gasoline car can travel barely over two kilometers (km).¹⁷ The same amount of energy can power an e-scooter for over forty times that distance, or about 90 to 100 km (see Figure 3).¹⁸ Every time an e-scooter substitutes for a personal automobile, it thus saves a significant amount of end-use energy.

Yet e-scooters are not emission-free. If a scooter is charged on the German electric grid, the associated power plant emissions are approximately five grams of carbon dioxide per kilometer of scooter travel.¹⁹ As with all other electric vehicles, however, the cleaner the grid becomes, the more climate-friendly e-scooters will be. And due to their electric motors, e-scooters never produce local emissions.

Nevertheless, consideration of energy efficiency and power plant emissions is only the first step in a robust analysis of shared e-scooter impacts. Modal shift, fleet management, manufacturing, and durability impacts are all key elements in assessing the overall sustainability of e-scooters.

2.2 Modal shift

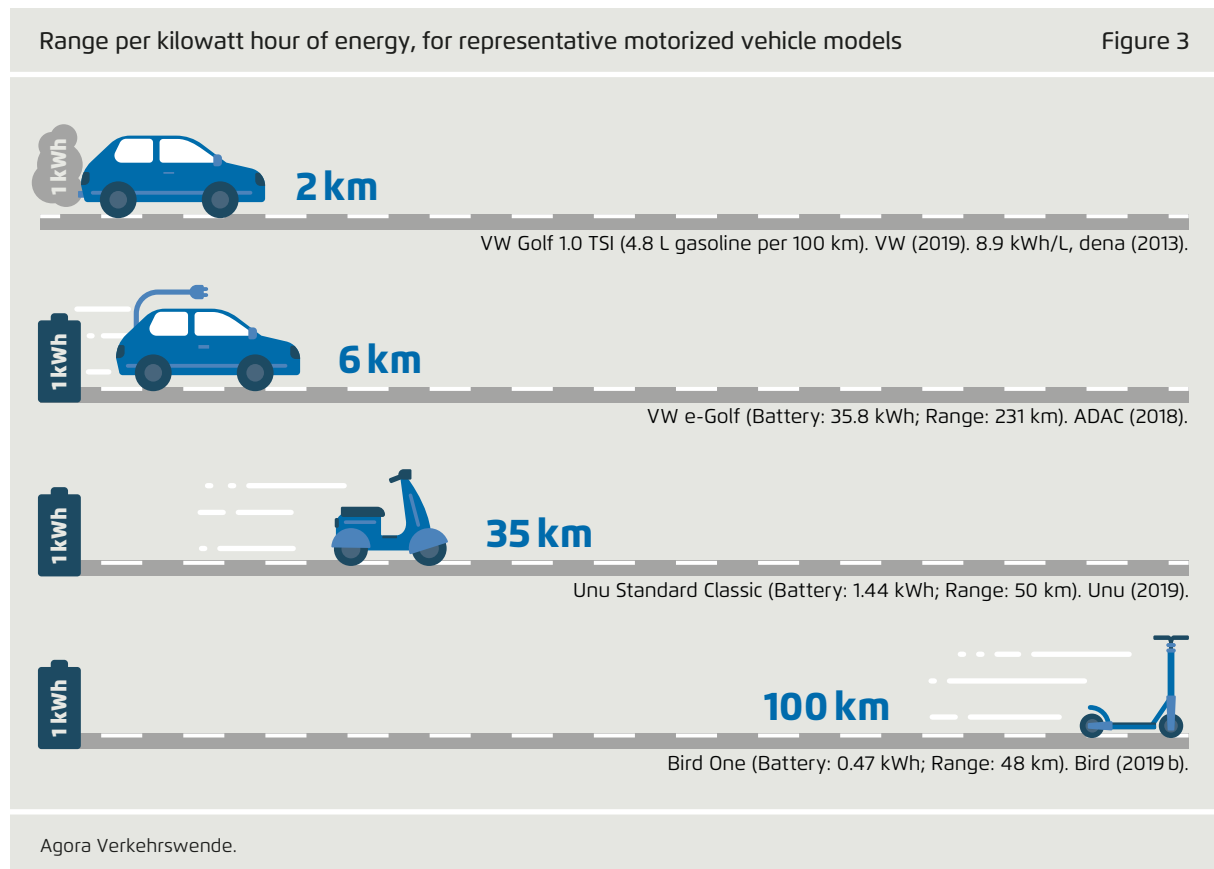
Whether e-scooters ultimately reduce congestion and carbon emissions depends in large part upon what modal shifts are occurring – in other words, what existing trip types and forms of transportation e-scooters are shifting,

¹⁷ Assuming 4.8 liters of premium gasoline per 100 km.

VW (2019). One liter of premium gasoline is equivalent to 8.9 kWh. dena (2013).

¹⁸ The Bird One can travel approximately 30 miles (48 km) on a single charge (0.47 kWh). This corresponds to roughly 100 km/kWh. Bird (2019 b).

¹⁹ Equivalent to approximately 7 g CO₂ per mile. The Bird One consumes approximately 0.01 kWh/km, as noted above. The average carbon intensity of the German grid in 2017 was 474 g CO₂/kWh. UBA (2019).



and to what degree. To the extent that shared e-scooters replace car trips and complement public transportation, they have a clear positive impact. To the extent that they substitute for walking and bicycling, however, any claims of environmental or traffic benefits are more questionable.

While it is still too early to fully understand the modal share impacts of e-scooters, initial studies in early-adopting cities internationally can help guide discussion.

In this section, we primarily consider three key evaluations available to date: the shared e-scooter pilot evaluation conducted by the *Portland Bureau of Transportation (PBOT)*,²⁰ the *San Francisco Municipal Transportation Agency (SFMTA)* e-scooter pilot mid-point evaluation,²¹ and a user survey conducted by *6-T Bureau de Recherche* in Paris, Marseille, and Lyon²² (see Figure 4).

While each evaluation differs somewhat in its method-

ology and reflects slightly differing regional programs, overall they provide valuable insights into trends in shared e-scooter use. Importantly, walking was the transportation mode replaced by the most e-scooter users, in all three studies. Across the three French cities, 47 percent of survey respondents reported that they would have walked to their destination on their most recent trip, had a shared scooter not been available. In Portland and San Francisco, roughly one third of respondents reported that they would have walked. Yet at the same time, only six percent of respondents in the French study reported walking less in general since the introduction of e-scooters. These somewhat conflicting results indicate the difficulty in accurately assessing e-scooter impacts, though they could be explained if most e-scooter riders are only infrequent users.

In France, a similarly high modal shift away from public transportation was also found; 29 percent of survey respondents stated that they would have used mass transit to reach their most recent destination, had a shared e-scooter not been available. Again, however, only six

20 PBOT (2019).

21 SFMTA (2019).

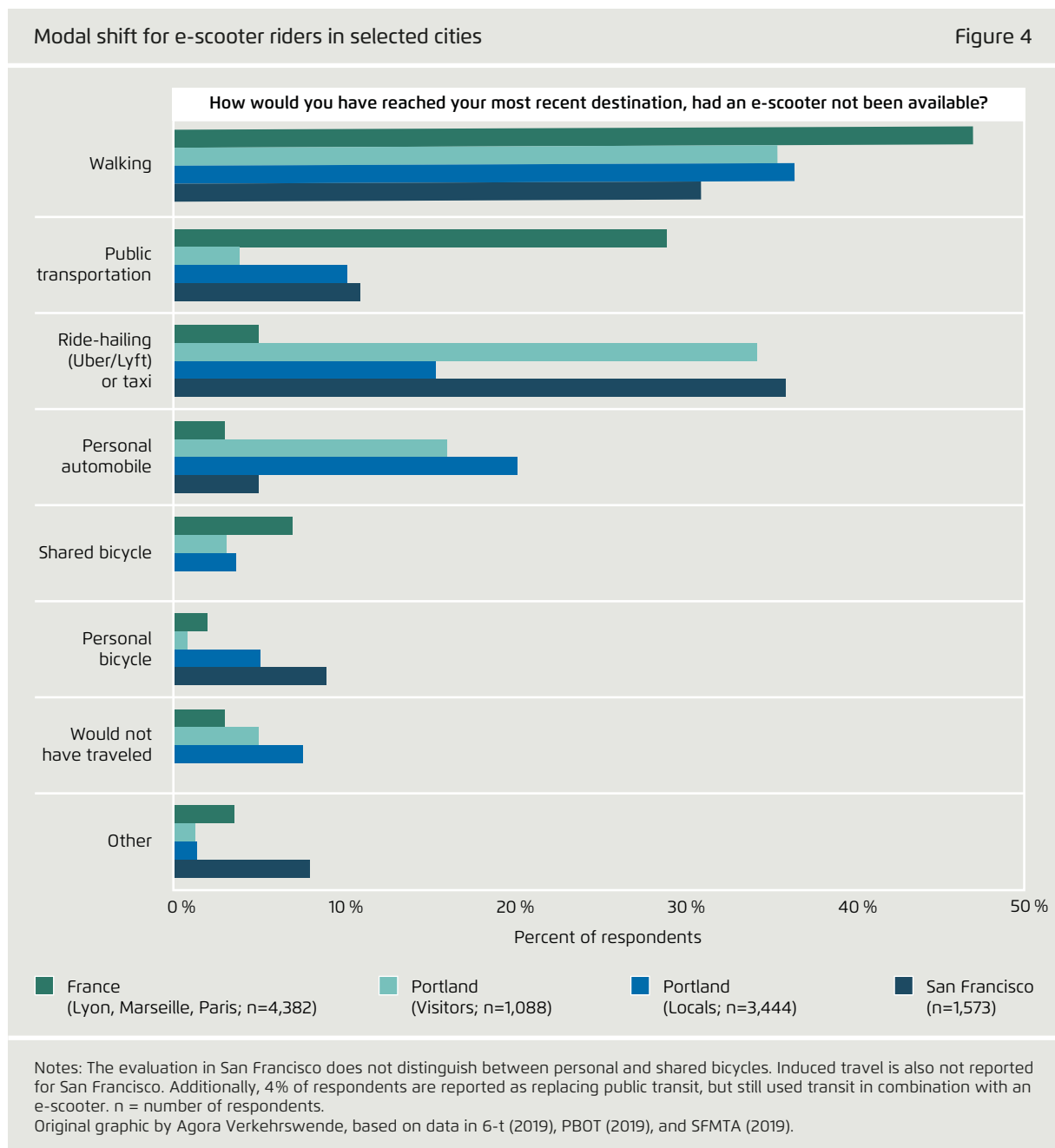
22 6-t (2019).

percent of respondents self-reported a significant drop in their use of public transit since the introduction of shared e-scooters.

In comparison, both substitution for bicycles and induced trips (in which the respondent would not have traveled at all, if not for the availability of an e-scooter) were less common. When riders were asked about their

most recent trip, each of these categories represented under ten percent of responses, across all three studies.

Yet in addition to these modal shifts away from active and public transportation, the evaluations also reveal a significant potential for shared e-scooters to substitute for automobile trips. While in the French study three percent of respondents reported that they would



have otherwise driven a car on their last trip, 20 percent of Portland locals reported that their most recent trip substituted for a personal automobile and another 15 percent reported that they would have otherwise taken a taxi, Uber, or Lyft. In San Francisco, well over a third of respondents stated that they would have used a ride-hailing service, had a scooter been unavailable. Portland tourists and visitors had the highest rates of substitution for automobile trips, at 50 percent: 34 percent would have taken a taxi or ride-hailing service, and 16 percent would have used a private automobile.

Moreover, even if a high percentage of trips substitute for active and public transportation, it does not necessarily follow that shared e-scooters have negative environmental and climate impacts system-wide. Due to their high energy efficiency relative to automobiles, even a small modal shift from cars to e-scooters can result in significant carbon savings overall – provided that fleet management is conducted in a climate-friendly manner that avoids significant indirect emissions (see Section 2.5).

At present, it is too early to know whether the modal shifts seen to date will persist over the medium and long term, or whether they represent only short-lived trends. At typical prices of one euro to unlock and 15 to 25 cents per minute to ride, e-scooters are significantly more expensive than public transportation and bikesharing, particularly for intermediate and longer distances (see Figure 5).²³ Pricing is, however, competitive with taxis and similar ride-hailing services. During rush hour and in congested areas, e-scooters may also be price-competitive with free-floating (one-way) carsharing. As a result, there may be a significant potential for e-scooters to substitute for short taxi trips and free-floating carsharing, a particularly popular offering in Germany's larger cities.

Yet whether a significant share of private or ride-hailing automobile miles can be replaced with e-scooter miles also depends on broader transportation policies. The more that cities, states, and the federal government are able to discourage private automobile use and ownership,

the greater the opportunity that shared e-scooters will have to reduce emissions and congestion.

2.3 Outreach and equitable access

Shared e-scooters can only contribute meaningfully to transportation goals if they are accessible to a broad spectrum of individuals, across many demographics. Yet studies have found scooter riders internationally to be disproportionately male (66 percent of all local respondents in France, and 80 percent of daily riders), young (31 percent of local respondents in Portland were in their twenties), higher-income (about two-thirds of respondents in San Francisco reported income over \$100,000 per year, and only nine percent were low-income²⁴), and well-educated (over 65 percent of respondents in Portland had at least a college/4-year degree).

In light of these statistics, it is important for communities to set expectations for equitable e-scooter access. Barriers and opportunities for widespread transportation access can be classified under five categories, all of which can be considered in the context of a given community: spatial, temporal, economic, physiological, and social.²⁵ Common examples are shown in Figure 5. These barriers are not necessarily unique to e-scooters, and are often addressed in other modes of transportation. For example, public transit systems worldwide offer significant discounts for lower income, elderly, disabled, and youth/student riders, as well as wheelchair-accessible stations.

While equitable access to new mobility services has not been extensively considered in German municipalities, e-scooter equity measures have been actively pursued in the United States. Programs instituted in American cities include fare discounts for low-income riders, adaptive vehicle initiatives to accommodate disabled users, vehicle placement requirements in low-income and high-pollution communities, cash and smartphone-free payment options, multilingual customer service, and education and outreach in disadvantaged communities. Relatedly, e-scooters – and any other object occupying

23 Scooter prices vary by company and location. For example, Circ scooters in Berlin cost one euro to unlock and 15 cents per minute to ride, while Lime scooters in Munich cost one euro to unlock and 25 cents per minute to ride. Circ (2019); Lime (2019). In other countries, prices can be even higher.

24 Defined as under 200 percent of the Federal Poverty Guidelines. After additional community outreach, low-income enrollment has since increased.

25 Shaheen et al. (2017).

public space – must be accepted by the general public or face being driven out by dissatisfied residents, vandalism, and lack of adoption. As a result, e-scooter companies have a clear interest in regularly seeking input from many demographic groups in the community, and in using that input to adjust their offerings and promote widespread accessibility. It is also their responsibility to proactively educate riders on riding and parking rules that respect not just legal requirements, but also local rules and community wishes.

Cities and towns should likewise actively engage with community members and interest groups to support achievement of widespread mobility benefits, promote safety, and ensure that e-scooters contribute to other community goals.

To promote truly widespread substitution for cars and augmentation of public transportation, cities and communities will need to work cooperatively with e-scooter companies on any programs, and to consider a range of local economic, demographic, and social factors. Solutions will likely include a mix of both low-cost outreach and accessibility measures and some form of public support for any higher-cost measures, particularly those focused on integration with public transportation.

2.4 Complementing public transportation

E-scooters are often touted as a potential complement to public transit, particularly as a first and last mile solution for multi-modal trips. However, existing data provide

Potential barriers to e-scooter access

Figure 5



Original graphic by Agora Verkehrswende, based on Shaheen et al. (2017)

mixed indications as to whether e-scooters increase or decrease transit ridership overall, and outcomes may evolve as e-scooters become less of a novelty. In San Francisco, 34 percent of surveyed scooter riders reported that their most recent trip was multi-modal to or from public transit, 28 percent stated that they would not have used transit at all but for the presence of an e-scooter, and only seven percent of respondents stated that they had replaced public transportation with a single-mode e-scooter trip – a significant net increase in public transportation usage.

In France, meanwhile, 15 percent of respondents reported that their last shared scooter trip was multi-modal to or from transit. However, six percent of riders reported using public transportation less frequently overall since the introduction of e-scooters, and only two percent reported using it more often. In Portland, only about twelve percent of survey respondents reported regularly using a shared e-scooter in combination with public transportation (at least once per week), and 20 percent reported using public transportation less overall, since the introduction of shared e-scooters.

Considering these international experiences, as well as the current price structures and availability limitations of shared scooter systems, it is clear that a business as usual approach will yield only limited integration of shared e-scooters into public transportation systems. To facilitate multi-modal use of e-scooters in conjunction with public transportation, it is particularly important to address the following factors:

- **Pricing:**
With a standard unlock fee of one euro per ride, frequent short trips in combination with public transportation become particularly expensive. Accordingly, it is unlikely that a large percentage of the public will see shared e-scooters as a viable option for regular first and last mile use, if current price structures persist. It is therefore incumbent upon shared scooter companies to develop multi-modal programs in cooperation with local transit agencies, and to develop alternative tariff structures such as monthly subscriptions, bulk purchase discounts, or the selective waiving of unlock fees, in order to encourage multi-modal use.

- **Availability:**
As with all dockless sharing systems, providing sufficient guarantee of availability can be a challenge. Demand-oriented fleet sizing and rebalancing,²⁶ advance vehicle reservations, cross-provider booking apps, and designated parking areas immediately adjacent to public transit can help to address this issue.
- **Digital integration:**
The more seamlessly e-scooters are integrated into public transportation offerings, the greater the chance that e-scooters will be considered as a first and last mile option in conjunction with public transit. Digital integration with transit agency products, such as navigation apps and booking platforms, represents a particularly important step.

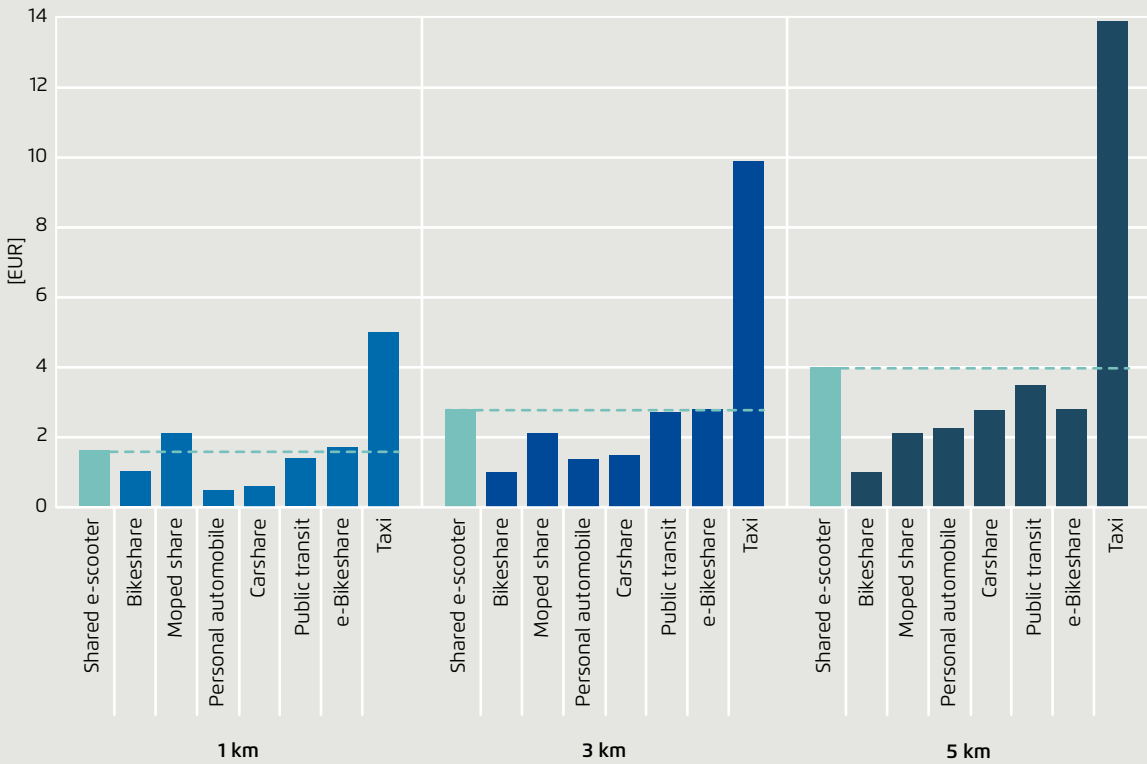
Beyond the first and last mile, shared e-scooters can complement public transportation in other ways as well. In areas with limited or capacity-strained public transportation, shared e-scooters can provide a convenient alternative. As with bikesharing systems, there is particular potential for dockless e-scooters to supplement public transportation in smaller cities and towns, as well as in less central areas of major cities. While scooter companies do have economic limitations associated with operating in less dense areas, they have also demonstrated a readiness to cooperate with interested communities on mutually beneficial solutions. In urban centers, meanwhile, shared e-scooters can help to reduce the strain on public transportation during rush hour, and to provide a convenient alternative to transit riders in the event of system delays or breakdowns.

E-scooters also present an opportunity to support local tourism, in both urban and more rural locations. For many, they are a fun way to explore a destination – and since tourists often already have e-scooter accounts and apps that can be used anywhere a company's scooters are present, it is a particularly easy mode of transportation to book and pay for.

26 Rebalancing is the redistribution of e-scooters to desired locations in order to meet demand and/or local vehicle placement requirements.

Typical transportation costs by mode, Berlin

Figure 6



	Pricing*	Assumed Speed** (km/h)
Shared e-scooter	€1 + €0.15/min	15
Bikeshare	€1/30min	15
Moped share	€0.21/min, €2.10 minimum	30
Personal automobile	€0.45/km	N/A
Carshare	€0.26/min	30
e-Bikeshare	€1 + €0.15/min	17
Public transit	€2.80 (short trip €1.70)	N/A
Taxi	€5 up to 2 km, otherwise €3.90 + €2/km	N/A

* Based on pricing for the following transportation services in Berlin: Shared e-scooters: Circ; Bikeshare: nextbike; Moped share: COUP; Personal automobile: VW Golf 1.0 TSI, per ADAC (2019); Carshare: Car2go; e-Bikeshare: JUMP; Public transit: BVG short trip for 1 km, standard fare for 3 and 5 km; Taxi: regulated taxi tariffs, assuming no waiting time or supplemental charges. All vehicle pricing assumes single ride/ticket purchases, rather than subscription or bulk purchase rates.

** Assumptions made in light of limited data availability and inherent variability in congestion levels, as well as the typical speed limit of 30 km/h in German residential and downtown areas. Does not include time to book, unlock, or park vehicles. Original graphic by Agora Verkehrswende.

As a result, there is a significant potential for cooperative agreements to promote shared scooter use in combination with public transportation to reach and explore tourist destinations. Local governments, transit agencies, cultural and entertainment destinations, local interest

groups, and e-scooter companies may all be involved in such partnerships. If no scooter company is currently active in the community, a request for tender (also known as a request for proposals) with the offer of co-financing and/or municipal branding may encourage market entry.

2.5 Manufacturing, durability, and end of life

As with all vehicles, e-scooters have environmental impacts across their lifecycle. One of the most important to consider in the case of e-scooters is that of the battery. The most recent scooter models typically have lithium-ion batteries with a capacity of 0.3 to 0.7 kWh; their manufacturing and disposal results in approximately 25 to 50 kg of CO₂ equivalents (CO₂-eq).²⁷ Emissions from manufacturing vehicle parts out of aluminum can be even more significant, at over 100 kg CO₂-eq per scooter.²⁸

Any lifecycle assessment of e-scooters must also consider their durability. E-scooter companies suggest a battery life of approximately 1,000 cycles, which is typical for lithium ion batteries.²⁹ With daily recharging and in the absence of any external damage, a battery could thus last nearly three years. However, wear and tear on parts such as brakes and tires, as well as damage due to vandalism or water penetration into the battery case, leads to shorter vehicle lifetimes.

When shared e-scooters were initially introduced, many companies deployed vehicle models that were originally designed for personal and not for shared use. As a result, the vehicles often lasted mere weeks, or a few months at most. Since their initial launches, many e-scooter companies have developed new, more robust models that are specially designed to meet the demands of shared use. How durable the latest vehicles will prove to be cannot yet be known, but according to e-scooter companies, they are expected to last at least ten to 18 months as part of a shared fleet.

27 For example, the Bird One has a battery size of 0.473 kWh. Bird (2019b). Battery manufacturing and disposal emissions based on German Environment Agency (UBA) values for e-bikes (lithium-ion-cobalt batteries). UBA (2014).

28 A North Carolina State University life cycle assessment of shared electric scooters suggests that the greenhouse gas emissions to manufacture a typical e-scooter (Xiaomi m365) can be as high as 45 kg CO₂-eq for the battery and 122 kg CO₂-eq for the aluminum frame and parts. Hollingsworth et al. (2019).

29 This value is consistent with that assumed by UBA for e-bikes. UBA (2014).

Regular maintenance and replacement of faulty parts will also be essential to ensuring long vehicle lifetimes. However, given the direct relationship between increased vehicle life and profitability, e-scooter companies have a strong incentive to continue to improve vehicle maintenance and durability in the future.

Ultimately, at the end of their useful life, e-scooters should be appropriately recycled or disposed of. Within the next one to two years a significant number of e-scooter batteries can be expected to reach the end of their useful life, and second-life applications should therefore be explored soon. If second-life applications are not possible, unusable batteries should be appropriately collected and recycled.

To maintain safety and minimize pollution, companies in Germany and the EU must comply with existing laws and directives, including the German Battery Law (BattG, which implements the European Battery Directive) and the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).³⁰ In the future, scooter-specific modifications to the European Battery Directive (2006/66/EG) could also be considered.³¹

2.6 Fleet management: collection, maintenance, charging, and distribution

Fleet management plays a particularly important role in e-scooter operations, and in their environmental and climate impacts. While the first models with swappable batteries are being introduced worldwide, at present only e-scooters with fixed batteries are deployed in Germany; these must be collected and recharged roughly daily, at typical usage intensities. And even for scooters with swappable batteries, scooters must be collected and then redistributed as part of regular maintenance and rebalancing.

In Germany today, e-scooters are typically collected and rebalanced by the shared scooter company itself or by an external logistics service provider. Collection generally occurs overnight, and vehicles are maintained and

30 BattG (2009) and ADR (1957).

31 2006/66/EC (2006).

recharged in local warehouses by scooter company staff. As a result, scooters may be unavailable overnight.³² Internationally, some scooter companies have pursued partnerships with local businesses, property owners, and transportation agencies to charge vehicles on-site, in a decentralized manner. Others have announced early-stage plans for riders to swap batteries themselves in the future, at local kiosks or other locations.

Some scooter companies have also pursued a “gig economy” approach, hiring private individuals to recharge and rebalance at least some portion of their fleet; payment is per scooter, rather than on a salary basis with benefits. These individuals, referred to by scooter companies as Juicers, Chargers, or Hunters, register with the scooter company and can then independently collect, recharge, and rebalance scooters. They also bring broken scooters to the local warehouse for maintenance. As freelance workers, they can decide how many scooters they wish to collect on any given night. This business model is becoming increasingly common in Germany and is already quite common in other countries, but due to legal ambiguities and a lack of worker protections, it has come under significant criticism.

The nightly collection and rebalancing of e-scooters has the benefit of maximizing orderliness and ensuring a fresh fleet each morning. However, it also leads to extensive operational vehicle use for fleet management. Importantly, most fleet management miles are driven in fossil fuel vehicles such as diesel vans and trucks. And whether fleet management is done in-house or contracted out to logistics companies or freelancers, it takes significant amounts of time, effort, and capital to pursue low- or zero-emission alternatives.

Data from one US city show that roughly half a mile in fleet management (operations) travel is required per mile of end-user scooter travel in that location.³³ Meanwhile, a study in Raleigh, North Carolina found that each scooter requires roughly 0.6 to 2.5 miles of operational

vehicle travel daily for collection and rebalancing. Given the local automobile mix, the study authors calculated that this mileage accounts for approximately 43 percent of Raleigh e-scooter lifecycle emissions, or nearly 90 g CO₂-eq per scooter mile ridden. Reducing the average operational miles traveled each day to 0.6 miles per scooter would reduce collection and rebalancing emissions to just over 30 g CO₂-eq per scooter mile ridden; collecting low-battery scooters only (but not changing the average rebalancing mileage per collected scooter) would result in collection and rebalancing emissions of just under 50 g CO₂-eq.³⁴ In Germany, e-scooter companies have indicated that they and their logistics providers travel dramatically less per e-scooter mile traveled. However, reliable data are not yet available, and even much reduced mileage would still contribute a significant share to e-scooters’ lifecycle emissions.

Key measures to reduce the carbon footprint of e-scooter fleet management thus include the use of electric vehicles for scooter collection and rebalancing, and the purchase of certified green energy for recharging both fleet management vehicles and the e-scooters themselves. As previously noted, some scooter companies are also developing and deploying swappable batteries, which will enable more efficient recharging via employees or contractors driving small electric or non-motorized cargo bikes, mopeds, or similar vehicles.

2.7 Public space and infrastructure

Whether they are being ridden, carried, or parked, e-scooters share infrastructure with other, existing forms of transportation and uses of public space. Though they use only a small fraction of public space when compared to that devoted to automobiles, during initial rollout many have complained that scooters interfere with the use and enjoyment of public space, particularly areas reserved for pedestrians. E-scooters can also severely impact the safety and mobility of individuals with disabilities. Managing use of shared spaces therefore represents one of the most essential elements of e-scooter policy.

32 For example, TIER fleets have varying operating hours by city. The company website lists operating hours for each location. TIER (2019).

33 These data are reliable but as yet unpublished, and were shared directly with the authors by transit agency staff. Upon request, the name of the city is not cited.

34 Hollingsworth et al. (2019).

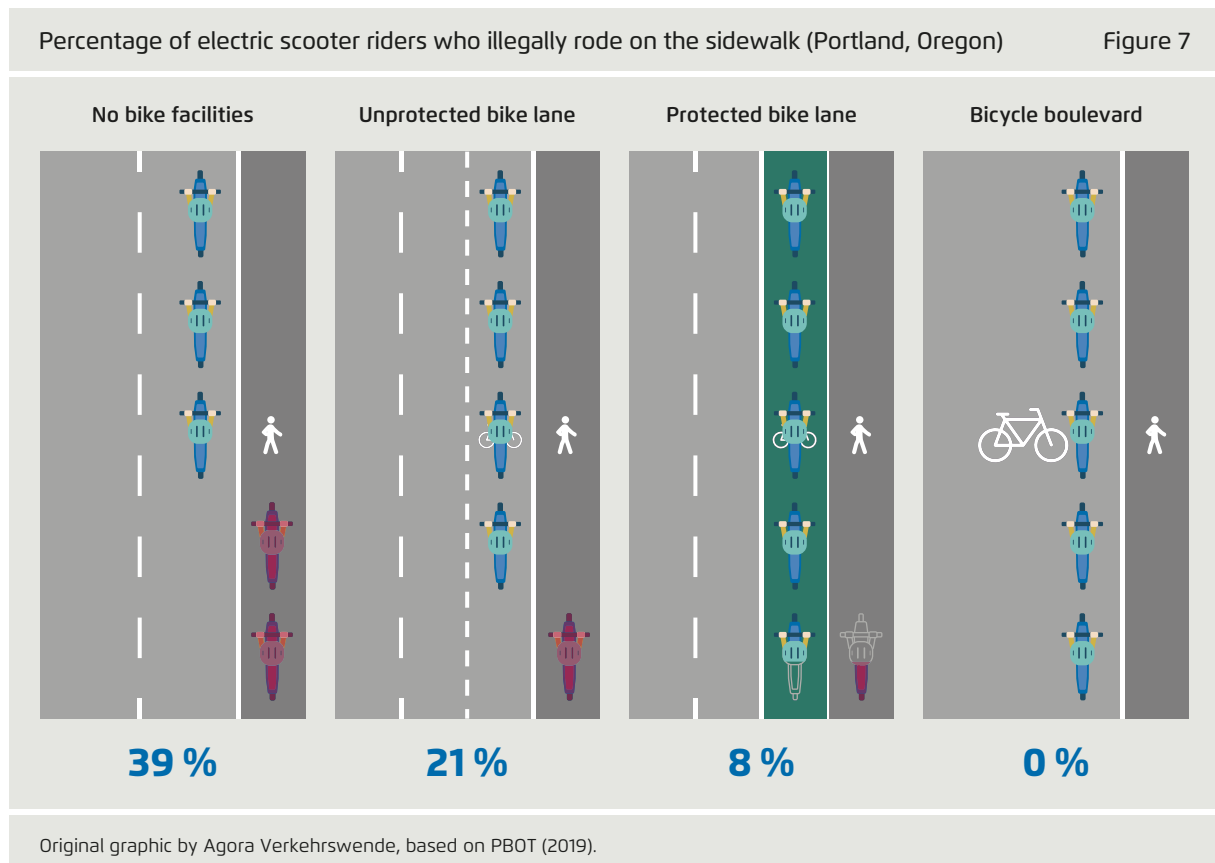
Improper parking on sidewalks and in public spaces is often the most significant issue for e-scooters, unless addressed systematically by both e-scooter companies and municipalities. In Germany, as in most other countries, e-scooters may not be parked in ways that block public transportation access, guidance systems for visually impaired individuals, or other pedestrian movement; however, international experiences to date demonstrate that these rules are not always followed. For example, the Portland pilot evaluation found only 73 percent of observed scooters to be properly parked. Three percent of scooters were impeding disabled access, five percent completely blocked the sidewalk, and another nine percent were partly blocking pedestrian movement or transit access.

Over time, however, both scooter companies and cities have developed best practices to support shared use of sidewalks and public spaces. Practices to promote proper parking include technological solutions such as tipping sensors and geofenced no-park zones, as well as direct

and regular communication with riders. However, even properly parked scooters can obstruct public spaces at times. To reduce conflict over congested public spaces, cities have introduced additional measures such as clearly marked parking corrals and utilization-based, dynamic modulation of e-scooter fleet size. Such measures have been shown to dramatically reduce public complaints, and are summarized in Section 4. Additionally, as the shared e-scooter market matures, market consolidation and an increased focus on profitability is expected. These trends may naturally lower the numbers of deployed scooters, as companies look to meet but not exceed customer demand.

E-scooters also impact bicycle traffic in Germany, as they must be ridden on bicycle infrastructure whenever it is present.³⁵ While this is appropriate for e-scooters

35 A statement from the German Cyclists' Association (ADFC) regarding e-scooter impacts on bicycle infrastructure is included as an appendix to this document.



given their similar size and speed, it also poses a number of challenges. Most importantly, even though use of bicycle infrastructure is legally required, if it is insufficiently wide, protected, and smooth, scooter users will instead ride on the sidewalk, endangering both themselves and pedestrians. In the Portland evaluation, on streets with an unprotected bike lane 21 percent of observed scooter users illegally rode on the sidewalk, as compared to only eight percent who did so when a protected bike lane was available (Figure 7). No scooter riders used the sidewalk adjoining bicycle boulevards (streets designated for bicycle/scooter traffic and local automobile traffic only).

Where bicycle infrastructure is not present, e-scooters must be ridden on the street. However, the data from Portland again show that this is not a realistic expectation for streets with fast traffic: on streets with a 20 mph (32 km/h) speed limit, 18 percent of scooter users illegally rode on the sidewalk; on 30 mph (48 km/h) streets, half did so; and on 35 mph (56 km/h) streets, 66 percent of scooter users rode on the sidewalk, even though it was prohibited.

These results underscore the need not just for short term measures but also for a long-term, strategic approach to how communities allocate public space across multiple uses and various modes of transportation to better support public safety, active transportation, micromobility, public transit, and public open space.

03 | Orderly integration into transportation systems

Dockless shared e-scooters have the potential to serve as one element of a broader climate-friendly and sustainable transportation system. At the same time, achieving an orderly integration of e-scooters into existing systems is a key challenge for communities. In particular, cities and towns must ensure that more vulnerable individuals and transportation modes are not negatively impacted.

In light of the often-contentious rollout of dockless shared bicycles in Germany, as well as international challenges with both e-scooter and ride-hailing growth, it is clear that cities and towns must actively communicate and coordinate with e-scooter companies in order to ensure a smooth introduction of e-scooters into their communities. Communities should set clear rules and requirements, but also explore potential incentives and privileges to encourage societally beneficial e-scooter operations. The following section addresses how cities, towns, and shared e-scooter companies can work together to maximize the ability of e-scooters to contribute to local transportation goals and minimize risks.

3.1 Integration into transportation strategic planning

As previously noted, it is still uncertain what role e-scooters and other forms of micromobility may play in cities and towns over the long term. However, there is potential for these vehicles to contribute to sustainable and climate-friendly mobility – not just in large cities, where transportation systems are increasingly oriented towards multi-modal trips, but also in smaller cities and towns, which may have more diverse layouts and transportation infrastructure.

Similar to bikesharing, e-scooters are best suited to replace automobile use for short trips,³⁶ typically under three kilometers, or for short segments of longer, multi-modal trips. These use cases represent a significant potential to reduce automobile use; yet to achieve that potential, it will be necessary for communities to develop a strategic plan for shared mobility that reflects local

conditions, with goals and measures that holistically incorporate all shared transportation modes, not just e-scooters.

Such plans should aim to ensure that shared mobility contributes to a significant decrease in automobile use, and does not develop primarily into an alternative to public and active transportation. To that end, they must also be integrated into broader transportation plans and policies that promote an overall transformation of the local or regional transportation system to support safety, sustainability, and other community goals. As cities and towns develop operational agreements with shared e-scooter companies, they can then reference local strategic plans to ensure alignment with broader community goals.

When developing city-wide and regional mobility strategies (in Germany these include Transportation Plans, Sustainable Urban Mobility Plans, and Mobility Masterplans) as well as a city's overall vision for use of public space (including form, function, and economic development), emerging mobility vehicles and services should be considered at both the strategy and individual measure levels.

Even in the earliest planning stages, communities can establish guiding principles – for example, concerning the integration of shared mobility with public transportation or the allocation of public space across end uses and transportation modes. Links and connections between rural, suburban, and urban areas should also be considered, such as the ability to transfer seamlessly between a shared scooter and commuter or regional rail. See Section 4 for a complete listing of measures that local governments may wish to consider.

To facilitate local planning and implementation, it is helpful to conduct mobility and modal share studies. Study design should focus on providing actionable information that can aid in strategic planning and support development of data-driven measures, potentially targeting specific transportation modes, demographics, and neighborhoods. Cities and towns should also designate a specific staff person to be responsible for emerging mobility; in larger cities, additional staff may be necessary.

Large new developments should also be assessed to determine whether a mix of shared mobility vehicles can contribute to meeting on-site and/or neighborhood

36 In the San Francisco pilot, the mean trip length was just under one mile, and the mean duration was 20 minutes. The median trip was 0.7 miles in length and lasted nine minutes. SFMTA (2019).

mobility needs. New housing developments and urban redevelopment projects represent particularly promising opportunities for developers to proactively explore shared mobility options.

Due to the rapid expansion of shared mobility, local governments often have had very little time to plan strategically and must implement measures very quickly in response to new developments. Yet the pace of change does not make strategic vision and planning any less essential. Wherever possible, even short-term and stopgap measures should be designed so as to support a community's overall goals.

3.2 Special use permitting

In Germany, much of the regulatory discussion surrounding micromobility is tied to the concept of "Sondernutzung" or special use. In many countries worldwide, shared micromobility services constitute an unambiguous case of special use, and thus may be locally permitted and regulated. While many uses of public space in Germany also require a special use permit, such as restaurant tables on a sidewalk, dockless micromobility lies in a legal gray area.

In 2009, an early dockless shared bicycle program in Hamburg was declared by the courts as equivalent to private use, rather than a case of special use.³⁷ As such, special rules or prohibitions could not be applied to dockless shared bicycles; any regulations of shared systems would also need to be applied to personal bicycles. Since then, shared micromobility providers have generally taken the court's ruling to mean that the rules for the placement and parking of any shared micromobility vehicle are the same as those for private micromobility vehicles, that shared micromobility does not require any permitting, and that it cannot be subject to special regulation.³⁸

However, micromobility market conditions have changed dramatically since that early court decision. While there

were only a few hundred dockless shared bicycles in Hamburg in 2009, there are now over 10,000 scooters in some cities. E-scooters are also different from shared non-motorized bicycles, most importantly in that they are typically collected and rebalanced daily. As a result, while the existing court decision continues to influence e-scooter regulatory approaches, it is possible that a future legal challenge would result in shared e-scooters being required to apply for special use permits, thus making them unambiguously subject to direct regulation. Alternatively, the federal or state governments could modify current laws to clarify this legal ambiguity and provide more regulatory certainty.

For the moment, most cities and e-scooter companies in Germany have pursued voluntary agreements concerning use of public space, in contrast to the mandatory permitting processes and pilot programs found in many other countries, particularly the United States. These voluntary agreements are a welcome development, as they allow parties to move forward without the need to resolve the question of special use law.

At the same time, there are many potential advantages to a special use permitting requirement, both for cities and for shared micromobility companies. For cities, special use permitting allows for clearer and more formal regulatory authority. For shared micromobility companies, a permitting process could enable certain privileges, such as sole use of certain spaces for the duration of the permit, or reduced competition (until the next permitting round). Such an arrangement could be similar to other common city programs, such as the allocation of booths at a farmer's market.

Because of the advantages of special use permitting, several German cities (including Berlin, Bremen, Leipzig, and Düsseldorf) have pursued regulatory approaches based in whole or in part on this concept, despite its legal ambiguity. Application of special use law is a worthwhile approach and should be continued, but it is important that any ensuing arrangements be mutually beneficial.

For example, communities should not treat e-scooter permitting as a potential source of new income; they should instead focus on using their regulatory authority to ensure safe and reliable operations and to promote a societally beneficial evolution of mobility. While funds

37 openJur (2013) and OVG Hamburg (2009).

38 Universally applicable micromobility vehicle rules do apply to shared micromobility, however. For example, e-scooters may not block public transportation access, guidance systems for visually impaired individuals, or other pedestrian movement.

may be necessary to support e-scooter regulation, permitting costs should be kept as low as possible. Other creative solutions to address community concerns can be found, such as in the city of Stuttgart, where a refundable security deposit is collected to cover abandoned scooters in the event of bankruptcy.

3.3 Rules, requirements, and incentives: agreements as the basis for orderly scooter operations

Since the expansion of shared e-scooter services to Germany, consensus has emerged amongst cities and towns that some form of binding agreement or mandatory collaboration is necessary to ensure the safe and orderly operation of shared e-scooters in public spaces. Several German cities, including Hamburg, Munich, and Stuttgart, have already developed guidelines that define local policies and serve as a foundation for agreements with individual scooter companies.³⁹

For any agreement between a local government and an e-scooter company, the goal should be to arrive at a reasonable solution that appropriately balances the interests of all stakeholders. These stakeholders include not just the municipality and e-scooter company, but also e-scooter riders, users of other transportation modes, and the general public.

Ultimately, the agreements should promote e-scooter systems that are not just orderly, but also used and useful. To that end, they should focus not just on short-term measures, but also on the long-term integration of shared e-scooters into the overall transportation system – and they should incorporate the opportunity for future modifications based on experience and new technological developments.

If a community instead raises numerous barriers to e-scooter deployment, it runs the risk of deterring companies from introducing e-scooters altogether. Yet particularly at this early stage, it is important to gain experience with shared micromobility, to collect data on how vehicles are used and what policies work best.

Over the long term, a community that declines to explore micromobility will lose the opportunity to diversify its mobility options and pursue associated goals such as traffic reduction, air quality improvement, and decarbonization.

Ideally, agreements should be adopted in a manner that is seen as binding and as providing a high degree of certainty to all stakeholders, despite current legal ambiguities. To that end, agreements should include not just rules, processes, and enforcement mechanisms, but also incentives and privileges for e-scooter companies, to the extent appropriate under local circumstances. The development of such agreements should also be conducted in a collaborative manner, and should serve as the basis for a long-term positive working relationship. The involvement of additional stakeholders, such as the local public transit provider and community interest groups, may also be warranted.

The format and degree of formality of such agreements may vary from location to location. However, non-binding agreements such as a Memorandum of Understanding should be avoided if possible, as they provide less certainty to parties. Potential provisions to include in such agreements are described in Section 4.

Since the first, somewhat contentious international deployments of e-scooters in 2017, the willingness and interest on the part of e-scooter companies to collaborate and come to binding agreements with municipalities has risen dramatically. In light of this development, communities may wish to consider not just non-monetary policies and incentives, but also co-financing for certain services. This approach may give cities and towns more direct and binding influence over system design, features, service quality, and longevity. Co-financing and similar approaches may be particularly helpful in smaller cities and towns, as well as in ensuring sufficient service coverage in outlying or lower-income neighborhoods of larger cities (see Section 4.2).

39 Hamburg (2019); Munich (2019); Stuttgart (2019).

04 | Policy toolkit: recommendations for cities, towns, and shared scooter companies

Both municipalities and e-scooter companies must actively work to ensure that e-scooters make a positive and sustainable impact on the overall urban fabric. The following sections outline elements that may be considered in developing voluntary or binding agreements, as well as recommendations for other measures and policies to promote the orderly and mutually beneficial integration of e-scooters into existing public space and transportation systems. They are based on both international best practices and structured interviews with cities and scooter companies. Brief case studies of pioneering policies and measures in various countries are also presented. Because there is no one-size-fits-all solution to e-scooter deployment and regulation, parties should consider the options presented below in light of local conditions and community priorities.⁴⁰

40 For further valuable reading on regulatory approaches and measures in the context of the United States and Canada, see *Guidelines for Regulating Shared Micromobility*, developed by the National Association of City Transportation Officials. NACTO (2019b).

4.1 Regulate strategically

As with all transportation modes and services, the potential impacts of shared e-scooters – whether relating to emissions, the environment, traffic, safety, health, or ease of access – depend not only on the quality and design of the scooters and services themselves, but also on the broader transportation policy framework in which they operate. Shared mobility is best considered strategically as a mix of vehicles that can together meet diverse transportation needs. Importantly, transportation policy must shift its focus away from prioritizing personal automobiles, in order to enable emerging forms of mobility – in conjunction with public transportation, walking, and bicycling – to contribute meaningfully to public policy goals.

With this in mind, cities and towns should integrate new mobility options into all relevant strategic planning processes; in Germany, these include Transportation Plans, Sustainable Urban Mobility Plans, and Mobility Masterplans. Internal responsibility for regulation of e-scooters and other forms of emerging mobility should be clarified, including both a primary staff person and approaches to coordination across all impacted departments or agencies (e.g., transportation planning, law enforcement, hospitals, transit agencies, and others). Coordination with neigh-

CASE STUDY

The **Portland Bureau of Transportation (PBOT)** has authorized a one-year shared e-scooter pilot, with the express purpose of aiding the city in evaluating whether shared scooters can support local policy goals. These goals include: “1. Increase the share of trips made using active and low-carbon transportation modes; 2. Prevent fatalities and serious injuries; 3. Improve pedestrian safety, accessibility, and convenience for people of all ages and abilities; 4. Provide equitable transportation services; and 5. Reduce air pollution, including climate pollution.” In its previous pilot, PBOT also structured its evaluation to assess whether e-scooters were contributing to key Transportation System Plan goals. Further information:

www.portlandoregon.gov/citycode/article/690212



boring communities can also promote regional consistency and leverage staff resources. Staffing resources should be increased as necessary.

In this way, communities can incorporate new mobility services into their overall transportation vision, establish clear goals, and actively communicate with stakeholders (see Section 3.1). Formal incorporation of e-scooters into overall strategic planning can also promote more collaborative public-private efforts and mutual willingness to enter into binding agreements.

4.2 Dynamically adjust fleet size

Particularly in larger cities, where numerous e-scooter companies are in competition and demand in city centers

is high, management of fleet size has been a challenge. Internationally, many cities initially responded by introducing static upper bounds on fleet size per scooter company. However, these seldom differentiated sufficiently between over-served city centers and underserved outlying or lower-income neighborhoods. Such upper limits have not been as effective as desired in reducing conflict over public space, as they simply further incentivize e-scooter companies to focus their deployment on city centers, where demand is highest.

As a result, many cities have shifted to dynamically regulated upper limits on fleet size, in combination with some form of lower limit on deployment in underserved areas. This approach allows e-scooter fleets to expand in response to increasing demand, while at the same time avoiding the excess clutter associated with unused

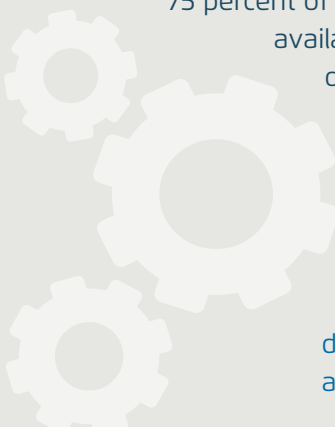
CASE STUDIES

Santa Monica, the birthplace of shared e-scooters, has instituted dynamic fleet size regulations for dockless e-bikes and e-scooters. The pilot program began with a city-wide limit of 1,000 e-bikes and 2,000 e-scooters, divided among several approved operators. If a given company's scooter fleet is utilized for an average of more than four trips per scooter per day, the company may apply to increase its maximum fleet size. If utilization is lower, the fleet size must be reduced accordingly. Adjustments may be made up to every two weeks. Further information:

www.smgov.net/uploadedFiles/Departments/PCD/Transportation/SM-AdminGuidelines_04-19-2019_Final.pdf

The **San Francisco Municipal Transportation Agency (SFMTA)**, meanwhile, is introducing minimum service requirements for e-scooter companies. In Key Neighborhoods (low income and often highly polluted areas), at least 75 percent of the land area in the neighborhood must have a scooter available within a quarter of a mile (400 m), for at least 75 percent of the time between 6 am and 10 pm. The same requirement must also be met in any outlying neighborhoods served by an e-scooter company. Operators must also commit to maintaining minimum absolute numbers of scooters in each Key Neighborhood. Further information:

www.sfmta.com/sites/default/files/reports-and-documents/2019/07/appendix_5_-_distribution_guidelines_and_requirements.pdf



scooters. It also guarantees lower demand areas sufficient service coverage for e-scooters to serve as a viable transportation option.

In establishing a dynamic upper limit, cities should collaborate with interested e-scooter companies to define an initial maximum fleet size per company, as well as any minimum requirements that may be appropriate. A scooter utilization target should also be set, with the potential for companies to deploy more scooters if they are able to exceed that target – and for cities to mandate fleet size reductions if the target is not met.

Some e-scooter companies have suggested that a minimum of three trips per scooter per day is necessary for economically sustainable operations, and city utilization targets internationally are typically three or four trips per scooter per day. However, the exact target – and the overall framework for dynamic adjustments to maintain target utilization – should be determined on a case by case basis, considering local conditions such as service territory size and seasonal variability in demand.

Communities that nevertheless wish to set a static upper limit on e-scooter fleet size, rather than a dynamic one as described above, should at minimum incorporate neighborhood-specific regulations. For example, the city of Munich allows a maximum of 100 scooters per operator in the historic city center, and a maximum of 1,000 in the more central portions of the city beyond the historic core. In outlying areas, there is no upper limit on the number of e-scooters that may be deployed.⁴¹

In addition to upper limits, it can also be helpful to set lower limits on service coverage in target areas. In this manner, a minimum level of transportation access can be guaranteed to individuals in underserved neighborhoods such as less dense, less central, lower income, highly polluted, or otherwise disadvantaged areas. In addition to minimum service requirements, cities can also develop incentives, such as permitting additional e-scooters in higher demand city centers, contingent upon achieving targets in lower-demand locations. For towns and neighborhoods with particularly low demand, co-financed services or white-label programs can also be considered.

4.3 Develop vehicle deployment guidelines and requirements

In many cases it is not the overall fleet size that puts a strain on public space, but rather a high concentration of scooters in particularly high-demand locations. In such locations it can be helpful for city staff, in consultation with local e-scooter companies, to establish clearly defined deployment locations that do not interfere with other uses of public space. Agreed-upon deployment locations can also be helpful in lower-demand areas, to ensure sufficient availability and accessibility.

German cities have also frequently adopted policies limiting the number of scooters that can be deployed in any given location. For example, in Berlin up to four scooters may be placed together. If a scooter operator deploys more than four scooters in a single location, it is considered by the city to be an excessive use of public space that would require a special use permit (see Section 3). At the same time, a municipality may wish to make exceptions to such default rules, particularly if it establishes designated micromobility parking corrals. In such parking areas, a larger number of vehicles could be accommodated. And likewise in particularly congested areas, such as historic town centers, a smaller number of vehicles per deployment location may be appropriate.

4.4 Allocate and clearly designate parking spaces

International experience to date shows that creating clearly defined parking for e-scooters is one of the most effective ways to encourage proper parking and maintain public sidewalk accessibility. Such parking corrals are particularly helpful in high-demand and congested areas, such as city centers and multi-modal transportation hubs, but they are also useful throughout a city or town. Once a city has designated parking corrals, scooter companies can communicate to their customers that parking in these locations is encouraged (or even required), and clearly mark the corrals in their apps. E-scooter companies can further incentivize their customers to use designated parking spaces by offering free rental minutes or by waiving unlock fees.

41 Munich (2019).

Parking corrals can serve not just e-scooters, but also other forms of micromobility, and they can be created via a simple conversion of a single automobile parking spot. Locations adjoining intersections are best suited for parking corral conversion because they are not only easy to recognize and access, they also contribute to pedestrian and bicycle safety by increasing visibility at crosswalks. Existing bulb-outs can similarly be converted to sidewalk parking corrals, as can other locations with particularly wide sidewalks. Small stretches of the street that are too small or curved to accommodate an automobile (e.g., between two nearby driveways) can also be converted into e-scooter parking. Any parking corral should be clearly marked with standardized paint and signage.

4.5 Establish no-parking, no-riding, and slow zones

Another essential measure to promote safe and considerate user behavior is to establish zones in which riding and/or parking is prohibited. These areas can be digitally demarcated by a city or town and provided to e-scooter companies for implementation, a process known as geofencing.⁴² Once implemented, no-parking and

42 Geofencing is defined as “the use of GPS or RFID technology to create a virtual geographic boundary, enabling software to trigger a response when a mobile device enters or leaves a particular area.” Lexico (2019).

CASE STUDIES



Photo: Mark Gombert



Photo: Jonathan Seidman

At the main train station in Frankfurt, German rail operator **Deutsche Bahn (DB)** has placed an e-scooter parking corral in a highly visible location just outside the terminal (left). The new parking corral enables fast, no-hassle transfers between e-scooters and public transit.

As of 1 August 2019, shared scooters in downtown **Tel Aviv** may only be parked in on-street corrals (right). The corrals are 100 to 150 meters apart, and were created by converting automobile parking spaces. Each is clearly marked with one sign indicating no automobile parking and with another that reads, “Space reserved for parking bicycles and e-scooters only.” Further information:

<https://en.globes.co.il/en/article-tel-aviv-to-introduce-e-scooter-bike-restrictions-1001289771>



no-riding zones can be enforced both by scooter companies, which can automatically fine users for violations, and by local parking and traffic enforcement officials.

Geofencing is generally welcomed by scooter companies; however, if prohibited areas are too small (e.g., one side of a street), they become technically impossible to implement reliably. Additionally, GPS is less reliable in densely built areas, posing further challenges in some city centers. And when technical reliability suffers, usability for riders also suffers. Just as important, prohibited areas should also be easy for riders to recognize and understand. To that end, a consistent and simply explained designation of prohibited zones – such as all large parks, pedestrian areas, and sensitive historic locations – can be helpful, along with clear signage.

In addition to no-parking and no-riding zones, geofencing also enables the designation of slow zones, where the speed of e-scooters is automatically reduced, typically to walking speed. This technology has been successfully applied internationally in cities such as Vienna, where scooters automatically reduce their speed in certain pedestrian areas.

At the same time, slow zones raise the question of whether it is reasonable to make shared mobility companies responsible for their customers' driving behavior; private automobiles do not incorporate any automated

enforcement of speed limits or other traffic rules, so it is unclear whether it is appropriate to treat shared e-scooters differently. Moreover, it is also not certain whether such external interference in vehicle operations is legally permitted under the German Small Electric Vehicles Act. Nevertheless, automated e-scooter throttling can be a useful measure under certain circumstances, for example when permitting e-scooters in otherwise prohibited locations such as pedestrian areas.

4.6 Clarify and expand signage

Beyond the need to integrate e-scooters in transportation planning, signage rules and regulations must also be considered. Regulators should examine whether additional signs ought to be introduced that are specific to e-scooters, and whether the use of existing signage may result in any unintended consequences or confusion.

In Germany, the Small Electric Vehicles Act established an "e-scooters permitted" sign, as well as clarifying how relevant existing signs should be applied to e-scooters (Figure 6). However, additional modifications are likely necessary. For example, because they are motorized vehicles, e-scooter counterflow traffic is not permitted on one-way streets, even if signs permit counterflow bicycle traffic. Since scooters otherwise use bicycle infrastructure, this regulation is likely to cause confu-

CASE STUDY



The city of **Munich's** designated no-parking and no-riding zones are clearly marked in the Circ app. If a user rides into a no-parking zone, they cannot end their rental in the zone and must first depart it. Further information:

https://www.muenchen.de/rathaus/dam/jcr:694fe285-062c-497f-b3d2-fe7817ee1f48/08_2019_EKF_Fahrverbots_Parkverbotszonen_Stpl.pdf



sion. Rules should therefore be updated to allow counterflow e-scooter traffic wherever counterflow bicycle traffic is permitted.

There is also no formally adopted sign or regulation to allow municipalities to specifically prohibit e-scooters (but not bicycles or other vehicles) in particular areas where it is necessary for pedestrian and rider safety. Additionally, there is no ability to permit e-scooters in designated pedestrian areas but only at designated times (e.g., from 10 pm to 9 am). Moreover, while there is a standard sign to permit bicycles at certain times, this sign does not apply to e-scooters as motorized vehicles. In the absence of a sign specifically prohibiting scooters (or new regulations stating that the bicycle sign also applies to e-scooters), scooter riders may thus mistakenly think that the bicycle signage applies to them, and inadvertently violate the law.

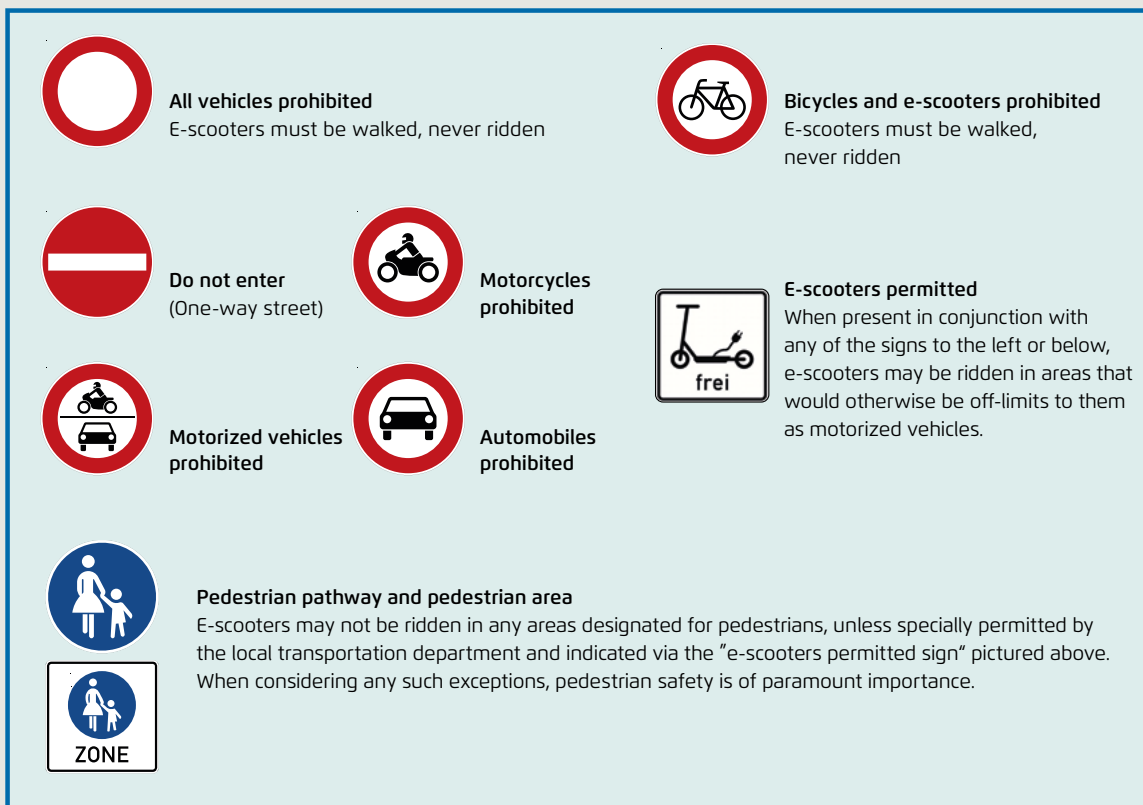
4.7 Conduct outreach to encourage safe and law-abiding user behavior

Shared scooter companies can contribute significantly to good driving and parking behavior through active customer education and outreach. Nearly all e-scooter companies already utilize in-app tutorials and notifications to regularly remind their users of the local rules of the road. Some also incorporate such reminders into the booking process; they may even require users to confirm that they have read and accepted the local rules before beginning their ride.

In Germany, scooter companies should be particularly clear in communicating that even though scooters use bicycle infrastructure, they are subject to motorized

Signage applicable to e-scooters in Germany

Figure 8



Agora Verkehrswende.

vehicle regulations and fines, and not those of bicycles. Tutorials and reminders should emphasize the prohibitions against riding while intoxicated, bringing along a passenger, riding on the sidewalk, and blocking accessibility for others.⁴³ Reminders can also encourage positive behavior, such as wearing a helmet.

Other forms of public outreach, including events, websites, and social media posts, can both overtly and subtly reinforce this in-app messaging (e.g., via social media posts of riders wearing helmets and parking appropriately, helmet giveaways, and websites featuring related FAQs). Some micromobility companies also use their apps to provide event-specific and seasonal notifications, such as reminders for orderly use at festivals, and tutorials on riding in inclement weather. In the future, other safety-related notifications could be added, such as tutorials on how to avoid common causes of crashes and falls.

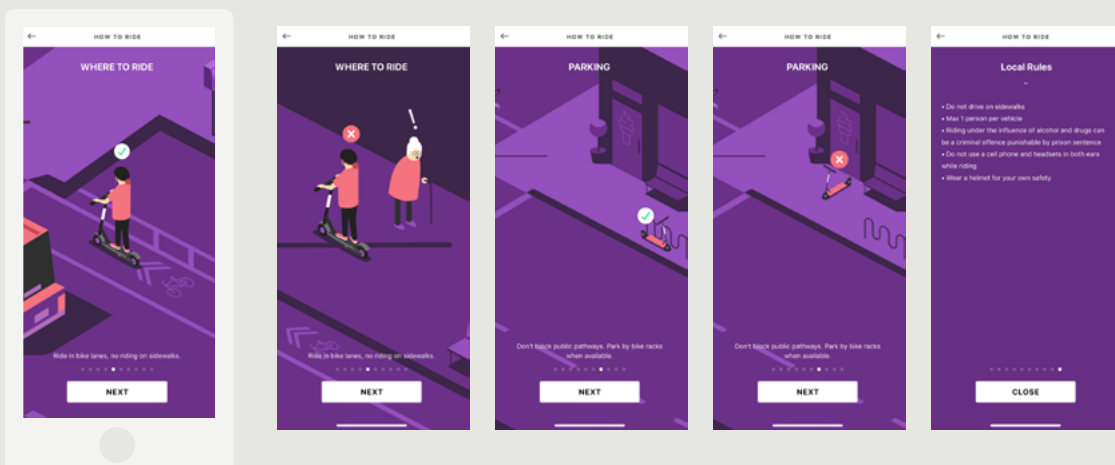
43 In Germany, the alcohol limit for driving a motorized vehicle (0.5 parts per thousand) is lower than that for riding a bicycle (1.6 parts per thousand).

4.8 Establish robust alert and complaint processes, and ensure fast response times

In spite of all efforts to promote orderly and law-abiding scooter use, some scooters will inevitably be improperly parked or damaged. It is therefore essential for e-scooter operators to be easily reachable by both the public and city staff, and able to respond quickly. To enable reporting of public complaints, a scooter company's contact information should be readily available not just on its website and apps, but also on its scooters, in large and easily legible print. It should be possible for members of the public to register complaints via multiple media channels, including via phone; prevalent local languages should be supported. Scooter companies can also use technological approaches such as tipping sensors to automatically detect when a scooter may need attention, and thus be alerted to problems even if no complaint has yet been made.

Municipalities can also contribute to efficient complaint management. City and town websites can display the contact information of locally active e-scooter companies. City services hotlines and apps can accept

CASE STUDY



Bird customers can click through a tutorial educating them on where to ride and park. At the end of the tutorial, the customer is presented with a summary of local rules.



e-scooter complaints and route them in as automated a manner as possible to the applicable e-scooter operator (see the Vienna case study, below). These measures can increase the accessibility of the complaint process to those who do not ride e-scooters or use smartphones, and result in problems being reported much more rapidly. However, successful implementation is dependent on clear staff responsibilities and coordination processes, as well as direct channels of communication between city administration and e-scooter company staff.

When a complaint or automated alert is received, the responsible e-scooter company should address the issue in a timely manner. Municipalities and scooter companies should jointly discuss what an appropriate reaction time may be, in light of local conditions. While most cities have set time limits for scooter companies

to respond to complaints, they vary significantly by location – from two hours in many cities in the United States (e.g., Los Angeles and San Jose), to up to 24 hours in Paris. Especially on weekdays, when traffic is greatest, it is important to ensure that instances of improperly parked or damaged scooters are resolved as quickly as is reasonably possible.

4.9 Develop climate and environmentally friendly fleet management practices

As described in Section 2.6, fleet management practices are a critical component of shared e-scooters' carbon balance and broader environmental impact. Shared scooter companies should therefore strive to minimize

CASE STUDIES



If a **TIER** scooter is improperly parked, passersby can report it by calling a hotline listed on the vehicle; all information is printed in both German and English.

With the Vienna city services app **Sag's Wien** (*"Tell it to Vienna"*), members of the public can quickly upload a photograph (and text, if preferred) to report any public space issue – including improperly parked e-scooters. The system

also automatically checks whether the problem has already been reported. Incoming scooter complaints are routed to the city's Waste Management, Street Cleaning and Vehicle Fleet Department, and to the responsible e-scooter company. The scooter company then has four hours to address the problem on weekdays, or 12 hours on nights and weekends. If the problem is not remedied within the allotted time (e.g., by moving or repairing the vehicle, as appropriate), the Waste Management, Street Cleaning and Vehicle Fleet Department may impound the scooter at the expense of the scooter company. No registration is required in order to submit a complaint, and the user can be informed via push notification when the problem has been resolved. Further information:

<https://smartcity.wien.gv.at/site/en/sags-wien-application/>



the operational vehicle miles traveled to charge, maintain, and rebalance their fleets, and they should also deploy the lowest-carbon fleet management vehicles that are reasonably feasible, such as electric cargo bikes (see case study below).⁴⁴

One key measure to minimize operational vehicle miles traveled is the deployment of scooters with swappable batteries. These can allow e-scooter companies to more frequently leave vehicles on the street overnight, rather than bringing them to a warehouse for recharging each evening (or having gig economy contractors recharge scooters overnight). If a vehicle only needs to be recharged and does not require substantial maintenance, a fresh battery can simply be delivered via cargo bike – or users can swap batteries themselves, if companies establish battery swapping kiosks. Scooters could thus also be available at all hours, which would enable transportation accessibility for additional user demographics. While some municipalities and scooter operators prefer to remove scooters from the street each night in order to

avoid more disorderly usage and limit late-night vandalism, the benefits of dramatically reduced fleet management vehicle emissions and more equitable accessibility are significant, and nevertheless worth pursuing.

Other measures can also reduce fleet management mileage. For example, scooters may be charged in a decentralized manner, such as via partnerships with local small businesses, property owners, and major destinations such as transit hubs. Dynamic pricing can also be employed to encourage users to bring low-battery scooters to the nearest charging station, and fully charged scooters to areas with high demand. This could reduce the operational miles required for both recharging and rebalancing.

Yet no matter how optimized fleet management may be, it will always be necessary to transport scooters to some degree, whether to conduct maintenance or to rebalance them. It is therefore essential for e-scooter companies to strive, over the medium to long term, to deploy zero emission vehicles for fleet management. At the same time, cities and towns should not set zero emission vehicle targets in isolation, only for shared mobility companies. Rather, such targets should be developed in accordance with broader community climate protection and mobility strategies.

44 Rebalancing is the process of strategically distributing scooters throughout the service territory, which may occur nightly or even continuously during the day, depending on local conditions and company business models.

CASE STUDY



environmentally-friendly a manner as possible. Further information:

<https://k-ryole.com/les-trottinettes-electriques-leur-logistique-economique-verte-et-sans-effort/>

For its fleet management, Dutch shared scooter company **Dott** employs bicycles with electrically assisted cargo trailers developed by French manufacturer **K-Ryole**. The trailers can hold up to five scooters, which are securely fixed to specially designed rails located in the base of the trailer. Such solutions can enable not just recharging, but also maintenance and rebalancing, to be conducted in as



Beyond operational miles traveled, the electricity used to recharge scooters (and any electric fleet management vehicles) is also an essential component of sustainable fleet management. Scooter operators are aware that the emissions intensity of the German grid negatively impacts their carbon balance, and many are already moving towards climate-friendly scooter charging, even in the absence of municipal requirements.

When purchasing electricity, scooter companies should seek renewable energy products that also guarantee further build-out of renewable electricity generation, such as one meeting the EcoTopTen Standard.⁴⁵ This will ensure that their choice results in true and long-lasting emissions reductions that would not otherwise have occurred. For countries without liberalized (deregulated) electricity markets, there may be less choice available in electricity purchases. In such cases, voluntary renewable energy credits or carbon offsets may be a good alternative.

45 EcoTopTen (2018).

4.10 Integrate shared e-scooters into public transportation systems

To support multi-modal use of e-scooters in conjunction with public transportation, the two systems should be integrated to some degree. Municipalities, transit agencies, and scooter companies should therefore work collaboratively to make such trips cost-competitive, convenient, and accessible to as many demographic groups as possible. While transit agencies and scooter companies should pursue digital product integration over the medium to long term (e.g., common navigation and booking apps), they can also take other important steps in the near term, even before such deep integration has been implemented.

Most importantly, the current rate structure for e-scooter rentals – with a one euro unlock fee per trip – strongly discourages multi-modal usage. To remove this barrier, it will be necessary to introduce alternative pricing options such as monthly subscriptions, bulk pur-

CASE STUDY

With its new app Jelbi, the **Berlin transit agency BVG** (*Berliner Verkehrsbetriebe*) gives users access to both public transportation and mobility services from external partners, all on one platform. BVG is also pursuing integration of physical infrastructure via multi-modal mobility hubs, where users can transfer between public transportation and a wide variety of shared mobility vehicles. Jelbi partners include e-scooter company **TIER**, whose scooters can be booked and paid for directly in the Jelbi app. E-scooter charging stations from **Swiftmile** have also been installed at the first two mobility hubs. Further information:

<https://www.jelbi.de/english>

The **Hamburg transit agency** (*Hamburger Hochbahn*) is also pursuing integration with e-scooters, in partnership with Swedish scooter company **VOI**. From July through December 2019, they are piloting initiatives to promote first and last mile trips in combination with the metro system. Sixty shared e-scooters have been deployed in outlying neighborhoods Berne and Poppenbüttel, and they may be parked in the local metro station park and ride lots. For residents enrolled in the pilot program, the one euro unlock fee is waived on every e-scooter trip. The first 500 registrants with pre-existing transit subscriptions (e.g., monthly passes) also receive 100 free scooter minutes per month. Further information:

https://www.hochbahn.de/hochbahn/hamburg/de/Home/Naechster_Halt/Ausbau_und_Projekte/voi



chase pricing, transfer pricing, or limits on the number of unlock charges. Some of these features are already being piloted or deployed in other markets and for other shared micromobility vehicle types worldwide. Meanwhile, e-scooter reservations (whether a few minutes or a few hours ahead), can improve the reliability and convenience of both first and last mile scooter trips.

Financial partnerships may also prove helpful in promoting multi-modal travel. For example, support from a transit agency could facilitate the waiving of unlock fees or free minutes for transfers. Alternatively, a transit agency could offer shared e-scooter services directly via a white-label program, thereby enabling even more integrated product offerings. The Munich and Cologne bikesharing systems already utilize this approach, as do many other bikesharing systems internationally.

Finally, integration of physical infrastructure is also essential for ensuring swift and easy transfers. Parking areas for shared micromobility vehicles should be created directly at or immediately adjacent to transit stations; these should be sufficiently large and supplied with enough vehicles to meet demand. Transit agencies and municipalities may also request that e-scooter companies place additional vehicles in areas with poorer public transportation service, where they can support first-mile trips to reach more distant transit stations.

4.11 Build out bicycle and e-scooter infrastructure

Integrating new forms of mobility into existing transportation systems is a significant infrastructure challenge. Given limited spatial resources, there is invariably a need to take traffic regulations into account (see Section 4.6). Moreover, it can be hard to plan for e-scooters when it is still too early to know how significant a modal share they will ultimately acquire (and maintain).

Yet no matter their ultimate modal share, e-scooters can only add to the existing need to massively expand and enhance bicycle infrastructure in order to increase availability, quality, and safety; serve a growing diversity of bicycle types; and meet capacity needs as communities strive to increase the modal share of bicycles. For example, existing infrastructure in Germany is often too nar-

row to accommodate traffic flow and allow riders to pass one another. This deficiency is of increasing importance given the growing mix of traditional bicycles, e-scooters, delivery vehicles, family cargo bikes, and e-bikes – all of which may be ridden at different speeds. And because e-scooters are more sensitive to road surface than bicycles, it is important for both comfort and safety to maintain smooth road surfaces that are free of tree roots, potholes, and even sharp curbs at intersections. Additional protected or physically separated bicycle lanes must also be created, with the degree of protection depending on the quantity, type, and speed of adjacent automobile traffic. Areas with high levels of congestion or a high incidence of crashes require particular attention.

At the same time, in space-constrained locations (such as historic city centers) there may not be enough room to create sufficiently wide, protected bicycle infrastructure. And dedicated bicycle infrastructure is generally not provided on side streets with a 30 km/h (19 mph) speed limit. In such situations, bicycles and e-scooters are likely to share the road with automobile traffic indefinitely.

However, municipalities can use other approaches to support safe and comfortable micromobility usage, such as lowering the speed limit on key stretches of main thoroughfares from 50 to 30 km/h (from 31 to 19 mph). Cities and towns can also create additional bicycle boulevards (streets open to micromobility vehicles and within-block automobile traffic, but closed to automobile through traffic). Yet simply marking a street as a bicycle boulevard is insufficient; municipalities designing bicycle boulevards should always consider international best practices regarding width, signage, painted markings, obstacles to automobile through traffic, and interactions with parking (and parked) cars.

While a more detailed presentation of these topics is beyond the scope of this paper, the further development of bicycle infrastructure is an active and important topic of discussion in Germany, and one that is also closely tied to e-scooter policy. Regardless of specific measures and approaches taken, it is also clear that in order to expand and modernize micromobility infrastructure, some public space currently dedicated to private automobiles must necessarily be reallocated.

4.12 Collect standardized data to inform regulations

For e-scooters to contribute to community goals and be incorporated into local and regional mobility strategies, reliable data are needed to inform decision-making. This includes both real-time operational data, which many e-scooter companies provide to local governments as a matter of course, and longer term observational studies and surveys that can shed light on user demographics and mobility choices.

At the same time, cities and towns should always clearly and transparently communicate – to both scooter companies and the public – what data they wish to collect, how they plan to use it, and how both personal privacy

and any trade secrets will be preserved. Data should not be collected unless there is a clear purpose, and any sharing of data with third parties should be carefully considered and discussed in advance with scooter companies.

Collection and application of e-scooter company operational data is often not uniform across municipalities. Some receive static PDF reports or simple spreadsheets on a monthly basis, while others use an Application Programming Interface (API) to access real-time data in JavaScript Object Notation (JSON) format. Some cities do not know what to do with the data they receive, while others conduct Geographic Information System (GIS) and other analyses to better understand the traffic or equity impacts of e-scooters in key locations or at key times.

CASE STUDY

NAVIGATING THE DASHBOARD

Reports Tab
Daily, weekly and monthly metrics including unique riders, rides, vehicles, miles ridden and time spent.

All Time Report
Top-line metrics showing how your partnership with Bird has complemented the mobility menu of your city.

Ride Insights
Get insights into how your community is using Bird with visibility into all-time cumulative rides and week-to-date rides per hour.

Maps Tab
See real time maps of vehicle locations, in-progress rides and popular start and end ride locations. Hover over to view location to three decimal places, and click the icon to zoom in.

Today
See a live map of where vehicles are located in your city and today's usage metrics.

Your Bird Rep
Who to reach out to at Bird with any questions that arise.

Source: Bird

Cities and towns can register for the **Bird** online dashboard to receive confidential statistics on scooter operations in their municipality. The real time and historical datasets are automatically aggregated, and provided along with frequently-used charts and graphs. Bird additionally shares raw data with cities via API, in MDS format. These data include trip distances and durations, route information, trip pricing, and real-time vehicle status. Further information:

www.bird.co/cities



Internationally, the Mobility Data Specification (MDS), which allows for standardized data access using an API, is increasingly becoming the standard for operational data on micromobility. Communities should thus seek to use this standard, with slight modification if necessary, wherever possible. Increasingly, municipalities are also automatically posting non-confidential subsets or aggregations of MDS data for public use via online open data portals.

Use of international data standards with APIs not only saves time and energy for all parties, it also creates economies of scale that enable the development of more powerful data analysis and decision-making tools. Moreover, international standards are essential for analyses comparing or aggregating impacts across multiple cities and towns. For further reading on micromobility data in the USA and Canadian contexts, see *Managing Mobility Data*, a joint publication of the National Association of City Transportation Officials and the International Municipal Lawyers Association.⁴⁶

For those municipalities that lack the necessary capacity to analyze raw data themselves, an online data dashboard can be a valuable alternative. A dashboard allows a city to quickly access automated fleet analyses and visualizations, and to download more specific data as needed. Many e-scooter companies already offer city staff such dashboards free of charge (see case study). However, cities that wish to jointly analyze multiple fleets or consider highly complex questions will need to either conduct their own analyses or engage a third party.

While MDS data are continually updated in real time, monthly or quarterly reports can also be helpful, and may be required as part of agreements between cities or towns and e-scooter companies. Particularly for agreements with performance-based provisions (e.g., with dynamic requirements based on fleet utilization or other targets), regular reporting is important to track and document performance.

For transparency in fleet management, it is also recommended that e-scooter companies provide data on the types of vehicles deployed for operations, and their vehicle miles traveled. Data on other topics, such as

crashes and falls, vandalism, and public complaints, may also be provided by e-scooter companies. Coordination with other organizations and departments is essential to address specific concerns, such as working with hospitals and the police department to better understand crash and fall frequencies, causes, and outcomes. As with all data collection, however, the city should be transparent about its data needs, and how they relate to the community's strategic goals.

Beyond daily data collection, development of long-term strategies for e-scooters will require empirical studies. These can inform policymakers on e-scooter user behavior, traffic impacts, and rider demographics. In Germany, the Federal Ministry of Transport and Digital Infrastructure has been tasked with evaluating the Small Electric Vehicles Act (see Section 1.1), and a robust shared e-scooter impact analysis would be a valuable element to include. Such an analysis, conducted at the federal level, would enable comparisons between many municipalities and scooter companies and thereby contribute to a better understanding of trends and best practices across the country.

4.13 Actively engage the public to promote safety and support community priorities

E-scooters can only achieve their potential if they are accepted and used by the general public. As a result, both municipalities and shared scooter companies have a clear interest in engaging the public in dialogue. Such efforts can increase public awareness and safety, inform the development of new services and approaches to support community goals and needs, and potentially also reduce the risk of vandalism – all of which can contribute greatly to successful shared e-scooter systems that become woven into the urban fabric.

Potential outreach approaches for both cities and e-scooter companies include: public workshops and meetings; test and ride events; door to door and print outreach; a webpage and social media presence; coordination with existing community groups; surveys and focus groups; advisory bodies; and targeted outreach to specific communities (e.g., minority language groups,

46 NACTO (2019a).

seniors, disabled individuals).⁴⁷ Larger cities may wish to develop longer term community engagement plans and metrics, and ask local scooter companies to do the same, to ensure that the public remains informed and involved.

Based on community input, cities and scooter companies may wish to take additional measures to support local priorities.

47 List adapted from the Los Angeles e-scooter permit application, <http://basic.cityofla.acsitefactory.com/sites/g/files/wph266/f/Final%20One-Year%20Dockless%20Permit.pdf>. For further reading on micromobility-related community engagement in the USA and Canada, see *Strategies for Engaging Community*, NACTO (2018).

CASE STUDIES

The **Portland Bureau of Transportation** and participating e-scooter companies actively engaged the community throughout the city's 2018 pilot program. The city attended community events, provided test rides, held safety events, distributed printed educational materials in five languages, posted information on its website, posted an online complaint and feedback form, and conducted both a rider survey and a citywide poll. Staff also convened focus groups to solicit input from African Americans, people with disabilities, and East Portlanders.*

E-scooter companies distributed information in their apps, on scooters, on printed flyers, and on social media. They also engaged brand ambassadors to educate members of the public in person, and distributed free helmets either in person or via mail. Further information:


www.portlandoregon.gov/transportation/article/709719

In Germany, **Hamburg, Munich, and Stuttgart** (among other cities) have posted detailed information about shared e-scooter offerings on their city websites. The websites also include descriptions of e-scooter rules and regulations. Further information:

www.hamburg.de/verkehr/12732854/e-tretroller/

www.muenchen.de/aktuell/2019-07/e-scooter-leihen.html

www.stuttgart.de/e-scooter



* East Portland is less central, lower income, and higher percentage minority than Portland as a whole.

05 | Conclusion

Over the past two years, shared e-scooters have spread to cities worldwide, and since the passage of the Small Electric Vehicles Act in Spring 2019, they have come to Germany as well. Across the country, these small scooters have elicited an outsize, strongly polarized response. Some believe they herald a mobility revolution that will make private automobiles obsolete in urban areas, increase transportation accessibility and efficiency, and improve quality of life. Others do not see e-scooters as beneficial to the overall transportation system, and believe they constitute not just an eyesore but also a danger both to their riders and others – especially pedestrians. Data-driven, contextualized, and nuanced discussions remain the exception, not the rule.

Fundamentally, shared e-scooter systems do have the potential to contribute to efficient and sustainable urban mobility – particularly for short trips – but only as one piece of a larger puzzle. If operated and regulated with this goal in mind, they can serve as one of many attractive alternatives to automobiles, alongside public transportation, active transportation, and other emerging mobility services.

To facilitate this, local governments should consider e-scooters holistically as part of the larger urban fabric, incorporate them into local and regional strategic planning initiatives, and pursue close integration with public transportation. The addition of e-scooter traffic also intensifies the existing need to invest in expanding and improving bicycle infrastructure. Just as important, use of private vehicles in urban areas must also be made less attractive; only then will new mobility services have the opportunity to achieve their full potential.

Ultimately, communities must redesign their entire transportation systems to be more sustainable, more efficient, and more supportive of local quality of life. This is not a simple task, and it can only be accomplished if local, state, and federal governments all work together toward that common vision.

Yet despite their potential, e-scooters can also cause problems. Due to the rapid growth of the shared scooter market and the pressures of competition, many e-scooter companies are jockeying for visibility and market share in popular locations. As a result, the highest-demand areas are often overrun with e-scooters, while outlying

neighborhoods and smaller cities or towns – the locations that could most benefit from scooters as a complement to public transportation – often find themselves without any service at all.

Particularly considering analogous developments in dockless bikeshare systems, it is clear that guidance and regulations from local government are necessary to address this and other challenges, and to ensure that e-scooters ultimately have a positive impact. At the same time, it is also important not to be excessively focused on short term issues, which may resolve themselves as the market matures and consolidates. Strategic intervention is best supported by a goal-oriented and performance-based approach that emphasizes transparency and accountability. Evaluations of the medium- and long-term impacts of shared e-scooters are essential to such efforts, and can also support any modifications of federal micromobility regulations that may be warranted; experimental design and data collection should therefore begin as soon as possible.

While German cities and towns may be in a legal gray area regarding special use permitting and associated regulatory authority, this ambiguity should not stop them from developing binding rules, guidelines, and formal agreements for the operation of shared e-scooter systems within the municipality. These should be drafted based on collaborative discussions with locally active e-scooter companies, and should include measures to be taken by both parties to promote orderly and societally beneficial e-scooter services. Such measures may include the establishment of parking areas (corals) for micromobility vehicles, as well as the creation of additional and improved bicycle and e-scooter lanes. Formal partnerships between municipalities and scooter companies can also be developed to promote better service coverage and support for first and last mile trips in outlying and disadvantaged neighborhoods.

Whether shared e-scooters in Germany are ultimately found to be a short-lived tourist trend or whether they establish themselves as a vital mode of urban transportation will depend in large part on the ability of municipalities and scooter companies to find common ground and come to mutually beneficial agreements. The future of e-scooters thus depends on cities and towns viewing shared e-scooters not only as a problem, but also as an

opportunity to contribute to transportation decarbonization and improved quality of life. E-scooter companies, meanwhile, must acknowledge their roles not just as private companies but also as users of public space and providers of a basic service – transportation – and engage accordingly with both municipalities and the general public, acting in a manner that is collaborative and civic-minded.



GERMAN CYCLIST ASSOCIATION (ADFC) STATEMENT:

Infrastructure requirements for e-scooters in cities

E-scooters are a space-saving and relatively efficient form of shared mobility in urban areas. As such, they can be a part of a move toward sustainable mobility, the modal shift from private vehicles to a variety of networked transport options tailored to the needs of individuals. Moreover, e-scooters may motivate new groups to use eco-friendly forms of micromobility for, say, completing the last mile of their commutes.

With the findings of the first international studies on the effects of e-scooters now in, we know that this mode of transportation has so far replaced only a small fraction of the total number of bike trips. Accordingly, the rapidly growing shared mobility market is likely to bring a massive increase in bicycle infrastructure use. This will also affect the infrastructure requirements for existing bike paths and bike lanes in urban areas. If increasing numbers of e-scooters are to share the bikeway infrastructure, we need wide and comfortable bike paths and smooth, protected bike lanes that are physically separate from roadways.

There are three ways in which many existing bikeways are inadequate to handle the additional volume created by e-scooter users:

- First, most existing bike paths are already far too narrow to handle today's increasing number of bike commuters, a significant portion of whom are now using multi-lane cargo bikes for carrying children and large loads.
- Second, cyclists travel at different speeds, which means that faster cyclists frequently have to pass slower ones, but most of the bikeway infrastructure is not designed for safe overtaking. Though e-scooters, with a top speed of 20km/h, travel in the general speed range of cyclists, their presence on bikeways will aggravate already existing problems between faster and slower cyclists. It is fair to assume that many e-scooter users will frequently be passed and want to pass by other bikeway users, including cyclists.
- Third, e-scooter users, like cyclists, frequently do not travel in a straight line. But there is often not enough space to keep a safe distance between them, parking cars, pedestrians, and cyclists.

Recommendations for expanding and improving the roadway infrastructure for cyclists and e-scooter users can be found in the ADFC booklet "So geht Verkehrswende – Infrastrukturelemente für den Radverkehr," which is available for download at <https://www.adfc.de/artikel/so-geht-verkehrswende/>.

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In partnership with key players in the field of politics, economics, science and civil society, Agora Verkehrswende aims to lay the necessary foundations for a comprehensive climate protection strategy for the German transport sector, with the ultimate goal of complete decarbonisation by 2050. For this purpose we elaborate the knowledge base of climate protection strategies and support their implementation.



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