A PRACTICAL GUIDE TO

MOBILITY DATA SHARING AND CITIES

May 2020

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An Introduction to Mobility Data

As private shared mobility services such as Uber, Lyft, shared electric scooters, and delivery of food and goods continue to proliferate, it is clear that these services represent an ever increasing portion of travel in the public right of way. Access to data from mobility services is essential for public agencies to make informed policy and planning decisions that reduce congestion, expand equitable access, and limit the environmental impacts of transportation in cities.[1] While private mobility operators may also desire to serve societal goals, it is public agencies that are held accountable - and they require information to chart the path forward.

In 2017, when dockless shared bikes and scooters began to rapidly expand across the globe, many cities began to require that these "micromobility" companies provide access to data generated by these vehicles. Initially started in Seattle and Washington, D.C., these data-sharing requirements often took the form of self-reported static data with occasional requests for dynamic real-time data streams. Given the ease at which local municipalities can require that micromobility operators provide data, mobility data-sharing requirements have expanded significantly and have become common practice.

The following are a few basic definitions related to mobility data are used in this report:

- **GPS:** The majority of shared mobility vehicles have either a global positioning system (GPS) device embedded on the vehicle itself (e.g., dockless scooters) or onboard the vehicle through the form of a driver's or rider's GPS-enabled smartphone.

- **API:** An application programming interface (API) is a communication protocol between computer systems that enables mobility data to be dynamically shared, including in real time.

- **Vehicle data:** GPS-enabled vehicles can deliver a host of mobility data including a live update (or history) of their status (e.g., available for rent) and location.

- **Individual trip data:** Most mobility operators create a GPS trace record for each unique trip, including the start/ end locations, timestamps, and full route, with varying levels of detail.

[1] San Francisco County Transportation Authority. (2018). *Emerging Mobility Evaluation Report*.

KEY TAKEAWAYS

- The ability for cities to receive data from private fleets of vehicles has been greatly accelerated by the introduction of micromobility (i.e. shared bikes and scooters), largely due to the ease with which cities can regulate them.

- Public agencies have several key transportation policy and planning use cases that necessitate vehicle and trip data from private mobility operators, including planning expanded bike/scooter lane infrastructure, parking areas, or pick-up and drop-off areas (in the case of Uber, Lyft, and delivery services). Without access to this type of data, transportation planners are less able to effectively integrate new mobility services into the fabric of cities.

- Geolocation data, such as that contained within trip data, is defined as “personal” information by newer privacy policies including the General Data Protection Regulation (GDPR) and California Consumer Privacy Act (CCPA). Both public agencies and private companies that manage this data will need to develop robust information and security policies to manage it.

- Current mobility data standards intended for the sharing of vehicle and trip data to public agencies are quite nascent. In addition to adapting to the changing landscape of privacy policies, new and existing standards will need to continue to evolve to better address the more common use cases for data that are required by public agencies.

Mobility Data Needs and Use Cases

Best practice suggests that the mobility data requested serves a particular use case or purpose. There are a number of critical use cases that public agencies have for requiring access to data, including the key operational and planning needs described below.

MOBILITY PROGRAM MANAGEMENT AND EVALUATION

Public agencies have varying levels of regulatory authority over mobility services. More recently, it has become common for cities to establish pilots through which a limited number of operators are permitted to deliver an emerging mobility service, providing an opportunity to evaluate these services before a larger scale rollout.[2] Conversely, there are also cities that have opted to allow a larger number of mobility companies to operate with relatively few restrictions. Both circumstances have similar mobility program evaluation needs that require access to mobility data.

Monitoring Fleet Size

Many micromobility pilots require that operators adhere to a maximum restriction (or a "cap") on the number of vehicles allowed in a service area - typically the municipal boundary, or a larger boundary if the mobility program is regulated by a regional transportation authority such as a metropolitan planning organization. Vehicle counts obtained from micromobility vehicle data are utilized to determine how many vehicles are operating in real-time, and historically, in the permitted service area. Cities may then use this information to determine whether or not operators are in compliance with their program or pilot requirements (see Fig 1).

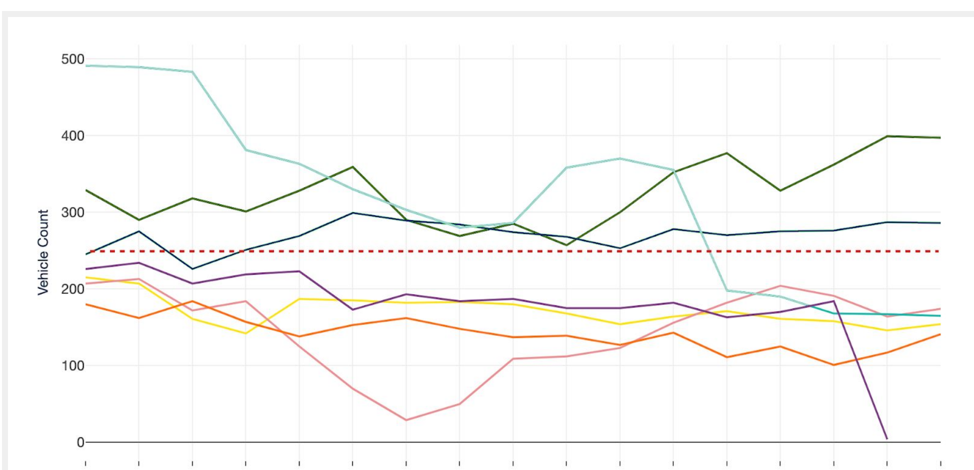

Figure 1. Vehicle fleet size by operator over time compared to a vehicle cap.

[2] National League of Cities. (2019). *Micromobility in Cities: A History and Policy Review.*

Service Areas

Depending on their regional transportation needs, cities may restrict mobility service operators to a smaller, specific service area within their municipal boundary. For example, in Chicago's scooter pilot, the service area was designed to test scooters in a diverse set of geographies, including neighborhoods with limited access to public transit or the city-managed docked bikeshare system (see. Fig. 2).

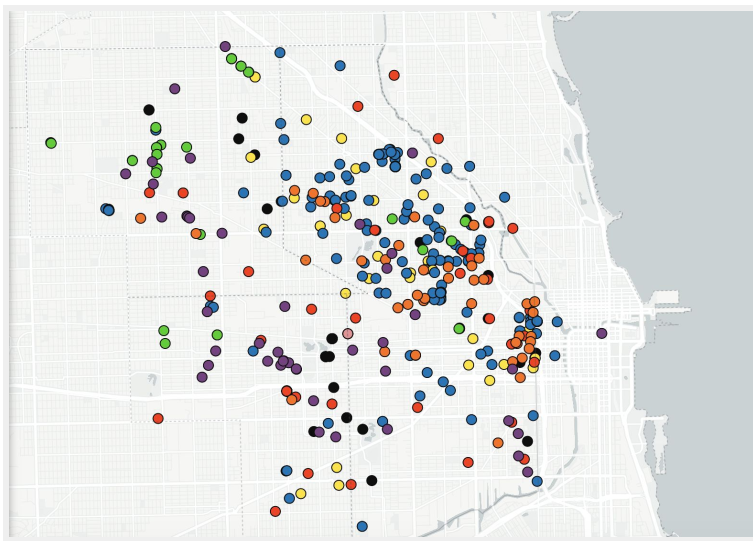

Figure 2. Live map of vehicles within a designated service area in Chicago, IL.

Through access to real-time data from mobility operators, city staff managing mobility programs are able to more easily answer questions from the general public and elected officials about whether mobility services are adhering to service area requirements. It is also common for a city to use a live map of vehicles based on real-time data to troubleshoot issues such as incoming complaints from cities about vehicles parked for too long on their property or ones that may require maintenance.

Equity Analysis

As new transportation solutions arrive in cities, a key concern for many public agencies is ensuring that these services are available to those that have been systematically excluded from the transportation planning process.[3] Policies that many cities have adopted include requiring that a specific number or portion of a micromobility vehicle

[3] Transportation for America. (2019). *Shared Micromobility Playbook*.

fleet be deployed in low income neighborhoods, including in Baltimore[4], Portland[5], and San Francisco[6], among many others (see Fig. 3)

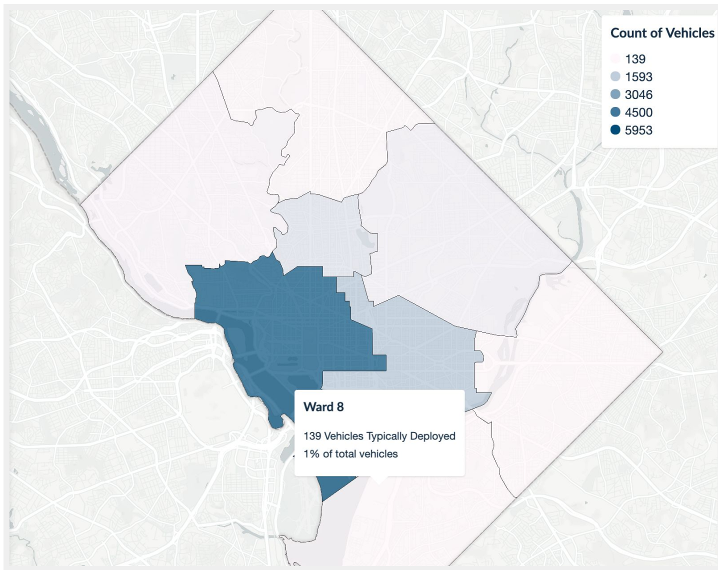

Figure 3. Simple analysis of vehicle distribution by ward in Washington, DC.

Access to mobility data can help public agency staff ensure that these equity requirements are being met by operators, evaluate whether these requirements result in expanded utilization in equity priority areas, and inform new policies, such as subsidized rides, to achieve their desired goals.

Performance Based Management

Public agencies require access to data to evaluate the success of mobility programs using performance-based metrics. For example, many cities examine a utilization rate (e.g. rides per operational vehicle) to determine whether the program is delivering a valuable service to their citizens. Performance-based measures such as a utilization rate can help a city decide whether to increase a citywide cap on the number of vehicles operating and/or reward mobility operators that are performing well (see. Fig 4).

[4] Baltimore City Department of Transportation. (2019). *Dockless Vehicle Pilot Program: Evaluation Report.*
[5] Portland Bureau of Transportation. (2018). *E-Scooter Findings Report*.
[6] San Francisco Municipal Transportation Authority. (2019). *Powered Scooter Share Permit and Pilot Program.*

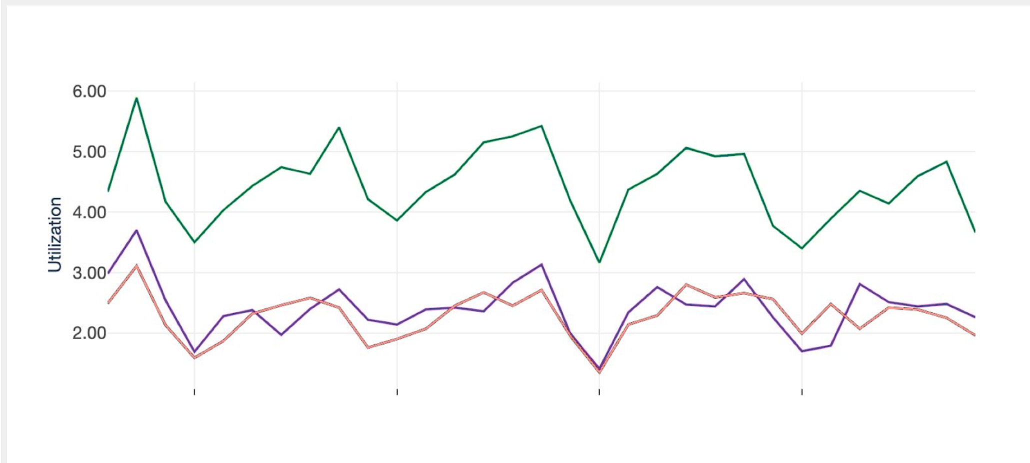

Figure 4. Comparison of utilization rates as performance metrics.

TRANSPORTATION PLANNING

There is considerable value to mobility data for both short- and long-range transportation planning needs. From making decisions about new mobility parking to mitigating broader traffic congestion challenges, access to new sources of data as cities is essential for transportation planners to plan and manage the future of mobility.

Identifying and Measuring New Mobility Parking

While services such as ridehailing (e.g. Uber and Lyft) grew quickly and with limited information available to cities, shared scooters were easily regulated and quickly began providing data to public agencies. As a result, many cities were able to nimbly respond with dedicated parking for these new mobility options.

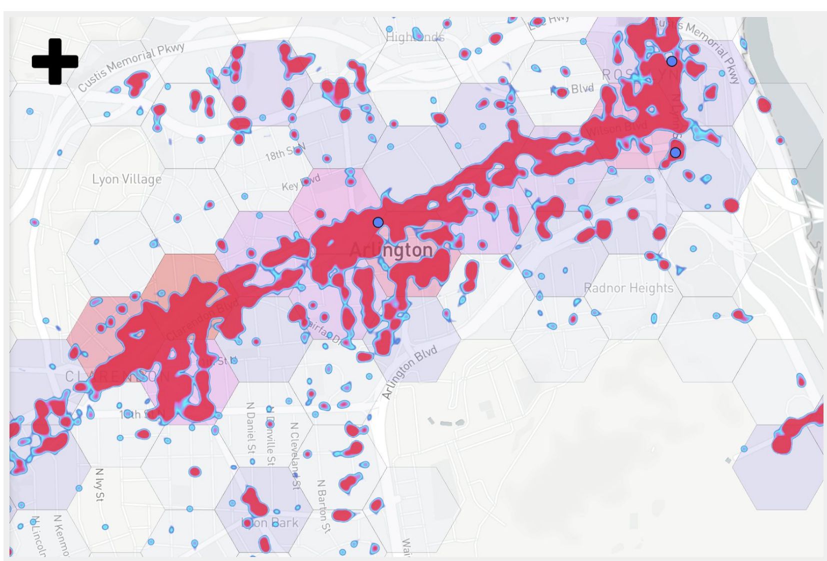

Figure 5. Heatmap of frequent parking events in Arlington County, VA.

For example, in Arlington County, which has been receiving micromobility data through Populus since late 2018, heat maps of historic scooter parking events indicate where new micromobility “corrals” or “drop zones” might be needed (see Fig. 5). The county quickly developed new parking areas for bikes and scooters, and can easily evaluate the effectiveness of this new infrastructure by harnessing data (see Fig. 6).

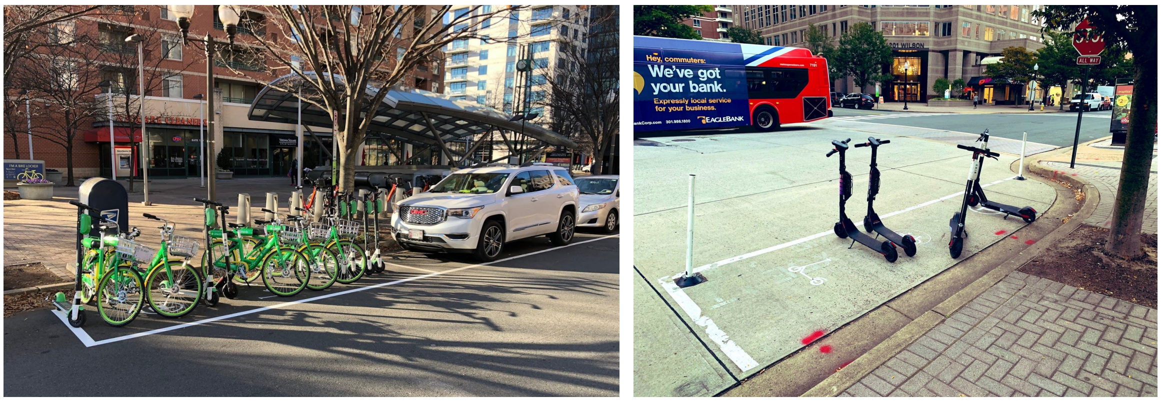

Figure 6. Micromobility corrals installed in Arlington County.

Expanding Bike or “Micromobility” Lanes

An interesting contribution of shared electric scooters is that they attracted new user groups to “micromobility” (i.e. bikes and scooters) in cities. In just one year, the number of micromobility trips more than doubled (from 36.5 million trips to 84 million trips) according to a recent report by the National Association of City Transportation Officials.[7] A longstanding concern for cities, which bear much of the responsibility for improving the safety of our streets, has been a steady increase in traffic fatalities in many major metropolitan areas, particularly for vulnerable road users such as cyclists and pedestrians. According to the National Highway Traffic Safety Administration, 2018 was the deadliest on record for cyclists, with deaths rising by 6.3 percent, even while overall traffic deaths (for non-vulnerable road users, i.e., people in cars) went down.[8]

Mobility data, particularly when based on more detailed GPS trace data, can provide rich information about where vulnerable road users, such as cyclists and scooter riders, are making trips so that transportation planners can expand safe micromobility infrastructure (see Fig. 7). Many regional agencies, including Arlington County, Omaha, and Oakland, which have access to mobility data, are now harnessing it to update bike master plans, and to inform decisions about where to place “slow street” or “open street” policies.

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[7] National Association of City Transportation Officials. (2019). *Shared Micromobility in the U.S.: 2018.*

[8] National Highway Traffic Safety Administration. (2019). *Traffic Safety Facts: Research note.*

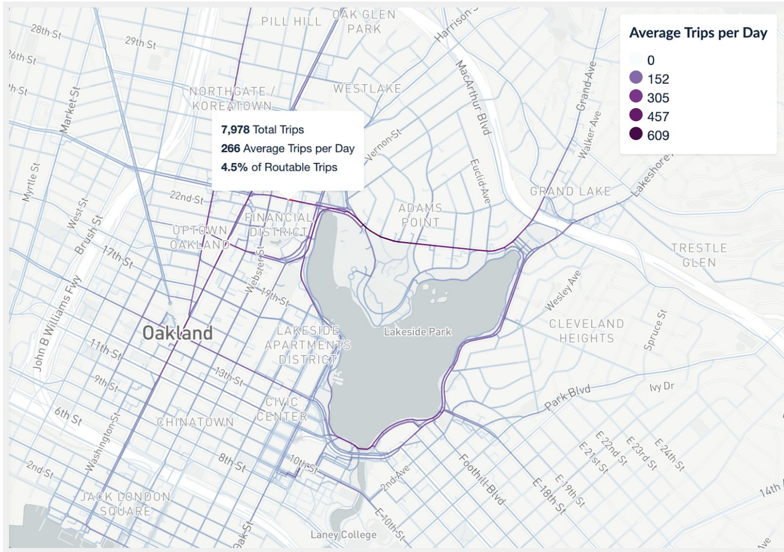

Figure 7. GPS trace data aggregated into routes in Oakland, CA.

Curb Management

Beyond bikes and scooters, many cities are looking to mobility data to inform curb management strategies that can help them mitigate the safety and congestion impacts of growing demand for curb space. In late 2018, Lime and Populus partnered to expand the Mobility Data Specification (MDS) to carsharing, utilizing vehicle data to validate their use of curbside parking.[9]

By accessing mobility data about pick-up and drop-off activity, including temporal data, cities can better develop flexible curb policies in congested downtown areas. Perhaps more importantly, access to data helps transportation planners present evidence that can shape the political will required to accept changes in parking policies that are often politically challenging.

[9] How Populus Is Improving Use of City Curbs With Lime. (2018). Populus Blog.

Current Methods for Data Sharing and Analysis

DATA STANDARDS

The following is a brief overview of transportation data standards that cities have begun to adopt to require data from private mobility operators, including primarily dockless bikes and scooters.

General Bikeshare Feed Specification

The General Bikeshare Feed Specification (GBFS)[10] was developed by the North American Bikeshare Association in 2015. Key characteristics:

- GBFS provides real-time information about docked and dockless bike/scooter systems and their available vehicles. (Note: the data does not include vehicles that are in use by riders or removed by operators for rebalancing, maintenance, or other reasons).
- GBFS delivers current system status, location of vehicles (i.e. latitudinal and longitudinal coordinates), and availability.
- For electric bikes and scooters, GBFS data may also include vehicle battery charge level.

GBFS recently underwent a major update that focused on enabling new features in bikeshare systems through data standardization and to also better protect user privacy. Although in the earlier days of scooter sharing (e.g. late 2017 to early 2018), GBFS was often utilized by cities for regulatory purposes, its new focus is oriented toward delivering real-time data for the end users of bike and scooter services (e.g. vehicle location information in mobile apps), not for regulators per se.

One of the key changes that will change the utility of GBFS for transportation planning purposes is that the vehicle IDs within the data feeds will be rotated or removed so that origin and destination pairs cannot be identified. Given the rider-oriented approach of GBFS, this change is an improvement to protect the personal privacy of the users of these systems. However, if agencies in the United States or elsewhere use this data to determine how long a vehicle has been parked or to reconstruct trip patterns, they are likely to find that the new data feeds are not compatible with these transportation analysis use cases.

[10] North American Bikeshare Association (NABSA). (2020). General Bikeshare Feed Specification. Retrieved from: https://github.com/NABSA/gbfs/blob/master/gbfs.md

Mobility Data Specification (MDS)

The Mobility Data Specification (MDS)[11] was introduced in September 2018 by the Los Angeles Department of Transportation (LADOT) and a consulting partner to standardize data flows to/from cities and mobility operators, such as shared scooters, for the purposes of actively managing the public right of way. Its management was shifted to the Open Mobility Foundation in late 2019. Key characteristics:

- In addition to the status of available vehicles, MDS also specifies that vehicles report when their position and "vehicle state" change due to rebalancing, maintenance, low battery or other reasons through status_change updates (see below).
- MDS introduced a specification for sharing information about historical trips, including starts, ends, and full GPS trip trajectories/ routes.
- MDS is currently primarily used for shared bikes and scooters.

MDS includes three distinct types of data specifications:

- Provider specifications are designed for mobility companies to deliver data to regulating authorities and/or companies working on behalf of cities.
- Policy specifications are designed to standardize how regulating authorities deliver data about policies, such as a restricted parking area, to operators.
- Agency is designed for regulating authorities to deliver data and instructions designed to actively manage these vehicles operating in the public right of way. This portion of the data specifications aligns with a vision that would enable cities to more directly control the vehicles operating in the public right of way, in real time.

A key contribution of MDS is the standardization of trip data, which in the context of bikes and scooters in particular, can be valuable for identifying where to place new protected lanes. Historic trip data is relatively straightforward; however, there are some key issues that have been raised among providers and users of MDS data around the latency and granularity at which it can reasonably be delivered from a privacy perspective, as well as from an engineering feasibility perspective.

Vehicle data delivered to public agencies in real-time (Provider "Status Changes") is much less straightforward and has presented cities with various challenges, as was described in the recent Chicago *E-Scooter Pilot Evaluation*.[12] The status_changes data

[11] Open Mobility Foundation (OMF). (2020). Mobility Data Specification. Retrieved from: https://github.com/openmobilityfoundation/mobility-data-specification

[12] Chicago Department of Transportation. (2020). *E-Scooter Pilot Evaluation.*

specification requires that operators deliver data only when a vehicle experiences a change in status, as opposed to simply providing a current snapshot of all vehicles (operational or not) that are in the public right of way. As a result, many cities have experienced a “lack of certainty with the underlying data [which has] caused difficulty in establishing metrics that were agreed upon by all stakeholders involved.”

For example, a vehicle might have the following sequence of events:

8:05AM Vehicle is available
8:12AM Vehicle begins a trip
8:14AM Vehicle has a low battery
8:23AM Vehicle ends a trip
8:45AM Vehicle was dropped off by an employee in a new location

Based on a sequence of events, a regulatory authority would have to reconstruct the series of events to calculate at any given point in time or in any geography of interest, how many vehicles were in the public right of way. Oftentimes, there are sequences of events that are illogical for several reasons[12], including:

- The majority of operators internal data feeds do not naturally or consistently map to the MDS vehicle status_changes specification;
- The MDS vehicle status_changes specification definitions are internally inconsistent;
- GPS is inconsistent, so a vehicle status change may not be recorded; and
- Operational staff moving scooters or bikes may not register events (e.g. the start event and end event for moving a vehicle).

The majority of cities primarily want to *count* how many vehicles are in the public right of way, either in real-time or historically, for analysis purposes. Many cities and operators have found that it is difficult to answer this question given the way that the MDS Provider vehicle “status changes” was originally designed because of its alignment with a control systems architecture, as opposed to the data use cases that most cities desire.

Recommendations to overhaul this element of the specification so that cities receive more accurate data were first introduced in spring 2019, and were ultimately developed and approved in May 2020. Most mobility operators are unlikely to be able to deliver data in this very recently approved format until the fall of 2020. The formal transition to this new method of providing vehicle data will likely significantly improve cities abilities to manage and plan for micromobility services.

ANALYSIS METHODS

The analysis of data delivered through APIs or data streams can be onerous, particularly if the data specifications change over time or operators' methods of delivering data change over time. The data also requires significant cleaning and processing in order to turn it into information that can be used in a transportation planning and operational context.

An approach to ensuring cities only access information they need without incurring the risks of holding sensitive geolocation data is the use of third party data aggregators such as Populus. Trusted third parties can verify the quality and completeness of the data and deliver de-identified aggregate trip and vehicle data for cities. A recent survey found that more than 80% of cities using MDS use a third-party data platform to manage their data.

For example, Populus processes route data for individual trips into insights about the most common routes that people take on scooters without revealing the exact traces of individual trips. Holding individual-level, sensitive information can be more difficult or expensive for cities that may not have the data management protocols to protect this data and to limit access to it. Perhaps more importantly, third parties can also achieve economies of scale by building systems that work for multiple jurisdictions, providing access to only those individuals with authorized access from a regulatory agency.

Another key issue that has emerged with the proliferation of mobility data sharing are the lack of common definitions for key performance metrics. For instance, many city permits for dockless scooter programs including metrics associated with various terms, including "deployments," yet both cities and operators had different understandings of these terms. The SAE Mobility Data Collaborative recently released a best practice based on feedback from a broad range of public agencies and private operators, *Metrics for Shared Micromobility*,[13] to develop consistent and clear definitions for key micromobility metrics.

DATA LIMITATIONS AND OPPORTUNITIES

Many of the key questions that cities have about new mobility services cannot be answered by access to vehicle or trip data alone. Public agencies also need to know how new services, such as shared scooters or Uber/Lyft, impact citizens' vehicle ownership

[13] SAE International Mobility Data Collaborative Recommended Practice, "Data Sharing Glossary and Metrics for Shared Micromobility," SAE MDC0002202004, Rev. May 2020.

decisions, their choices to use or not use public transportation, and to understand the demographics of users to ensure that these new services provide equitable access.

Conducting a survey as part of a mobility pilot or mobility program is one key example of how a number of cities gather additional data on mobility service adoption and impacts. In Brookline, the sole municipality in the state of Massachusetts to conduct an e-scooter pilot in 2019, Populus conducted a community-wide survey as well as a scooter rider survey to gather data for a more comprehensive evaluation of the program.[14]

In Brookline and other municipalities, Populus has conducted mobility evaluation surveys designed to answer the many questions unanswered by operational data, including:

- What transportation options would people have used if the new mobility service (e.g. scooters) were not available?
- Do people feel safe using these new services?
- What are the reasons that citizens do not use these services?
- How does the use of these services impact broader transportation choices, such as vehicle ownership and use of other transport modes?

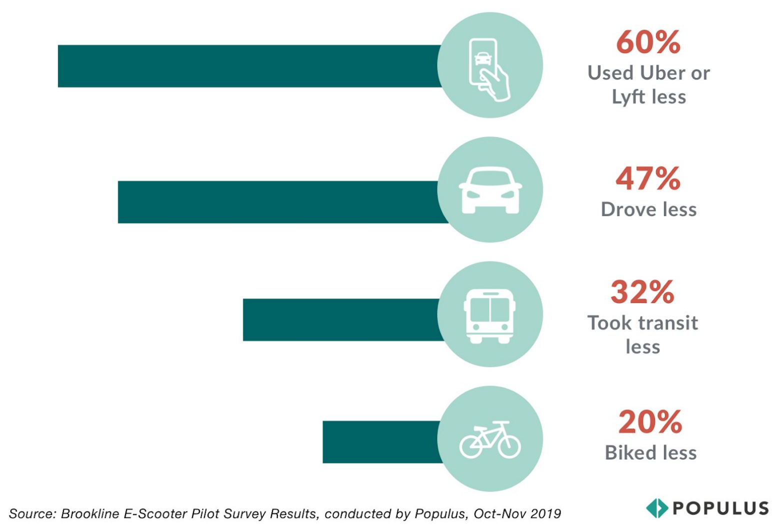

Figure 8. Impact on other transportation modes after the use of shared scooters in Brookline, MA.

[14] Surveying methods for mobility evaluation, Populus, Retrieved from: https://www.populus.ai/solutions/mobility-evaluation

Data Privacy and Related Challenges

Mobility Data and Personal Information

A growing body of research demonstrates that "anonymous" mobility data (data that does not specifically reference a person's name, email, or address for example) can still be used to re-identify specific individuals, their whereabouts, and activities. Thus, GPS and location data is considered "personal" information according to more recent privacy policies such as the General Data Protection Regulation (GDPR) and the California Consumer Privacy Act (CCPA).

Although most city mobility data-sharing policies do not require direct identifiers such as names or emails, if they require access to mobility data that contains the starts and ends of trips and/or the entire GPS trace of a trip, these policies will also need to consider how this data will be protected.

Several cities have adopted robust data information and security policies that outline specific organizational guidelines and practices that have been put in place to ensure that, if mobility data is received by the public agency, it is protected and secured. Third-party solutions, such as Populus, can also provide value to agencies of varying sizes by delivering sufficiently aggregated data to city employees for key transportation use cases, while ensuring that more sensitive, disaggregated trip data is secured. For cities located in regions with broad public disclosure acts laws that may make it difficult to host sensitive data, a key benefit of a third party is that it can more easily secure disaggregated trip data, and provide comprehensive pre-aggregated transportation analysis to the city.

The Evolving Policy Landscape

Varying concerns have been raised over the past year about whether cities can require the provision of location data or granular trip information (historical or real-time) from mobility operators. Some operators have objected to the requirement of the provision of data in exchange for the right to operate under a mobility permit (e.g. a scooter permit).

Several bills have been introduced in the State of California, and potentially other states, that could restrict the ability of cities to require vehicle and trip data, even though there are clear use cases for city departments of transportation and public works for which access to this data is valid.

In California, the state with one of the more strict consumer privacy laws in place, current legal opinion differs on whether or not the existing California Electronic Communication Privacy Act (CalECPA; passed into law in 2016) should apply to the collection of mobility data as required by many local jurisdictions in the state. In 2019, the Legislative Counsel for the State of California released an opinion stating that CalECPA restricts a local jurisdiction from requiring *real-time trip* data from an operator to obtain a permit. City lawyers, including those in Los Angeles, disagree with this opinion. The issue was raised in a Federal case brought by Jump against the City of Los Angeles in March of 2020.[15] The case is currently ongoing; however, it is likely to be complicated by the recent transfer of the Jump business by Uber to another scooter operator, Lime, which had not voiced similar concerns.

As other states adopt similar consumer privacy legislation, more legal challenges may be raised against some of current data reporting standards and requirements. This may lead to different versions of existing data standards, or new standards altogether depending on the local jurisdiction's ability to require certain data points or data latency. Internationally, for example, a variety of different data standards have emerged over the past year, in part due to concerns on the part of cities and operators about how to best comply with GDPR.

As the policy landscape continues to evolve and legal precedents are set, it is likely that the data standards designed to facilitate the seamless transfer of information between companies and public agencies will also need to evolve.

[15] Teale, C. (2020, March 26). Uber sues LADOT over data-sharing requirements. *Smart Cities Dive.* Retrieved from: https://www.smartcitiesdive.com/news/uber-jump-sues-los-angeles-mobility-data-sharing-requirement/574893/

ABOUT THE AUTHORS

At Populus, we're helping cities and private mobility providers deliver safe, efficient, and equitable streets through better data. The Populus platform is a comprehensive digital solution that empowers cities to manage the public right of way, including their curbs, streets, and sidewalks, and develop data-driven policies with access to data from mobility operators (e.g. shared bikes, scooters, and cars). Founded by transportation PhDs from MIT and UC Berkeley, the Populus team combines over 30 years of experience building software for public agencies to plan for the future of transportation.

REGINA CLEWLOW

Regina is the CEO and Co-founder of Populus. She has over a decade of experience in transportation, having served as a research scientist and lecturer at Stanford, UC Berkeley, and UC Davis. Prior to forming Populus, Regina was the Director of Business Development and Strategy at RideScout, an early mobility-as-a-service aggregator that was acquired by Daimler's mobility services unit. Regina has been named a 40 Under 40 by Mass Transit magazine and the San Francisco Business Times. She has a Ph.D. in transportation and energy systems from MIT, and a bachelor's in computer science from Cornell.

RODNEY STILES

As the Head of Policy at Populus, Rodney leads development of the team's policy agenda, communications, and relationships with cities around the world. Previously, he worked at the New York Taxi and Limousine Commission where he led taxi and ride-hail policy and data reporting. He also worked as a demographer for the New York City Department of Planning, developing solutions to help the city plan for its future. His interests include walking, biking, and data visualization. He is a 2009 graduate of the Edward J. Bloustein School of Planning and Public Policy at Rutgers University.

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For additional resources on mobility data sharing and best practices, please visit:
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If you have further questions or feedback, members of our team may also be reached at:
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ABOUT THIS DOCUMENT

This practical guide is intended to share a current overview of mobility data sharing between private mobility operators and cities. It does not constitute legal advice, nor should it be a substitute for legal advice. Practitioners should always consider existing laws in their local jurisdiction.

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