DATE: October 15, 2019

SUBJECT: Evaluation of the Shared Mobility Devices Pilot Program, and Request to advertise a public hearing on an ordinance to amend, reenact and recodify Chapter 14.2 (Motor Vehicles and Traffic) of the Arlington County Code to regulate the use of Micro-Mobility Devices (including motorized scooters, motorized skateboards and power-assisted bicycles) and issuance of permits for the use of County right of way and rental of such Devices. The amendments, if approved, would also implement a permit fee structure for Micro-Mobility Services for-hire.

C. M. RECOMMENDATION:

Adopt the attached resolution (Attachment 1) to authorize advertisement of a public hearing on November 16, 2019, for the County Board to consider enacting amendments to Chapter 14.2 (Motor Vehicles and Traffic) of the Arlington County Code relating to the use of Micro-Mobility Devices and issuance of permits for the use of County right of way and public rental of such Devices. The amendments, if approved, would also implement a permit fee structure for Micro-Mobility Services for-hire.

ISSUES:

1. New State legislation specifically requires municipalities to adopt an ordinance by January 1, 2020 (rather than issue regulation or administrative action) if the municipality desires to prohibit sidewalk riding of motorized skateboards or scooters.

2. Revisions to the County Code are proposed to allow use of motorized Micro-Mobility Devices on designated sidewalks and all County multi-use trails. Based on feedback during the demonstration, this may be an area of concern for community members, requiring explanation of staff’s recommendation.

3. A permit system is proposed to regulate and enable businesses to offer micro-mobility services on public streets and rights of way, and to create a fee structure for the County’s administrative costs.

SUMMARY: In September 2018, the County Board approved a nine-month Shared Mobility Device (SMD) Pilot Program (“Pilot”) to evaluate the impacts of for-hire services offering motorized-scooters (“e-scooters”), power-assisted bicycles (“e-bikes”), and regular dockless
bicycles operating on County streets and rights of way. During the 2019 Session, the General Assembly passed legislation, subsequently signed by the Governor, requiring municipalities to adopt an ordinance by January 1, 2020 (rather than issue regulation or administrative action) if the municipality desires to prohibit sidewalk riding of motorized skateboards or scooters. In June 2019, the County Board extended the Pilot Program through the end of 2019 to allow for sufficient public input and analysis, as well as the development of recommendations of ordinance changes in response to new State legislation. While Staff’s proposed ordinance language responds to the State directive, it also prepares the County for future micro-mobility innovation, as it defines a permitting process that can be extended to additional modes of shared vehicles.

The key takeaways from the evaluation of the Pilot are threefold.

1. Deployment and utilization of SMDs in Arlington have increased over the duration of the pilot with a positive response from riders in Arlington. This report supports evidence pointing to SMDs providing a viable complement to the County’s transportation ecosystem that increases mobility options and provides potential sustainability benefits.

2. Certain aspects of the Pilot have shown mixed results for the community, including the focus on equity concerns—with one measure being a disparity in deployment (normalized by residential population) between North and South Arlington—and the need for clearer communication of rules and regulations to the Arlington community.

3. There are specific challenges with the integration of SMDs with other street and sidewalk users in Arlington that should be addressed in any permanent program. These include safety concerns from the standpoint of riders, pedestrians and drivers in Arlington, pointing to the need for more appropriate infrastructure (e.g. protected bike lanes), and concerns about parking impacts on sidewalk users in particular.

The Pilot demonstrates that the devices are well-utilized, and that they have potential for community benefits as a more sustainable form of transportation than the car. The average scooter trip is about one mile long, which is longer than a typical walking trip but shorter than a typical public transit trip. Operator origin-destination data indicate heaviest use to and near Metrorail corridors and stations. Rider-respondents to the feedback form report often using scooters to access Metrorail (18%, third most popular purpose). Further, about 10% of rider-respondents reported using transit more frequently than before scooters were available, suggesting that the devices may help bridge the first-mile/last-mile gap, making transit more accessible.

It is likely that the technology will persist and continue to evolve as businesses try to provide a product that fills this transportation demand. This emerging means of transportation could become even more prevalent in the future and that local measures are needed to address the identified concerns. Given all these variables, staff proposes revisions to the County Code to address State requirements and the results of the Pilot evaluation, establishing a permit program for Micro-Mobility Services for-hire.

As a result of the Pilot program and evaluation process, recommended Code changes include changes to Chapter 14.2, Article II, titled “Bicycles”, to encompass matters related to the use of
Micro-Mobility Devices¹. Staff finds that Micro-Mobility Devices are most similar to bicycles in their size, travel speed, carrying capacity and use, and markedly different in these respects from other motorized vehicles such as automobiles and motorcycles. As such, staff recommends that e-scooters, e-bikes and motorized skateboards be treated like bicycles in the operations and user requirements defined in Code. Staff proposes that people be legally permitted to use County sidewalks (with limitations), trails, bike lanes and low-speed streets for micro-mobility travel, unless specifically signed-marked otherwise. One of the first steps in implementation of the new regulations and program would be to sign/mark as prohibited for riding those key sidewalk conflict areas identified during the Pilot program. Based on data thus far, staff will initially be considering opportunities for these sidewalk restrictions along the Rosslyn-Ballston corridor, which is the most heavily-used corridor for scooter riders but also one with several stretches of protected and regular bicycle lanes and some of the County’s densest levels of pedestrian activity.

The provision of e-scooters and e-bikes for-hire in the public right-of-way would be regulated by a new section to Chapter 14.2 that establishes micro-mobility business permits and processes. The permit program would establish an application process, a fee structure, performance requirements, communication and information sharing requirements, insurance and other risk management requirements, and other features to reasonably govern the provision of these mobility services.

Staff commits to a review of the program and consideration of potential refinements to the ordinance at or about one year after ordinance changes go into effect.

BACKGROUND: In late May 2018, motorized scooters for-hire were placed on County streets and rights-of-way by a private sector company with no public notice and without authorization from the County. In this service model, e-scooters and e-bikes are owned and maintained by a private company offering short-term rentals of the devices for personal transportation. The rentals are controlled by smart phone app, and the devices may be picked up and dropped off anywhere in the service area defined by the company. These e-scooter rentals are part of an emerging transportation innovation, known as micro-mobility, that utilizes small, battery-powered, low-speed devices for personal travel.

In response to this innovation, Arlington County initiated a demonstration project (“Pilot”) to test out a regulatory and operational framework for these new mobility options. The County Board authorized the Pilot at its September 25, 2018 meeting and the program officially kicked off on October 1, 2018. The Pilot established a Memorandum of Agreement (MOA) and a Permit Application for operators similar to that used by the District of Columbia and Montgomery County pilot programs already underway. Key terms of the MOA included:

- Companies paid an $8,000 permit application fee per mode to assist with County costs for monitoring, management and evaluation;
- Fleet cap of 350 devices per mode per company with opportunities for growth based on performance;

¹“Micro-Mobility Device” or “Device” means human-scaled, motorized vehicles intended for transportation use by individual persons. Micro-Mobility Devices include power-assisted bicycles, motorized scooters, motorized skateboards and similar devices that conform with the Code of Virginia definition standards.
• 10 mph and 20 mph top speed for e-scooters and e-bikes, respectively;\(^2\)
• Data-sharing requirements similar to those required from the regional Capital Bikeshare operations and maintenance contractor; and
• Various operational requirements regarding parking, device safety, ridership restrictions, and customer service requirements.

In March 2019, Governor Northam signed legislation amending various provisions regarding e-scooters and e-bikes and making explicit a local governments’ ability to regulate the for-hire services. The State’s legislation specifically requires municipalities to adopt an ordinance by January 1, 2020 (rather than issue regulation or administrative action) if the municipality desires to prohibit sidewalk riding by motorized skateboards or scooters.

Close to half million trips were taken on for-hire e-scooters in Arlington during the first nine months of the Pilot (October 2018 through June 2019). Trips during the summer of 2019 averaged about 80,000 a month and are poised to grow further as new businesses are entering the market and other providers are upgrading equipment and services. An unknown number of trips are currently being made on personally owned Micro-Mobility Devices as data on their use is not available. This growth in use and ownership offers new opportunities for local travel, potentially replacing many thousands of daily automobile trips. Proposed changes to Article II of the current County Code are intended to specify where and how all Micro-Mobility Devices, including those that are personally-owned, should operate. A proposed new Section, X, to the County Code, creates a Permit program for Micro-Mobility Devices for-hire.

The County Board extended the Pilot at its June 18, 2019 meeting. At that meeting the Board also approved requiring an additional $5,000 permit fee for companies to participate in the Pilot’s six-month extension period.

In response to community input during the Pilot, staff has undertaken enforcement of requirements in the Memorandum of Agreement with Operators, as well as requesting program improvements from operators as a show of good faith. These areas of enforcement and improvement include:

• **Device speeds:** During County testing, two of seven operators were found not in compliance with the Pilot’s e-scooter device top speed. The two operators were each sent a notice to correct and their devices retested. Upon retest, the devices met the speed requirement.
• **Device safety:** SMD operator Skip was suspended from the Pilot after several of their e-scooters experienced a battery fire in DC. They have since resolved their safety concerns and have been reinstated.
• **Sidewalk riding:** Operators were asked to include a message in their app that sidewalk riding in Arlington is not permitted during the Pilot, and that message was implemented by providers.
• **Parking and device deployment:** County staff tracked reports of mis-parked devices, including at bus stops, and gave operators two hours to remove them; requested removal of devices left in the public right-of-way for more than seven days; created a “parking

\(^2\) The top speed for e-bikes was adjusted up from 15 mph to 20 mph during the Pilot.
prohibition map” (including property owned by the Federal government, certain County parks, and the vicinity of Arlington Public Schools) and provided it to operators for inclusion in their respective apps; and provided to operators GIS locations of SMD parking corrals.

- **Data requirements:** One SMD operator was not providing required data in their monthly report. The County sent a notice to correct giving the operator seven days to provide the information or be suspended for 30 days for a breach of the Memorandum of Agreement. The operator then provided the information by the deadline and came into compliance with the MOA.

As these devices have never before been this widely used, current County ordinances do not address where and how they should safely and appropriately operate in our transportation ecosystem. County Code does not yet address how to manage these devices when they are made available for-hire using Arlington’s streets and sidewalks as their primary location for storage. Virginia State Code now allows the operation of scooters on motor vehicle travel lanes on local streets, as well as sidewalks and trails, although Arlington’s Pilot program is more restrictive. Unless local ordinances with different rules are adopted beforehand, on January 1, 2020, scooters will be allowed unrestricted access to sidewalks under State law. While the use of sidewalks and multi-use trails by e-scooters, e-bikes and other Micro-Mobility Devices is not allowed under the Pilot MOA, riding on these facilities has been common throughout the Pilot, with riders reporting their preference to ride in protected bike lanes or regular bike lanes when available.

Over the past year, staff conducted extensive work to determine how best to address the emerging use of Micro-Mobility Devices, including those being offered for public hire, on County streets, sidewalks, trails and public spaces. The efforts have included a multi-pronged public outreach campaign that included thousands of responses to an online feedback form, in-person discussions at many community events, and a dedicated e-mail comment line (the “Mobility Inbox” received a high of 3.6 emails per 1,000 trips in October 2018, and emails received per month decreased consistently after that to a low of .6 emails per 1,000 trips in June 2019). Staff created a multidisciplinary work group composed of individuals from Arlington Public Schools, Police, Parks and Recreation, and Environmental Services to consider County Code updates. In addition, throughout the process, numerous presentations were made to advisory commissions/committees and other stakeholders. A detailed summary of the entire public engagement process over the course of the Pilot is provided in Attachment 3. Lines of regular communication were maintained with participating companies to convey community and transportation operational needs.

All community input received, along with operational data collected during the Pilot and research gathered from other communities inside and outside the region, were analyzed in a formal **Pilot Evaluation Report** (Attachment 4) and were presented to an interdepartmental staff work group to inform the development of proposed ordinance changes (Attachment 2). The primary objectives of the proposed ordinance changes are:

- to establish where and how Micro-Mobility Devices may safely and appropriately operate and park, and
- to establish the permitting process for companies to offer such devices for-hire in Arlington.
Although the ordinance is intended to allow for some extent of future innovation, with such rapid changes in technology and service models as this region experiences, amendments to this ordinance are likely be necessary in the future.

**DISCUSSION:** This section discusses the results of the evaluation of the Pilot as well as Staff’s recommendations, including ordinance changes.

**SMD Evaluation Overview - Data Sources:** At the core of the evaluation is the collection and examination of primary and secondary data which together help build a comprehensive picture of the SMD Pilot from the perspective of both system performance and impact on the community. Several data sources were available for the evaluation of the SMD Pilot, including but not limited to: direct usage data from operators, data collected from residents and users through online surveys and feedback forms, direct feedback from the community, and various types of third-party data applied to questions pertinent to this evaluation (considered “secondary” data for this purpose because the data were not originally collected with this study in mind).

<table>
<thead>
<tr>
<th>Data</th>
<th>Data Type</th>
<th>Description</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility Inbox</td>
<td>Primary</td>
<td>Qualitative Dedicated email address: <a href="mailto:mobility@arlingtonva.us">mobility@arlingtonva.us</a></td>
<td>Platform for Arlington County community to voice opinion; unguided/unstructured feedback</td>
</tr>
<tr>
<td>Staff and advisory board opinion</td>
<td>Primary</td>
<td>Qualitative Experience with day-to-day operations and insights from outreach activities</td>
<td>Leverage all sources of information available for the pilot</td>
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<tr>
<td>Outreach events - County in-person outreach (pop-up engagements)</td>
<td>Primary</td>
<td>Quantitative/Qualitative In-person engagement in school and family events, farmer’s market, metro stations and community events</td>
<td>Support the online feedback from the broader community and shared device users - reach people who would not have otherwise clicked the survey or written in</td>
</tr>
<tr>
<td>County online feedback</td>
<td>Primary</td>
<td>Quantitative Online survey to gather information from all stakeholders</td>
<td>Assess user experience and perceptions regarding the pilot and identify issues; collect data that is not available in the operator’s data</td>
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<tr>
<td>Virginia Tech Survey</td>
<td>Secondary</td>
<td>Quantitative Online survey by Virginia Tech students on pilot utilization and perception restricted to Rosslyn</td>
<td>Assess utilization, demographics and perceptions</td>
</tr>
<tr>
<td>Operator’s data</td>
<td>Secondary</td>
<td>Quantitative Trip data submitted monthly by operators</td>
<td>Information on deployment and utilization</td>
</tr>
<tr>
<td>Populus</td>
<td>Secondary</td>
<td>Quantitative Interface for all SMD deployment and utilization</td>
<td>Aggregation; real-time representation of deployment and use</td>
</tr>
<tr>
<td>County Channels – Arlington County Crash Tracker</td>
<td>Secondary</td>
<td>Quantitative Incident data collected from local law enforcement and health services VHC- Hospital data; Police; TE&amp;O</td>
<td>Mainly to obtain crash data</td>
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</table>

The following are the key findings and direction from the Pilot Evaluation and serve as the outline for the rest of this Discussion section:

1. The Devices Are Well-Utilized and Offer Potential Community Benefits
2. Ordinance Should Establish Safe and Compatible Places to Park
3. Ordinance Should Establish Safe and Compatible Places to Ride
4. Ordinance Should Establish Safe and Compatible Speed Limits
5. Ordinance Should Address Other Safety Concerns
6. Ordinance Should Establish Permit Process to Hold Operators to Performance Standards, including Data Reporting Requirements
7. Ordinance Should Establish Equity Expectations in the Permit Process

1. Key Finding: The Devices Are Well-Utilized and Offer Potential Community Benefits

The Shared Mobility Devices (SMDs) in the Pilot program rapidly became another transportation option for resident and visitors, advancing a key goal of the County’s Adopted Master Transportation Plan (MTP) – Goal 2: Move More People Without More Traffic – providing alternatives to single-occupancy motor vehicle trips. In the nine months of the Pilot (which included winter months), there were over 453,000 trips, 1.7 times the number of Capital Bikeshare trips taken in Arlington in all of 2018, mirroring the nationwide popularity of shared-scooter use. Arlingtonians and visitors traveled 409,548 miles mostly on e-scooters between October 2018 and June 2019. The average trip length was 0.94 miles and lasted 14 minutes.

<table>
<thead>
<tr>
<th></th>
<th>SMD (pilot period, 8 mo.)</th>
<th>Capital Bikeshare (2018)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total trips</td>
<td>453,690</td>
<td>261,129</td>
</tr>
<tr>
<td>Total miles</td>
<td>409,548</td>
<td>511,887</td>
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<tr>
<td>Average trip length (miles)</td>
<td>0.94</td>
<td>1.96</td>
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<tr>
<td>Average trip duration (minutes)</td>
<td>14</td>
<td>16</td>
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<tr>
<td>Service level</td>
<td>4.0 SMDs/1,000 people</td>
<td>3.1 SMDs/1,000 people</td>
</tr>
</tbody>
</table>

*Evaluation Report Table from Executive Summary, SMDs vs. Capital Bikeshare: Key Statistics*
Evaluation Report Figure 16 above shows there is seasonality to scooter use, with the spring, summer, and fall months producing two to four times as many trips as winter months. Scooter use is not purely recreational; approximately 42% of trips occurred during the commute peak periods, and 70% took place during weekdays, though the highest use day of the week is Saturday. Though most operators offer “regional” service, 89% of trips in Arlington occurred wholly within Arlington, consistent with the short length and duration of the average trip.

Scooters appear to improve accessibility, particularly to public transit, as most trips were found to originate and/or terminate in areas with high levels of transit service. According to the online feedback form responses, the most popular primary scooter trip purpose was “social/entertainment” (21%), followed by “shopping or errands” (18%) and connecting to or from Metrorail (18%). Two to three percent reported replacing a transit trip with their scooter trip. In addition, about 10% of respondents reported using transit more frequently than before, suggesting that the devices help bridge the last-mile gap, making transit more accessible. Overall, about 30% of respondents thought that e-scooters increased their ability to access destinations and public transit while decreasing their need for parking.

Scooters also may replace car trips that have a bigger impact on the County’s transportation system and environment. Scooter-rider respondents to the online feedback form reported that if SMDs had not been available, 13% would have taken a personal vehicle and 19% would have taken a ride-hailing trip, for a total of 32% of respondents foregoing an automobile trip in favor
of a scooter one. 37% of user-respondents reported that SMDs replaced walking trips and 11% of users reported walking more, not less, after using the devices.

When asked more generally about their transportation choices after having started using e-scooters, 31% reported using their personal vehicles less frequently and 38% reported using ride-hailing services less frequently. Given the evidence of increased congestion from ride-hailing services in some cities, SMDs likely help make the County more sustainable by helping people replace ride-hailing trips with scooter trips, resulting in reductions in congestion and emissions. When asked why they choose to ride scooters, the largest share of user-respondents (55%) selected “to get around faster” as one of their top three choices, followed by “convenient” (44%) and “fun to ride” (36%).

**Proposed Ordinance Response:**

Overall, the high utilization of SMDs indicates the popularity of the devices as a transportation option. Users report less overall use of personal vehicles and ride-hailing services and data indicates a positive impact on connectivity to transit service, while not replacing many transit trips. Staff proposes that the appropriate County response to this
information is to look to modify the County Code to acknowledge, define, and regulate these services in a way that is as compatible as possible with other road and sidewalk users, with a special emphasis on safety, as discussed in subsequent findings and proposed ordinance revisions below.

2. **Key Finding: Ordinance Should Establish Safe and Compatible Places to Park**

A plurality of open-ended responses to the online feedback form (884 responses, or 31% of total open-ended responses received) was about how improperly parked SMDs blocked the path of pedestrians in sidewalks, driveways, and other common-use areas in Arlington County. The second most frequent open-ended feedback was how these improperly parked SMDs pose a safety hazard to pedestrians who can trip on them (417 responses, or 14% of total feedback received). The third-most frequent feedback category was from the feedback form respondents who reported minimal to no negative impact from improperly parked SMDs (398 responses, or 14% of total feedback received). Concern about improperly parked SMDs was also voiced by members of the Pedestrian Advisory Committee, the Disabilities Advisory Committee, and the Commission on Aging.

Improperly parked e-scooters have the potential to create a tripping hazard for people walking, particularly people with visual or mobility impairments, and can add to the perception of sidewalk “clutter” including signage, utility poles, trash cans and street furniture. Although mis-parking was the top emailed complaint, complaints declined over time. The online feedback form responses indicate that those who use e-scooters are much less likely to perceive scooters as blocking their use of the sidewalk (a total of 16% said often or always), as compared to those who use neither e-bikes nor e-scooters (65% said often or always encounter scooters blocking the sidewalk). This difference in perceived mis-parking is consistent with the results obtained by a Virginia Tech graduate student class study on the Arlington Pilot project. The Virginia Tech student project conducted a “parking audit” of specific stretches of sidewalk in Rosslyn, Courthouse, and Crystal City (one linear mile in each neighborhood). The students conducted weekday observations after the morning and evening commute to capture rider parking behavior versus the behaviors of those who charge and deploy the scooters on behalf of companies. In the audit, the overall rate of parking noncompliance was 16% (97 of 606 parked e-scooters), with 6% of e-scooters mis-parked in such a way that blocked the pedestrian right-of-way.

Cognizant of the potential hazard, during the Pilot program the County required operators to provide education through their apps. The County has educational material on the County SMD webpage to improve the parking habits of users. In addition, County contractors have constructed nine on-street corrals to encourage on-street riding at high demand locations: Ballston Metro, Virginia Square Metro, Courthouse Metro, Rosslyn Metro, Lynn & Fairfax, Pentagon City Metro, Crystal City Metro, Columbia Pike & S Edgewood St, and S Clark St & S Glebe Rd. Some operators have included the corrals in their apps and one operator has begun to offer incentives for riders to use corrals rather than sidewalks for parking. Convenience to Metrorail stations appears to be a key factor in popularity of corrals.

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4 Buheler 2019: [https://ralphbu.wordpress.com/2019/05/20/final-studio-class-report-e-scooters-in-rosslyn/](https://ralphbu.wordpress.com/2019/05/20/final-studio-class-report-e-scooters-in-rosslyn/), the student survey formed the basis of the County’s longer online feedback form.
Staff continues to work with operators to “geofence” certain areas to help prevent parking, including areas such as property owned by the Federal government, certain County Parks, and the vicinity of Arlington Public Schools. The interests of private property owners are mixed: a few managers and condo board associations with private streets or plazas have asked operators to restrict users from parking on their properties, while others have sought out partnerships with operators to designate parking zones or stations specifically for scooters.

**Proposed Ordinance Response:**

Staff proposes that the County Code section on bicycle parking be amended to address the need for clear and enforceable guidance on the appropriate manner to park SMDs in a way that minimizes conflicts with other roadway and sidewalk users and maximizes consistency of treatment across Micro-Mobility Devices:

**G. “F. Parking.”**

“1. No person shall stand or park a bicycle, electric power-assisted bicycle, motorized skateboard or motorized scooter:

   a. upon the street other than upon the street roadway against the curb, or in a corral marked and designated for the purpose; No person shall stand or park a bicycle

   b. upon the sidewalk other than in a rack to support the vehicle bicycle, or attached to a streets sign, or light post, or against a building, or at the curb, at the back edge of the sidewalk; This will be done in such a manner as to afford the least obstruction to pedestrian and vehicular traffic.

   c. where they would obstruct curb ramps, pedestrian access within bus stops, or fire access;

   d. on private property without the owner’s permission; or

   e. on Public Places other than streets and sidewalks as noted above, unless where specifically designated through signage or provision of racks.

2. Bicycles, electric power-assisted bicycles, motorized skateboards and motorized scooters shall be parked upright, in such a manner as to afford the least obstruction to pedestrian and vehicular traffic.

3. Violations of this section shall be subject to a civil penalty of not more than Fifty Dollars ($50.00).”

In addition to clarifying where it is appropriate to park these devices, County staff will work with companies and riders to encourage deploying and parking in corrals in the street wherever possible, rather than on the sidewalk. County staff continues to identify and act on opportunity areas for corral installation. Furthermore, fees collected through the permitting process are eligible to be used toward targeted infrastructure improvements directly related to the program, such as corral installations and bicycle racks which may be used by bicycles or scooters, as long as the baseline costs of administering the program are covered.
3. Key Finding: Ordinance Should Establish Safe and Compatible Places to Ride

Another common concern received throughout the Pilot was sidewalk riding, and to a lesser extent, riding on trails. The Pilot Memorandum of Agreement with operators prohibits riders of power-assisted bicycles and motorized scooters from using sidewalks and trails, these vehicles are currently prohibited by County Code from using trails and the code is silent on sidewalk use. The operator smartphone apps are required to remind riders of those restrictions.

In terms of reported actual use, bike lanes were the most-used facility, with 62% of e-scooter riders reporting always or often using bike lanes, followed by shared lanes with cars (24%). 19% of users reported using sidewalks. Trails were the least-used facility (16%). This result was similar to Portland’s e-scooter pilot, where 8% of riders used a sidewalk when a protected bike lane was available. Users in Arlington overwhelmingly reported preferring to ride in protected bike lanes (67% of respondents chose it as a top or second choice) followed by regular bike lanes (slightly under half of respondents chose it as either a first or second choice). The least preferred facility was sharing travel lanes with cars (9%), and sidewalks were second-least preferred (16%). Only a few segments of the most popular e-scooter routes in the County have protected bike lanes.

*NA refers to respondents who chose to skip this question or give less than 5 rankings.

**Evaluation Report Figure 25, Current and Preferred Use of Infrastructure**

Key stakeholder groups including the Pedestrian Advisory Committee and Bicycle Advisory Committee expressed support for allowing responsible sidewalk-riding where it was not inconsistent with volumes of pedestrians using the facility, and where safe in-road options are
Proposed Ordinance Response:

Staff proposes that the County Code section on where bicycles may be ridden be amended to address the need for safe places for Micro-Mobility Devices to be operated as well. There are roadways in the County where the travel lanes in the street do not feel safe for most riders, and there are sidewalks in the County where pedestrian activity is dense enough that scooter-riding is not advisable. To address these divergent needs, alternative approaches are proposed. Alternative 1, as stated below, would allow Micro-Mobility Devices to operate on sidewalks except where prohibited. Riding on sidewalks would be prohibited on streets where a protected bicycle lane is available. Alternative 2 would prohibit riding on sidewalks where any type of bicycle lane is available (protected or unprotected). Alternative 3 prohibits the use of all sidewalks by motorized skateboards and motorized scooters.

“Riding on sidewalk.

1. A person of any age may ride a bicycle, electric power-assisted bicycle, motorized skateboard or motorized scooter upon any sidewalk, except for those sidewalks, designated by the County Manager or designee on which bicycle-, electric power-assisted bicycle-, motorized skateboard- or motorized scooter-riding is prohibited. Signs indicating such prohibition shall be conspicuously posted in general areas where bicycle sidewalk-riding is prohibited. The use of sidewalks for operating bicycles, electric-power assisted bicycles, motorized skateboards and motorized scooters is prohibited along streets where [protected] bicycle lanes are available in the direction of travel. A person riding a bicycle, electric personal assistive mobility device, motorized skateboard or scooter, motor-driven cycle, or electric power-assisted bicycle on a sidewalk or across a roadway on a crosswalk shall yield the right-of-way to any pedestrian and shall give an audible signal before overtaking and passing any pedestrian. Violations of this section shall be subject to a civil penalty of not more than Fifty Dollars ($50.00).

or

2. A person of any age may ride a bicycle or an electric power-assisted bicycle upon any sidewalk, except for those sidewalks designated by the County Manager or designee on which bicycle riding is prohibited. Signs indicating such prohibition shall be conspicuously posted in general areas where bicycle riding is prohibited. No person shall ride a motorized skateboard or scooter on the sidewalk. Violations of this section shall be subject to a civil penalty of not more than Fifty Dollars ($50.00).”

4. Key Finding: Ordinance Should Establish Safe and Compatible Speed Limits

The Pilot program set a 10 miles-per-hour (mph) speed limit for scooters, regardless of the facility on which they were riding. However, a key complaint from riders has been that the speed limit is too low for them to feel comfortable and safe riding in the street. For example, 47% of
riders felt that 10 mph was fast enough for on-street riding. On the other hand, feedback from the non-riding community included numerous concerns about scooters traveling too fast when they were on sidewalks, as compared to the speeds of pedestrians. All but one company has a speedometer on their devices, which would help riders self-regulate their speed. Operators have indicated that the technology to regulate sidewalk riding speed remotely through a GPS governor on the device is not feasible at this time due to how fine-grained the network would have to be to differentiate between the street roadway and the sidewalk.

Upon extension of the Pilot program in June, the County initiated several enforcement actions related to compliance with the MOA. Regarding the top speed requirement of 10 mph, in August, County consultants met with the two operators who had been exceeding the top speed limit to re-test their devices’ top speed. Both were determined to have come into compliance.

**Proposed Ordinance Response:**

Staff proposes that the County Code section on bicycle speed be amended to address the need for Micro-Mobility Devices to be operated at safe speeds that are consistent with the nature of the infrastructure being used and the other travelers sharing that space. Staff recommends setting the maximum speed to 15 mph for motorized skateboards or e-scooters while operating on streets or multi-use trails. Electric power-assisted bicycles would be permitted to operate at up to 20 mph on streets and trails.

Two alternatives for a maximum speed are proposed for motorized skateboards, e-scooters and e-bikes when they are operating on sidewalks. Alternative 1 would limit the operating speed of Micro-Mobility Devices to six (6) mph on the sidewalk. Alternative 2 would permit the Micro-Mobility Devices to travel up to 15 mph when operating on sidewalks, consistent with the speeds they would be permitted to operate on other facilities:

“A. Speed. No bicycle, electric power-assisted bicycle, motorized skateboard or motorized scooter shall be ridden faster than is reasonable and proper, but each every bicycle shall be operated with reasonable regard for the safety of the operator and every other person upon the streets, multi-use trails, and sidewalks of the County.

“When operating on streets and multi-use trails, motorized skateboards and motorized scooters shall not operate at speeds exceeding fifteen (15) miles per hour, and electric power-assisted bicycles shall not operate at speeds exceeding twenty (20) miles per hour.

“When operating on public sidewalks motorized skateboards, scooters, and electric power-assisted bicycles shall not operate at speeds exceeding:

1. six (6) miles per hour.
   or
2. fifteen (15) miles per hour.”

Further, the proposed ordinance requires the devices to have speedometers:
§ 14.2-123. Micro-Mobility Devices: Equipment Requirements

A. Equipment requirements. The following requirements shall apply to all Micro-Mobility Devices:”…
“2. Every Device shall be equipped with a properly installed speedometer, maintained in good working order and exposed to view.”

5. Key Finding: Ordinance Should Address Other Safety Concerns

Crashes

Arlington County collected e-scooter crash data from a variety of sources including operators, local law enforcement, health services, and news outlets to track the count and type of SMD incidents and crashes in Arlington County. A total of 68 crashes, 31 injuries, and no fatalities were reported during the first nine months of the Pilot. The results suggest that e-scooter crashes and injuries are closer in magnitude to pedestrian-involved and bicycle-involved crashes and injuries, with incident rates falling roughly between the two.

When comparing to other modes, normalized measures of crashes reflect the difference in exposure between the modes given variation in speed, distance traveled, and trip volumes. The evaluation found qualitatively that normalized scooter crash rates are lower than those of pedestrians being hit by cars but higher than rates of bikes being hit by cars. The Evaluation Report goes into greater detail on the types of rates that may be examined and the several caveats that are related to crash data.

Similar to perceptions of mis-parking, the evaluation revealed a difference in perception around safety and comfort for SMD users and non-users. Feedback form results indicate that respondents who had ridden e-scooters were far less likely to report feeling unsafe around the devices than non-rider respondents.

Rider Training and Education

In the feedback form, 20-22% of rider-respondents and 43% of non-rider respondents did not know what the “laws” (of the Pilot program) were. 30% of rider-respondents indicated they received any information from operators about local regulations. The operators’ education of riders has improved over the course of the Pilot and will be required to improve further. At the beginning, messaging on safety and where riding is legal was generally found by riders through operator apps solely at registration, or through the occasional email. More recently, however, this type of messaging is often made to appear every time a customer opens an operator app. Possibly in part due to this improved messaging, staff has seen complaints about rider behavior decline since the Pilot’s launch.

Staff will work with operators to improve customer communication about safety and ordinance changes. Staff will also ensure that the County SMD webpage is current to any new regulations. In addition, Staff will weave these concepts into safety and other messaging campaigns to raise public awareness about safe and proper use of Micro-Mobility Devices.

Proposed Ordinance Response:
As part of the operators’ permit applications, the County will request operators to submit plans as to how they will educate their customers for greater adherence to rules of the road as well as safe and courteous operations. Those plans could include measures such as tutorial videos, safety instructions via the apps, training classes and prominent safety instructions on the vehicles.

As a part of the Permit Service Requirements, “User Safety Training” will be required as follows:

“A. User safety training. Upon registration, the Permit-holder shall require each rider to review the Permit-holder’s safety and etiquette rules and regulations, rider requirements pursuant to the Arlington County Code, including but not limited to the maximum speed on sidewalks of six (6) miles per hour, and any State laws applicable to the operation of these Micro-Mobility Devices. The Permit-holder shall regularly offer free instruction to interested persons on how to use their Micro-Mobility Devices.”

Operation Locations and Hours

In response to stakeholder concerns about the safety of using Micro-Mobility Devices during late night hours or in certain locations where there may be a higher potential for conflict, Staff proposes the following language to provide the Manager authority to address those concerns if necessary.

Proposed Ordinance Response:

“B. Restricting Services. In the interest of public safety and welfare, the County Manager or designee may determine certain areas of the County in which no Micro-Mobility Devices may operate, as well as, determine certain times during which no Micro-Mobility Devices may be made available for operation by the Permit-holder(s). A list of such time and place restrictions shall be maintained by the County Manager or designee, shall be subject to amendment by the County Manager or designee, and shall be made available to the public.”

6. Key Finding: The Ordinance Should Establish a Permit Process to Hold Operators to Performance Standards, Including Data Reporting Requirements

The Pilot program relies upon a Memorandum of Agreement (MOA) between Arlington County and each company operating for-hire Micro-Mobility Services in Arlington. The MOA established the County’s requirements in areas such as company contact information, necessary vehicle equipment, deployment, and data reporting. Experience gained from the Pilot program as well as insights gathered from other communities have been helpful in identifying the areas in which regulations are most needed.

Staff finds that County’s regulatory methods used to manage other private companies that provide local transportation services, such as taxicabs and car-sharing companies, can provide a useful model for how to regulate Micro-Mobility Businesses. However, as the Micro-Mobility Businesses are part of a rapidly developing new industry, the regulations will need to be supple enough to adapt to expected changes in the industry.
Proposed Ordinance Response:

Staff proposes a new subsection X under Chapter 14.2 of the County Code: “Shared Micro-Mobility Services For-Hire, Permit Program”. The proposed new code section would replace the Pilot program MOA with a permit process with the following purpose:

“A. Purpose. The purpose of this section is to regulate shared Micro-Mobility Services for-hire in Arlington County, the operation of such services for-hire, the qualification of businesses providing such services through this issuance of Permits, and the compliance and enforcement of such Permits in order to preserve the health, safety, and welfare of Arlington County citizens and the public at-large, achievement of County transportation goals and objectives, as well as assuring competition among providers that results in high quality Micro-Mobility Services throughout Arlington County.”

Within the Permit program, an application process is proposed wherein prospective operators would submit applications and agree to follow the established conditions of their Permit. Applications for Permits would be evaluated by the County Manager or designee based upon the companies’ submittals and against the goals of the Master Transportation Plan and any other relevant information the Manager deems appropriate. Permits may be renewed annually upon a company’s satisfactory compliance with their stated plans and payment of renewal fees for their Devices.

Although more Micro-Mobility Devices could improve transportation options and benefit the community, there is also a risk that expansion of the program based simply on customer demand could result in more sidewalk obstruction and possibly hinder mobility and safety for pedestrians. Therefore, the following language is proposed to authorize the Manager to establish and adjust a cap on the maximum number of for-hire vehicles that may participate in the program, if warranted:

“Countywide Permit Cap. Subject to Sections 14.2-115 B, C, and D, this ordinance authorizes the County Manager or designee to establish, modify, or eliminate a cap on the total number of Micro-Mobility Devices permitted to operate under this program when the County Manager or designee determines that such action is appropriate considering factors such as the public’s safety, health and welfare, as well as any other factors or considerations under section 14.2-114.B.”

The ordinance also authorizes the Manager to manage fleet sizes generally, through Permit renewal, approval or denial of expansion applications, and fleet reductions, when considering factors including but not limited to public health, safety, and welfare.

The proposed Permit program would include Micro-Mobility Device requirements (such as lights and bells), service requirements (such as operations center and complaint response time), and a fee structure (such as application fees and annual vehicle operations fees) all of which will apply to any companies and vehicles operating inside Arlington County. Whether the fleet vehicle is deployed in Arlington or ridden into Arlington from nearby, all the Permit requirements would apply to that device and its operations.
In the interest of monitoring and compliance, Staff proposes that an element of the Permit program specifically address the provision of information by Permit-holders to the County:

“§ 14.2-124. Records and Reports

“The Permit-holder shall maintain and provide to the County information, plans, documents, and data at a level of detail, format, and frequency as determined by the County to allow the County to accurately determine permit compliance, evaluate system performance and impact, and answer other planning, research, regulatory, and compliance questions.”

Finally, a company’s failure to adhere to their Permit requirements or non-compliance with other applicable County, State, or federal laws could lead to suspension or revocation of their Permit and the removal of devices from the County.

7. Key Finding: Ordinance Should Establish Equity Expectations in the Permit Process

Consistent with MTP Goal 4 to “Establish Equity” by serving the mobility and accessibility needs of all residents regardless of age, income, or ability, the Pilot sought to understand the equity implications of these new Shared-Mobility Services. The primary tools used to understand equity impacts were geographic dispersion of devices and device trips, and the demographic data available through the feedback form and through other County sources. Results of the feedback form suggest that rider respondents were:

- more male than female
- a lower average age than non-rider respondents
- mostly employed full time
- less educated than non-rider respondents, but still educated
Geographically speaking, most scooter trips occurred along the Rosslyn-Ballston and Route 1 corridors. For example, 60% of all County trips began in the Rosslyn-Ballston corridor while 55% of trips ended there. For the Route 1 corridor, 17% of trips began there while 35% of trips ended there. The Columbia Pike corridor experienced far fewer trips with only 4% of trip origins and 5% of trip destinations, lower than would be explained by the relatively lower population.

A map of trip origins and incomes across the county suggests that there is no observable association between income and vehicle use (with areas falling into all four defined quadrants of income and trips combinations). Moreover, the fact that all low-income areas with high utilization (except one) fall within the R-B and Route 1 corridors could be qualitatively suggesting that the association is stronger between vehicle utilization and location or deployment and (i.e. within or outside a commercial transit corridor and areas of high deployment) rather than the income level and vehicle utilization.

While most SMD operators offer significant discounts and alternative payment options for low-income individuals in the County the uptake rate has been very limited in other cities and just two riders reported signing up in Arlington. Operators do not offer a Spanish language option through their app or a call center that provides help in Spanish.
Proposed Ordinance Response:

To address the fact that the evaluation suggests a positive association between deployment geography and utilization geography, seemingly independent of average incomes in those neighborhoods, the proposed ordinance language offers the following:\footnote{This type of distributional requirement is in place in at least two other jurisdictions in the region. The City of Baltimore requires operators to deploy 25% of their devices within 15 Community Statistical Areas selected based on household incomes. The District of Columbia also has distributional requirements in their program.}

“A minimum of fifteen percent (15%) of Permit-holder’s Vehicles in service must be deployed each morning in locations that are outside of the Rosslyn-Ballston and Richmond Highway Metro corridors, as identified on the General Land Use Plan’s (GLUP) Map. The County Manager or designee may amend the percentage or geographic specificity of the distribution requirement based on performance data from ongoing operations.”

Based on conversations with stakeholder groups and industry recommended practice, staff proposes to also address equity through access to these services for people with differing physical abilities. The proposed ordinance language creates an incentive to include “Accessible Vehicles” in the Permit-holder’s fleet:

“With approval by the County Manager or designee, a Permit-holder may include Accessible Micro-Mobility Devices (e.g. handcycles, tricycles) in its Permit expansion amendment application, and such Micro-Mobility Devices will neither incur a per-device annual operations fee nor be counted towards the Permitted fleet size or against any applicable Countywide cap. If an Applicant proposes an entire fleet of Accessible Micro-Mobility Devices, the County Manager or designee may apply established fees and fleet caps as deemed reasonable based on the application.”

Although existing discount programs by operators are underutilized, staff would like to ensure that an official Permit program accounts for cost as a potential barrier to access. To address the potential for cost being a barrier to use of these services among some members of the Arlington community, the ordinance is proposed to include the following:

“Permit-holders shall provide discounted access programs to encourage use by lower-income community members.”

To address the issue that requiring a driver’s license as evidence of meeting a Permit-holder’s minimum age requirement for riders could discriminate against people who do not drive for various reasons independent of their ability to safely operate a Micro-Mobility Device, the ordinance is proposed to include the following:

“Permit-holders shall not discriminate against non-drivers by requiring a driver’s license as the only form of acceptable proof of minimum age, but shall accept one or more legal alternate proofs of minimum age.”
To address relatively large population of community members for whom Spanish is their first language, Staff proposes that the new County Code section on for-hire services be amended to read as follows:

“The Permit-holder shall have a customer service phone number for reporting safety concerns, complaints, and questions that is live twenty-four (24) hours a day and has a Spanish language ability.”

PUBLIC ENGAGEMENT: The following very briefly summarizes public engagement undertaken for the Shared Mobility Device Pilot program.

Level of Engagement: Communicate, Consult, and Involve. The design of the Pilot and the measurement areas with which to evaluate it were informed by initial stakeholder outreach. Since the Pilot began, phased formal and informal outreach have created an iterative process wherein early stakeholder input informed program operations and enforcement, as well as design of the online feedback form and the features and topics of later pop-up public engagement activities and commission/committee presentations. Community concerns/views are reflected and analyzed in the Final Evaluation Report. Finally, proposed ordinance revisions were designed to address interests and concerns identified during the public engagement process.

Outreach Methods Used: Project webpage, printed materials, project email address, in-person presentations to community stakeholder groups on request, email newsletters, Arlington County homepage link, internal staff stakeholder meetings, official Commission and Committee update presentations, Countywide online feedback form (4,000+ responses), operator stakeholder meetings, pop-up event outreach, and social media.

Community Feedback: The draft Micro-mobility ordinance was presented to the Transportation Commission for consideration at their meeting on October 3, 2019. The commissioners and staff engaged in an extensive discussion of micro-mobility regulatory policy, the proposed ordinance language and results from the SMD Pilot evaluation report. Ultimately the commission voted (6 to 1) to adopt a motion supporting advertisement of the ordinance language as identified in the County Manger’s report to the Board. Six amendments to the motion were approved by the commissioners. Those amendments expressed the Commission’s: (1) disapproval of any nighttime use restrictions on e-scooters; (2) disapproval for any measures that would prohibit Micro-Mobility Devices from traveling on roads with 30 or 35 mph speed limits; (3) disapproval of speed limits for micro-mobility vehicles on streets or in bike lanes, (4) disapproval of any prohibitions on Micro-Mobility Devices using sidewalks, (5) the Commission expressed a desire to move away from sidewalk speed limitations, and (6) the Commission supports including geographic definitions of the Rosslyn-Ballston and the Route 1 transit corridors in the ordinance. Staff has revised the ordinance to incorporate the Commission’s recommendation regarding a map definition of the two transit corridors.

A complete accounting of public engagement events and strategies may be found in Attachment 3, Public Engagement. The analysis of community input received through this outreach may be found in Attachment 4, Final Evaluation Report.
FISCAL IMPACT: During the Pilot, permit fees, which were established consistent with similar pilot programs elsewhere in the region and country, generated $72,000 for the original nine-month Pilot period and an additional $35,000 during the six-month extension period, totaling $107,000, or about $89,500 for a 12-month period. However, the effort needed to administer the Pilot program, including both Staff and County contractor time, exceeded expectations and, thus, the revenues collected from permit fees.

Staff estimates that over 2,000 contractor hours and 1,000 staff hours were expended to administer the program during the Pilot period (not counting the work since July 1 to evaluate the program and develop ordinance recommendations). However, only about 40% of contractor hours were for general program operations and administration. The balance of hours was attributable to program start-up costs (initial pilot program design, early community engagement, extensive operator meetings) and evaluation costs (survey design, data cleaning and development of templates and forms for collecting data, etc.). Considering average contractor and staff billing rates and past hours attributable to administration, the estimated future annual costs of administration is roughly $95,000, representing close to 800 contractor hours over the course of a year, and close to 400 staff hours.

Based on this assessment of ongoing program administration costs, under the ordinance Staff recommends a permit fee structure as follows:

- $1,000 per vendor per mode for an initial/first application processing fee
- $100 to process each amendment request to increase fleet size (regardless of whether the request is granted)
- $80 per vehicle annual operations fee for each vehicle approved under the Permit, or under subsequent amendments to the Permit

All fees are non-refundable, but per vehicle operations fees may be pro-rated to partial year for expansion requests depending on when they are received.

All currently operating vendors would be required to apply and pay all applicable fees under the new program. If all current operating vendors were granted new permits to operate at the service levels they currently have deployed, the County would receive close to $95,000 in revenue for the first year, before any expansion requests. This is comparable to the estimate of staff and contractor time needed for program administration.

Although the target revenue is primarily intended to cover Staff and contractor effort to administer, educate about, and promote the on-going program, it may, at the County Manager’s discretion, be used for targeted infrastructure improvements directly related to the program, such as bicycle racks and corral installations, signing or marking sidewalks where riding is prohibited, or temporary pavement markings to test facility improvement designs for future permanent installation.
Attachment 1:

Resolution

RESOLUTION TO AUTHORIZE ADVERTISEMENT OF A PUBLIC HEARING BY THE ARLINGTON COUNTY BOARD ON NOVEMBER 16, 2019 ON AN ORDINANCE TO AMEND, REENACT, AND RECODIFY CHAPTER 14.2 (MOTOR VEHICLES AND TRAFFIC) OF THE ARLINGTON COUNTY CODE RELATING TO THE USE OF MICRO-MOBILITY DEVICES (INCLUDING MOTORIZED SCOOTERS, MOTORIZED SKATEBOARDS AND POWER-ASSISTED BICYCLES) AND ISSUANCE OF PERMITS FOR THE USE OF COUNTY RIGHT OF WAY AND PUBLIC RENTAL OF SUCH DEVICES.

The County Board of Arlington hereby resolves that revisions to Chapter 14.2 of the Arlington County Code shall be advertised for a public hearing to be held by the County Board on November 16, 2019.
ARTICLE II.
BICYCLES, ELECTRIC POWER-ASSISTED BICYCLES, MOTORIZED SKATEBOARDS and MOTORIZED SCOOTERS

§ 14.2-61. Reserved. Definitions

The following words and terms, when used in this section, shall have the following meaning unless context clearly indicates otherwise:

“Public Places” means public rights-of-way, streets, easements or other real property interests dedicated or conveyed for public use.

“Multi-Use Trails” means trails typically eight to twelve (12) feet wide with a yellow line striped down the middle to separate users traveling in each direction, used by a wide variety of users including children and adults, pedestrians, dog walkers, runners and people on bicycles and micro-mobility devices, where cars and other motor vehicles are prohibited except in special circumstances outlined in 14.2-64.1.

“Protected Bike Lane”, also known as “cycle track”, means a facility that provides a physical separation between people traveling in the lane and those in motor vehicles. The separation may be provided in a number of ways, including but not limited to: plastic bollards, concrete barriers, landscaping or large planters, curbs, or motor vehicle parking.

"Vehicle" means every device in, on or by which any person or property is or may be transported or drawn on a highway, except electric personal delivery devices and devices moved by human power or used exclusively on stationary rails or tracks. Bicycles, electric personal assistive mobility devices, electric power-assisted bicycles, motorized skateboards or scooters, and mopeds shall be vehicles while operated on a highway, or as may otherwise be defined in the Virginia State Code 46.2-100.

§ 14.2-64. Equipment Requirements.

A. Every person fourteen (14) years of age or younger shall wear a protective helmet that at least meets the Consumer Product Safety Commission standards promulgated by the American National Standards Institute in the American National Standard for Protective Headgear for Bicyclists approved on March 12, 1984, or the Snell Memorial Foundations’ 1990 Standard for Protective Headgear, as amended, whenever riding or being carried on a bicycle or electric power-assisted bicycle on any highway as defined in [Code of Virginia, §] 46.2-100, sidewalk, or multi-use trail. A copy of these standards are is kept on file in the office of the Police Department's Staff Support Section and may be examined from 8:00 a.m. until 4:00 p.m. on regular business days.

B. Violation of subsection A shall be punishable by a fine of Twenty-Five Dollars ($25.00). However, such fine shall be suspended (i) for first-time violators and (ii) for violators...
who, subsequent to the violation but prior to imposition of the fine, purchase a helmets of the type required by this section.
(12-7-74; Ord. No. 92-33, 7-11-92; Ord. No. 93-12, 7-1-93; Ord. No. 99-5, 2-20-99; Ord. No. 12-06, 5-19-12)

§ 14.2-64.1. Establishment of Bicycle Paths Multi-Use Trails and Regulation of the Use Thereof.

A. The existing and approved bike multi-use trails designated on in the Arlington Bicycle Element of the Master Transportation Plan, adopted by the County Board and of which not fewer than three (3) copies have been and are now filed in the office of the Clerk of the County Board and the Department of Environmental Services and may be viewed there during regular business hours on their regular business days, and the same is hereby adopted and incorporated as fully as if set out at length herein and such trails are hereby established as the bicycle paths of Arlington County.

B. The use of such off-street bicycle paths multi-use trails by persons operating vehicles other than bicycles, electric power-assisted bicycles, scooters, skateboards, motorized skateboards or scooters, electric personal assistive mobility devices, or County-authorized or Northern Virginia Regional Park Authority-authorized vehicles entering the multi-use trails for maintenance, fire, and police patrol purposes is prohibited and violations of this section shall be a misdemeanor. This list of permitted vehicles is administered by the Division of Transportation and posted on the County website. The list may be amended at any time by the County Manager or designee.

C. The prohibitions of this section do not apply to vehicles being used by handicapped persons with disabilities when such use is necessary because of the handicapped disabled condition of the person or persons using such vehicles.

D. A person riding a bicycle, electric personal assistive mobility device, motorized skateboard or scooter, motor-driven cycle, or electric power-assisted bicycle on a multi-use trail or across a roadway on a crosswalk shall yield the right-of-way to any pedestrian and shall give an audible signal before overtaking and passing any pedestrian.

E. Violations of this section shall be subject to a civil penalty of not more than Fifty Dollars ($50.00).
(1-25-75; Ord. No. 92-33, 7-11-92; Ord. No. 99-5, 2-20-99; Ord. No. 04-25, 10-2-04; Ord. No. 12-06, 5-19-12)


Every person riding a bicycle, electric power-assisted bicycle, motorized skateboard or motorized scooter upon a roadway has all the rights and is subject to all the duties applicable to the driver of a motor vehicle except those provisions which by their very nature can have no application.
A. **Speed.** No bicycle, electric power-assisted bicycle, motorized skateboard or motorized scooter shall be ridden faster than is reasonable and proper, but each every bicycle shall be operated with reasonable regard for the safety of the operator and every other person upon the streets, multi-use trails, and sidewalks of the County.

When operating on streets and multi-use trails, motorized skateboards and motorized scooters shall not operate at speeds exceeding fifteen (15) miles per hour, and electric power-assisted bicycles shall not operate at speeds exceeding twenty (20) miles per hour.

When operating on public sidewalks motorized skateboards, scooters, and electric power-assisted bicycles shall not operate at speeds exceeding:

1. six (6) miles per hour.
   or
2. fifteen (15) miles per hour.

B. **Observation of traffic regulations.** Every person riding or propelling a bicycle, electric power-assisted bicycle, motorized skateboard or motorized scooter on any public highway, multi-use trail or sidewalk in the County shall observe all authorized traffic signs, signals, and traffic-control devices. Whenever signs are erected indicating that no right or left or U-turn is permitted, no person operating a bicycle shall disobey the direction of any such signs, except where such person dismounts from the bicycle to make any such movements or turns, in which event such person shall then obey the regulation applicable to pedestrians.

C. **Stop signs.** All persons riding a bicycle on a sidewalk or a public roadway shall stop at all stop signs.

D. **Riding on bicycles.** No person propelling a bicycle shall permit any person to ride on the handlebars. **Number of riders.** The number of riders of bicycles, electric power-assisted bicycles, motorized skateboards and motorized scooters should not exceed the manufacturer’s design capacity for the device.

E. **Riding on sidewalk.**

1. A person of any age may ride a bicycle, electric power-assisted bicycle, motorized skateboard or motorized scooter upon any sidewalk, except for those sidewalks, designated by the County Manager or designee on which bicycle-, electric power-assisted bicycle-, motorized skateboard- or motorized scooter-riding is prohibited. Signs indicating such prohibition shall be conspicuously posted in general areas where bicycle-riding is prohibited. The use of sidewalks for operating bicycles, electric-power assisted bicycles, motorized skateboards and motorized scooters is prohibited along streets where [protected] bicycle lanes are available in the direction of travel. A person riding a bicycle, electric personal assistive mobility device, motorized skateboard or scooter, motor-driven cycle, or electric power-assisted bicycle on a sidewalk or across a roadway on a crosswalk shall yield the right-of-way to any pedestrian and shall give an audible signal before...
overtaking and passing any pedestrian. Violations of this section shall be subject to a civil penalty of not more than Fifty Dollars ($50.00).

or

2. A person of any age may ride a bicycle or an electric power-assisted bicycle upon any sidewalk, except for those sidewalks designated by the County Manager or designee on which bicycle riding is prohibited. Signs indicating such prohibition shall be conspicuously posted in general areas where bicycle riding is prohibited. No person shall ride a motorized skateboard or scooter on the sidewalk. Violations of this section shall be subject to a civil penalty of not more than Fifty Dollars ($50.00).

F. E. Bicycle lane. Where the County Board has by ordinance designated a bicycle lane is present for the exclusive use of bicycles, a motor vehicle may cross a bicycle lane for the purpose of entering or exiting adjacent property, for making a turn, or for the purpose of parking, but no person shall stop, stand or park a motor vehicle in a bicycle lane, nor shall any person drive a motor vehicle in a bicycle lane for a distance of more than one hundred (100) feet. Bicycles, electric power-assisted bicycles, motorized skateboards and motorized scooters may use bicycle lanes when operating in the intended direction of travel.

G. F. Parking.

1. No person shall stand or park a bicycle, electric power-assisted bicycle, motorized skateboard or motorized scooter:
   a. upon the street other than upon the street roadway against the curb, or in a corral marked and designated for the purpose; No person shall stand or park a bicycle
   b. upon the sidewalk other than in a rack to support the vehicle bicycle, or attached to a streets sign, or light post, or against a building, or at the curb, at the back edge of the sidewalk; This will be done in such a manner as to afford the least obstruction to pedestrian and vehicular traffic.
   c. where they would obstruct curb ramps, pedestrian access within bus stops, or fire access;
   d. on private property without the owner’s permission; or
   e. on Public Places other than streets and sidewalks as noted above, unless where specifically designated through signage or provision of racks.

2. Bicycles, electric power-assisted bicycles, motorized skateboards and motorized scooters shall be parked upright, in such a manner as to afford the least obstruction to pedestrian and vehicular traffic.

3. Violations of this section shall be subject to a civil penalty of not more than Fifty Dollars ($50.00).

(Ord. No. 92-33, 7-11-92; Ord. No. 99-5, 2-20-99; Ord. No. 12-06, 5-19-12)

The County Board hereby establishes bicycle lanes upon and along the following streets, at the following locations, which lanes shall be of such dimensions as determined by the County Manager and which lanes shall be for the exclusive use of bicyclists:

- **Patrick Henry Drive** between Wilson Boulevard and North George Mason Drive.
- **North Rhodes Street** between Arlington Boulevard and Wilson Boulevard.
- **North Scott Street** between Lee Highway and Key Boulevard.
- **Key Boulevard** between North Scott Street and North Nash Street.
- **Yorktown Boulevard** between North George Mason Drive and 26th Street North.
- **North Veitch Street** between Lee Highway and Wilson Boulevard.
- **South Eads Street** between South Glebe Road and 23rd Street South.
- **South Abingdon Street** between 31st Street South and 34th Street South.
- **34th Street South** between South Abingdon Street and South Stafford Street.
- **South Stafford Street** between 32nd Road and 34th Street South.
- **Wilson Boulevard** between North Oak Street and North Washington Boulevard.
- **Clarendon Boulevard** between North Washington Boulevard and North Oak Street.
- **Fairfax Drive** between North Glebe Road and Wilson Boulevard.
- **15th Street South** between Crystal Drive and South Joyce Street.
- **South Hayes Street** between Army Navy Drive and 18th Street South.
- **18th Street South** between South Eads Street and South Hayes Street.
- **North Pershing Drive** between North Washington Boulevard and Arlington Boulevard.
- **Walter Reed Drive** southbound between South Pollard Street and South Four-Mile Run Drive.
- **South Randolph Street** between South Arlington Mill Drive and 31st Street South.
- **North Quincy Street** between Lee Highway and Wilson Boulevard.
- **Nelly Custis Drive** between Lorcom Lane and Military Road.
- **Military Road** between Nelly Custis Drive and North Old Glebe Road.
- **North Ohio Street/McKinley Road** between North Washington Boulevard and Wilson Boulevard.
- **Yorktown Boulevard** between North George Mason Drive and Little Falls Road.
- **John Marshall Drive** between North Little Falls Road and Lee Highway.
- **Lorcom Lane** between Military Road and North Edgewood Street.
- **Crystal Drive** between 27th Street South and 15th Street South.
- **Lee Highway** between North Quincy Street and North Kenmore Street.
- **North George Mason Drive** between Wilson Boulevard and 10th Street North.
- **Williamsburg Boulevard** between North Glebe Road and Westmoreland Street.
- **Old Dominion Drive** between Lee Highway and 26th Street North.
- **Kirkwood Road** between Washington Boulevard and Lee Highway.

(Ord. No. 01-17, § 1, 7-28-01; Ord. No. 02-4, § 1, 3-23-02; Ord. No. 02-14, § 1, 6-8-02; Ord. No. 03-05, 3-15-03; Ord. No. 12-06, 5-19-12)

§ 14.2-66. Penalties

It shall be unlawful to violate any of the provisions prohibitions of this Article § 14.2-63. If a fine or penalty is not otherwise specified, any person who violates any of these provisions shall be subject to punishment by a fine of not more than Two Hundred and Fifty Dollars ($2500.00).
ARTICLE X. Shared Micro-Mobility Services For-Hire, Permit Program

§ 14.2-111. Purpose and Persons Covered

A. Purpose. The purpose of this section is to regulate shared Micro-Mobility Services for-hire in Arlington County, the operation of such services for-hire, the qualification of businesses providing such services through this issuance of Permits, and the compliance and enforcement of such Permits in order to preserve the health, safety, and welfare of Arlington County citizens and the public at-large, achievement of County transportation goals and objectives, as well as assuring competition among providers that results in high quality Micro-Mobility Services throughout Arlington County.

B. Persons covered. Any person who engages in Micro-Mobility Business, as defined below, provides Micro-Mobility Service, or applies to provide such service in Arlington County shall be governed by the provisions of this section.

§ 14.2-112. Definitions

The following words and terms, when used in this section, shall have the following meaning unless context clearly indicates otherwise:

“Accessible Micro-Mobility Device” also known as “adaptive” means a device with features designed to make it comfortable to ride for persons with various temporary or permanent physical disabilities. Such devices may include, but not be limited to – electric-assisted or not – recumbent bicycles, handcycles, tricycles, recumbent tricycles, side-by-side tandem bicycles and cargo tricycles. It is possible that certain motorized scooters may also be classified accessible if they have features which make them useable by persons with disabilities.

“Applicant” means any individual, company, corporation, partnership or other such legal entity that seeks a Permit, or an amendment, modification, or revision to such Permit.

“Corral” means a space in the roadway designated, through signage or marking, specifically for parking of Micro-Mobility Devices.

“Micro-Mobility Business” means the entity providing Micro-Mobility Devices for-hire. These Businesses rely on the right-of-way to store Micro-Mobility Devices for customer access and use. Micro-Mobility Businesses shall not include regional multi-jurisdictional or County-provided shared transportation services.
“Micro-Mobility Device” or “Device” means a human-powered, partially human-powered, or fully motorized small Vehicle, such as bicycles, power-assisted bicycles, motorized scooters, motorized skateboards as defined in the Code of Virginia, or as otherwise designated as such by the County Manager or designee. The Master Transportation Plan also refers to several of these as “Small Electric Vehicles”.

“Micro-Mobility Service” means the service provided by a Micro-Mobility Business.

“Permit” means the permit issued by Arlington County to a Micro-Mobility Business as provided in this section.

“Permit-holder” means any entity that has been granted a Micro-Mobility Business Permit.

“Permit Term” means the calendar period for which a Permit is effective, as defined by the County Manager or designee in the Permit application.

"Revoke" or "revocation" means the removal of rights and privileges conferred through a Permit.

“Suspend” or “suspension” means the temporary removal of rights and privileges conferred through a Permit.

“Multi-Use Trail”, “Protected Bicycle Lane”, and “Vehicle” shall have the same meaning as defined in Article II.

§ 14.2-113. Micro-Mobility Business Permit Application

A. Permit Required. A Micro-Mobility Business seeking to operate a fleet of Micro-Mobility Devices for public hire must first contact the County Manager or designee to request a Micro-Mobility Business Permit (Permit) application.

B. Application Process

1. Each application package shall be made, under oath, by a Micro-Mobility Business by filing an application form and application fee with the County Manager or designee, upon forms provided by the County for such purpose.

2. A separate application form and application fee shall be filed for each unique type of Micro-Mobility Device desired to be publicly offered by the Applicant.

3. Upon receipt of an application package, the County Manager or designee shall notify each Applicant in writing that an application has been filed and whether it is complete. Only complete applications will be considered. A complete application is valid for up to one year from date of notification of completion, at which point a new application may be required before Permit consideration or issuance.

4. It shall be unlawful for any person knowingly to make or cause to be made, either
directly or indirectly, any materially false statement on any application, accompanying documents or reports submitted pursuant to this chapter. Any such application containing a materially false statement may be rejected by the County Manager or designee. Upon rejection of the application due to such a false statement, the Applicant shall not be permitted to resubmit an application for a period of two (2) years after the date of the application containing the false statement(s).

C. Application Fee A non-refundable application fee of One Thousand Dollars ($1,000.00) shall be paid upon submission of an application for a new Permit. The amount shall be paid to the Treasurer of Arlington County.

§ 14.2-114. Establishing Countywide Permit Cap; Evaluation of Applications; Initial Micro-Mobility Device Permit Allocations

A. Countywide Permit Cap. Subject to Sections 14.2-115 B, C, and D, this ordinance authorizes the County Manager or designee to establish, modify, or eliminate a cap on the total number of Micro-Mobility Devices permitted to operate under this program when the County Manager or designee determines that such action is appropriate considering factors such as the public’s safety, health and welfare, as well as any other factors or considerations under section 14.2-114.B below.

B. Application Evaluation. The County Manager or designee, will evaluate each application and notify the Applicant in writing about its decision to approve or deny an application. In making such an approval or denial, the County Manager or designee may consider the established Countywide Permit Cap on total number of Micro-Mobility Devices in Arlington County, demand for services, support for an open marketplace, and the following goals from the Master Transportation Plan (or subsequent goals as the Plan is amended), in no particular order:

1. Quality Transportation Services: How the Micro-Mobility Business provides high-quality transportation services for all users and modes.


3. Advance Environmental Quality: How the Micro-Mobility Business reduces the impact of travel on community resources including air and water quality and increase energy efficiency.

4. Promote Safety: How the Micro-Mobility Business provides transportation system operations that are safe and secure.

5. Establish Equity: How the Micro-Mobility Business serves the mobility and accessibility needs of all residents regardless of age, income, or ability.
6. Manage Effectively and Efficiently: How the Micro-Mobility Business supports the County in efforts to fund, develop, manage, and maintain transportation facilities and services in an equitable and cost-effective manner.

The County Manager or designee may also consider any other relevant information as he/she deems appropriate.

C. An Applicant must request an initial allocation of Micro-Mobility Devices. In consideration of 14.2-114.B. above, the County Manager or designee will determine the initial number of Micro-Mobility Devices approved under the Permit. The Applicant must pay an initial annual operations fee of Eighty Dollars ($80) per each approved Micro-Mobility Device for a three-hundred and sixty-five (365) day Permit Term. This fee will be pro-rated if an application is processed and approved for any Permit Term of less than three-hundred and sixty-five (365) days.

D. With approval by the County Manager or designee, a Permit-holder may include Accessible Micro-Mobility Devices (e.g. handcycles, tricycles) in its Permit application, and such devices will neither incur a per-device annual operations fee nor be counted towards the Permitted fleet size or against any applicable Countywide cap. If an Applicant proposes a fleet the majority of which is made up of Accessible Micro-Mobility Devices, the County Manager or designee may apply established fees and fleet caps as deemed reasonable based on the application.

§ 14.2-115. Changes in the Number of Permitted Micro-Mobility Devices per Permit-holder

A. The Permit-holder is responsible for maintaining its fleet size within Arlington County to no more than one hundred and five percent (105%) of their permitted number of Micro-Mobility Devices, subject to B and C below.

B. Increases.

1. A Permit-holder may request in writing to the County Manager or designee, no more than once a month, a Permit Amendment to expand its fleet by a maximum of fifty (50) Micro-Mobility Devices. For amendment approval, the Permit-holder shall demonstrate:

a. at least an average of three (3) trips per device per day for the entire prior month (when operating at least an average of ninety percent (90%) of its maximum permitted fleet size during the entire prior month), and

b. compliance with this Chapter’s requirements.

2. The request must be accompanied by an amendment application fee of One Hundred Dollars ($100.00). For every approved additional Micro-Mobility Device, the Eighty-Dollar ($80.00) per-device annual operations fee must be paid but will be pro-rated with respect to the original Permit Term.
3. Such expansion requests may or may not be approved pursuant to considerations under Section 14.2-114.A or B.

C. Decreases.

1. The County Manager or designee may decrease the Permit-holder’s permitted fleet size by any amount when the Permit-holder cannot demonstrate at least an average of two (2) trips per permitted Micro-Mobility Device per day for the entire prior month.

2. The County Manager may also decrease the Permit-holder’s permitted fleet size at renewal pursuant to considerations under Section 14.2-114.A or B.

D. With approval by the County Manager or designee, a Permit-holder may include Accessible Micro-Mobility Devices (e.g. handcycles, tricycles) in its Permit expansion amendment application, and such Micro-Mobility Devices will neither incur a per-device annual operations fee nor be counted towards the Permitted fleet size or against any applicable Countywide cap. If an Applicant proposes an entire fleet of Accessible Micro-Mobility Devices, the County Manager or designee may apply established fees and fleet caps as deemed reasonable based on the application.

§ 14.2-116. Permit Annual Renewal Fee and Terms

A. Term. Subject to compliance with the requirements of this Chapter, each Permit is valid for a Permit Term as defined by the County Manager or designee in the Permit application.

B. Renewal.

1. To continue service for an additional term, the Permit-holder shall send a written request to the County Manager or designee with its annual operations fee at least thirty (30) calendar days before the end of the Permit Term. Upon renewal, the Permit-holder is responsible for paying the per-device annual operations fee as specified in their Permit, or as amended by the County Board. Such fee is nonrefundable.

2. The County Manager or designee may limit the fleet size eligible for renewal pursuant to considerations under Section 14.2-114.A or B.

C. Non-renewal. If the Permit-holder decides not to renew the Permit, Permit-holder must provide the County at least thirty (30) calendar days written notice prior to the end of the Permit Term of its intent not to renew. Failure to remove all Micro-Mobility Devices from the County right-of-way and streets prior to expiry of the non-renewed Permit may result in confiscation of the Micro-Mobility Devices. The County has the right to charge for the costs of removal.

§ 14.2-117. Business License Requirement

A. All applicants shall possess a valid Arlington County Business, Professional and Occupational License.

§ 14.2-118. Insurance Requirements
A. The Permit-holder must provide to the County Manager or designee a Certificate of
Insurance indicating that the Permit-holder has in force at a minimum the coverages below to
cover damages for any liability incurred on account of any injury to persons or damage to
property resulting from the operation of Micro-Mobility Devices, and which holds the County
harmless for any such claims. The Permit-holder must maintain this coverage until the
completion of the Permit. All required insurance coverage must be acquired from insurers that
are authorized to do business in the Commonwealth of Virginia, with a rating of “A-” or better
and a financial size of “Class VII” or better in the latest edition of the A.M. Best Co. Guides.

1. Workers Compensation - Virginia statutory workers compensation (W/C)
coverage, including Virginia benefits and employer’s liability with limits of
$100,000/$100,000/$500,000. Arlington County will not accept W/C coverage issued by the
Injured Worker's Insurance Fund, Towson, MD.

2. Commercial General Liability – One Million Dollars $1,000,000 per occurrence,
with Two Million Dollars $2,000,000 annual aggregate covering all premises and operations
and including personal injury, completed operations, contractual liability, independent
contractor, and products liability. The general aggregate limit must apply. Evidence of
contractual liability coverage must be typed on the certificate.

3. Business Automobile Liability – One Million Dollars $1,000,000 combined single-
limit (owned, non-owned and hired).

4. Additional Insured – Arlington County and its officers, elected and appointed
officials, employees and agents must be named as additional insureds on all policies except
workers compensation and automotive and professional liability; and the additional insured
endorsement must be typed on the certificate.

5. Cancellation - If there is a material change or reduction in or cancellation of any of
the above coverages during the term, the Permit-holder must notify the County Manager, or
designee, immediately and must, with no lapse in coverage, obtain replacement coverage that
is consistent with the terms of this ordinance. Not having the required insurance throughout
the permitted term is grounds for termination of the Permit.

6. Claims-Made Coverage - Any “claims made” policy must remain in force, or the
Permit-holder must obtain an extended reporting endorsement, until the applicable statute of
limitations for any claims has expired.

7. Contract Identification - All insurance certificates must state the permit’s title. If a
purchased insurance policy is furnished, the minimum amount of coverage will be:

a. For injury to one (1) person in any one (1) accident: one hundred thousand dollars
($100,000.00)
b. For injury to two (2) or more persons in any one (1) accident: three hundred thousand dollars ($300,000.00)

c. For property damage in any one (1) accident: fifty thousand dollars ($50,000.00)

d. If a combination of self-insurance and a policy of insurance is approved, such combination will provide the coverage specified above.

e. The Permit-holder must disclose to Arlington County the amount of any deductible or self-insurance component of any of the required policies. With Arlington County’s approval, the Permit-holder may satisfy its obligations under this section by self-insurance for all or any part of the insurance required, provided that the Permit-holder can demonstrate sufficient financial capacity. To do so, the Permit-holder must provide Arlington County with its most recent actuarial report and a copy of its self-insurance resolution.

8. Arlington County may request additional information to determine if the Permit-holder has the financial capacity to meet its obligations under a deductible and may require a lower deductible; that funds equal to the deductible be placed in escrow; a certificate of self-insurance; collateral; or another mechanism to guarantee the amount of the deductible and ensure protection for Arlington County.

9. Arlington County’s acceptance or approval of any insurance, or any event of cancellation of the policy, will not relieve the Permit-holder from any liability or obligation imposed by Permit documents.

10. The Permit-holder is responsible for the for all materials, tools, equipment, appliances and property used in connection with the Permit. The Permit-holder assumes all risks for direct and indirect damage or injury to the property used or persons employed in connection with any activities associated with the Permit and for all damage or injury to any person or property, wherever located, resulting from any action, omission, commission or operation under the Permit or in connection in any way whatsoever with the activities performed pursuant to the Permit. The Permit-holder’s insurance shall be the primary non-contributory insurance for any work performed or activities or services provided for under the Permit.

11. The Permit-holder is as fully responsible to Arlington County for the acts and omissions of its sub-contractors and of persons employed by them as it is for acts and omissions of persons whom the Permit-holder employs directly.

§ 14.2-119. Surety Bond

A. The Permit-holder shall maintain a surety bond which Arlington County may use to pay costs related to removing and storing devices that are abandoned or do not comply with these Permit requirements, if such costs are not borne by the Permit-holder.
B. The amount of the surety bond shall be Twenty-Five Dollars ($25.00) for each Micro-Mobility Device. The Permit-holder shall increase the amount of the surety bond to reflect any approved amendment that increases the Permitted fleet size.

§ 14.2-120. Suspension or Revocation of Permits; Hearing Procedure

A. The County Manager or designee may revoke or suspend a Permit for any violations of this Chapter.

1. Notice of Possible Suspension or Revocation. The County Manager or designee shall notify the Permit-holder, by certified mail or hand delivery, that the County Manager or designee is considering a suspension or revocation of the Permit-holder’s Permit. The notice shall state the reasons for the possible suspension or revocation and shall provide an appropriate cure period as solely determined by the County Manager or designee by which the Permit-holder shall remedy all failure(s) and violation(s) giving rise to the possible suspension or revocation.

2. Notice of Hearing for Suspension or Revocation. Upon the expiration of the cure period, the County Manager or designee shall notify the Permit-holder, by certified mail or hand delivery, of the date and time and place for a hearing before the County Manager or designee. During such hearing the Permit-holder shall be given an opportunity to be heard, including the opportunity to present relevant evidence against any suspension or revocation.

3. If, after the hearing and consideration of the facts, the County Manager or designee determines that a suspension or revocation is warranted, then the Permit-holder shall be so notified in writing and the Permit shall be suspended or revoked as provided in such notice. Such action shall be effective upon receipt by the Permit-holder of such written notice, by certified mail or hand delivery.

4. When the County Manager or designee determines that the period for suspension has concluded and/or such suspension is no longer warranted, the County Manager or designee will provide written permission to resume Micro-Mobility Business under the Permit and the Permit-holder shall not be required to reapply for a Permit.

5. If the County Manager or designee revokes a Permit, then the prior holder of the revoked Permit shall not engage in the Micro-Mobility Business in Arlington County, unless and until the prior Permit-holder reapplies for a Permit in accordance with the application process of this Chapter and is issued a Permit. The prior Permit-holder shall be entitled to reapply for a Permit not sooner than three hundred and sixty-five (365) calendar days after the effective date of the revocation.

§ 14.2-121. Appeal from Suspension, Revocation, or Denial of a Permit

A. The appeal of a decision of the County Manager or designee concerning the suspension, revocation or denial of a Permit shall be by notice of appeal, made in writing, signed
by the Permit-holder, stating an address at which the Permit-holder will receive subsequent notifications. The notice of appeal shall be filed with the Clerk of the County Board no later than fourteen (14) calendar days after the date a notice of the decision of the County Manager or designee has been hand-delivered or mailed by certified mail. The notice of appeal shall clearly and specifically state: the decision appealed from, all reasons why the decision is claimed to not be in accordance with this Chapter, and the requested relief. Any such notice which is not timely filed or fails to provide such required information may be denied.

B. The Clerk of the County Board will notify the County Manager or designee of the filing of a notice of appeal. After the receipt by the Clerk of a valid notice of appeal, the Permit-holder will be entitled to a hearing by the County Board which shall be held no sooner than ten (10) calendar days after the filing of the notice of appeal. The Permit-holder will have the right to present his or her case in person or by counsel licensed to practice law in the Commonwealth of Virginia.

C. The Board will consider information and documents offered by the Permit-holder and County staff. The hearing need not be conducted according to technical rules relating to evidence and witnesses, provided, however, that the Board only need consider relevant information and documents. The Board may affirm, reverse, or modify the decision of the County Manager or designee.

D. If the Board reverses the County Manager’s or designee’s decision so as to restore a Permit, then the Board will direct the County Manager to restore the Permit in accordance with the order of the Board.

E. During the pendency of an appeal, the decision of the County Manager or designee shall remain in full force and effect.

§ 14.2-122. Service Requirements

A. User safety training. Upon registration, the Permit-holder shall require each rider to review the Permit-holder’s safety and etiquette rules and regulations, rider requirements pursuant to the Arlington County Code, including but not limited to the maximum speed on sidewalks of six (6) miles per hour, and any State laws applicable to the operation of these Micro-Mobility Devices. The Permit-holder shall regularly offer free instruction to interested persons on how to use their Micro-Mobility Devices.

B. Customer Service. The Permit-holder shall have a customer service phone number for reporting safety concerns, complaints and questions that is live twenty-four (24) hours a day and has a Spanish language ability.

C. Parking.

1. The Permit-holder shall ensure that its Micro-Mobility Devices are parked in accordance with the requirements of this Chapter, and in compliance with all State and local laws.
2. Micro-Mobility Devices are not permitted to park in one location longer than three (3) consecutive days without moving.

3. Within two (2) hours of reporting by Arlington County or others, the Permit-holder shall correct a Micro-Mobility Device parked in violation of this section or otherwise in conflict with applicable laws and regulations.

4. Failure to adhere to these parking requirements may result in Arlington County removing the Micro-Mobility Device, with the Permit-holder responsible for all costs associated with removal and storage of Micro-Mobility Devices so removed, in addition to any applicable fines or fees, or other penalties as appropriate under the law. Arlington County may consider Permit-holder’s Micro-Mobility Devices abandoned and dispose of them if the Permit-holder fails to retrieve the Device within seven (7) days upon being notified of removal and storage. Notwithstanding, the County’s ability to remove improperly parked Micro-Mobility Devices, such removal shall not waive any other legal remedies available to the County, including but not limited to, the County Manager’s or designee’s authority to pursue suspension or revocation of a Permit-holder's Permit for any violation of this Chapter.

D. Service Requirements in the Interest of Equity: The County Manager or designee may establish, in consultation with Permit-holders, equity plans to ensure that access to these services is made as broad as possible among members of the community. The baseline requirements of the plan are as follows:

1. A minimum of fifteen percent (15%) of Permit-holder’s Micro-Mobility Devices in service must be deployed each morning in locations that are outside of the Rosslyn-Ballston and Richmond Highway Metro corridors, as identified on the General Land Use Plan’s (GLUP) Map. The County Manager or designee may amend the percentage or geographic specificity of the distribution requirement based on performance data from ongoing operations.

2. Permit-holders shall provide discounted access programs to encourage use by lower-income community members.

3. Permit-holders shall not discriminate against non-drivers by requiring a driver’s license as the only form of acceptable proof of minimum age, but shall accept one or more legal alternate forms of proof of minimum age.

After such consultation, baseline elements of the equity plan may be modified at the County Manager’s or designee’s discretion.

E. Emergencies. Upon the request of the County Manager or designee, due to emergency, severe weather, construction, parade, public gathering or other situation affecting the normal operation of the right-of-way including sidewalks and trails, the Permit-holder shall collect and secure all of, or a portion of, its owned or controlled Micro-Mobility Devices to a location outside of the public right-of-way or to a location that does not otherwise impede Arlington County’s access and response to the situation for the duration of the situation.
**F. Communication.** Except as otherwise specified in this Chapter, the Permit-holder shall respond within five (5) business days regarding issues or questions raised by Arlington County, in meetings, through telephone inquiries, or any other form of correspondence.

**G. Operations Center.** The Permit-holder shall have a staffed operations center in the Washington, D.C. region to adequately and timely address any operational concerns that arise from providing service in Arlington County.

**§ 14.2-123. Micro-Mobility Devices: Equipment Requirements**

**A. Equipment requirements.** The following requirements shall apply to all Micro-Mobility Devices:

1. Every Device shall be so constructed and shall be maintained as to provide for the safety of the rider and the public, for continuous and satisfactory operation and otherwise in compliance with all federal and state vehicle requirements.

2. Every Device shall be equipped with a properly installed speedometer, maintained in good working order and exposed to view.

3. Every Device shall comply with Virginia Code §46.2-1015 requiring both headlight and taillight. The headlight and taillight shall illuminate for at least ninety (90) seconds after the Device comes to a complete stop.

4. Every Device in operation shall have functioning brakes and a bell.

5. The Permit-holder shall provide visible safety language on every Device.

6. The Permit-holder shall ensure each deployed Device is fully operable, free of defects, conforms to relevant safety standards and is well-maintained and clean.

7. If a Permit-holder’s Device is reported in need of maintenance and/or cleaning, the Permit-holder shall immediately prevent further use of the Device, and within one (1) day of notification, shall remove it from Arlington County right-of-way.

8. **New Device or Device Component.** The Applicant or Permit-holder shall not deploy any Device or Device component before receiving approval by the County Manager or designee. The Applicant or Permit-holder shall furnish design specifications, any applicable certifications of compliance with safety standards and illustrative images of the Device or Device components. Upon request by Arlington County, the Applicant or Permit-holder shall provide an opportunity for the County Manager or designee to physically inspect and test-ride the same model proposed for deployment. Such inspecting or testing shall not constitute any warranty by the County.

**B. Electric Power-Assisted Bicycles.** The following requirements shall apply to specifically to electric power-assisted bicycles:

2. They shall meet the definition in the Virginia Code §46.2-100 et seq. and shall be subject to the same requirements as Bicycles.

3. They shall have fully operable pedals that allow propulsion by human power, and an electric motor with an input of no more than one thousand (1,000) watts and be set by the Permit-holder(s) to have a top motor-powered speed not to exceed twenty (20) miles per hour.

C. Motorized Scooters. The following requirements shall apply to motorized scooters:

1. They shall meet the definition of a motorized foot-scooter in Virginia Code §46.2-100 et seq.

2. They shall be powered by an electric motor having an input of no more than one thousand (1,000) watts and be set by the Permit-holder(s) to have a top motor-powered speed of fifteen (15) miles per hour.

D. Vehicle Identification. The Permit-holder shall have its customer service phone number, email address, website, company logo on every Micro-Mobility Device that is in service within Arlington County. This information shall be provided in a minimum size of sixteen (16) point font. Each Micro-Mobility Device shall also have a unique identifying number which shall be in at least forty-eight (48) point font. All the information in this paragraph shall also be provided on the Micro-Mobility Device in braille, which shall be on the stem near the handlebars if handlebars are present.

§ 14.2-124. Records and Reports

The Permit-holder shall maintain and provide to the County Manager or designee information, plans, documents, and data at a level of detail, format, and frequency as determined by the County Manager or designee to allow the County Manager or designee to accurately determine permit compliance, evaluate system performance and impact, and answer other planning, research, regulatory, and compliance questions.

§ 14.2-125. Public Safety

A. The Permit-holder shall report to the County Manager or designee, or shall respond to reports by the County Manager or designee, within twenty-four (24) hours, of any known issues which could affect public safety, including but not limited to reports of maximum sidewalk speed violations, reports of criminal activity involving their Micro-Mobility Devices, reports of any crash with a fatality or hospitalized injury involving the Permit-holder's Micro-Mobility Devices, any contact with the Arlington County Police Department, any contact with Arlington County Fire or EMS, or any defects in equipment including but not limited to fires, tampering,
damaged/leaking batteries, electrical issues or charging issues.

B. Restricting Services. In the interest of public safety and welfare, the County Manager or designee may determine certain areas of the County in which no Micro-Mobility Devices may operate, as well as, determine certain times during which no Micro-Mobility Devices may be made available for operation by the Permit-holder(s). A list of such time and place restrictions shall be maintained by the County Manager or designee, shall be subject to amendment by the County Manager or designee, and shall be made available to the public.
Attachment 3:
Public Engagement During the Shared Mobility Device Demonstration Project and Development of Proposed Ordinance Changes

The Mobility Inbox. The Mobility Inbox is an Arlington County e-mail address made available via Arlington County’s website and all Pilot program communications to accept ongoing and unstructured feedback from the community about the SMD Pilot program. Starting in October 2018, all complaints received in the Mobility Inbox were screened for keywords and language corresponding to categories of inquiries related to the SMD Pilot Program. These categories include common topics of interest such as: “parking”, “sidewalk riding”, and “underage riding”. Using this methodology, one email may be tallied under multiple categories (e.g. a single email complaint about parking and sidewalk riding would be counted once in each category). As such, the sum of tallies for each category does not equal the number of emails received. Evaluating self-initiated voluntary submissions helps to uncover: (1) themes that community members feel strongly about, and (2) within the themes, the dimensions they associate with SMDs.

Through the Mobility Inbox, staff received and responded to 727 emails over the Demonstration Project period. The total number of emails decreased considerably from October (226 e-mails) to February (24 e-mails) (see Figure 46 below). In absolute terms, counts increased again between February and May but accounting for the number of trips (i.e. exposure), complaints decreased consistently from 3.7 inbounds per 1,000 trips in October 2018 to just 0.6 e-mails per 1,000 trips in June. Increasing familiarity with SMD service maybe a contributor to this decrease, as may be rider familiarity with rules and parking etiquette. This decrease is consistent with Staff’s experience running a similar email account for free-floating car-sharing services during that pilot program.

![Complaints to the Mobility Inbox over time (N=727)](image)

**Data Source:** Arlington County Mobility Inbox

*Evaluation Report Figure 46, Inbound Inquiries Received to the Mobility Inbox Over Time*
### Main topics for the complaints received through the Mobility Inbox (N= 727 emails)

<table>
<thead>
<tr>
<th>Topic</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking</td>
<td>50%</td>
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<tr>
<td>Sidewalk Riding</td>
<td>36%</td>
</tr>
<tr>
<td>Safety</td>
<td>28%</td>
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<tr>
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<td>26%</td>
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<tr>
<td>Underage Rider</td>
<td>20%</td>
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<td>Trail Riding</td>
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<tr>
<td>Fast Speed</td>
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</tr>
<tr>
<td>Close Call</td>
<td>8%</td>
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<tr>
<td>Enforcement</td>
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<tr>
<td>Abandoned/Vandalized</td>
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<tr>
<td>Number of Devices</td>
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<tr>
<td>Disabled/Broken</td>
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</tr>
<tr>
<td>Slow Speed</td>
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<td>Infrastructure</td>
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<td>Deployment</td>
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</tr>
<tr>
<td>Parking</td>
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</tr>
<tr>
<td>Other</td>
<td>10%</td>
</tr>
</tbody>
</table>

*Data Source: Arlington County Mobility Inbox*

### Evaluation Report Figure 47, Key Topics Identified in the Mobility Inbox

**Online Feedback Form.** The research team designed an online feedback form aimed at complementing operators’ data to give a better understanding of the Arlington community’s experience and satisfaction with the SMD Pilot. The feedback form was pre-tested internally by Arlington County to check for wording confusion and question fatigue and was revised accordingly before release to the public. The survey was open from May 15 to June 30 and was distributed via the following outlets:

- **InsideArlington** - 130,000 subscribers – link sent twice: 5 newsletters for a total of 305 clicks and 13 newsletters for a total of 1,292 clicks
- **Arlington County Social Media (DES and Countywide)** (Twitter: DES – 4,889; ARL – 26,200; Facebook: DES – 3,288; ARL – 29,583)
- **Emails to those who emailed the Mobility Inbox** – 553 recipients
- **County commissions and committees**
- **SMD operators to their users** (Lime sent it to 14,500 recipients; Lyft: sent to 2,500 recipients)

The feedback form generated a total of 4,063 responses. More than two thirds of the respondents to the survey were non-SMD users (N=2,840). Among SMD users, most were e-scooter users (1,066). Three percent of total respondents (135 respondents) reported having used both e-scooters
and dockless e-bikes in Arlington. Most respondents lived (98%) and worked (68%) in Virginia. Thirty percent of respondents worked in Washington, D.C.

**In-person engagement.** Throughout May and June, community engagement staff from the Department of Environmental Services brought information and displays to 13 community events around Arlington to provide opportunities for feedback. Attendees were invited to consider how Arlington could improve its demonstration project by reviewing a display board with different mitigation options. The options presented were selected by reviewing how other cities have been addressing commonly reported issues. Attendees were invited to place stickers on preferred options or propose their own new idea. Depending on the event, attendees were also given the opportunity to complete a shorter version of the feedback form or an information card with a link for the online feedback form. During this formal engagement period, Staff engaged over 970 individuals, collecting 120 intercept feedback forms and receiving over 400 preferences on mitigation options and over 50 new ideas. Typical community attendees to such community events acknowledge the pilot having challenges but expressed an interest in resolving the issues rather than ending the program.

<table>
<thead>
<tr>
<th>Event Date (2019)</th>
<th>Event Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/17/19</td>
<td>Bike to Work Day: Rosslyn Gateway Park</td>
</tr>
<tr>
<td>5/17/19</td>
<td>Bike to Work Day: New District Brewing: Shirlington</td>
</tr>
<tr>
<td>5/18/19</td>
<td>Big Truck Day: Columbia Pike Library</td>
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<tr>
<td>5/19/19</td>
<td>Ballston Quarterfest: Ballston</td>
</tr>
<tr>
<td>6/1/19</td>
<td>Marymount Farmers Market: Marymount University</td>
</tr>
<tr>
<td>6/2/19</td>
<td>Westover Farmers Market: Westover Library Plaza</td>
</tr>
<tr>
<td>6/7/19</td>
<td>Fridays at the Fountain: Crystal City Waterpark</td>
</tr>
<tr>
<td>6/8/19</td>
<td>Arlington Farmers Market: Courthouse</td>
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<tr>
<td>6/12/19</td>
<td>Rosslyn Farmers Market: Central Place Plaza</td>
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<tr>
<td>6/13/19</td>
<td>Shirlala Music Thursdays: Shirlington</td>
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<tr>
<td>6/14/19</td>
<td>Movie Night: Moana (Columbia Pike Arlington Mill)</td>
</tr>
<tr>
<td>6/15/19</td>
<td>Movie Night: Black Panther (Columbia Pike Penrose)</td>
</tr>
<tr>
<td>6/16/19</td>
<td>Columbia Pike Bluesfest: Columbia Pike</td>
</tr>
</tbody>
</table>

**Commission and Committee Presentations.** The following is a list of meetings at which presentations on this topic were given to commissions, committees, and other advisory or community bodies upon request or as arranged by Staff for key stakeholder groups:

*Communication During First Phase of the Pilot Program:*

<table>
<thead>
<tr>
<th>Meeting Date</th>
<th>Group Name</th>
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<tbody>
<tr>
<td>8/6/18</td>
<td>Bicycle Advisory Committee</td>
</tr>
<tr>
<td>9/5/18</td>
<td>Transportation Commission</td>
</tr>
<tr>
<td>9/11/18</td>
<td>Economic Development Commission</td>
</tr>
<tr>
<td>9/12/18</td>
<td>Pedestrian Advisory Committee</td>
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<tr>
<td>9/17/18</td>
<td>Neighborhood Complete Streets Commission</td>
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<tr>
<td>9/18/18</td>
<td>Commission on Aging</td>
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<tr>
<td>9/18/18</td>
<td>Disability Advisory Commission</td>
</tr>
<tr>
<td>9/25/18</td>
<td>Parks and Recreation Commission</td>
</tr>
<tr>
<td>10/31/18</td>
<td>Metropolitan Washington Council of Governments</td>
</tr>
<tr>
<td>11/7/18</td>
<td>Advisory Committee on Transport Choices</td>
</tr>
<tr>
<td>11/13/18</td>
<td>Transit Advisory Committee</td>
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<tr>
<td>11/16/18</td>
<td>County Council of PTAs</td>
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<tr>
<td>2/7/19</td>
<td>Transportation Commission</td>
</tr>
<tr>
<td>2/13/19</td>
<td>Aurora Highlands Civic Association</td>
</tr>
<tr>
<td>3/30/19</td>
<td>Lee Highway Alliance</td>
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<tr>
<td>4/10/19</td>
<td>Committee of 100</td>
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<td>5/1/19</td>
<td>Advisory Committee on Transport Choices</td>
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<td>5/2/19</td>
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<td>Pedestrian Advisory Committee</td>
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<td>5/14/19</td>
<td>Transit Advisory Committee</td>
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<tr>
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<td>Commission on Aging</td>
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<tr>
<td>5/20/19</td>
<td>Neighborhood Complete Streets Commission</td>
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<td>5/28/19</td>
<td>Parks &amp; Recreation Commission</td>
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<td>6/3/19</td>
<td>Crystal City Civic Association</td>
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<td>6/3/19</td>
<td>Bicycle Advisory Committee</td>
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<tr>
<td>6/13/19</td>
<td>National Federation for the Blind – Potomac Chapter</td>
</tr>
<tr>
<td>Meeting Date</td>
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<tr>
<td>7/10/19</td>
<td>Pedestrian Advisory Committee and Bicycle Advisory Committee</td>
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<tr>
<td>8/15/19-8/18/19</td>
<td>Arlington County Fair</td>
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<tr>
<td>8/22/19</td>
<td>Our Shared Streets Pop-Up, Columbia Pike</td>
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<td>9/9/19</td>
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<td>9/11/19</td>
<td>Pedestrian Advisory Committee</td>
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<td>9/16/19</td>
<td>Commission on Aging</td>
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<td>Disability Advisory Commission</td>
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<td>9/20/19</td>
<td>Parking Day pop-up</td>
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<td>9/24/19</td>
<td>Parks and Recreation Commission</td>
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<td>10/3/19</td>
<td>Transportation Commission (For Endorsement of RTA)</td>
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<td>Scheduled for 10/16/19</td>
<td>Chamber of Commerce Government Affairs Committee</td>
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<td>Scheduled for 10/30/19</td>
<td>Transportation Commission (For Endorsement of Adoption of Ordinance)</td>
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<tr>
<td>Scheduled for 11/20/19</td>
<td>Ashton Heights Civic Association</td>
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ARLINGTON COUNTY
SHARED MOBILITY DEVICES (SMD)
PILOT EVALUATION REPORT

September 2019 / FINAL REPORT
Prepared for Arlington County, Virginia
Authors:
The following staff from Mobility Lab performed the pilot evaluation and developed this report for Arlington County:

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Funders:
This work was funded by the Virginia Department of Rail and Public Transportation (DRPT).

Collaborators:
The following Arlington County staff and contractors collaborated over the supervision of the SMD pilot operations, outreach and evaluation:

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- Melissa McMahan, Transportation Research and Site Plan Development - SMD Pilot Project Manager
- Erin Potter, Arlington County, SMD Pilot Communication specialist – Outreach Lead
- Alex Held, Arlington County, SMD Pilot Communication specialist – Outreach Lead
- Louie Al-Hashimi – Arlington County Intern – Mobility Inbox monitoring and analysis
- Paul DeMaio, MetroBike Principal - SMD Pilot operations
- Greg Matlesky, MetroBike - (former) SMD Pilot operations
- Zack DesJardin, MetroBike - SMD Pilot operations
- Henry Dunbar, DS&MG Active Transportation Director, Bike Arlington - Subject matter expert

Citations and Sources:
Any information or graphic extracted from this report should be properly cited.

Suggested Citation:


Tables and Figures: Mobility Lab, Arlington County Commuter Services (ACCS). (2019). [Figure 3: Available datasets for Arlington County’s SMD Pilot evaluation]. Arlington County Shared Mobility (SMD) Pilot Evaluation Report.
EXECUTIVE SUMMARY

In September 2018, the County Board in Arlington voted to launch a nine-month SMD demonstration project (pilot) intended to evaluate the community impacts of dockless electric-assist (e)-bikes and electric stand-up scooters, together referred to in the pilot program and throughout this report as shared mobility devices (SMDs). In June 2019, the pilot was extended for another six months until December 31st 2019, to allow enough time for staff to complete the necessary evaluation and recommendations.

By doing so, Arlington County joined many other cities, such as Portland, Oregon and Santa Monica, California, in piloting SMDs in their respective jurisdictions. Results from pilot programs undertaken in other cities indicate the potential for SMDs to advance sustainability, promote equity, and increase accessibility and mobility. They also document potential challenges such as community complaints pertaining to sharing the right-of-way and safety.

This report provides the results of the evaluation of the nine-month Arlington County pilot program, including trends in deployment, utilization and feedback from the community to understand SMD adoption and system performance in the context of Arlington specifically. SMD performance was primarily evaluated against Arlington County’s transportation goals as documented in the Master Transportation Plan (MTP), pertaining to increased mobility, accessibility, equity, sustainability and efficient management of transportation options.

The analysis proceeded in three main steps, looking first at pilot operations (i.e. the supply-side), then service utilization (i.e. the demand-side) and finally the community’s reaction to the pilot for both SMD riders and non-riders.

The key takeaways of this evaluation report are threefold. First, deployment and utilization of SMDs in Arlington have increased over the duration of the pilot with a firmly positive response from riders in Arlington. This report supports evidence pointing to SMDs providing a viable complement to the County’s transportation ecosystem that increases mobility options and provides potential sustainability benefits. Second, certain aspects of the pilot have shown mixed results for the community, including the focus on equity concerns, with one measure being a disparity in deployment (normalized by residential population) between North and South Arlington), and the need for clearer communication of rules and regulations to the Arlington community. Finally, the third key takeaway is that there remain some challenges with the integration of SMDs in Arlington that will need to be addressed. This includes safety concerns from the standpoint of riders, pedestrians and drivers in Arlington, pointing to the need for more adequate infrastructure (e.g. protected bike lanes), and community concerns over parking and clutter on the sidewalk resulting from the program.
Based on the results, eight main recommendations were derived as follows:

I. **Accelerate infrastructure investments to address rider and community safety and comfort concerns; focus on available route detail data**

   • Evaluate the possibility of increasing the share of protected bike lanes in key SMD corridors with the Rosslyn-Ballston corridor as a high priority given high ridership and elevated vehicle and pedestrian traffic.

II. **Continue working on innovative ways to address parking**

   • Communicate more stringent parking restrictions for operators – if addressable through technology – such as systematic restrictions by operators from parking at or near an intersection, outside residential or commercial entrances, in the middle of a sidewalk or near handicap parking space.
   • Provide operators with map of desired deployment areas in each neighborhood and conversely of no-parking areas.
   • Monitor and enforce operator response time in addressing parking complaints, where applicable.
   • Examine further potential for SMD-specific parking infrastructure such as corrals or lock-to devices.

III. **Create, monitor, and refine equity expectations, go beyond geography**

   • Monitor and enforce as required proportional deployment in specific target areas.
   • Perform more detailed equity and access analysis to ensure SMDs are being deployed in lower-income areas.
   • Aim to assess equity from three standpoints (1) accessibility (in terms of location and the need for a smartphone to unlock the mobility service), (2) existence of equity programs, and (3) payment methods (e.g. needing a credit card).

IV. **Focus on and invest in communicating the rules and regulations to the public, including riders and non-riders**

   • Establish clear guidelines and messaging that is consistent across county resources and operator information platforms (websites, apps, and devices).
   • Monitor operators’ messaging to ensure rules, regulations and rider resources are clearly communicated.
   • Suggest or mandate creative ways in which operators can better communicate rules and regulations including, more innovative methods such as quizzes\(^1\).
   • Clearly state when rules are different from neighboring jurisdictions such as Washington, DC.
   • Continue to conduct community outreach events, soliciting feedback and communicating how the county is addressing key community concerns flagged in this evaluation.

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\(^1\) Any such initiative should be done while balancing the importance of the convenience to riders so as not to negatively impact demand and the overall rider experience.
V. Continue monitoring operations and requiring complete and robust data from operators

SMDs are growing significantly while still at an early stage in terms of technology, best practices, and operational guidelines, making close monitoring a critical requirement for their continued operation.

- Require operators to comply with the data template and to submit additional operational data that they have not submitted yet (e.g. idle time, thefts and vandalism, broken SMDs, vehicle-specific trip and incident-level data).
- Require unified data (in terms of variables provided and format) from operators, allowing easier processing and cleaning of the data, which would leave more room for research and analysis.
- Monitor the difference between Washington DC and Arlington in terms of the service level (SMDs per 1,000 people).
- Monitor the difference between SMDs and Capital Bikeshare bikes in terms of the service level (SMDs per 1,000 people).
- Monitor incident rates such as broken SMDs and crashes with a specific focus on systematic or operator-specific patterns pointing to structural challenges.

VI. Share results and county initiatives with the public, make the integration of SMDs into Arlington an inclusive and interactive conversation

- Share key SMD-related studies with the public including how the County is thinking about sidewalks, the rationale behind opening them up to SMD ridership and how it envisions the coexistence between SMDs, pedestrians and bikers.
- Inform the public on how the County is dealing with speed limitations without compromising on safety, including how speed limits, if applicable, are monitored and how operators are held accountable.
- Address perceptions of lack of safety, a key challenge to SMD popularity or even acknowledgment. This could include undertaking a specific study on SMD safety, exploring alternatives available (e.g. helmets, bike lanes) and misconceptions, and share findings with the public.
- With assistance from Arlington law enforcement, provide insight into the SMD enforcement process and potential deterrents for infractions.
- Share the results of this pilot evaluation as well as experiences from pilots in other cities to provide comparison and benchmarking, which are critical with early-stage technologies.

VII. Collect or compile more robust data within and outside the SMD program and mandate periodic evaluation of SMD trends

A broader array of data sources could enable more accurate analysis of SMDs in Arlington. This could include:
• Daytime population for Arlington using more granular measures than county-wide can help with a better comparison of (1) who actually is demanding SMDs at any point and (2) between areas that receive higher levels of commuters/workers (e.g. North vs. South Arlington).

• More detailed income data than above or below median household incomes could help examine equity concerns more accurately.

• Request crash data from law enforcement and health services to start differentiating between scooters and other modes when dealing with incidents to improve tracking.

• Repeat SMD evaluations to assess SMD trends and truly characterize the service and its long-term evolution (e.g. crashes).

VIII. Undertake additional research or studies including more detailed analysis of specific issues of interest flagged in the pilot evaluation

This evaluation provides a valuable starting point in terms of flagging the most critical issues but has foregone detailed focus on specific issues in the interest of a holistic assessment of the SMD pilot. Several more detailed analyses could be undertaken with available data and separate longer-term studies and/or surveys incorporating learnings from this evaluation could help improve SMD system performance, rider experience and community responses, including:

Short term studies with available data

• Examining key results (e.g. perceptions) by sample segment including perception and experience by gender, primary mode, and frequency of use.

• Examining trip characteristic differences by corridor.

• Looking at trip characteristics by time of the day and weekends versus weekdays.

• Examining geographic distribution of operational problems – are incidents concentrated in one or more areas in Arlington? Do they correlate with elements of the infrastructure or land use?

• Taking a closer look at “late night travel”, potentially complemented with an intercept survey to characterize such trips and their link to accessibility.

• Examining the community’s reaction to the pilot before and after the installation of corrals - did complaints, operational challenges and trip change after the installation of corrals?

• Performing more sophisticated modeling of SMD behavior using attitudinal and demographic variables in order to understand the determinants of satisfaction, frequency, trip purpose etc.

• Conducting more sophisticated content analysis of the Mobility inbox data.

• Conducting more sophisticated correlation analysis based on bivariate maps obtained and discussed in this report.

Long-term studies with additional data

• Studying the impact of e-scooters on accessibility and comfort for people with disability.
• Collaborating with other pilot programs and leveraging findings from Arlington utilization rates to estimate an “adequate” level of service that planners should aim for in designing SMD programs. This would be a similar effort to the ITDP bike share planning.
• Evaluating acceptable levels of broken SMDs for new technologies or a new mobility service.
• Evaluating communication techniques for best retention rates within apps (tests, games etc.).
• Examining travel behavior from the perspective of mode substitution between cars/TNCs and SMDs.
• Developing performance measures for shared mobility devices.
• Developing a scoring system/service standard for performance measures to rank and evaluate operators, mandating a minimum service level for continued operation in Arlington County.

The results and the recommendations of this report should be read within the context of Arlington County and the data collected during the pilot. The limited time SMDs have been in operation and the corresponding limited data and research means that the characterization of SMDs and how cities manage them will continue to evolve. This makes it important for local policymakers to continue monitoring and collecting data in order to derive structural and systemic trends, accurately characterize these services and ensure their integration into the Arlington County transportation landscape that yields desired benefits while mitigating negative externalities.

**Arlington County’s SMD pilot program: key highlights**

**Service operations (i.e. “Supply”)**

• The pilot was launched with an average of 706 daily SMDs deployed with two operators and ended with 806 SMDs deployed in June with six operators. It fluctuated in between, with the lowest deployment occurring during winter months.
• Most of the SMD deployment was concentrated in the Rosslyn-Ballston (45%) and Route 1 corridors (10%) with Columbia Pike less well-served by SMDs when accounting for respective residential population.
• Arlington County received more service per population (4.0 SMDs per 1,000 people) than Washington DC (2.4 SMDs per 1,000 people) and Capital Bikeshare bikes in Arlington (3.1 SMDs per 1,000 people).
• North Arlington received 1.3 to 2.5 times more service than South Arlington.
• Ten main operational challenges were identified in the pilot consisting of: (1) inconsistent deployment of SMDs, (2) problematic deployment sites such as bus stops and pedestrian right-of-way on sidewalks, (3) high operating speed, (4) sidewalk riding, (5) broken SMDs, (6) stolen and vandalized SMDs, (7) idle SMDs, (8) incorrectly parked SMDs, (9) crashes and injuries and (10) data. Five of the operational challenges are also breaches of the MOA.
• There were 69 crashes in total between October 2018 and June 2019. Those resulted in approximately 29 injuries².
• In terms of the adequacy of the pilot-related information supplied during to the pilot:
  o 20% of non-riders received their information on the SMD pilot from Arlington County’s website.

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² See body of the report for a discussion of crash data and safety analysis limitations.
20-22% of SMD riders and 43% of non-riders did not know what the “laws” are.

Less than half of respondents (45%) indicated that they had received information from operators on local regulations, and less than a third (30%) indicated that they received information from operators on how to file a complaint.

Service utilization (i.e. “Demand”)

- There was a total of 453,690 SMD trips in Arlington County between October 2018 and June 2019.
- The lowest-trip months were January and February (around 23,000 trips each month) and the highest trip month was May (around 80,000 trips).
- The average trip distance was 0.94 miles and 90% of trips were for less than two miles. SMD riders traveled a total of 425,124 miles in Arlington between October 2018 and June 2019.
- The average trip duration was 14 minutes.
- 25% of trips occurred during peak travel times with 12% of trips taking place during the morning peak and another 13% of trips (approximately 58,500 trips) during the afternoon.
- 70% of trips took place during weekdays while 30% of trips took place on weekends, although Saturday ridership was the highest day of ridership over the nine-month period.
- Most riders remain within the bounds of the County, with 89% of trips starting and ending in Arlington.
- Most trips and routes clustered around the two main transit/commercial corridors – the Rosslyn-Ballston corridor and Route 1 corridor.
  - The Rosslyn-Ballston corridor included 60% of trip origins and 55% of trip destinations. Within the Rosslyn-Ballston corridor, key e-scooter arterials included the Key Bridge (in and out of Washington DC), N Lynn Street, Wilson Boulevard, Clarendon Boulevard, and 9th Street between Clarendon and Wilson boulevards is also used.
  - The Route 1 corridor included 17% of trip origins and 35% of trip destinations. For this corridor, 12th St S, S Eads St, and S Crystal Dr were areas of highest use.
  - The Columbia Pike corridor recorded fewer trips, with 4% of trip origins and 5% of trip destinations.
- In terms of infrastructure use, bike lanes were most used with 62% of e-scooter riders always-to-often using bike lanes, followed by shared lanes with cars (24%). The least-used facility was trails.
- SMD- riders preferred to ride on protected bike lanes (67% of respondents chose it as a top or second choice) followed by regular bike lanes (47% of respondents chose it as either a first or second choice). The least-preferred facility was sharing travel lanes with cars, and sidewalks were second-least preferred.
- Trips occurred in areas of high transit supply with scooter trips originating 0.38 miles away from a Metrorail station and ending 0.48 miles away from a Metrorail station. Ballston Metrorail has the most trips in its vicinity (78,000 parking events within 500 meters\(^\text{3}\)).
- The feedback form pointed to social and/or entertainment (21% of e-scooter riders) as the category most cited as a primary trip purpose for using e-scooters in Arlington, followed by shopping or errands (18% of e-scooter riders) and connecting to Metrorail (18% of e-scooter riders).
- When asked about the mode they would have used to make the trip, 37% of e-scooter riders and 22% of dockless e-bike riders indicated replacing walking, while one in five SMD riders indicated replacing

\(^3\) 500 meters is equivalent to 0.31 miles.
a ride-hailing trip, and 13% indicated replacing a personal car or other motor vehicle (for a total of
32% of e-scooter riders having replaced an automobile trip).

• The online feedback form provided some preliminary insights into SMD rider profiles. In particular, a
larger proportion of rider respondents were male (63%) than were female (37%), and rider-
respondents reported a relatively lower average age than non-rider (more than 63% of e-scooter
riders born after 1980 (compared to 22% for non-SMD riders). In terms of occupation and education,
the largest proportion of riders was made up of full-time employees (66% for e-scooters and 63% for
dockless e-bikes) and with a lower rate of advanced degrees (34% for e-scooter riders) than non-rider
respondents (51%), yet still educated.

The community’s reaction to the pilot

• When asked about why they use SMDs in Arlington County, the majority of e-scooter rider
respondents (55%) selected “to get around faster” as one of their top three choices. This was followed
by “convenient” (44%) and “fun to ride” (36%).

• When asked about why they haven’t used e-scooters in Arlington in a close-ended form, the first
popular choice was “I don’t think e-scooters are safe” selected by 58% of non-SMD riders and 32% of
dockless e-bike riders and the third most popular choice was “I feel unsafe riding in the street”
selected by 36% of non-SMD riders and 21% of dockless e-bike riders. This suggests that the main
barrier to using e-scooters in Arlington pertain to the adequacy of the infrastructure or a safe place
to ride.

• When asked about specific measures that could lead them to start using SMDs, most non-SMD riders
(68%) said that “none of these changes would encourage them to start using SMDs”. For e-scooter
riders, the most popular responses for what would make them use e-scooters more often were “safer
places to ride” (51% for e-scooter riders and 44% for dockless e-bike riders), and “more e-scooters
available in Arlington” (42% for e-scooter riders and 27% for dockless e-bike riders).

• When asked what infrastructure would make them feel safer, most SMD riders (e-scooter riders and
dockless e-bike riders) wanted bike lanes separated from motor vehicles traffic with a physical barrier
while most non-SMD riders wanted designated e-scooter parking.

• When asked which type of problems they encountered, 36% of e-scooter rider respondents chose
“none of the above”. Of the remaining 64%, the majority (60%) encountered either mechanical issues
with their e-scooters or issues unlocking/locking e-scooters via the mobile app.

• When asked about safety and comfort around e-scooters as pedestrians and drivers, the analysis
revealed a difference in perception between SMD riders and non-SMD riders.
  o 73% of non-SMD riders who responded to the survey did not feel safe as pedestrians around
riders on e-scooters as opposed to 41% of dockless e-bike riders, and just 15% of e-scooter
riders.
  o 65% of non-SMD riders reported often to always encountering blocked sidewalks due to e-
scooters being improperly parked compared to 43% of dockless e-bike riders and only 16% of
e-scooter riders.
  o 76% of non-SMD riders reported being very uncomfortable to uncomfortable as drivers in
Arlington County around riders on e-scooters compared to 47% of dockless e-bike riders and
only 21% of e-scooter riders.

• The online feedback form also included open-ended questions about the impact of improperly parked
SMDs. Out of the people who responded to this question (2,876, 71%), a plurality (884 responses, or
31% of total open-ended responses received) qualitatively suggested that SMDs block the path of pedestrians in sidewalks, driveways, and other common-use areas in Arlington County. After that, the responses were mixed with the same share of respondents (14%) qualitatively stating a safety concern on one hand and no to minimal negative impact on the other.

- The analysis also examined voluntary, self-initiated emails received to the Mobility Inbox (mobility@arlingtonva.us). A total of 727 emails were received to the Mobility inbox. The number received each month decreased significantly over the course of the pilot, from October (226 e-mails) to June (38 e-mails). This is consistent with staff’s experience running a similar email account for the free-floating car-sharing services during that pilot program.

- Key topics in the emails received to the Mobility inbox included: “parking” followed by sidewalk riding, safety, rider behavior and underage riding.

- Additionally, outreach community events in Arlington were an important source of community feedback. Most intercepted respondents confirmed that the pilot has challenges, but the majority expressed an interest in resolving issues rather than ending the program. This summarizes an important (qualitative) perspective of people who potentially did not have access to the online feedback form. The documented difference or more positive reaction to the pilot should be taken into consideration when evaluating the Arlington Community’s reaction to the pilot, potentially offsetting in part some biases in self-selected complaints received through the Mobility Inbox or the feedback form.

### SMDs vs. Capital Bikeshare: key measures

<table>
<thead>
<tr>
<th></th>
<th>SMD (pilot period)</th>
<th>Capital Bikeshare (2018)</th>
</tr>
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<tbody>
<tr>
<td>Total trips</td>
<td>453,690</td>
<td>261,129</td>
</tr>
<tr>
<td>Total distance (miles)</td>
<td>425,124</td>
<td>511,887</td>
</tr>
<tr>
<td>Average trip distance (miles)</td>
<td>0.94</td>
<td>1.96</td>
</tr>
<tr>
<td>Average trip duration (minutes)</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Service level</td>
<td>4.0 SMDs/1,000 people</td>
<td>3.1 SMDs/1,000 people</td>
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Glossary of terms

Dockless e-bikes: electric-assist bikes that do not require a station.

E-scooter: electric-assist scooters (e-scooters) that do not require a station.

Rosslyn-Ballston Corridor (RB Corridor): Spanning two square miles, is composed of the Rosslyn, Ballston, Courthouse, Clarendon, and Virginia Square neighborhoods of Arlington, VA.

Route 1 corridor (formerly Jefferson Davis, now Richmond Highway) Corridor: Includes key nodes in Pentagon City and Crystal City and is served by four Metrorail stations.

Shared Mobility Devices (SMD): SMDs were the devices vendors entered into the pilot program, including pedal bikes, electric-assist bikes (e-bikes), and electric-assist scooters (e-scooters) that do not require a station, as is required by the County's station-based Capital Bikeshare service.

Glossary of abbreviations

ARL: Arlington County, VA
ICT: Information and Communication Technology (e.g. smartphones)
MOA: Memorandum of agreement
MPH: Miles per hour
R-B Corridor: Rosslyn-Ballston corridor
ROW: Right of Way
SMD: Shared Mobility Devices
CHAPTER 1: INTRODUCTION

Transportation is an inherently complex and dynamic sector. It is multidisciplinary, ever-evolving and cuts across many vital dimensions for communities such as public health, livability, sustainability and the regional economy. While these numerous linkages make transportation interesting to examine, plan for and regulate, its complexity also makes such efforts all the more challenging.

Today, the transportation ecosystem is as dynamic as ever with the advent of technology-fueled and shared mobility solutions such as car and bike-sharing, ride-sourcing and, most recently, dockless bikes and e-scooters. In the United States, since first emerging at a commercial scale in 2017, e-scooters and dockless bikes have gained market share at a faster rate than any new mobility service in recent history\textsuperscript{v}. The National Association of City Transportation Officials (NACTO) estimated the combined trip count of scooters and dockless bikes throughout the U.S. in 2018 to have outpaced that of the nearly decade-old station-based bikesharing systems\textsuperscript{v}. The ubiquity of smartphones and ease of app-based transactions, flexibility and convenience of dockless parking and pick-ups, lack of pre-requisites and ease of use of e-scooters have all contributed to the rapid growth in ridership.

However, the sudden emergence of dockless e-bikes and e-scooters, or shared mobility devices (SMDs) as defined by Arlington’s pilot, across urban areas throughout the world has created a new challenge for local governments. Local policymakers now face the challenging task of effectively integrating the influx of new transportation devices within the existing transportation ecosystem. This involves achieving a delicate balance between facilitating the growth of popular innovative solutions with potential long-term sustainability benefits on one hand and creating an effective regulatory framework that mitigates its potential negative externalities for the existing transportation infrastructure, pedestrians and residents on the other.

To deal with these partially conflicting objectives, some local governments around the U.S. (such as Santa Monica, CA, Portland, OR, and Washington, DC) created pilot programs with operators. These pilots provided an opportunity for policymakers to study SMD operations and conclude on the impact of these services on the urban environment and local communities.

In Arlington, the County Board approved a nine-month SMD pilot project at the September 25, 2018 County Board meeting. The project is intended to evaluate the impacts of dockless bikeshare bikes and electric stand-up scooters (i.e. SMDs). The pilot was originally intended to go from October 1, 2018 until June 30, 2019 but was subsequently extended through December 31, 2019 at the June 2019 County Board meeting to allow enough time for staff to complete the necessary evaluation and recommendations. This report summarizes that evaluation.

The objective of the evaluation is to understand what the collected data on SMDs over the first nine-month period of the pilot can tell us about the performance of these new shared mobility options, how we manage them, regulate them and plan for them. For this purpose, the performance of SMDs in Arlington was checked against five main goals as described in Arlington County’s Master Transportation Plan (MTP)\textsuperscript{vi}.
• Providing High-Quality Transportation Services
• Moving More People Without Traffic and Advancing Environmental Sustainability
• Promoting Safety
• Establishing Equity
• Managing Effectively and Efficiently

This report documents the pilot program’s evaluation objectives, methods and results. The first chapter provides an overview of Arlington’s SMD pilot and a review of the limited literature on SMDs to provide context for the analysis. The second chapter describes the research approach, including the evaluation questions, main datasets and methodology used for the analysis. The third chapter describes the results in terms of: (1) pilot operations, (2) utilization, and (3) the community’s reaction to the pilot.

CHAPTER 2: BACKGROUND

Before delving into the evaluation methods and results, this chapter provides an overview of Arlington County demographics and transportation, a brief description of the pilot and a quick review of shared mobility devices pilot findings to-date. This is meant to provide context for the rest of the analysis.

A brief overview of Arlington County

The results of the evaluation of the pilot should be read within the context of Arlington County. The local environment is unique in many ways, including demographics and socio-economic conditions, geographic proximity to the Washington DC metropolis and an abundance of transportation options. Below are key points to keep in mind while reading the results of the pilot as described in this report.

• Arlington has an estimated population of 226,400 residents.
• Arlington has an estimated 227,000 at-place employees.
• Arlington County is the most educated county in the Nation: 74% of residents have a bachelor’s degree or higher and 39% have a graduate or professional degree.
• Arlington offers many transportation options with 11 Metrorail stations, 17 ART bus routes, 92 Capital Bikeshare stations, and over 100 miles of biking, walking, and jogging trails.
• The average household size in Arlington is 2.2, below the average size of 2.6 in the U.S.
• The median household income is $112,138/year, slightly less than double the U.S. average.
• 2015 Arlington commute patterns as estimated by the 2015 Arlington Resident Travel Survey:
  o Commuters drove alone to work for 41% of their total weekly trips
  o Commuters rode a train for more than 27% of their trips and ride a bus for 12% of their weekly trips
  o Commuters rode a bike for 5.2% of their weekly trips
  o Commuters walked for 4.3% of their weekly trips
  o Commuters rode taxi for 0.2% of their commute trips and Uber/Lyft for 0.5% of their commute trips

4 This summary is based on Arlington 2019 as developed by Arlington County; Image taken from Arlington County Profile 2018.
A brief overview of the pilot

**Timeline.** The SMD pilot program’s timeline is illustrated in Figure 1 below and covers the period between the initial approval of the pilot in September 2018 to the end of the pilot extension in December 2019.

![Arlington SMD Pilot Timeline](image)

*Figure source: Developed by Mobility Lab, ACCS. Template from Microsoft Office 365 templates.

**Figure 1 Arlington SMD Pilot Timeline**

**The participants.** As described in the timeline, seven operators were issued permits to operate in Arlington County: Bird, Bolt, Lime, Lyft, Skip, Spin and Jump. Jump did not deploy any SMDs between October and June and is therefore not part of this evaluation. Lime is the only company to have deployed dockless e-bikes during the evaluation period.

**The agreement.** The issued Memorandum of Agreement (MOA)\(^5\) describes the conditions for participation in the pilot as follows:\(^5\):

- Companies are required to pay an $8,000 permit application fee per mode to assist with County costs for monitoring, management and evaluation (an additional $5,000 fee would be levied for the pilot extension)
- Fleet cap of 350 devices per mode per company with opportunities for growth based on performance;
- Speed limits of 10 mph (adjusted to 15 mph during the course of the pilot) and 20mph\(^6\) for e-scooters and e-bikes, respectively
- Data-sharing requirements similar to those of the regional Capital Bikeshare service

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\(^6\) The top speed for e-bikes was adjusted up from 15 mph to 20 mph during the course of the Pilot.
Various operational requirements regarding parking, device safety, ridership restrictions, and customer service

Community resources. Arlington County created a specific email address for community feedback (complaints and compliments) at mobility@arlingtonva.us, identified as the Mobility Inbox. In addition, Arlington County communications staff participated in a series of 10 community events during the pilot.

Equity considerations. The SMD services were not restricted to or from any area in Arlington. In addition, operators offered five equity-oriented options for individuals who qualify for a state or federal assistance program: (1) Bird’s text to ride feature and one bird program, (2) Bolt forward, (3) Lime access, (4) Lyft community pass and (5) Skip’s rider accessibility program. These include a combination of solutions from waiving the unlocking fee ($1) to a discount (e.g. 50%) on all rides to a low fee for unlimited free 30-minute rides. Detailed information on equity programs is available to riders on the Arlington County website at https://transportation.arlingtonva.us/scooters-and-dockless-bikeshare/.

A brief overview of SMD literature to-date

Dockless e-bikes and e-scooters are relatively new entrants in the urban transportation landscape, with limited data collected and research performed to truly characterize these services and their impact on transportation systems. Nevertheless, the early literature reveals some unified themes along several important dimensions.

SMDs are popular and gaining market share at a rapid pace. The most comprehensive assessment of SMD penetration data to date comes from NACTO®. They suggest that the number of SMD trips taken surged from less than a million trips in 2017 to an estimated 47.5 million trips in 2018. According to Populus, a company that processes a wide array of SMD data, this rapid expansion of trips taken by SMDs suggests that this service appeals to a diverse group of people. This adoption rate, according to studies they have reviewed, could push the market for micro-mobility to include between 8% to 15% of all trips under five miles and grow to $200 billion to $300 billion in the U.S. alonexi. Data also shows significant market penetration in Europexii.

This market adoption comes with significant potential for expanding transportation optionsxiii, promoting equity and advancing sustainability. SMDs represent an expansion of transportation options for some types of trips such as short trips (i.e, Portland’s pilot showed that 71% of e-scooter riders use e-scooters most frequently to get to a destination)xiv, first and last-mile connections to transit but also provide desirable services to under-served segments of the population. Early signs of higher adoption rates for womenxv and low-income groupsxvi relative to existing active transportation options reflect this trend.

In fact, several SMD operators have rolled out equity programsxvii, xviii that could increase accessibility of low-income neighborhoods to affordable transportation options and connectivity to other transportation modes such as transit. Nevertheless, pilot evaluation studies show that there is still room for these services to gain traction as only 43 people were enrolled in equity programs in Portland and less than 100 people per company in San Franciscoxx. In comparison, Portland numbers are slightly below Capital Bikeshare numbers in Arlington, that had 131 participants with active accounts in the Community Partners (equity) Program in calendar year 2018. Those members took 2,857 trips in 2018.
In terms of advancing sustainability, SMDs could act as a complement to a multimodal system, promoting transit use and decreasing the need to own a car or travel by car, especially for short trips. Some cities are devoting resources to promote transit connectivity of SMDs, such as Denver requiring e-scooters to be readily available at transit and bus stops. Results from the Portland pilot e-scooter survey revealed that 6% of riders reported getting rid of their car and 16% said they considered it because of scooters.

SMDs have also been found to potentially (1) promote adequate infrastructure for sustainable active transportation and (2) provide an active transportation alternative for women to services such as docked bike share, which have historically seen a gender skew due to safety concerns, with SMDs potentially helping close the gender gap in active transportation. Results from the Portland pilot showed that e-scooters could be bringing more people (not only women) to active modes whereby 42% of survey respondents who used e-scooters reported having “never” biked before.

While there are clear positives, there are also important concerns that have emerged as a result of SMDs and their management, mainly pertaining to safety, community embrace and infrastructure use.

Several studies published in 2019 looked at the safety of scooters. Santa Monica researchers found that people going into the hospital for scooter injuries was 50 times more than for bike injuries in the same year. Another study by the Centers for Disease Control and Prevention (CDCP) examined injuries in Austin to find that there were 20 individuals injured per 100,000 trips for e-scooters taken during the three-month period. In comparison to other modes, by looking at an absolute measure of e-scooter injuries, the City of Baltimore showed that e-scooters are less dangerous than other modes (8.8 injuries per 1,000 drivers each year compared to 0.66 injuries per 1,000 scooter users each year). Other major pilot evaluation reports did not make comparisons, potentially due to the lack of comparative data (e.g. total number of trips and miles traveled for bike and pedestrians) as Portland’s evaluation points to. SMD companies are showing more commitment to prioritize the safety of the community in the services they supply. For example, Lime started a Public Policy and Safety Advisory Board in July 2019 to determine what research and policy initiatives to undergo, and what regulations to advocate for to overcome safety concerns of cities and riders. Studies have shown that a third of incidents occur on first use, suggesting familiarity and time could help mitigate some of the safety issues associated with a novel technology and inexperienced riders.

In terms of infrastructure use and community embrace, studies have documented complaints mainly pertaining to e-scooters blocking sidewalks. However, time, familiarity and experience with the services could help bridge this divide to some extent as results from the Virginia Tech survey showed a distinct difference in perception between those who have tried the services and those who had not.

Aside from these overarching themes, early results from pilot evaluations such as Portland, Santa Monica, Baltimore City and Washington DC offer useful insights into what people are using SMDs for, their attitudes towards them, the impact of SMDs on sustainability, the differences in adoption based on demographics, frequency of use, and what would make people use them more. These are summarized in Table 1 below.
Table 1 Review of key results from pilot evaluations across the U.S.

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>SMD TRIP PURPOSE</th>
<th>ATTITUDES TOWARDS SMDS</th>
<th>SMDS AND SUSTAINABILITY</th>
<th>SMDS BY DEMOGRAPHICS</th>
<th>FREQUENCY OF SMD USE</th>
<th>WHAT WOULD ENCOURAGE RIDERS TO INCREASE SMD USE?</th>
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<tr>
<td><strong>PORTLAND</strong>&lt;sup&gt;xxxiv&lt;/sup&gt;,&lt;sup&gt;xxxv&lt;/sup&gt; (E-SCOOTERS)</td>
<td>Transportation/commute to work or work-related (30%) and fun/recreation (28%)</td>
<td>85% of surveyed Portlanders were “extremely” or “very likely” to recommend e-scooters to a friend</td>
<td>Replacing automobile trips. 34% would have driven a personal car (19%) or hailed a taxi, Uber or Lyft (15%) on their last trip</td>
<td>E-scooters more popular among men (62%) than women (36%).</td>
<td>19% only ridden once and 26% ride one to three times per week</td>
<td>58% said &quot;more e-scooters available,&quot; 44% said &quot;safer places to ride 9% said e-scooters with seats.</td>
</tr>
<tr>
<td><strong>SANTA MONICA</strong>&lt;sup&gt;xxxvi&lt;/sup&gt; (ELECTRIC SCOOTERS AND BICYCLES)</td>
<td>Work (31%) and recreation trips (23%)</td>
<td>N/A</td>
<td>50% of respondent’s most recent trips displaced a car trip</td>
<td>Skews young, male, and affluent</td>
<td>44% used it less than once a week, 30% used it one to three times per week and 26% used it more than three times per week</td>
<td>N/A</td>
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<td><strong>WASHINGTON DC</strong>&lt;sup&gt;xxxvii&lt;/sup&gt;</td>
<td>N/A</td>
<td>415 public comments</td>
<td>N/A</td>
<td>N/A</td>
<td>Of those who used them:</td>
<td>N/A</td>
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<td></td>
<td>The majority supported the program</td>
<td></td>
<td></td>
<td></td>
<td>50% of respondents at least once a week</td>
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<td></td>
<td>The primary negative concern was clutter, blocked pedestrian</td>
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<td></td>
<td></td>
<td>21% used them daily</td>
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<tr>
<td>SMD TRIP PURPOSE</td>
<td>ATTITUDES TOWARDS SMDs</td>
<td>SMDS AND SUSTAINABILITY</td>
<td>SMDS BY DEMOGRAPHICS</td>
<td>FREQUENCY OF SMD USE</td>
<td>WHAT WOULD ENCOURAGE RIDERS TO INCREASE SMD USE?</td>
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<td>BALTIMORE CITY\textsuperscript{xxxviii} (E-SCOOTERS AND BICYCLES)</td>
<td>Most cited was “socializing” followed by “commute”</td>
<td>40% for the pilot, 29% against it and 31% had a mixed feeling about it</td>
<td>Providers estimate that the equivalent of 738,150 pounds of carbon emissions was avoided</td>
<td>Younger people again being more likely to have used the vehicles. Usage by gender and by race did not vary as greatly, indicating that the vehicles appeal to a range of riders</td>
<td>32% few times a week, 31% few times a month, 19% only once or twice</td>
<td>More scooters and safe places to ride most cited options</td>
</tr>
<tr>
<td>OTHER RESEARCH REPORTS – NOT CITY-SPECIFIC</td>
<td>Around 35% use it to commute and another 35% use it for recreation/exercise (NACTO)</td>
<td>70% of people in major cities perceive SMDs positively. (Populus)</td>
<td>70% of people viewed e-scooters “as a way to get around without the hassle of owning a car, a substitute for short driving trips, a complement to transit”</td>
<td>The gender gap might be smaller for SMDs than for prior bikeshare services: 3.2% of women have tried electric scooters, compared to 4.4% of men.</td>
<td>N/A, N/A</td>
<td></td>
</tr>
</tbody>
</table>

\textsuperscript{*}N/A indicates that it was not discussed in the published study
CHAPTER 3: RESEARCH APPROACH

Given this context, the research team developed a research and evaluation approach that would enable Arlington County to uncover what it could learn from the utilization and performance of SMDs in Arlington during the pilot in order to better plan for and regulate the penetration of SMDs into the local transportation ecosystem.

To this end, the evaluation approach consisted of examining whether and how performance measures and community feedback pertaining to these innovative mobility services fit within Arlington County’s transportation goals as laid out in Arlington’s Master Transportation Plan (MTP). In addition, the research approach also targeted informing what additional planning, rules or regulations from local policymakers could be required to improve this fit. The detailed research and evaluation objectives and data used for this research effort are presented in this section.

Main research and evaluation objectives
The research and evaluation objectives of this study are presented in this section in the form of the questions it seeks to answer to the extent possible given data available, organized within the framework of the six goals set forth in Arlington’s MTP as described in Figure 2 below:
Figure 2 Evaluation objectives and research questions

**Goal 1: Provide high-quality transportation services**
*Defined by MTP as: Provide high-quality transportation services for all riders and modes.*

- Has the level of SMD service in Arlington during the pilot been adequate given rider demand?
- Is the public receiving enough information on how to interact with these “new” services?
- Is the Arlington infrastructure adequate to support a smooth operation of these services?
- Are these services increasing residents’, workers’ and visitors’ access to activities?
- Is the rate of broken SMDs adequate?

**Goals 2 & 6: Move more people without traffic & advance environmental sustainability**
*Defined by MTP as: Provide more travel choices and reduce the relative proportion of single occupant-vehicle (SOV) travel. Reduce the impact of travel on community resources including air and water quality, and increase energy efficiency.*

- Are SMDs substituting for car trips?
- Are SMDs providing a differentiated and useful complement to Arlington’s multimodal transportation system in such a way that it would allow riders to require less cars or SOV uses?

**Goal 3: Promote safety**
*Defined by MTP as: Provide transportation system operations that are safe and secure, and enable prompt and effective emergency response.*

- Do crash rates confirm that SMDs are relatively safe?
- Do riders and non-riders feel safe around SMDs?

**Goal 4: Establish equity**
*Defined by MTP as: Serve the mobility and accessibility needs of all residents regardless of age, income, or ability.*

- Are lower-income residents adequately served by SMDs compared to higher-income residents?
- Do SMDs help Arlington County cater to the needs of disadvantaged segments of the population and promote equity?
- Are SMDs negatively affecting accessibility and comfort for people with disability? (e.g. scooters parking on sidewalks and ramps)

**Goal 5: Manage effectively and efficiently**
*Defined by MTP as: Fund, develop, manage, and maintain transportation facilities and services in an equitable and cost-effective manner.*

- Have operators been compliant with the memorandum of agreement (MOA) framing their participation in the Arlington County SMD pilot project?
- Are the current rules and regulations governing the use of SMDs in Arlington adequate given what has been learned from the pilot project?
- Are community’s expectations being managed well for both users and non-riders?
- Are adequate resources being devoted to the management of SMD deployment and operations?
Data and methodology

At the core of the evaluation and analysis that this study sets out to perform is the collection of primary and secondary data, which together help build a comprehensive picture of the SMD pilot from the perspective of both system performance and impact on the community. Several data sources were available to Arlington County researchers in order to conduct the evaluation of the SMD pilot, including but not limited to direct data from operators, data collected from residents and riders through online surveys and feedback forms, direct feedback from the community and third-party sources. The breadth and depth of data used in this study is summarized in Figure 3 below.

**Primary data** is defined as data that is solely collected and stored for the purpose of evaluating SMDs in Arlington within the context of the pilot program. **Secondary data** is data collected by Arlington County or other entities (including operators or third-party data providers) for other purposes that were made available to the research team as inputs for the evaluation of SMDs.

Data can be categorized into qualitative and quantitative datasets:

- **Qualitative datasets** are important in terms of offering a platform for the Arlington County community to express (without any pre-determined research questions from researchers) their opinions and experiences with the SMD pilot. This data collection effort is valuable in that it reflects community feedback without being pre-structured by researchers. Examples of such data
include submitting compliments and complaints to the *Mobility Inbox* ([mobility@arlingtonva.us](mailto:mobility@arlingtonva.us)), communicating opinions to staff or participating in outreach events.

- **Quantitative datasets** help measure and quantify the performance of SMDs and the opinions of the community and SMD riders on a larger and more statistically significant scale. Quantitative data collection efforts, including an online feedback form and survey (conducted with the help of Virginia Tech University) were based on best practices in survey design.

A detailed summary of the type, description and discrete objective of each dataset collected and used in this study is provided in Table 2 below. A detailed explanation of the data collection methodology for each subset is provided thereafter.

Table 2 Arlington SMD pilot evaluation datasets

<table>
<thead>
<tr>
<th>Data</th>
<th>Data Type</th>
<th>Description</th>
<th>Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobility Inbox</td>
<td>Primary</td>
<td>Qualitative Dedicated email address: <a href="mailto:mobility@arlingtonva.us">mobility@arlingtonva.us</a></td>
<td>Platform for Arlington County community to voice opinion; unguided/unstructured feedback</td>
</tr>
<tr>
<td>Staff oversight</td>
<td>Primary</td>
<td>Qualitative Experience with day-to-day operations and insights from outreach activities</td>
<td>Leverage all sources of information available for the pilot</td>
</tr>
<tr>
<td>Outreach events - County in-person outreach (pop-up engagements)</td>
<td>Primary</td>
<td>Quantitative /Qualitative In-person engagement in school and family events, farmer's market, Metrorail stations and community events</td>
<td>Support the online feedback form the broad community and shared devices - reach people who would not have otherwise clicked the survey</td>
</tr>
<tr>
<td>County online feedback</td>
<td>Primary</td>
<td>Quantitative Online survey to gather information from all stakeholders</td>
<td>Assess rider experience and perceptions regarding the pilot and identify issues; collect data that is not available in the operator’s data</td>
</tr>
<tr>
<td>Virginia Tech Survey</td>
<td>Secondary</td>
<td>Quantitative Online survey by Virginia Tech students on pilot utilization and perception restricted to Rosslyn</td>
<td>Assess utilization, demographics and perceptions</td>
</tr>
<tr>
<td>Operator’s data</td>
<td>Secondary</td>
<td>Quantitative Trip data submitted monthly by operators</td>
<td>Information on deployment and utilization</td>
</tr>
<tr>
<td>Populus</td>
<td>Secondary</td>
<td>Quantitative Interface for all SMD deployment and utilization</td>
<td>Aggregation; real-time representation of deployment and use</td>
</tr>
<tr>
<td>County Channels – Arlington County Crash Tracker</td>
<td>Secondary</td>
<td>Quantitative crash data collected from local law enforcement and health services VHC- Hospital data; Police; TE&amp;Os</td>
<td>Mainly to obtain crash data</td>
</tr>
</tbody>
</table>

The *Mobility Inbox*. The Mobility Inbox is an e-mail address and inbox made available via Arlington County’s website soliciting feedback from the community and accessible to all. Starting in October 2018, all complaints received in the Mobility Inbox were screened for keywords and language corresponding to categories of inquiries related to the SMD Pilot Program. These categories include common topics of interest such as: *parking*, *sidewalk riding*, and *underage riding*. Using this methodology, one complaint can be tallied under multiple categories (e.g. a single complaint about parking and sidewalk riding would be counted once in each category). As such, the sum of tallies for each category does not equal the number of comments received.
**Staff oversight.** Since the pilot was launched in October 2018, Arlington County staff and contractors have been closely monitoring its progress, accumulating important experience and knowledge that helped inform operations and provided valuable context to the evaluation. Moreover, Arlington staff at the leadership level communicated any and all direct feedback from the community that fed into this analysis.

**Arlington outreach: in-person engagement.** Throughout May and June, community engagement staff from the Department of Environmental Services (DES) brought information and displays to ten community events around Arlington (See Table 3 below) to provide opportunities for feedback. Staff engaged over 970 individuals, collecting 120 intercept feedback forms and receiving over 400 preferences on mitigation options and over 50 new ideas.

Table 3 Arlington County SMD outreach events and timeline

<table>
<thead>
<tr>
<th>Date (2019)</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Friday, May 17</td>
<td>Bike to Work Day: Rosslyn Gateway Park</td>
</tr>
<tr>
<td>2 Friday, May 17</td>
<td>New District Brewing: Shirlington</td>
</tr>
<tr>
<td>3 Saturday, May 18</td>
<td>Big Truck Day: Columbia Pike Library</td>
</tr>
<tr>
<td>4 Sunday, May 19</td>
<td>Ballston Quarterfest: Ballston</td>
</tr>
<tr>
<td>5 Saturday, June 1</td>
<td>Marymount Farmers Market: Marymount University</td>
</tr>
<tr>
<td>6 Sunday, June 2</td>
<td>Westover Farmers Market: Westover Library Plaza</td>
</tr>
<tr>
<td>7 Friday, June 7</td>
<td>Fridays at the Fountain: Crystal City Waterpark</td>
</tr>
<tr>
<td>8 Saturday, June 8</td>
<td>Arlington Farmers Market: Courthouse</td>
</tr>
<tr>
<td>9 Wednesday, June 12</td>
<td>Rosslyn Farmers Market: Central Place Plaza</td>
</tr>
<tr>
<td>10 Saturday, June 15</td>
<td>Columbia Pike Bluesfest: Columbia Pike</td>
</tr>
</tbody>
</table>

Attendees were invited to consider how Arlington could improve its demonstration project by reviewing a display board with different mitigation options. The options presented were selected by reviewing how other cities have been addressing commonly reported issues. Attendees were invited to place stickers on preferred options or propose their own new idea. Depending on the event, attendees were also given the opportunity to complete a shorter version of the feedback form or an information card with a link for the online feedback form. A hundred respondents completed the shorter version of the online feedback form.

**Virginia Tech survey.** Virginia Tech’s urban affairs and planning studio class for Spring 2019 performed a study on SMDs in Arlington and developed a survey in collaboration with Arlington County that was distributed to the Rosslyn Community. Although limited geographically to the Rosslyn area, this survey served as important template and test-case for the longer feedback form that was designed for Arlington County, discussed below.

**Arlington online feedback form.** The research team designed an online feedback form aimed at complementing operators’ data to give a better understanding of Arlington’s community’s experience and satisfaction with the SMD pilot. The survey was inspired by Virginia Tech’s survey (itself inspired by Portland’s survey to assess its own SMD pilot program) but expanded to include questions particular to Arlington County’s evaluation objectives. The feedback form was designed into four sections as described in Figure 4 below:
The feedback form was pre-tested internally by Arlington County to check for wording confusion and question fatigue and was revised accordingly before release to the public. The survey was open from May 15 to June 30 and was distributed via the following outlets:

- **InsideArlington** - 130,000 subscribers—link sent twice
  - Five newsletters for a total of 305 clicks.
  - 13 newsletters for a total of 1,292 clicks.
- **Arlington County Social Media** (DES and Countywide)
  - Twitter: DES – 4,889; ARL – 26,200
  - Facebook: DES – 3288; ARL – 29,583
- **Emails to those who emailed the mobility inbox** – 553 recipients
- **County commissions and committees**
- **SMD operators to their riders**
  - *Lime sent it to 14,500 recipients*
  - *Lyft sent to 2,500 recipients.*
The feedback form generated a total of 4,063 responses. Due to the diffused nature of data collection and solicitation for feedback, a response rate cannot be computed. All collected data was anonymized and analyzed in aggregate. The research team examined the data quality against (1) missing responses, (2) flatlining (providing the same answer to most/all questions), (3) non-sensical comments, (4) contradictory responses and (5) speeding. It was determined that none of these quality issues were problematic for interpretation and no responses were removed from the dataset due to the sensitivity of the topic to the Arlington community.

More than two thirds of the respondents to the survey were non-SMD riders (2,840). Among SMD riders, most were e-scooter riders (1,066). Three percent of total respondents (135 respondents) reported having used both e-scooters and dockless e-bikes in Arlington (See Figure 5 below). Most respondents lived (98%) and worked (68%) in Virginia. Thirty percent of respondents worked in Washington DC.

![Venn diagram of survey respondent type](image)

Due to limited available resources and time constraints, the feedback form was distributed using a convenience sample rather than random sampling. As such, the results should be read as reflective of the obtained sample and not be generalized to the wider Arlington population. The feedback forms and the results are made available to the public on Arlington County’s website.

Operators' data reporting. An important part of the evaluation comes from SMD service provider’s data. According to the memorandum of agreement (MOA), operators were required to submit monthly data on trips (origin and destination coordinates, start and end times, distance traveled and duration of the trip), SMDs in service (daily available SMDs in the County), operational data such as the number of broken

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7 Those who did not respond to the SMD filtering questions (i.e. skipped the questions rather than answered “no”), constituted a small portion of the non-SMD group (7% skipped the question for e-scooter and 8% skipped the question for dockless e-bikes).
SMDs, incorrectly parked SMDs and complaints received. Operator’s data were processed and cleaned by the research team using filters on distance, time, speed and location.

**Populus.** Populus is a third-party software that provided valuable insights in the evaluation, including: looking at trips in real time, looking at aggregated operator data in one place, looking at spatial deployment or available SMDs per neighborhood or block level (not available through monthly operator reporting), looking at the utilization of corrals in Arlington County and comparing service level with Washington DC.

**County channels.** County channels were used for crash data. Arlington County developed a crash tracker that would aggregate data from operators, local law enforcement and health services, and news outlets to track the number and type of SMD incidents and crashes in Arlington County.
CHAPTER 4: RESULTS

This section of the report presents the main findings based on the analysis of the data described in the Research Approach and guided by the context provided in the Background. This chapter starts with describing pilot operations, followed by utilization and ends by detailing the community’s reaction to the SMD pilot.

SECTION 1 - PILOT OPERATIONS

Pilot operations refers to the supply-side of the SMD pilot in terms of (1) daily average SMDs available in the County and their spatial distribution, (2) main operational challenges and (3) the efficacy of communicating to the community the rules, regulations and best practices in terms of SMDs. The demand-side of the SMD pilot, or utilization of SMD services, will be examined in the following section.

Daily SMDs in service in Arlington County

Key question: How many SMDs were available for use in Arlington and how did this availability change monthly?

The pilot was launched with 706 daily SMDs on average made available by participating providers during the first month (i.e. October 2018). Although fluctuating significantly month to month, average daily SMD availability remained relatively range-bound through most of the fall and winter seasons, in the 600-850 SMDs per day range (see Figure 6). Month to month variability could owe to weather conditions and temperature during winter months impacting operations. The average daily count increased considerably in March, with more providers joining the pilot. The average daily vehicle count surged to 1,074 SMDs in March, up more than 50% from the average of 720 SMDs for the period of October 2018 to February 2019, with average SMD counts remaining above 1,100 vehicles through May. Data indicates a fall in SMD supply in June, potentially in large part due to one operator effectively pulling out from the pilot during the second half of the month. The total aggregate SMD cap as determined by the MOA was never reached or exceeded.

<table>
<thead>
<tr>
<th>Average daily SMD vehicles in Arlington County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct-18</td>
</tr>
<tr>
<td>Nov-18</td>
</tr>
<tr>
<td>Dec-18</td>
</tr>
<tr>
<td>Jan-19</td>
</tr>
<tr>
<td>Feb-19</td>
</tr>
<tr>
<td>Mar-19</td>
</tr>
<tr>
<td>Apr-19</td>
</tr>
<tr>
<td>May-19</td>
</tr>
<tr>
<td>Jun-19</td>
</tr>
</tbody>
</table>

Data Source: Operator monthly reporting data

Figure 6 Average daily SMD vehicles in Arlington County by month
Adequacy of the level of service to Arlington under the SMD pilot

Key question: Is the supply of SMDs in Arlington sufficient? And how does it compare to neighboring jurisdictions?

While it is challenging to define what “sufficiency” is given scarce available research on service levels adequacy for SMDs and a dynamic demand landscape, literature and best practices on bike-share service levels suggest using a metric of SMDs per 1,000 residents as plotted in Figure 7 below.

<table>
<thead>
<tr>
<th>SMD service rate for Arlington, VA and Washington, DC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arlington Service Level</strong></td>
</tr>
<tr>
<td>Daily SMD per 1,000 resident</td>
</tr>
<tr>
<td>Oct-18</td>
</tr>
<tr>
<td>Nov-18</td>
</tr>
<tr>
<td>Dec-18</td>
</tr>
<tr>
<td>Jan-19</td>
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<tr>
<td>Feb-19</td>
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<tr>
<td>Mar-19</td>
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<tr>
<td>Apr-19</td>
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<tr>
<td>May-19</td>
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<tr>
<td>Jun-19</td>
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<tr>
<td>Nov-18</td>
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<td>Dec-18</td>
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<tr>
<td>Jan-19</td>
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<td>Feb-19</td>
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<td>Mar-19</td>
</tr>
<tr>
<td>Apr-19</td>
</tr>
<tr>
<td>May-19</td>
</tr>
<tr>
<td>Jun-19</td>
</tr>
</tbody>
</table>

Data Source: Populus for SMDs, Census (for D.C.) and Arlington Profile for population data

Figure 7 SMD service rate comparison between Arlington and Washington, DC

On average, operators deployed 3.5 SMDs per 1,000 residents in Arlington during the first nine month of the pilot compared to 2.4 for Washington DC during the same time period, making Arlington more highly serviced by SMDs than Washington, DC. This comparison also holds when calculating a service measure of SMDs per 1,000 day-time population to account for the population who can use SMDs. Service levels fluctuated during the pilot between an average of 2.9 and 4.5 SMDs/1,000 day-time persons. The variability in coverage can be explained by deployment fluctuations discussed previously.

Does this mean that Arlington’s level of service is adequate? The service level is still below the recommended 10-30 bikeshare bikes for every 1,000 residents by the Institute for Transport and Development Policy (ITDP). However, those guidelines refer to station-based services, with dockless services potentially altering the norms. And in that sense, Arlington is more highly served by SMDs (average of 3.5 SMDs/1,000 people) than station-based bike sharing services (Capital Bikeshare = 3.1 SMDs/1,000 people). Moreover, taking a holistic view, the combined deployment of SMDs and station-based bike sharing services in Arlington, ranging between 6.6 and 8.1 SMDs per 1,000 residents, reflect active transportation coverage closer to the ITDP range. Nevertheless, this evaluation suggests that to

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8 Note: unlike Arlington, Washington DC was not conducting a pilot during the comparison timeframe and the differences in terms of geography, population and intra-regional service variability across the city limit the conclusiveness of single-point comparison.
9 Refers to the number of people who are present in an area during normal business hours, including workers.
10 Average of 2.1 for Arlington versus 1.4 for Washington DC.
better answer this question, research should examine and develop adequacy measures pertinent to SMDs, which are likely to emerge as the technology matures and deployment patterns stabilize around a prospective long-term supply/demand equilibrium.

**Spatial distribution of SMDs in Arlington**

**Key question:** Where are available SMDs clustered in Arlington? And how does it relate to land use and low- and high-income neighborhoods?

After looking at the overall availability of SMDs in Arlington and examining the question of “adequacy” or “sufficiency” of service, this section turns to looking at the spatial distribution of available SMDs in Arlington County.

**Overall distribution of SMDs in Arlington County**

While the Arlington County agreement with operators is for deployment throughout the Arlington region, the population of SMDs in operation over the first nine months of the pilot did cluster around two major corridors: Rosslyn-Ballston (R-B) and Route 1, as seen in Figure 8 below. This holds true both in terms of daily vehicles/1,000 people\(^\text{11}\) (Figure 8 below) and the absolute measure of average daily SMDs. The map shows a binary distribution of levels lower than average service in Arlington (0-4 SMDs/1,000 people) and above average service in Arlington (4-22 SMDs/1,000 people).

\*Data source: Populus.ai.

\(^{11}\) Four was chosen as a cutoff representing the average daily SMD for the County.
This distribution of SMD availability expectedly correlates with areas of high population or commuter density but also high transit accessibility. The characteristics of the major planning corridors (depicted in Figure 9 below) are as follows:

- **The R-B Metro corridor** represents an area of high-density, mixed-use development with high Metrorail supply. It is served by five closely spaced Metrorail stations providing access to the Blue, Orange, and Silver lines as well as local and regional bus routes. The corridor was served on average by six SMDs/1,000 people and received 45% of total deployed SMDs.

- **Route 1 (Richmond Highway) Metro corridor** includes key nodes in Pentagon City and Crystal City and is served by four Metrorail stations. Pentagon City is a dining and shopping destination and is home to an estimated 8,200 residents. Crystal City is a neighborhood in transformation, close to both the Pentagon and Washington National Airport and potentially set to experience an influx of new residents and businesses as Amazon establishes its second headquarters in the area. The corridor was served on average by four SMDs per 1,000 people and 10% of the total deployed SMDs in Arlington over the first nine months of the pilot, equal to the average for Arlington.

By comparison, Arlington’s third planning corridor – **Columbia Pike**- is not as well-served. Despite a similar SMD count to Route 1 (10% of total SMDs deployed), higher population causes the coverage to drop to just two SMDs/1,000 people. It should be noted that this analysis only takes into consideration “residents“. However, traffic in these corridors might differ when accounting for daytime population. While daytime population data by corridor was not available for this analysis, data indicates that in 2019, the R-B corridor had 12 times more employed people than Columbia Pike and around twice as much as Route 1, not including employment rates at the Pentagon and National Airport. Therefore, normalized measures of service level based strictly on residents might be overestimating the disparity between the corridors.

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12 Data from Arlington Profile 2019: [https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/31/2019/05/Profile2019_5_10_19_FINAL.pdf](https://arlingtonva.s3.amazonaws.com/wp-content/uploads/sites/31/2019/05/Profile2019_5_10_19_FINAL.pdf); based on Arlington County’s CPHD estimates, there is an estimated 26,560 jobs in Pentagon and 7,750 jobs in National Airport.
Equity consideration of daily available SMDs

Key question: What does the distribution of SMDs say about operations and equity? For example, how does the service level of SMDs differ between lower- and higher-income neighborhoods in Arlington? and, how is South Arlington served as compared to North Arlington?

13 Jefferson Davis Metro Corridor is Route 1 corridor also to be renamed as Richmond Highway
Lower than Arlington median income neighborhoods and SMD service levels

Overlaying Figure 9 in the previous section (SMD distribution) with a map of income levels in Arlington, paints a picture of the difference in services between lower than Arlington median household income and higher than Arlington median household income (See Figure 10 below). Arlington’s 2018 median household income of $110,388$\textsuperscript{ivii}.

This measure, chosen primarily due to availability of data, quantifies differences between uneven regions in terms of income but does not entirely characterize “low income residents” or areas of “poverty” as defined by Arlington$^{14}$.

The results reveal four key combinations: higher-income/higher service (black), higher-income/lower service (blue), lower income/higher service (red) and lower income/lower service (white), with areas having insufficient data colored in gray. This analysis shows that there are lower than ARL median income areas receiving high service levels as depicted in red in Figure 10 below implying the potential for this mobility service to serve lower-income neighborhoods.

---

$^{14}$ There is a data mismatch between deployment (at the block level) and poverty levels (available at the neighborhood level) as well as a lack of conversion from HH income to poverty level to be able to do an analysis of true “low income” areas.
However, looking closer at the distribution of service level along the four quadrants/colors identified in Figure 10 (See Table 4 below) also reveals that there is room in improvement for better serving low-income neighborhoods as 29% of Arlington’s population falls in low-income areas with lower than average service level. To improve this situation, this analysis could be highlighting areas to start with.

<table>
<thead>
<tr>
<th>Service Level</th>
<th>Median Household Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below ARL median income</td>
<td>Above ARL median income</td>
</tr>
<tr>
<td>Below four SMD/1k people</td>
<td>30% of ARL population</td>
</tr>
<tr>
<td>Above four SMD/1k people</td>
<td>13% of ARL population</td>
</tr>
<tr>
<td></td>
<td>42% of ARL population</td>
</tr>
</tbody>
</table>

*Data source: Populus.ai.

Figure 10 Bivariate distribution of SMD service level and income in Arlington County
Daily average SMDs in South versus North Arlington

Available data through Populus also allows for an analysis of the difference in service between North and South Arlington, which they define as separated by U.S. Route 50 based on Arlington County’s definition. Figure 11 below shows the difference between the service received between the two areas considering the respective resident population size of each area.

![Figure 11: Comparison of SMD service level between North and South Arlington County](image)

Normalized measures of service by residents shows that North Arlington service levels exceeded South Arlington levels throughout the pilot period to date. In fact, it received between 1.3 times and 2.5 times more service, with the gap widening since April. However, in the absence of daytime population by subcounty level, this disparity might be overstated. Employment levels in 2015 show that North Arlington has 1.3 more employed people than South Arlington. North Arlington might also be getting more visitors than South Arlington. This remains an analysis for future research. In the absence of daytime population data, to promote equity, local policymakers could use this analysis to mandate for a more equitable distribution of service across North and South Arlington.
Operational challenges and compliance with the agreement

The evaluation of the pilot identified ten main operational challenges resulting from the presence of SMDs. Some of these challenges are breaches of the Memorandum of Agreement between operators and Arlington County. The challenges are enumerated below and described thereafter in Table 5 below:

1. Inconsistent deployment of SMDs
2. Inadequate deployment sites such as buses and sidewalks
3. High operating speed
4. Sidewalk riding
5. Broken SMDs
6. Thefts and vandalism of SMDs
7. Idle SMDs for more than seven days
8. Incorrectly parked SMDs
9. Crashes and injuries
10. Data
<table>
<thead>
<tr>
<th>Operational Challenges</th>
<th>MOA Breach? And how it was addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inconsistent deployment of SMDs</strong></td>
<td>No</td>
</tr>
<tr>
<td>In March 2019, an operator formally suspended their e-bike service with bikes removed</td>
<td></td>
</tr>
<tr>
<td>from service beginning in February 2019 when the operator decided to pull out due to</td>
<td></td>
</tr>
<tr>
<td>differences in regulations between Arlington and Washington, D.C.</td>
<td></td>
</tr>
<tr>
<td>Deploying too many e-scooters at any site.</td>
<td>No</td>
</tr>
<tr>
<td><strong>Inadequate deployment sites</strong></td>
<td>Yes - the County required the operator remove device within two hours of a report.</td>
</tr>
<tr>
<td>Deployment sites at bus stop zones and main footpath of sidewalks were obstructed by</td>
<td></td>
</tr>
<tr>
<td>SMDs being deployed in these sites.</td>
<td></td>
</tr>
<tr>
<td>Limiting service to certain neighborhoods, a breach of the MOA</td>
<td>Yes - addressed by the operator upon the County’s request.</td>
</tr>
<tr>
<td><strong>High operating speed</strong></td>
<td>Yes - County staff speed-tested the vehicles, however, no formal request was made to correct.</td>
</tr>
<tr>
<td>Arlington County received complaints of speeding, which suggests that operators were not</td>
<td></td>
</tr>
<tr>
<td>limiting speed to 10 MPH for e-scooters as agreed in the MOA.</td>
<td></td>
</tr>
<tr>
<td><strong>Sidewalk riding</strong></td>
<td>No – customer-focused, rather than operator-focused.</td>
</tr>
<tr>
<td>263 emails (36% of emails) received by the Mobility Inbox discussed sidewalk riding.</td>
<td></td>
</tr>
<tr>
<td><strong>Broken SMDs</strong></td>
<td>Maybe – the County enforced a suspension due to a fleet defect, however, not for broken devices.</td>
</tr>
<tr>
<td>Four out of the six active operators reported broken SMDs. Monthly variability ranges</td>
<td></td>
</tr>
<tr>
<td>between two and five percent of SMDs were reported broken in the County. For November,</td>
<td></td>
</tr>
<tr>
<td>December and January, when there was a possible distinction between scooters and e-</td>
<td></td>
</tr>
<tr>
<td>bikes, broken SMDs mostly were scooters (88-98%).</td>
<td></td>
</tr>
<tr>
<td>17 emails out of 727 (2%) sent to the Mobility inbox referenced a broken SMD.</td>
<td></td>
</tr>
<tr>
<td><strong>Thefts and Vandalization</strong></td>
<td>No</td>
</tr>
<tr>
<td>As a separate category, one operator reported one SMD being vandalized or stolen in</td>
<td></td>
</tr>
<tr>
<td>February 2019 but 28 of 727 emails received (4%) to the mobility inbox discussed stolen</td>
<td></td>
</tr>
<tr>
<td>or vandalized SMDs.</td>
<td></td>
</tr>
<tr>
<td><strong>Idle SMDs for more than seven days</strong></td>
<td>Yes – the County notified the operator to remove the handful of idle vehicles.</td>
</tr>
<tr>
<td>N/A Only one operator reported idle SMDs for December to February.</td>
<td></td>
</tr>
<tr>
<td><strong>Incorrectly parked SMDs</strong></td>
<td>Yes – the County notified the operator to remove the improperly parked vehicle within two hours.</td>
</tr>
<tr>
<td>The number of incorrectly parked SMDs per 1,000 trips increased from 12 incorrectly</td>
<td></td>
</tr>
<tr>
<td>parked SMD per 1,000 trips in October to 37 incorrectly parked SMD per 1,000 trips in</td>
<td></td>
</tr>
<tr>
<td>February and decreased thereafter monthly to 13 incorrectly parked SMDs per 1,000 trips</td>
<td></td>
</tr>
<tr>
<td>in June.</td>
<td></td>
</tr>
<tr>
<td>Arlington County has been closely monitoring this issue by recording the time the</td>
<td></td>
</tr>
<tr>
<td>complaint was received and the time taken by operators to respond in order to determine</td>
<td></td>
</tr>
<tr>
<td>compliance. It is estimated that operators have been compliant with guidelines roughly a</td>
<td></td>
</tr>
<tr>
<td>third of instances, non-compliant a third of instances, with data insufficient to verify</td>
<td></td>
</tr>
<tr>
<td>response time for the remaining third of instances.</td>
<td></td>
</tr>
</tbody>
</table>

To in part address some of the parking concerns and to facilitate SMDs connecting commuters to public transportation options, the County
designed seven locations at six Metrorail stations on the Rosslyn-Ballston and Richmond Highway corridors for SMD parking “corrals”.

| Crashes and injuries | There were 69 crashes in total between October 2018 and June 2019. Those resulted in approximately 29 injuries. In terms of percentage of total trips, crashes increased from 1 SMD crash per 10,000 trips to 2.6 crashes per 10,000 trips in February 2019. This number fluctuated thereafter and was at 1.5 SMD/10,000 trips in June 2019. There were no reported fatalities. Crash statistics should be read in the context of a new technology for which studies have shown that a third of crashes occur on the first use, potentially skewing figures higher.
Twenty-five percent of crashes pertain to single SMD crashes, followed by SMD collision with a moving vehicle (12%), then SMD with a pedestrian (9%), SMD with a moving vehicle and a damaged SMD (3%) and crashes involving a cyclist and SMD (1%). |
| Data | Operators were not always compliant in the type of the data (e.g. operational data on broken SMDs) or quality of the data that was submitted and the timeframe requested for data submittal. Yes - County staff created a data template for operators to help optimize how the County oversees the operation and the evaluation. In one instance, the County sent a Notice to Correct to an operator as its data submittal was weeks late. |
A closer look at crashes and injuries

Arlington County collected e-scooter crash data from a variety of sources including operators, local law enforcement, health services, and news outlets to track the count and type of SMD crashes and injuries in Arlington County. A total of 69 crashes, 29 injuries and no fatalities were reported during the first nine months of the pilot.

To adequately characterize scooter safety performance based on crashes and injuries reported, it is necessary to (1) understand how it compares to other modes such as cars, and active transportation and (2) acknowledge the initial challenges with new technologies and the need to wait for technology to mature and for more people to be making regular (rather than first time) trips on scooters. In the case of the latter, this is because the first nine months of the pilot are expected to see higher incident and crash counts than that of which will characterize e-scooters in the long-term as familiarity increases. A study in Austin showed that a third of incidents happen on the first use and that sixty-three percent of people interviewed said they had ridden a scooter less than nine times when they were injured. Along those lines, the comparison with other modes is not entirely fair as other modes have matured and have more experienced riders. This should be kept in mind when interpreting the graph in Figure 12 below.

<table>
<thead>
<tr>
<th>Crashes, injuries and fatalities in Arlington County by mode</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="chart.png" alt="" /></td>
</tr>
<tr>
<td><strong>Number of crashes and injuries</strong></td>
</tr>
<tr>
<td><strong>2018</strong></td>
</tr>
<tr>
<td>Cars</td>
</tr>
<tr>
<td>2,535</td>
</tr>
</tbody>
</table>

Data Sources: Car crashes and injuries from DMV, pedestrian and bike crashes and injuries from police reports and TE&O, Arlington County, Capital bikeshare crashes and injuries from active transportation; data is not available for the number of injuries for Capital Bikeshare.

The results in Figure 12 above suggest that e-scooter crashes and injuries are closer in magnitude to pedestrian and bike crashes and injuries, with average crashes between pedestrians and bikes. Moreover,

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15 We did not have data on the number of injuries for Capital Bikeshare.
e-scooters in the pilot did not record any fatalities, while there were two car fatalities and one pedestrian-involved fatality in 2018.

However, when comparing to other modes, it is important to look at normalized measures of crashes that reflect the difference in exposure between the modes given the variation in speed, distance traveled and trip counts. These could be measures of (1) crashes per 1,000 miles, (2) crashes per 1,000 trips, and (3) crashes per 1,000 people.

Given available data including approximations of the number of bike and pedestrian trips in Arlington, an imperfect conversion rate for bike and pedestrian from trips to mileage and the absence of an accurate number of car trips, the research team found qualitatively that normalized measures of e-scooter crashes are lower than pedestrian but higher than bike crashes.

In comparison, looking at other major pilot program evaluation reports, the City of Baltimore was the only one that compared crashes and incidents across modes and found similar results of more crashes than bikes but less than pedestrians and categorized scooters as safer than cars based on the measure of crashes per 1,000 people.

In summary, the following should be kept in mind in terms of examining the safety performance of e-scooters:

- **Comparing new technologies with well-established modes**: Comparing e-scooter crashes to the rest of the modes could skew results given that a third of the crashes usually happen on the first ride, reflecting in part the unfamiliarity of first-time riders (and/or inadequate initial operator instructions) rather than an inherent risk of SMD devices themselves. Sixty-three percent of people interviewed in the Austin study said they had ridden a scooter less than nine times when they were injured.

- **Data for e-scooters and the rest of the modes are imperfect, limiting the ability to compare**. E-scooter data has limitations in terms of under-reporting in hospitals (i.e. not having a separate category for e-scooters). On the other hand, Arlington County does not have a perfect measure of the total number of miles and trips for pedestrians and bike. The counts used in the analysis in Figure 12 were taken from two counters around the County and are likely to be an underestimation of the total volume, thereby biasing the pedestrian and bike crash rate upwards.

- **It is likely that crashes or incidents are underreported**. SMD mode specific data on crashes is not currently available from local hospitals, and it has been impossible to get state-level data from the Virginia Department of Transportation (VDOT) as their crash reporting forms do not track shared e-scooter and e-bike crashes.

Finally, it should still be noted that scooters (as the rest of the evaluation will show) are expected to remove cars off the road, which could result in fewer crashes on a net basis.

Many operational challenges cited in the previous section can be limited by adequate communication with the community to raise awareness on the rules, regulations and good practices of SMD riding and parking. In the following section, the quality of the communication with the community is measured and assessed.
Information Supply: communication with the community during the pilot program regarding operations

**Key questions:** Where do people in Arlington get their information on SMDs from? Are they aware of the rules and regulations? How efficient were operators in communicating the necessary information?

The communication of information on the SMD pilot to the Arlington community was facilitated through multiple sources such as:

1. **Arlington County’s website**, containing information on the pilot, a link to the complaint email and external resources (such as Arlington Transportation Partners) on rules and regulations
2. **Arlington Outreach events** where Arlington communication staff attends major community events to increase awareness of the program and gauge reactions on the pilot
3. **Operator’s messaging** when a rider signs up for the service and before they unlock their SMD device

Arlington County’s online feedback form (described in the Research Approach section of this report) helped answer questions regarding the importance and efficacy of these communication platforms.

➢ Where do people in Arlington get their information from?

The results of the feedback form present several interesting conclusions with regards to the provenance of key information. The key elements are discussed below and provided in Figure 13.

The first is that **the main source(s) of information for SMD riders are the operators’ apps or websites**, stressing the importance of continuously monitoring and pushing information through this outlet to make sure that riders are getting a comprehensive and accurate set of information in the appropriate language as the County deems necessary to differentiate guidance from legal requirements (e.g. “you should not ride on sidewalks” vs. “it is illegal to ride on sidewalks in Arlington”).

The second important observation is that there is ample room for increasing awareness whereby 20-22% of SMD riders do not know what the “laws” are and 43% of non-riders (but potential future riders) are also unaware. The high percentage of non-SMD riders who do not know the laws is also critical because it could be biasing community opinions of scooters and scooter behavior in Arlington. For instance, if they think that SMD riders should be wearing helmets, they might consider riding without a helmet as erratic behavior and bias their opinion of the performance of this mobility service and of the pilot program more generally.

Third, **around 10% of riders and 20% of non-riders get their information from Arlington County’s website** which suggests that this platform should be leveraged to raise awareness.

Similar results were found in Virginia Tech’s SMD survey for Rosslyn.

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16 [https://transportation.arlingtonva.us/scooters-and-dockless-bikeshare/](https://transportation.arlingtonva.us/scooters-and-dockless-bikeshare/)
17 For feedback form length limitations, these questions were not included in the in-person feedback forms.
Are people in the Arlington Community aware of SMD rules and regulations in general?

After examining where respondents got their information from, their level of awareness of different rules and regulations in Arlington County was measured next. Respondents were prompted to determine which of a set of SMD riding options are “allowed” to do in Arlington, with results presented in Figure 14 below. For comparison purposes, the correct set of rules and regulations are marked with a check mark in Figure 14 and what they are not allowed are marked with an X.

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18 For “rules” tested in this question, refer to Arlington Transportation Partners (2019).
The results of this assessment are more striking, with a significant degree of variability in the relative familiarity of both riders and non-riders with the rules and regulations of SMD ridership. For instance, more than 80% of e-bike riders were unaware that they could ride on the sidewalk. While some rules, such as scooter ridership on sidewalks, appeared to be more broadly understood, albeit still below desired levels (12% of e-scooter riders thought they were allowed to), there remains ample room for improvement as results clearly indicate that a significant share of riders and non-riders are generally unfamiliar with rules and regulations.

Several other observations from this question are worth highlighting. A first observation is that the percentage of SMD riders who think they can ride on trails is relatively high (31% for e-scooter and 39% for e-bikes). In the case of e-bike riders, some confusion could be due to the fact that e-bikes are allowed on the W&OD trail only. The second observation is that the percentage of riders of either scooters or e-bikes who chose the correct laws corresponding to their used mode remains relatively low. For instance, only 18% of e-bike riders and 15% of non-SMD riders know that dockless e-bikes could be ridden on the sidewalk.

The main conclusion from this question is that there is room for improvement in raising awareness as to what riders can do. Uniform laws across neighboring jurisdictions (while complicated in practice) could
also help more clearly define a common set of parameters for riders to be familiar with. Also, while keeping in mind the importance of keeping the riders’ experience seamless (given that convenience is likely one of the main drivers of using SMDs), innovative pathways could be required to make sure riders are aware of rules and regulations. An example is a quick 30- to 60-second test before each new account unlocks an SMD type (scooter or dockless e-bike) for the first time with the options highlighted in our questions above, requiring successful completion of the questionnaire before unlocking the device.

➢ Are operators pushing SMD rules, regulations, messages and best practices adequately?

Operators provide pop-up messages to riders regarding correct parking procedure when riders first rent a device through an operators’ app and periodically thereafter. They also provide informational emails and ad campaigns to the general public, demonstrations at community events, and they have the ability to assess penalties to riders who park incorrectly.

Similarly, operators were also receptive to County requests to instruct their riders on proper operational etiquette promoting safe and responsible behavior. This included introductory and periodic instructional reminders when using the respective operator’s app to rent scooters; promotional campaigns such as Lime’s “Respect the Ride” campaign reminding riders to obey all traffic signs and signals; dispatching brand ambassadors into the County to educate those riding on the sidewalk; etc.

To test the efficacy of such communication, respondents were asked what information they got from operators and the results were summarized in Figure 15 below.

<table>
<thead>
<tr>
<th>Have you received any instructions from the e-scooter operators regarding the following in Arlington County? Answer YES (N=1,066)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parking</td>
</tr>
<tr>
<td>User etiquette</td>
</tr>
<tr>
<td>Local Regulation</td>
</tr>
<tr>
<td>Filing a complaint</td>
</tr>
</tbody>
</table>

*“user” etiquette was used in the feedback form and included here for accuracy. “users” are referred to as “riders” throughout this report. Note: axis not set to 100%.

Figure 15 Efficacy of operator messaging according to the feedback form respondents

Most respondents reported having received instructions from the e-scooter operators on parking (60%), and user/rider etiquette (44%). User/rider etiquette was intentionally left broad given the variability in the focus of different operators in this regard. As an example, user/rider etiquette could be acts of courtesy such as showing pedestrians you’re sharing the sidewalk that you are aware of their presence by making eye contact or smiling. Less than half of respondents (45%) indicated that they had received
information from operators on local regulations and less than a third (30%) indicated that they received information on filing a complaint.

This implies that there is room for improvement in terms of having companies push more and improve messaging on local regulations and on the ability to file a complaint. This would help cities better manage these services by (1) making sure riders know about the rules and regulations, and (2) by being able to track the performance of these services and address or hold operators accountable once they have access to the complaints. This is all the more important in the context of responses to the previous section where companies were the main source of information for riders of SMDs.

Below, the analysis turns to assessing the pilot from the rider’s standpoint in terms of trips taken and rider characteristics.
SECTION 2 - SHARED MOBILITY DEVICES (SMD) UTILIZATION

In this section, the analysis turns to the demand side of the SMD pilot to look at ridership data and riders’ characteristics. This section uses a combination of data sources, complementing operator data with feedback received through the online and in-person feedback forms.

Number of trips taken on SMDs in Arlington County

Key questions: How many trips were taken in Arlington during the pilot?

In line with patterns uncovered in the availability of SMDs in Arlington County, SMD utilization fluctuated over the course of the pilot (See Figure 16 and 17 below). The first month of the pilot saw ridership of around 60,000 monthly trips in October 2018 before decreasing significantly over the winter months, to lows around 23,000 trips per month in January and February 2019. Ridership increased gradually thereafter to a high of around 80,000 in May. The first phase of the pilot ended in June with around 60,000 trips, with the dip possibly in part reflecting the contraction in available SMDs in circulation, discussed previously. The fluctuation broadly mirrors some of the trends in availability of SMDs, with weather and lower winter deployment likely determinants in the seasonal decline in ridership.

<table>
<thead>
<tr>
<th>Total Number of Trips (N=453,690)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60,273</td>
</tr>
</tbody>
</table>

Data Source: Operator monthly reporting data

Figure 16 Total number of trips taken on SMDs in Arlington County by month between October 2018 and June 2019
Trip Characteristics

Key questions: what do we know about the characteristics of these trips? In terms of distance, time and distribution over the day?

Short trips dominated the SMD trips landscape in Arlington over the first nine months of the pilot with an average distance of 0.94 miles per trip. Figure 18 below represents the cumulative distribution of SMD trips in Arlington, showing that half of the trips were below 0.62 miles, 75% of the trips are below 1.1 miles and 90% are below two miles, which is the average trip distance for the Capital Bike Share system\textsuperscript{i}.

*Data Source: Operator Monthly reporting data
Figure 18 Distribution of distances traveled by SMDs between October and June

Figure 19 below represents the distribution of SMD trips by duration (in minutes). The average trip time is of 14 minutes, with half of the trips completed under seven minutes and 75% of the trip under 13 minutes in duration. While this is not surprising given that most SMD trips are under a mile in terms of distance, it remains an important indication that the extent of the interaction between SMD riders and their devices is relatively limited.

*Data Source: Operator Monthly reporting data

Figure 19 Distribution of SMD travel time between October 2018 and June 2019 in Arlington County

Key questions: how are these trips distributed in time?

Figures 20 and 21 below depicts the number of trips by time of the day for weekdays and weekends separately. Results show that on weekdays, 42% of trips occurred during rush hours with 24% of the trips taking place during the morning rush hour and another 18% of the trips (approximately 58,500 trips) occurring during the afternoon rush hour. This points to an important role of SMDs in commute patterns. The Portland evaluation also found that 19% of their trips occurred during the afternoon rush hour.

Furthermore, according to ridership data, 70% of trips took place during weekdays while 30% of trips took place on weekends, although Saturday ridership was the highest day in terms of ridership over the 9-month period. This usage distribution, at least in terms of rush hour peaks and weekend vs. weekday ridership, is similar to what was found in the Washington, DC SMD evaluation report.
**Number of trips by time of the day - WEEKENDS**

*Data Source:* Operator monthly reporting data

*Figure 20 Distribution of SMD trips by time of the day on weekends*

**Number of trips by time of the day - WEEKDAYS**

*Data Source:* Operator monthly reporting data

*Figure 21 Distribution of SMD trips by time of the day on weekdays*
Spatial distribution of trips taken on SMDs in Arlington County

Key question: Where are people in Arlington using SMDs to go to? (i.e. how are the trips discussed previously spatially distributed in Arlington County?)

Thanks to detailed trip origin and destination data (latitude and longitude) provided by operators, the research team was able to map out the entirety of the SMD pilot program, uncovering insights into travel patterns.

As expected, given the distribution of trip distances (with the majority of SMD trips under one mile), most riders remain within the bounds of the County, with 89% of the trips starting and ending in Arlington County. Eight percent of trips started in Arlington and ended outside of Arlington and 2% start outside of Arlington and ended in Arlington\(^1\).

The color-coded map of trip origins by destination colors in Figure 2 below also shows visually that SMD riders are staying within their neighborhoods\(^2\). The dots on the map represent trips beginning at the location of the dot. The color of the dots represents the destination, color-coded according to the legend provided in Figure 2.

For instance, the cluster of orange dots in the Georgetown neighborhood of Washington DC (the waterfront area connected to Rosslyn, VA by the Key Bridge) reflects trips that originated in Washington, DC (location of the dots) but ended in Rosslyn (the color of the dots). The similarity between the map and the legend (top and bottom of Figure 2) where dots are of the same color as their respective neighborhoods indicate that most often, riders are using SMDs within in their own neighborhoods, with any cross-over most often occurring near neighborhood boundaries. This is a conclusion that Washington DC policymakers also reached when assessing SMD travel patterns in their own pilot program.

\(^{19}\) 1% of the trips did not start or end in Arlington according to the classification used in this analysis due to the difference in boundary definitions used by operators and the one found on Arlington County’s website.

\(^{20}\) The neighborhoods were defined by the researchers based on the need to divide the region into no more than nine regions for feasibility of plotting the data.
In terms of specific corridors, ridership mirrors the distribution of SMDs available discussed previously in this report (section on “pilot operations”), with most of the trips clustered around the two main commercial and Metrorail corridors – the R-B corridor and Route 1 corridor (shaded in darker purple in Figure 23 below). The R-B corridor includes 60% of the trip origins and 55% of the trip destinations, Route 1 corridor includes 17% of the trip origins and 35% of the trip destinations. The Columbia Pike corridor receives fewer trips with 4% of the trip origins and 5% of the trip destinations for the trips between October 2018 and June 2019.

Figure 22 Trip destinations distribution for all trip origins in Arlington
It is difficult to say whether the lack of ridership along the Columbia Pike corridor is supply- or demand-driven as many factors play a role (land use, infrastructure, demographics, culture and preferences, etc...). Nevertheless, the combination of low utilization of SMDs in areas of lower deployment in Arlington County warrants further exploration. Increasing deployment in that corridor and assessing the corresponding change in utilization could help clarify the relative importance of deployment in driving ridership.

The trips are clustered in these corridors even when the population of the corridors is accounted for. Even when examining these patterns after normalizing for population, the distribution continues to show a similar concentration of trips (on a per rider basis) along the two key corridors.

*Data Source: Operator monthly reporting data

**Figure 23 Spatial distribution of SMD trip origins and destinations in Arlington County**

**Infrastructure utilization**

**Key question: How do SMDs use Arlington infrastructure?**

This sub-section looks at the main routes utilized by SMD riders, the modes used to access SMDs, the current and preferred infrastructure for riding SMDs and finally the utilization of SMD parking or corrals.

**Infrastructure utilization - main routes used in the County**

Based on detailed trip data including origins and destinations, the map in **Figure 24** below reflects the density of trips along key routes (87% of trips undertaken during that time) between January 1st and June 30, 2019\(^{21}\) as provided by Populus.

\(^{21}\) The Populus feature for routes was not available prior to January 1st, 2019.
Mirroring the overall deployment and trip patterns, the main routes used are found in the two corridors of high use, the R-B corridor and Route 1 corridor. Within the R-B corridor, key e-scooter arterials include the Key Bridge (in and out of Washington, DC), N Lynn Street, Wilson Boulevard, Clarendon Boulevard, and 9th street in between Clarendon and Wilson boulevard is also used. For the Route 1 corridor, 12th St S, S Eads St, and S Crystal Dr are routes of high use.

Highlighting these areas is important in helping inform the allocation of infrastructure capital given funding restrictions in order to ensure infrastructure investments yield the most optimal impact. High-use routes point planners towards areas they could prioritize in terms of SMD infrastructure such as protected bike lanes, corrals, bike racks or other active transportation infrastructure.

*Image source: Populus.ai – modified from original scale.

Figure 24 Distribution of SMD trips on routes in Arlington County
Infrastructure utilization - from macro to micro: where do SMD riders ride?

Based on responses to the feedback form, (in Figure 25 below) bike lanes are most commonly used with 62% of e-scooter riders always-to-often using bike lanes, followed by shared lanes (24%). The percentage drops to 19% for sidewalk and 16% for trails, although such rates remain relatively elevated given that under the Arlington pilot e-scooter riders were not allowed under the Arlington pilot to use sidewalks or trails.

Comparing this result to where riders prefer to ride shows that riders overwhelmingly prefer to ride on protected bike lanes (67% of respondents chose it as a top or second choice) followed by bike lanes (a bit under half of respondents chose it as either a first or second choice). Shared lanes were the least favorite with only 9% choosing it as their top two choices. An important distinction can be found in examining responses regarding street ridership (protected bike lanes, bike lanes and shared lanes), with the skew in preferences reflecting the relative importance of safety for SMD riders. Interestingly, despite the broad polemic surrounding sidewalk ridership of SMDs in Arlington and other areas of the U.S., SMD riders surveyed in Arlington appeared by and large to favor street ridership than utilizing sidewalks, with only 16% of respondents pegging sidewalks as a top two choice of where to ride SMDs.

These results suggest that for the County to support this community of riders, protected bike lanes should be more widely implemented.

Infrastructure utilization - the use of corrals

With SMD parking emerging as a key issue for the community given the rise in deployment and in order to facilitate SMD connectivity to public transportation options, Arlington County staff designated seven
locations to serve as SMD parking “corrals”, or on-street locations for parking SMDs. The seven corrals, located near six Metrorail stations on the Rosslyn-Ballston and Route 1 corridors, are as follows:

- N. Lynn St. & Fairfax Dr.
- N. Lynn St. & 19th St. N.
- Clarendon Blvd. & N. Uhle St.
- N. Monroe & 9th St. N.
- N. Stuart St. & 9th St. N.
- S. Hayes St. & 12th St. S.
- 18th St. S. & S. Bell St.

Using temporary materials and spray paint, County contractors were able to install the corrals over the course of two afternoons in December 2018, with some examples pictured in Figure 26 below, and worked with operators to include the parking areas in their respective apps.

Populus\textsuperscript{22} collected and provided visualization for data at five corrals around Arlington County as shown in the table below in Table 6. Two more corrals were added subsequently to their analysis at Ballston and Virginia Square.

*Images Source: DES and Greater greater Washington

Figure 26 Images of SMD corrals around Arlington County

Table 6 Arlington County SMD corral location

<table>
<thead>
<tr>
<th>Corral Location</th>
<th>Location Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crystal City Corral</td>
<td>18th St. S&amp;S Bell St. across from Metrorail</td>
</tr>
<tr>
<td>Pentagon City Corral</td>
<td>S Hayes St. &amp; 12th S, near Capital Bikeshare</td>
</tr>
<tr>
<td>Courthouse Corral</td>
<td>Clarendon Blvd &amp; N Uhle St.</td>
</tr>
<tr>
<td>Rosslyn: Lynn &amp; Fairfax Corral</td>
<td>N Lynn St. &amp; Fairfax Dr, near Capital Bikeshare</td>
</tr>
<tr>
<td>Rosslyn: Lynn &amp; 19th Corral</td>
<td>N Lyn St. &amp; 19th St. N, near Capital Bikeshare</td>
</tr>
</tbody>
</table>

As illustrated in Figure 27 below, the corrals were installed in areas of high trip utilization.

\textsuperscript{22} Populus started tracking utilization on 01/10/2019.
Analyzing ridership data in and around corrals reflects both the reasoning behind choosing such locations and the increase in parking utilization at corrals. Examining areas within 500 meters (0.31 miles) of a bike corral, the three corrals with most trips and parking events around them are in the Rosslyn-Ballston corridor: **Ballston corral, Lynn & Fairfax corral, and Virginia Square corral**. Ballston’s corral has the highest number of SMD parking events, trips origins, trips destinations, and deployment within 500 meters (0.31 miles) of the corral.

On a relative basis, bike corrals located in the Route 1 corridor (i.e., Crystal City corral and Pentagon city corral) had the lowest number of parking events, trip origins/destinations, and deployment among the six corrals identified. This can be explained in part by the relatively higher ridership along the R-B corridor.

Nevertheless, the elevated event counts in all key corral locations confirms the rationale behind staff selecting them as areas of key SMD density.

Focusing on the utilization of corrals specifically requires narrowing the scope of the analysis to these limited areas. Looking at a smaller area of **five meters** within the emplacement of a bike corral, the magnitude of activities expectedly drops from the wider area discussed above but reflects a noticeable number of parking events. The number of SMD parking events, number of SMD deployed, and trips originating and ending at five meters from a bike corral indicate that these areas are witnessing significant activity. The Virginia Square corral had the highest number of parking events within five meters from a bike corral, with around 2,800 parking events, followed by Pentagon City and Lynn & 19th St. at around 1,800 parking events a piece. Virginia Square corral has the highest number of trips originating and ending at the bike corral as well as highest deployment metrics. Using longitudinal data, there could be an opportunity to examine changes in deployment and parking trends following corral installation.
Trip Purpose

**Key Questions:** where are SMD riders taking trips to?

Insights from the online feedback form

According to responses from the feedback form, 18% of e-scooter riders and 8% of dockless e-bike riders indicated connecting to/from Metrorail as the primary purpose of using SMDs in Arlington County, as reflected in Figure 28 below. This response rate validates the positive suggestions that this mobility service could act as a viable complement to transit, prospectively helping lower car ridership and/or SOVs, although more research would likely be required to further examine the potential and limitations of SMDs in this regard specifically.

<table>
<thead>
<tr>
<th>What is the primary activity for which you use SMDs in Arlington County?</th>
</tr>
</thead>
<tbody>
<tr>
<td>[ ] Social/entertainment</td>
</tr>
<tr>
<td>[ ] Shopping or errands</td>
</tr>
<tr>
<td>[ ] Connect to/from Metrorail</td>
</tr>
<tr>
<td>[ ] To/from work or school</td>
</tr>
<tr>
<td>[ ] Recreation or exercise</td>
</tr>
<tr>
<td>[ ] To/from work-related meetings/appointments</td>
</tr>
<tr>
<td>[ ] Connect to/from bus</td>
</tr>
<tr>
<td>[ ] NA</td>
</tr>
</tbody>
</table>

Dockless E-bike Riders (N=292)

- Social/entertainment: 20%
- Shopping or errands: 14%
- Connect to/from Metrorail: 14%
- To/from work or school: 23%
- Recreation or exercise: 4%
- To/from work-related meetings/appointments: 17%

E-scooter Riders (N=1,066)

- Social/entertainment: 21%
- Shopping or errands: 18%
- Connect to/from Metrorail: 18%
- To/from work or school: 13%
- Recreation or exercise: 8%
- To/from work-related meetings/appointments: 5%
- Connect to/from bus: 15%

**Data Source:** Arlington County online feedback form

Figure 28 Primary trip purpose for SMD use in Arlington according to the online feedback form

In terms of activities driving SMD use more broadly, the feedback form pointed to social and/or entertainment as the category most cited as a primary purpose for using e-scooters in Arlington followed by connecting to Metrorail and shopping or errands. Washington DC’s pilot also showed that running errands and social travel were the most common uses for dockless vehicles.

For dockless e-bikes, recreation or exercise was the activity that was most chosen as a primary activity. Both options were bundled to mirror previous surveys and allow for comparisons, but the large share may warrant unbundling recreation from exercise in future surveys in order to add granularity to the analysis. Social and entertainment was also an important category where 20% chose it as their primary activity when using dockless e-bikes in Arlington, broadly in line with e-scooter ridership.

Importantly, while there does appear to be a significant share of discretionary ridership (for social or recreational purposes), activity distribution data also point to SMDs being used to facilitate necessary
activities such as commuting to/from work or school, running errands and connecting to transit. This distribution highlights that SMDs should not be thought of strictly as a recreational convenience, but rather as part of the County’s transportation ecosystem in all its facets.

The analysis below examines whether usage data from operators uncover similar trends. While examining trip data around Metrorail stations does not conclusively establish that people are using them to access Metrorail as these are also high commercial and residential areas, it nevertheless provides insight into travel patterns in and around transit stations which could indicate that riders are using SMDs to access transit.

Usage data plotted in Figure 29 below, illustrates that trips happen in areas of high transit supply suggesting a potential use of these SMD services as a complement or first and last mile modes for transit. The feedback form indicated this was the case from self-report perspective.

![Figure 29 Location of Metrorail stops and facilities on trip origin heat maps](image)

*Data source: Operator monthly reporting data

Transit: On average, scooter trips originated 0.38 miles away from transit and ended 0.48 miles away from transit. This short distance confirms previous discussions on trips occurring in high transit corridors and suggests the potential for scooter trips to complement transit. The analysis showed that late night trips originated and ended closer to transit stops (0.32 and 0.43 miles respectively) than overall trips indicating

---

23 Facilities include: Hospitals, Fire Stations, County Offices, Nature Centers Community Centers, Recycling Centers, Pools, Post Offices as found in Arlington County’s shape files (schools and Metrorail stations were filtered out).

24 The average distance is computed in GIS as a straight line and should be considered as an underestimation of the actual distance.
the importance of e-scooters complementing transit when it is unavailable during late night travel. The heat maps of late night travel show a comparable spatial distribution of trips to overall travel.

The research team had data available from Populus on trips around the following Metrorail Stations: Rosslyn Metrorail, Courthouse Metrorail, Clarendon Metrorail, Ballston Metrorail, Virginia Square Metrorail, East Falls Church Metrorail, Arlington Cemetery Metrorail, Pentagon Metrorail, Pentagon City Metrorail, Crystal City Metrorail, National Airport Metrorail.

When counting the larger area of 500 meters (0.31 miles) from a major Metrorail stops, the three major Metrorail stops with the most trips happening at their vicinity are Ballston Metrorail (78,000 parking events), Clarendon Metrorail (70,000 parking events), and Courthouse Metrorail (63,000 parking events) – all of which are located in the Rosslyn-Ballston Corridor.

Ballston Metrorail is the most likely to be connected to by SMDs, in terms of the highest number of parking events\(^{25}\), number of SMD deployment\(^{26}\), and trips starting and ending in the selected area. The least utilized major Metrorail stops in term of SMDs events (origins, destinations, origins or deployment) were East Falls Church Metrorail (866 parking events), and Pentagon Metrorail (1,729 parking events).

While elevated trip counts within 500 meters (0.31 miles) of transit stops directionally suggest the potential for multimodal ridership, more research is required to confirm this trend because Metrorail station areas are also areas of high commercial and residential density activity. Nevertheless, trip origin data does suggest Metrorail stations can be thought of as important nodes in the SMD network. For example, 64,000 trips on average originated within 500 meters (0.31 miles) of each of the five key Metrorail stops in the Rosslyn-Ballston corridor (Rosslyn, Courthouse, Clarendon, Virginia Square, Ballston) during the pilot, respectively, or almost 25% of all trips originating in the corridor.

However, direct integration with transit is difficult to ascertain given data available. In terms of “perfect” integration with transit, defined as SMD departures or arrivals exactly at Metrorail stops (within zero meters of a Metrorail stop), the number of SMD-related events (as logged by available data) diminishes dramatically. The number of SMD parking events, SMDs deployed, and trips originating and ending at zero meters from a major transit stop are much lower compared to activities recorded within the larger area of 500 meters (0.31 miles) from a major transit stop. The drop in the number of trips between 500 meters and trips within 0 meters might support the argument that not all trips near transit are taken by people using transit. However, due to data limitations, this result should not be stressed.

**Frequency of ridership: insights from the online feedback form**

With operator data limited in terms of identifying rider-specific usage patterns, the feedback form provided valuable insight into the SMD ridership landscape in terms of frequency of use.

When asked about the frequency of use of SMDs in Arlington County in the feedback form, more than half of dockless e-bike riders (57%) indicated not using dockless e-bikes often in Arlington by reporting to have ridden it only once or twice in Arlington. Only five percent of dockless e-bike respondents use the service four or more times a week. This could owe in part to the limited availability of dockless e-bikes in Arlington.

---

\(^{25}\) Parking events are events in between the vehicle is available for rent and the time it gets rented out.

\(^{26}\) Deployments are counts of initial deployment and rebalancing.
Conversely, 36% of e-scooter riders reported using scooters more than once a week, with 19% having only ridden once or twice in Arlington and 30% having ridden more than once or twice but less than once a week. The relative utilization patterns of e-bike and e-scooters are provided in Figure 30 below. In comparison, the Baltimore City evaluation found that 5% of e-scooter users use it every day, 32% use it a few times a week, 14% once a week, 31% few times a month and 19% used it only once or twice.

<table>
<thead>
<tr>
<th>How often do you SMDs in Arlington County?</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have only ridden e-scooters in Arlington County once or twice</td>
</tr>
<tr>
<td>Less than once a week, but I have ridden it more than twice</td>
</tr>
<tr>
<td>1-3 times per week</td>
</tr>
<tr>
<td>4-6 times per week</td>
</tr>
<tr>
<td>Every day</td>
</tr>
<tr>
<td>NA</td>
</tr>
</tbody>
</table>

Dockless E-bike Riders (N=292)  
- 57%  
- 23%  
- 4%  

E-scooter Riders (N=1,066)  
- 19%  
- 30%  
- 21%  
- 10%  
- 5%  

Data Source: Arlington County online feedback form

Figure 30 Frequency of SMD ridership according to the online feedback form

SMD rider characteristics

Key question: Who is using SMDs in Arlington County?

Summary: Result from the feedback form provide some preliminary insights into SMD rider profiles. In particular, statistics reflect a larger proportion of male riders than female, with a relatively lower average age of riders versus non-riders. In terms of occupation and education, the largest proportion of riders was made up of full-time employees and with lower rate of advanced degrees than non-riders yet still educated. This mirrors findings in Santa Monica, San Francisco and Portland Pilots. These findings and other takeaways on rider characteristics are examined in further detail throughout this section.

Gender: Results from the collected sample indicate that 46% of Arlington e-scooter riders identified as male, well above the 25% share for women. This finding mirror trends in other SMD pilot programs, although the skew towards male ridership was significantly more pronounced in pilot programs such as Santa Monica, Portland and San Francisco (See Table 7). Notably, roughly 20% of respondents to the feedback form (and more than 25% of e-scooter respondents) declined to disclose gender, thus skewing Arlington data lower in absolute than other programs. If limiting this analysis to respondents having disclosed their gender, then 63% of riders were male and 34% were female compared to 57% of female and 37% of male for non-SMD riders.

Table 7 Review of key results from pilot evaluations across the U.S. regarding gender

<table>
<thead>
<tr>
<th>Arlington</th>
<th>Santa Monica</th>
<th>Portland</th>
<th>San Francisco</th>
</tr>
</thead>
<tbody>
<tr>
<td>46%</td>
<td>25%</td>
<td>40%</td>
<td>45%</td>
</tr>
<tr>
<td>63%</td>
<td>34%</td>
<td></td>
<td>57%</td>
</tr>
<tr>
<td>37%</td>
<td></td>
<td></td>
<td>37%</td>
</tr>
</tbody>
</table>
**Age:** E-scooter riders in Arlington were also relatively **younger than non-riders**, with 47% of respondents using e-scooter aged 39 or less in 2019 (born after 1980). Interestingly, a relatively sizeable share of dockless bike-share riders that responded to the survey, around 30%, were born between 1965 and 1980 (~40-54 years of age), indicating some attractiveness of active SMD services to older generations as well, despite physical requirements. Once again, the lack of responses to demographic questions skews aggregate measures lower, and for example excluding those responses from the analysis would point to more than 63% of e-scooter riders born after 1980 (compared to 22% for non-SMD riders). Comparing these statistics to those of other pilot programs such as Portland and San Francisco reflect many directional similarities. In San Francisco, half of all survey respondents were between the ages of 25 and 34, while more than 50% of e-scooter riders in Portland were under 34 years of age.

**Education:** Comparing SMD riders to non-riders in the feedback form, a lower percentage of riders had advanced degrees, although it should be noted that the elevated proportion of advanced degrees (51%) for non-riders skews this comparison. This stands in contrast to the Portland pilot program for instance, which found a larger percentage of e-scooter riders having 4-year degrees than Portland residents, not supporting this conclusion.

**Ethnicity:** While there were limited differences between riders and non-riders to suggest a material skew in SMD ridership that would cause concerns in terms of equity and access, e-scooter riders in the feedback form had a higher proportion of Hispanic and black or African-American than non-SMD riders.

**Life stage:** E-scooter riders in the feedback form were more likely than non-riders to be undergoing a life transition, defined as experiencing a major life event altering their daily routine, with 38% of riders report a change of address or move in the past three years for example. Life events are important to transportation choices as they could make their travel less habitual and create conditions to break out of the inertia and open to new mobility solutions.

All these riders’ characteristics and others are provided in the charts below (Figure 31).
# Figure 31 Trip maker demographics according to the online feedback form

## Gender

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>NA</th>
<th>Non-conforming</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non SMD (N=2,840)</td>
<td>47%</td>
<td>30%</td>
<td>17%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dockless E-bike Riders (N=292)</td>
<td>32%</td>
<td>43%</td>
<td>21%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-scooter Riders (N=1,066)</td>
<td>25%</td>
<td>46%</td>
<td>26%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Age

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Non SMD (N=2,840)</td>
<td>17%</td>
<td>27%</td>
<td>29%</td>
<td>6%</td>
<td>21%</td>
<td></td>
</tr>
<tr>
<td>Dockless E-bike Riders (N=292)</td>
<td>1%</td>
<td>28%</td>
<td>30%</td>
<td>16%</td>
<td>1%</td>
<td>23%</td>
</tr>
<tr>
<td>E-scooter Riders (N=1,066)</td>
<td>2%</td>
<td>45%</td>
<td>21%</td>
<td>5%</td>
<td>27%</td>
<td></td>
</tr>
</tbody>
</table>

## Education

- Advanced degree (Masters, Doctoral)
- Associates degree, vocational school or certificate program
- Bachelor's degree
- Some college, but no degree

<table>
<thead>
<tr>
<th></th>
<th>Non SMD (N=2,840)</th>
<th>Dockless E-bike Riders (N=292)</th>
<th>E-scooter Riders (N=1,066)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>51%</td>
<td>45%</td>
<td>34%</td>
</tr>
<tr>
<td>Dockless E-bike Riders (N=292)</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>E-scooter Riders (N=1,066)</td>
<td>24%</td>
<td>28%</td>
<td>34%</td>
</tr>
</tbody>
</table>

## Race/Ethnicity

- White / Caucasian
- NA
- Asian / Pacific Islander
- Hispanic
- Black or African American
- Multiple ethnicity / Other (please specify)

<table>
<thead>
<tr>
<th></th>
<th>Non SMD (N=2,840)</th>
<th>Dockless E-bike Riders (N=292)</th>
<th>E-scooter Riders (N=1,066)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>66%</td>
<td>64%</td>
<td>59%</td>
</tr>
<tr>
<td>Dockless E-bike Riders (N=292)</td>
<td>22%</td>
<td>25%</td>
<td>29%</td>
</tr>
<tr>
<td>E-scooter Riders (N=1,066)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Household Income

- More than $150,000
- $125,000 - $149,999
- $100,000 - $124,999
- $70,000 - $99,999
- $50,000 - $74,999
- $25,000 - $49,999
- $15,000 - $24,999
- Less than $15,000
- I prefer not to answer
- NA

<table>
<thead>
<tr>
<th></th>
<th>Non SMD (N=2,840)</th>
<th>Dockless E-bike Riders (N=292)</th>
<th>E-scooter Riders (N=1,066)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>29%</td>
<td>34%</td>
<td>26%</td>
</tr>
<tr>
<td>Dockless E-bike Riders (N=292)</td>
<td>7%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>E-scooter Riders (N=1,066)</td>
<td>9%</td>
<td>10%</td>
<td>9%</td>
</tr>
</tbody>
</table>

## Housing Type

- Apartment or condominium
- Single-family, detached home
- Townhome, attached to other houses
- NA/ prefer not to answer

<table>
<thead>
<tr>
<th></th>
<th>Non SMD (N=2,840)</th>
<th>Dockless E-bike Riders (N=292)</th>
<th>E-scooter Riders (N=1,066)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>32%</td>
<td>31%</td>
<td>39%</td>
</tr>
<tr>
<td>Dockless E-bike Riders (N=292)</td>
<td>39%</td>
<td>33%</td>
<td>24%</td>
</tr>
<tr>
<td>E-scooter Riders (N=1,066)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Equity considerations of SMD utilization

*Key question: Are lower than Arlington median income neighborhood residents using SMDs?*

Looking at a bivariate map of trips and income levels, a map overlaying the count of trip origins and income distribution, shows that some neighborhoods with incomes below the Arlington County Median Household Income have a high trip generation number (colored in red in Figure 32 below) suggesting that SMDs could be appealing to lower-income residents and promoting equity. It should be noted as a caveat that due to lack of individual rider income data available, data in this chart reflect average income levels of the corresponding neighborhoods rather than those of riders themselves.

Conversely, areas colored in white in the chart below reflect neighborhoods with average incomes below the median household income that displayed a relatively low rate of SMD trip origination, particularly in South Arlington, mirroring the relatively lower rate of deployment of SMDs discussed in the Pilot Operations. While more research is likely required to examine the full extent of equity considerations, the bivariate map below does reflect some variability in ridership by income levels, with both positives and areas warranting further investigation.

*Data source: Operator monthly reporting data*
The feedback form included questions on federal assistance and awareness of operator’s equity programs but there were not enough responses to analyze the data. Only three e-scooter respondents indicated being eligible for federal assistance, and three riders indicated being aware and using Bird’s equity program, one respondent being aware of and using Lime’s equity program and one person having used Lyft’s equity program.

**Sustainability considerations of SMD utilization - mode replacement**

While difficult to measure through trip data, one of the aims of the feedback form was to measure the extent to which SMD penetration had led to mode replacement. To do so, the feedback form asked SMD riders how they would have made a trip in the absence of an SMDs and the change in use of other modes after starting to use SMDs.

**Alternative modes**

There are several important takeaways from the responses to this question as summarized in Figure 33 below. When asked about the mode they would have used to make the trip, the largest proportion of SMD-using respondents (37% of e-scooter riders and 22% of dockless e-bike riders) indicated walking as the alternative to their SMD trips. This is not surprising given the limited distances traveled on average by SMDs, as discussed in the Trip Characteristics section of this report.

The second most chosen alternative mode was ride-hailing (such as Uber, Lyft or Via). **Roughly one in five SMD riders suggested they would have used ride-hailing if not for SMDs**, indicating the potential for this mobility service to replace car trips. Understanding the competitive dynamics of SMDs vs. ride hailing is important in maximizing this trend, with convenience and flexibility of origins and destination at lower costs (especially for short trips, given ride-hailing fare minimums) likely one of the benefits leading to this substitution. This substitution in particular could result in congestion and air quality improvement as ride hailing is shown to increase traffic.

The third most common alternative mode substituted by e-scooters (13%) and dockless e-bikes (14%) were other motorized trips such as driving a personal car, also suggesting some sustainability and SOV mitigation potential. For the Portland pilot, they found that 19% would have driven a personal car, and 15% would have hailed a taxi, uber or Lyft. Interestingly, only 5% of e-scooter riders and 7% of e-bike riders referenced transit (bus or Metrorail) as the mode being substituted by SMDs, despite extensive transit service along both critical Arlington corridors.
When asked about their change of other modes after starting to use e-scooters in Arlington County, 38% of SMD riders indicated using services such as Uber less and 31% using their personal cars less. In terms of impact on walking, 17% of respondents said they walked less often which is not surprising, although another 11% of respondents also said they walked more, ostensibly to pick up SMDs from nearby locations. Eleven percent of respondents are also using Metrorail less, with some 10% increasing their use of transit (Metrorail or bus) suggesting a potential increase in first and last-mile access to transit.

Section three below turns to looking at the reaction of the community to the deployment described in section one and the utilization detailed in section two.
SECTION 3 - THE COMMUNITY’S REACTION TO THE PILOT

After examining the state of pilot deployment and trends in utilization, this section seeks to assess the Arlington community’s reaction to the SMD pilot. The approach consists first of evaluating riders’ experience and level of satisfaction with the service before examining the broader community’s (i.e. including non-SMD riders) reaction to the pilot and ending with a closer look at the unstructured complaints and compliments received by Arlington County.

SMD rider experience and satisfaction

**Key questions:** What were the main motivations behind using SMDs? Are riders satisfied with their experience in terms of access, safety, adequacy of infrastructure and appropriateness of rules and regulations? What were the main attitudes that were shaped during the pilot?

To evaluate the SMD rider experience, we focus primarily on responses from the online feedback form.

**Motivation to use SMDs**

When prompted to select their most significant driver for using SMDs (see Figure 34 below), the largest share of e-scooter riders (55%) selected “to get around faster” as one of their top three choices, making it the most selected answer of the option set. This was followed by “convenient” (44% of e-scooter respondents) and “fun to ride” (36% of e-scooter respondents). All three of the most popular answers mirror some of the key takeaways from utilization patterns, including short trips and relatively elevated rate of recreational riding. While e-bike responses were broadly similar, the main divergence in responses between e-scooter riders and dockless e-bike riders had to do with health benefits, with the “it’s healthier” response receiving 23% of responses for e-bike riders but almost nothing from e-scooters. “Avoid parking” is also among the top reasons (18% for e-scooter riders and 14% for dockless e-bike riders) which is noteworthy in that riders are acknowledging a competitive advantage for SMDs relative to cars. Similar to Arlington, 63% of survey respondents in the Portland e-scooter pilot survey chose “get around more easily, faster” as an answer to “why did you try e-scooters for the first time, either in Portland or another city?”.
Figure 34 Key determinants of SMD use in Arlington County according to the online feedback form

### Problem Experience

Another explicit goal of the feedback form was to assess how often SMD riders faced problems and what types of problems they encountered. Results from the feedback form related to the problem experience (provided in Figure 35 below) show that there is still room for improvement in terms of making the SMD experience more seamless. When asked which type of problem they encountered, only 36% of e-scooter rider respondents chose “none of the above”. Of the remaining 64%, the majority (60%) encountered either mechanical issues with their e-scooters or issues unlocking/locking e-scooters via the mobile app. Given the relative novelty of the e-scooter technology, some issues were to be expected, however, in the absence of comparable data with Capital Bikeshare or other pilots, there is no benchmark on what a “high” or “low” rate of problem experience is. More serious incidents were relatively scarce, with three percent...
of respondents having experienced a crash. Conversely, fewer respondents had problems with dockless e-bikes, with 59% not having experienced any of the given problems.

<table>
<thead>
<tr>
<th>Problem experience with riding SMDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Mechanical issues (brakes, wheels, lights or otherwise damaged e-scooters)</td>
</tr>
<tr>
<td>- Issues unlocking/locking e-scooters via the mobile app</td>
</tr>
<tr>
<td>- A crash in which you were hurt</td>
</tr>
<tr>
<td>- A crash in which someone else was hurt</td>
</tr>
<tr>
<td>- None of the above</td>
</tr>
</tbody>
</table>

Dockless E-bike Riders (N=292)  
- Mechanical issues: 10%  
- Issues unlocking/locking: 13%  
- A crash in which you were hurt: 2%  
- A crash in which someone else was hurt: 59%  

E-scooter Riders (N=1,066)  
- Mechanical issues: 33%  
- Issues unlocking/locking: 27%  
- A crash in which you were hurt: 2%  
- A crash in which someone else was hurt: 36%  

Data Source: Arlington County online feedback form

Figure 35 Problem experience with SMDs in Arlington according to the online feedback form

Satisfaction with the pilot and main attitudes shaped

Another important dimension the evaluation sought to explore was the attitude of riders towards the pilot, and first-hand recommendations from riders on how to improve the roll-out of SMDs in Arlington County. The full set of answers is provided in Figure 36, with the key takeaways as follows:

Positive attitudes: Overall the results suggest that e-scooter riders shared broadly positive attitudes towards e-scooters with 74% agreeing that e-scooters are convenient to ride and 74% agreeing that they enjoy riding, which sends a positive signal regarding rider satisfaction and future ridership. Also, 57% of respondents found that e-scooters are kept in good working condition. Finally, 58% of respondents agreed that they could find SMDs easily available near their office/school and 60% in their neighborhoods.

Expanding transportation options: Around 64% of respondents agreed that e-scooters have increased their ability to access destinations and 52% agreed e-scooter has increased their access to public transit and 57% agreed that e-scooters decrease their need for parking. This is a positive signal in terms of the potential for this new mobility service to expand transportation options, increase accessibility to destinations and decrease reliance on cars.

Room for improvement: A third e-scooter respondents (34%) agreed that the maximum speed of 10 MPH was adequate, and less than half (48%) felt safe riding e-scooters, both of which are key items for policymakers as they pertain to regulations and infrastructure, respectively. The percentage of people feeling safe riding an e-scooter can be expected to increase as people become more familiar with the technology (see section below on perceptions of safety).

Finally, a good share of respondents (40%) agreed that they prefer to use e-scooters over other transportation modes whenever possible providing encouraging signs in terms of long-term adoption rates.
### E-scooter Attitudes Developed During Arlington's SMD Pilot (N=1,066)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>I find e-scooters convenient to ride</td>
<td>53%</td>
<td></td>
<td>21%</td>
<td>6%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>I enjoy riding an e-scooter</td>
<td>52%</td>
<td></td>
<td>22%</td>
<td>6%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>I find e-scooters easy to use</td>
<td>46%</td>
<td></td>
<td>30%</td>
<td>4%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>E-scooters have increased my ability to access destinations around</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arlington County</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using e-scooters has decreased my need for parking</td>
<td>34%</td>
<td></td>
<td>30%</td>
<td>11%</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>E-scooters are easily available near my office/school</td>
<td>33%</td>
<td></td>
<td>24%</td>
<td>16%</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>E-scooters have increased my access to public transportation in Arlington</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>County</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-scooters are easily available in my neighborhood</td>
<td>26%</td>
<td></td>
<td>32%</td>
<td>13%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>I prefer to use e-scooters over other transportation modes whenever</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>possible</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel safe riding an e-scooter</td>
<td>19%</td>
<td></td>
<td>29%</td>
<td>18%</td>
<td>10%</td>
<td>8%</td>
</tr>
<tr>
<td>E-scooters are kept in good working condition</td>
<td>12%</td>
<td></td>
<td>45%</td>
<td>19%</td>
<td>6%</td>
<td>2%</td>
</tr>
<tr>
<td>The 10-mph e-scooter speed feels fast enough for where I ride</td>
<td>11%</td>
<td></td>
<td>23%</td>
<td>11%</td>
<td>17%</td>
<td>22%</td>
</tr>
</tbody>
</table>

*Figure 36 Rider’s attitudes with respect to SMDs according to the online feedback form*
**Broader community experience with SMDs**

Expanding the analysis to non-riders of SMDs provides interesting insights into how the pilot was perceived and the impact it has had on the community more broadly and on the transportation ecosystem in Arlington County. For this analysis we also rely on the findings of the feedback form.

**Perceptions of safety**

When asked about how safe respondents felt as pedestrians around different modes in Arlington, e-scooters stand out as a key source of concern for the community. More than half (57%) of respondents reported feeling unsafe to very unsafe around e-scooters compared to 26% for dockless e-bikes, 14% for capital bike share and 13% for regular bikes (as shown in Figure 37a below).

However, untangling the responses to this question with regards to e-scooters specifically by separating respondent groups (split between e-scooter riders, dockless e-bike riders and non-SMD riders), uncovers significant variance in perceptions. Results display a significant skew towards safety concerns by non-SMD respondents with 73% of non-SMD responding not feeling safe as opposed to 41% of dockless e-bike riders, and just 15% of e-scooter riders. Lack of familiarity with the service, rules and regulations pertaining to ridership and the rapid emergence of SMDs could all have contributed to this negative sentiment, with time, habit and experience (trying SMDs) potentially mitigating such concerns to some extent in the medium to long term.

*Figure 37 Pedestrian’s perception of safety (a) around all modes (b) around e-scooters*
Perceptions of comfort

The perceptions highlighted in the previous section towards e-scooters permeates throughout the feedback form including blocked sidewalks for pedestrians and safety concern for drivers. These results are provided for reference in Figures 38 through 41 below.

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**Figure 38** Pedestrian’s frequency of encountering blocked sidewalks due to transportation modes

**Data Source:** Arlington County online feedback form

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**Figure 39** As a pedestrian in Arlington County, how often do you encounter blocked sidewalks due to e-scooters being improperly parked?

**Data Source:** Arlington County online feedback form
Figure 39 Pedestrian’s frequency of encountering blocked sidewalks due to e-scooters by rider type

<table>
<thead>
<tr>
<th>Dockless e-bikes</th>
<th>E-scooters</th>
<th>Capital bikeshare</th>
<th>Regular bike</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Comfortable</td>
<td>11%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>Comfortable</td>
<td>19%</td>
<td>42%</td>
<td>15%</td>
</tr>
<tr>
<td>Neutral</td>
<td>26%</td>
<td>20%</td>
<td>23%</td>
</tr>
<tr>
<td>Uncomfortable</td>
<td>17%</td>
<td>7%</td>
<td>21%</td>
</tr>
<tr>
<td>Very Uncomfortable</td>
<td>10%</td>
<td>6%</td>
<td>13%</td>
</tr>
<tr>
<td>NA</td>
<td>0%</td>
<td>0%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Data Source: Arlington County online feedback form

Figure 40 Driver’s comfort around transportation modes

<table>
<thead>
<tr>
<th>Dockless E-bikes</th>
<th>E-scooters</th>
<th>Non-SMD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Comfortable</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Comfortable</td>
<td>11%</td>
<td>31%</td>
</tr>
<tr>
<td>Neutral</td>
<td>13%</td>
<td>16%</td>
</tr>
<tr>
<td>Uncomfortable</td>
<td>21%</td>
<td>10%</td>
</tr>
<tr>
<td>Very Uncomfortable</td>
<td>20%</td>
<td>53%</td>
</tr>
<tr>
<td>NA</td>
<td>0%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Data Source: Arlington County online feedback form

Figure 41 Driver’s comfort around e-scooters by rider type
The online feedback form also had an open-ended question about “how do improperly parked dockless e-bikes and e-scooters impact you”. Because this was an open-ended question, responses varied in length and topic. In this analysis, the responses were categorized based on common topics that arose while the survey responses were being reviewed (See Figure 42 below). Keywords were used to help group responses into common categories, such as “safe”, “walk around”, “wheelchair”, “property”, and “block”. For example, the keyword “block” was used to review responses about how incorrectly parked SMDs blocked the path of pedestrians in Arlington County.

There was a total of 2,876 responses for the open-ended feedback question about improper parking. This does not include the 1,187 who did not provide any additional feedback.

Most of the feedback (884 responses, or 31% of total feedback received) was about how improperly parked SMDs blocked the path of pedestrians in sidewalks, driveways, and other common-use areas in Arlington County. The second most frequent feedback is how these improperly parked SMDs pose a safety hazard to pedestrians, who can possibly trip on improperly parked SMDs (417 responses, or 14% of total feedback received). The size of the share of people who stated a safety concern is the same as those who reported minimal to no negative impact from improperly parked SMDs (398 responses, or 14% of total feedback received).

Other feedback categories that received high responses were from people who thought improperly parked SMDs clutter Arlington County (335 responses, or 12% of total feedback received), those who were concerned about how improperly parked SMDs may negatively affect people with mobility issues (307 responses, or 11% of total feedback received), and those who resorted to just walking around improperly parked SMDs27 (225 responses, or 8% of total feedback received).

Other categories of feedback received were general feelings of negative impact from parked SMDs (154 responses, or 5% of total feedback received), and more precise complaints such as finding it difficult to deal with SMDs that tip over (75 responses, or 3% of total feedback received), or improperly parked SMDs abandoned on private property (55 responses, or 2% of total feedback received).

How do improperly parked SMDs impact you?

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Responses</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMDs block my path</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>Safety hazard</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>No impact</td>
<td>14%</td>
<td></td>
</tr>
<tr>
<td>Clutter</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td>A concern for people with mobility issues</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>I just walk around them</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Difficult when SMDs tip over</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Left on private property</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Impacted negatively (general feeling)</td>
<td>5%</td>
<td></td>
</tr>
</tbody>
</table>

Data Source: Arlington County Feedback Form

27 This is not the same as “I just walk around them” which is closer to “no impact”.

76
The open-ended responses differed between riders and non-riders. Out of the people who reported “no impact”, 66% used either type of SMD and 34% were non-riders.

**Barrier to using SMDs and ways to address it going forward**

The feedback form also sought to assess the barriers for use, targeting specifically non-riders. When asked why they haven’t used e-scooters in Arlington in a close-ended form, the first popular choice was “I don’t think e-scooters are safe” selected by 58% of non-SMD riders and 32% of dockless e-bike riders and the third most popular choice was “I feel unsafe riding in the street” selected by 36% of non-SMD riders and 21% of dockless e-bike riders (see Figure 43 below). This suggests that the main barrier to using e-scooters in Arlington pertain to the adequacy of the infrastructure or a safe place to ride. This suggests that there is potential for further penetration of SMDs if safety concerns are addressed, be it through infrastructure or better maintained or designed devices. The second most popular deterrent was lack of interest in using SMDs, with 56% of non-SMD riders selecting this option.

When asked about specific measures that could lead them to start using or increase use of SMDs, the most popular responses across riders were “safer places to ride”, “more e-scooters available in Arlington” and “lower cost of e-scooters”. Detailed results are provided in Figure 44. A large number of non-SMD respondents (68% of respondents) reported that none of the options provided could make them ride
SMDs, illustrating some level of pre-conceived aversion to such devices. As the section on attitude comparison between types of riders show, this perception or response could change once non-SMD riders try the service or it becomes more familiar with fewer negative experiences.

From the in-person feedback form during the outreach events, 37% indicated nothing could make them ride more, 27% chose more SMDs in Arlington, 22% lower cost, 16% safer places to ride and 3% more SMDs in surrounding jurisdictions.

<table>
<thead>
<tr>
<th>What would encourage you to start using or to increase your use of e-scooters in Arlington County? Please select up to 3.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Safer places to ride</td>
</tr>
<tr>
<td>More e-scooters available in Arlington</td>
</tr>
<tr>
<td>Lower cost of e-scooters</td>
</tr>
<tr>
<td>More e-scooters available in surrounding jurisdictions</td>
</tr>
<tr>
<td>Longer battery life</td>
</tr>
<tr>
<td>Better condition of e-scooters</td>
</tr>
<tr>
<td>None of these changes would encourage me to...</td>
</tr>
<tr>
<td>Easier rental without a smartphone</td>
</tr>
<tr>
<td>Different e-scooter design</td>
</tr>
</tbody>
</table>

**Data Source:** Arlington County online feedback form

*Note: Other = 346*

*Figure 44 Factors that would encourage the community to use SMDs more*

When asked what infrastructure would make them feel safer (Figure 45 below), most SMD riders (e-scooter riders and dockless e-bike riders) wanted bike lanes separated from motor vehicles traffic with a physical barrier while most non-SMD riders wanted designated e-scooter parking. From the in-person responses during the outreach events, 66% wanted bike lanes separated from traffic with a physical barrier, 36% wanted smoother pavement, 36% wanted designated parking and 22% wanted wider bike lanes.
Figure 45 Factors that would make the community feel safer on or around SMDs

Unstructured feedback

Key questions: What are the dimensions they care most about? What is working and what is not working?

This section discusses feedback outside of the guided framework of the feedback form. This analysis provides valuable insights into the issues that the community genuinely cares about, unprompted and unguided by researchers or survey, complementing the rest of the analysis. The evaluation of unstructured feedback shows how the community is thinking about SMDs, both in terms of complaints and compliments.

A closer look at voluntary complaints and compliments: the Mobility Inbox (mobility@arlingtonva.us)

Evaluating self-initiated voluntary submissions helps uncover: (1) themes that community members feel strongly about, and (2) within the themes, the dimensions they associate with SMDs.

The total number of emails received, disregarding duplicates and irrelevant inquiries (as noted in the Methodology section), is 727 emails. The total number of emails decreased considerably from October (226 e-mails) to February (24 e-mails) (see Figure 46 below). In absolute terms, counts increased again between February and May but accounting for the number of trips (i.e. exposure), complaints have decreased consistently from 3.7 inbounds per 1,000 trips in October 2018 to just 0.6 e-mails per 1,000 trips in June. Increasing familiarity with SMD service maybe a contributor to this decrease, as may be rider familiarity with rules and parking etiquette.
Figure 46 Inbound inquiries received to the Mobility Inbox over time (N=727)

Examining the key topics flagged in e-mails sent to the Mobility Inbox (See Figure 47 below), “parking” received the highest number of complaints, followed by sidewalk riding, safety, rider behavior and underage riding.
Key topics identified in the Mobility Inbox

This is also illustrated in the word cloud in Figure 47 below depicting the relative frequency of the topics discussed in Figure 47. Overall, concerns relating to sidewalks are the most frequent source of complaints, whether it is about riding on the sidewalk or parking on the sidewalk.

A closer look at the qualitative complaints raises several important observations. First, within SMDs, scooters received much more attention than dockless e-bikes. This is expected given the small number of e-bikes in circulation during a shorter period of time compared to e-scooters.

In terms of how the community is thinking around SMDs, some dimensions stand out:

- The infrastructure
- Parking and riding
- Transportation modes
- Land use
- Rules and regulations
- Safety
- Speed
- Demographics
- Specific operators
- The human factor
Key comments pertaining to some of these key dimensions are described below with supporting direct quotes and pictures (when available) from the Mobility Inbox.

The infrastructure. Sidewalks is the most frequent word found in the word cloud. This mirrors other findings whereby complaints mainly pertain to people littering the sidewalks, blocking the sidewalks or causing danger when they interact with pedestrians on the sidewalks. For the infrastructure, “signs” show up.

“Despite Arlington's efforts to clarify expectations surrounding e-scooter usage, most riders do not have a helmet, are leaving their scooters in the middle of sidewalks, and displaying unsafe behaviors in the road that I worry will cause an accident. While I think that bikes and scooters are wonderful transportation methods, I think that bikes and manual scooters lend themselves to people who have experience riding them, while e-scooters are self-balancing and tend to draw the attention of people who really should not be riding them. I view this as a safety hazard both to pedestrians and riders, and do not think we have the infrastructure necessary to safely accommodate use during rush hour.”

As shown, the comments below include both “parked” and “active/riders” vehicles. The infrastructure also includes streets and roads, trails, and lanes.
“I am writing to let you know of my displeasure with the preponderance of Scooters in our neighborhood. They are parked all over the place (driveways, lawns, in the middle of sidewalks) and are an eyesore - I also believe that they can be a safety hazard if the operator is not paying attention.”

“Many riders are riding too fast, scooting around cars and barreling down the sidewalk where pedestrians can turn or step one direction and get slammed (as almost happened to me on a couple of occasions in the Ballston area) because you don’t hear them coming and don’t expect them flying down the sidewalks.”

The human factor. The community is also thinking about the human element which show up in the word cloud as “people”, “community”, “residents”, “public”.

“It would be preferable that these so-called “dockless scooters” would not be parked in places that inconvenience other people in the neighborhood. It is also unsightly to see them parked here and there. If parked on grass they could impede lawn mowing; if parked on sidewalks they could impede walkers; if parked in bike lanes, they could impede bikers. You need a better solution. What happens when it snows and people can’t shovel their sidewalks?”

Transportation modes. The word cloud also shows that people are thinking in terms of other modes and riders. Pedestrians for instance show up with a high frequency. Although to a lesser extent, words such as drivers/driving, cars, the buses, metro, walking, traffic and “transportation”, also show up in the list of complaints. This means that it is important that the County both examines the impact of SMDs on other modes but also educate the community on the findings through outreach and community events.

“As a car-free working adult, I personally love the electric scooters. While I love them, I also have come across some issues that we need to work out. I use Capital Bike share but find the locations not always convenient (and usually mean additional walking sometimes adding quite a bit of time) and not always available. I appreciate the electric scooters as they provide another option to get me to location, usually within a mile, where bike share may not be the best option (sweat), conveniently located, or even available. The cost for using the scooters is right. For example, I had to run an errand a mile away along the metro line. The simple and fastest way for me to get there was to use a scooter. Metro would have added 30-60 minutes to go one stop (walking, weekend hours, train ride, walking). Bus also would have been longer. Lyft would have cost 5 times as much. To fit the trip in and spend money locally instead or ordering my item on Amazon, I only got this errand done because of the scooter.”
Land use. People complaining about or complimenting SMDs often reflect on the land use. Words such as “neighborhoods”, “schools”, “property”, “areas” as well as specific areas such as “Clarendon”, “Wilson”, “Ballston”, “Washington” or “Glebe” all show up in inbound comments.

“I’m also curious as to how much the companies that own said scooters will be paying for the inevitable use of sidewalks and other public spaces / county property that ‘brick & mortar’ stores utilize and pay for through their taxes. From what I’ve read, one of the major advantages of ‘dockless’ technology is to get around having to pay a county or business for areas in which to place and maintain docks, instead just letting people leave them wherever, which means they skip out on some taxes related to land-use and property ownership while still using up public or private property & space.”

Rules and regulations. Key words: “Rules”, “regulations”, “laws”, “enforcement”, “police”, “allowed”.

“I understand that the regulations in place are meant to make the use of these safe for riders, drivers, and other pedestrians. But most riders don’t follow them and enforcing those regulations would be a herculean task and a waste of our police officers’ time. Any policy that relies on the good faith and sound judgement of a self-selecting group of individuals (with no real qualifications for use) is doomed to fail.”

Safety. Key words: “Dangerous”, “helmets” “safety” “hit”

“I think the new scooters are great as a way for people to get a little further a little faster than walking while being much cheaper and greener than having more cars. However, I notice on your website that ‘Dockless e-scooters and e-bikes are considered motorized vehicles and are subject to the same rules and regulations as a motor vehicle.’ I cannot think of a single time that I have seen a scooter rider obeying the rules of the road and not cutting across an intersection diagonally, riding against traffic, crossing streets in the middle of blocks, and generally behaving dangerously. I would encourage the County to launch an aggressive safety education campaign, because I don’t want to see an accident or injury.”

Speed. Key words: “Mph” and “fast speeds”

“Hi, I have a complaint regarding Arlington’s 2019 regulation of electric scooters. The new regulation mandates that all e-scooters should be limited to 10mph. Having ridden the scooters now that the new rule is in place in 2019, I can say with certainty that they have been rendered useless. At 10mph, they are a danger to the rider when ridden in the street, which is the only place the county allows people to ride them. At such slow speeds, they are inefficient, cost more to riders because the trips are longer, are very unsafe because no traffic on any street in the county goes only 10mph, and will cause traffic jams galore. Also, the scooters are supposed to solve the “last-mile” transit option, and if they can only go 10mph, they cannot be used for commuting of any kind because they are not much faster than a walking speed. With this speed reduction, people will have no incentive to take public transit because they won’t have an efficient ride home from the station and will opt instead to drive more.”

Information and communication. Key words: “information”

Aside from the Mobility Inbox analyzed in this section, Arlington County’s outreach events were an important source of qualitative unstructured feedback. These comments were obtained by intercepting
people at events who likely have not had access to the feedback form about SMDs. The analysis below describes the main findings from these events.

A closer look at the results from Arlington Community Outreach

As introduced in the research approach chapter of this report, Arlington County communication and outreach staff conducted a series of 10 outreach events. This section summarized the main insights gained from these sessions.

The main conclusion from the outreach is that most attendees acknowledged that the current program has challenges, with a majority expressing an interest in resolving issues rather than an end to the program.

“My opinion isn’t strong enough for a dot, but I support trying something.” - Non-rider
“I don’t dislike them, but it’s just hard. It’s a new technology and everyone’s figuring it out.” - Non-rider

The main comments received addressed: accessibility, parking, adequacy of the infrastructure, appropriateness of the rules and regulations and equity. These are summarized below.

Accessibility

- “I take two buses to get to work, and the scooter helps me make my first bus so I don’t have to hustle while walking or drive the whole way.” - Multimodal commuter
- “I like the scooters—Arlington should continue to be a leader in transportation. We should strive to be innovators.” - Non-rider
- “I used to take this trip to the grocery store for a few things with a car, now I can just do it with this” - Scooter rider
- “They feel more approachable, like less athleticism is required than the bikes.” - Rider, young woman

Parking

- “I’m going to go with incentives, because all these things (corrals, racks, lock-to) don’t mean anything without a way to get people to use them” - Non-rider
- “Better parking options are good ideas— but need to make it convenient and intuitive, or people won’t use them. Maybe with incentives?” - Non-rider
- “Concern for parking behavior presents special challenges in neighborhoods with narrow or no sidewalks. Some of the parking solutions proposed don’t make as much sense outside of the corridors”.

Adequacy of infrastructure

- “As a biker, I totally get the need to sometimes be on the sidewalk when the road doesn’t feel safe, but behavior needs to be better.”
- “The street isn’t a good place to ride sometimes. In those places, there need to sidewalks wide enough for everyone.” – Walker
- “These new devices with smaller wheels mean than potholes in the street are an even bigger risk than to bikers and cars. I didn’t want to ride on the sidewalk, so I rode on the street and broke my collarbone hitting a pothole.” - Former scooter rider
- “If there isn’t a bike lane, where should I ride? The street where cars are going fast or the sidewalk where I need to slow down for other people there?”

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Appropriateness of rules and regulations

Trails

- “We need to be able to use trails—so much of how you can get places safely is trails in Arlington” - E-scooter commuter
- A recurring concern from trail-riders of all types is the number of devices left along trails. They seem to stay longer than other devices and would be harder for operators to get access to pick up.

Speed limits

- “I understand the interest in having a speed limit, but the way e-scooters currently limit speeds don’t let us power up hills; it seems limited by power output rather than actual speed. If I have to kick up a hill, it limits the effectiveness of it as a transportation option. Small adults can go faster than large adults; makes it odd to ride with friends.” – Frequent scooter rider

Jurisdictional differences

- “It feels like each place you can ride them has different rules. It makes it confusing.” - Occasional rider

Age limits

- “I mean, I can drive a car. Why is a scooter different?” - High school student
- “If the companies are genuine about not targeting young riders, then they shouldn’t drop them off near Swanson, Gunston.” - Parent

Equity

- “I heard that some companies are limiting use to the major neighborhoods. That doesn’t seem right— if they’re here, they should be available everywhere.” - Occasional rider
- “I don’t have a smartphone. You look at the scooter, and even if I wanted to ride it, I can’t. There’s nothing that tells me how.”

Figure 49 Pictures from Arlington County outreach events

When asked about solutions they found most attractive (see Table 8 below), bike lanes were most popular (chosen 32% of the time across the events) followed by racks (chosen 22% of the time across the events) then corrals (chosen 16% of the time across the events), education (chosen 42 times), incentives (chosen 32 times), lock-to technology (chosen 18 times) and GPS fencing (chosen 17 times). Some people suggested other new ideas such as: one app for all scooters, scooter docks charging batteries, more stable scooters with better lights, and smoother pavement.
A closer look at open-ended feedback from the online feedback form

This section discusses the additional feedback gathered from the SMD online feedback form. Participants were asked for any additional feedback they may have about the SMD Pilot Evaluation and Arlington County. Because this was an open-ended question, responses varied in length and topic (See Figure 50 below).

In this analysis, the responses were categorized based on common topics that arose while the feedback form responses were being reviewed. Keywords were used to help group responses into common categories, such as “safe”, “dangerous”, “sidewalk”, “speed”, and “park”. For example, the keyword “park” was used to review responses about SMDs wrongly parked in private property and on sidewalks, as well as feedback about providing designated docks for SMDs.

There was a total of 1,978 responses for the “additional feedback” portion of the feedback form. This does not include the 2,085 who did not provide any additional feedback.

There was no plurality of open-ended feedback. The most frequent open-ended feedback was only 522 responses, or 26% of total open-ended feedback received and that was about safety concerns for pedestrians and SMD riders. The second most frequent open-ended feedback’s theme was about how SMDs need better regulation and enforcement (318 responses, or 16% of total open-ended feedback received). The third most frequent open-ended feedback’s theme was to ban SMDs (195 responses, or 10% of total open-ended feedback received).

The other feedback categories that appeared frequently in open-ended responses were about designated docks for SMDs (182 responses, or 9% of total open-ended feedback received), how SMDs provide another transit option in Arlington County (109 responses, or 6% of total open-ended feedback received), and complaints about how SMDs clutter Arlington Count (104 responses, or 5% of total open-ended feedback received).
One positive feedback received was how SMDs provide another option to get around Arlington County (109 responses, or 6% of total feedback received). Other general positive feedback about SMDs (i.e., “I like scooters!”) comprised of 78 responses or 4% of total feedback received. There were a few calls to deploy more SMDs in more areas around Arlington (19 responses, or 1% of total feedback received).

Note 1: Chart only shows feedback categories that received 50 or more responses

Figure 50: Open-ended feedback received, categorized by topic
CHAPTER 5: CONCLUSION – LESSONS LEARNED & RECOMMENDATIONS

This report presents a detailed analysis of Arlington County’s shared mobility devices (SMD) pilot as it pertains to its service operations, service utilization and the community’s initial reactions to the service. While more comprehensive in nature, the ultimate objective was to understand how these services performed. Performance was measured against the County’s transportation goals as defined in its Master Transportation Plan (MTP) mainly with respect to mobility, safety, equity and sustainability.

Coming to a single conclusion on SMD performance is challenging. The mobility service is new, the infrastructure is evolving with the increase in adoption (e.g. addition of SMD parking corrals), and changes in the technology. Moreover, data is scarce, and research and benchmarking measures are almost non-existent. Acknowledging these constraints, the main takeaways from this evaluation is that three levels of performance were identified:

**Good SMD performance** SMDs can provide a viable complement to the County’s transportation ecosystem that increases mobility options and advances sustainability. Results of the pilot confirm that shared mobility devices are popular, with high number of trips and adoption, they are positively perceived by those who them and could provide sustainability and equity benefits as it increases active transportation and access.

**Mixed SMD performance** Certain aspects of the pilot have shown more mixed results, with inconclusive results as to a clear success or failure in terms of performance. This includes the focus on equity concerns (with a disparity in normalized deployment between North and South Arlington), and the clear communication of rules and regulations to the Arlington community.

**Weaker SMD performance** There remain some challenges with the integration of SMDs in Arlington that will need to be addressed. This includes clear safety concerns from the standpoint of riders, pedestrians and drivers in Arlington pointing to the need for more adequate infrastructure (e.g. protected bike lanes), and community concerns over parking and clutter resulting from the program. Safety concerns are also expected to dampen with time as more people use SMDs and become familiar with such services. Results have shown considerable differences in perceptions between SMD riders and non-SMD riders. This suggests that perceptions should improve as more trips become repeat trips and not first trips.

The summary evaluation table below provide an overview of how the results of this pilot were used to evaluate performance with respect to advancing Arlington County’s transportation goals.
<table>
<thead>
<tr>
<th>KEY QUESTIONS</th>
<th>PILOT OPERATIONS</th>
<th>UTILIZATION</th>
<th>COMMUNITY’S REACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAS THE LEVEL OF SMD SERVICE IN ARLINGTON DURING THE PILOT BEEN ADEQUATE GIVEN RIDER DEMAND</td>
<td>YES, RELATIVELY - Arlington gets more SMDs per 1,000 resident (4.0) than Washington DC (2.4) and more vehicles than Capital Bikeshare in Arlington (3.1 SMDs per 1,000 resident).</td>
<td>N/A</td>
<td>NO – Too many - Several respondents in the open ended (5%) and feedback form (12%) referred to improperly-parked SMDs as “clutter”. Not enough (at key locations) – More than 30% of respondents disagreed that e-scooters were available in their neighborhood or near their office/school.</td>
</tr>
<tr>
<td>IS THE PUBLIC RECEIVING ENOUGH INFORMATION ON HOW TO INTERACT WITH THESE “NEW” SERVICES?</td>
<td>NO - Relatively low awareness of rules and regulations as well as acknowledgment of receipt of information on complaints and local regulations from operators. 20-22% of SMD riders and 43% of non-riders do not know what the laws are. Less than half of respondents (45%) indicated that they had received information from operators on local regulations and less than a third (30%) indicated that they received information on filing a complaint.</td>
<td>N/A</td>
<td>NO - Comments to the Mobility Inbox and open-ended questions to the feedback form showed recurrent lack of knowledge on rules, regulations and how to ride SMDs, indicating that riders should be educated regarding (1) sidewalk riding, (2) speed, and (3) parking. YES – Comments and complaints reflecting a lack of understanding of SMDs and rules/regulations decreased significantly over the course of the pilot, suggesting familiarity and experience could be having an impact.</td>
</tr>
<tr>
<td>IS THE ARLINGTON INFRASTRUCTURE ADEQUATE TO SUPPORT A SMOOTH OPERATION OF THESE SERVICES?</td>
<td>N/A</td>
<td>YES – Implementing corrals in areas of high ridership with signs of elevated utilization; NO - limited availability of protected bike lanes that would make riders feel safer. 67% of respondents of the feedback form prefer to ride on protected bike lanes.</td>
<td>NO - 58% of e-scooter riders would feel safer if there were bike lanes separated from motor vehicle traffic with a physical barrier.</td>
</tr>
<tr>
<td>ARE THESE SERVICES INCREASING RESIDENTS’, WORKERS’ AND VISITORS’ ACCESS TO ACTIVITIES?</td>
<td>N/A</td>
<td>YES - Riders use SMDs for transportation trips, only 8% of e-scooter riders and 23% of dockless e-bike riders use it for recreation or exercise purposes, pointing to a high use of SMDs to get to destinations and activities.</td>
<td>YES: SMD riders like the new mobility service. 74% from the online feedback form find it convenient to ride, 74% enjoy riding it, 76% find it easy to use. 4% of respondents said they would not have made their most recent trip if not for SMDs.</td>
</tr>
<tr>
<td>IS THE RATE OF BROKEN SMDS ADEQUATE?</td>
<td>Monthly variability ranges between 2% and 8% of SMDs reported broken over the pilot</td>
<td>N/A</td>
<td>NO - 33% of e-scooter riders reported having experienced a mechanical issue and 27% reported having experienced issues unlocking/locking e-scooters via the mobile app in Arlington County. YES – From an operational standpoint, broken SMDs have had a limited effect on overall deployment with the exception of one operator.</td>
</tr>
<tr>
<td>KEY QUESTIONS</td>
<td>PILOT OPERATIONS</td>
<td>UTILIZATION</td>
<td>COMMUNITY’S REACTION</td>
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<tr>
<td>------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td><strong>ARE SMDS SUBSTITUTING FOR CAR TRIPS?</strong></td>
<td>N/A</td>
<td><strong>YES</strong> – 19% of e-scooter riders would have used Uber or Lyft and 13% would have driven a personal car or other motor vehicles to make their most SMD-based recent trip.</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>ARE SMDS PROVIDING A DIFFERENTIATED AND USEFUL COMPLEMENT TO ARLINGTON’S MULTIMODAL TRANSPORTATION SYSTEM IN SUCH A WAY THAT IT WOULD ALLOW RIDERS TO REQUIRE LESS CARS OR SOV USES?</strong></td>
<td><strong>YES</strong> – Deployment is concentrated around areas of high transit accessibility and along key transit corridors.</td>
<td><strong>YES</strong> – 18% of e-scooter riders and 8% of dockless e-bike riders reported using SMDs to connect to/from Metrorail; 11% reported increasing their use of bus and 10% reported increasing their use of Metrorail after starting to use e-scooters in Arlington County Elevated count of trips originating or arriving at transit stops. Limited signs of significant direct substitution of transit trips by SMDs (7% reported less Metrorail and 3% less buses).</td>
<td><strong>YES</strong> - 14% of e-scooter riders chose &quot;it’s environmentally” friendly in their top three choices of why they use SMDs in Arlington. When prompted to select their most significant driver for using SMDs, “to get around faster” and “convenient” were the most popular answers, supporting the perceptions of SMDs as a useful complement to the Arlington transportation landscape.</td>
</tr>
<tr>
<td>KEY QUESTIONS</td>
<td>PILOT OPERATIONS</td>
<td>GOAL 3: PROMOTE SAFETY UTILIZATION</td>
<td>COMMUNITY’S REACTION</td>
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<tr>
<td><strong>DO CRASH RATES CONFIRM THAT SMDs ARE RELATIVELY SAFE?</strong></td>
<td>There were 69 crashes in total between October 2018 and June 2019 (~20 crash/100k miles)</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>YES</strong> – Crash statistics indicate that SMDs are relatively safer than cars</td>
<td>YES – Crash statistics indicate that SMDs are relatively safer than cars</td>
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<tr>
<td><strong>NO</strong> – Crash rates exceed average bike crash rates</td>
<td>NO – Crash rates exceed average bike crash rates</td>
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<td></td>
</tr>
<tr>
<td><strong>DO RIDERS AND NON-RIDERS FEEL SAFE ON OR AROUND SMDs?</strong></td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>NO</strong> – As riders, less than 50% of respondents felt safe riding SMDs in Arlington, with lack of infrastructure flagged as a key reason. As pedestrians, more than half of respondents reported feeling unsafe to very unsafe around e-scooters – skewed higher by non-SMD riders. 26% of open-ended questions discussed concerns about safety, which included helmet use. From the online feedback form, 58% of non SMD riders don’t think e-scooters are safe. Safety is the main barrier for not using SMDs according to the online feedback form and third most important source of complaints to the Mobility Inbox.</td>
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</tr>
<tr>
<td>KEY QUESTIONS</td>
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<tr>
<td>ARE LOWER-INCOME RESIDENTS ADEQUATELY SERVED BY SMDS COMPARED TO HIGH-INCOME RESIDENTS?</td>
<td>YES - While the analysis showed that North Arlington received between 1.3x and 2.5x more service than South Arlington, the analysis also showed that some lower than median income areas received higher than average service. NO – Certain neighborhoods with incomes below the median had low deployment measures.</td>
<td>YES - The analysis showed that trips are generated from and are ending in areas of lower than median household income. NO – Certain neighborhoods with incomes below the median had low ridership measures.</td>
<td>YES – Few comments had to do with lack of accessibility to SMDS or underserved neighborhoods. No – Comments did refer to the dependence of SMDS on smartphone, with accessibility limited without one.</td>
</tr>
<tr>
<td>DO SMDS HELP ARLINGTON COUNTY CATER TO THE NEEDS OF DISADVANTAGED SEGMENTS OF THE POPULATION AND PROMOTE EQUITY?</td>
<td>N/A</td>
<td>YES - There are areas with lower median incomes and high ridership rates. Late night travel provides opportunities for people to return back from home if need be when transit is not accessible during that time.</td>
<td>N/A</td>
</tr>
<tr>
<td>ARE SMDS NEGATIVELY AFFECTING ACCESSIBILITY AND COMFORT FOR PEOPLE WITH DISABILITY? (E.G. SCOOTERS PARKING ON SIDEWALKS AND RAMPS)</td>
<td>MIXED - The pilot recorded a number of incorrectly parked SMDs potentially impacting people with disability using the sidewalk. The number of incorrectly parked SMDs per 1,000 trips increased from 12 incorrectly parked SMD/1,000 trips in October to 37 incorrectly parked SMD/1,000 trips in February and decreased thereafter monthly to 13 incorrectly parked SMDs/1,000 trips in June.</td>
<td>N/A</td>
<td>YES - Sidewalk riding and parking had the highest number of complaints which could be affecting people with disabilities, including blocking sidewalk ramps.</td>
</tr>
<tr>
<td>KEY QUESTIONS</td>
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<tr>
<td>HAVE OPERATORS BEEN COMPLIANT WITH THE MEMORANDUM OF AGREEMENT (MOA) FRAMING THEIR PARTICIPATION IN THE ARLINGTON COUNTY SMD PILOT PROJECT?</td>
<td>MIXED. The evaluation identified five breaches of the MOA in terms of (1) inadequate deployment sites, (2) high operational speeds, (3) idle SMDs for more than seven days, (4) incorrectly parked SMDs and (5) data.</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>ARE THE CURRENT RULES AND REGULATIONS GOVERNING THE USE OF SMDS IN ARLINGTON ADEQUATE GIVEN WHAT HAS BEEN LEARNED FROM THE PILOT PROJECT?</td>
<td>YES - The rules and regulation in place were broadly adequate to enable a successful pilot program</td>
<td>NO - More people indicated wanting to ride on protected lanes (67%) or sidewalks (16%) than in shared lanes (9%), which was the least popular option</td>
<td>MIXED - 16% of the comments on the open-ended section of the feedback form discusses the need for better regulation and enforcement; less than half of e-scooter riders agreed with the statement &quot;the 10 mph e-scooter speed feels fast enough for where I ride&quot;. Several complaints pertain to enforcement rather than regulations themselves, with age limits, speed limits and sidewalk riding limits all acknowledged but not enforced.</td>
</tr>
<tr>
<td>ARE COMMUNITY’S EXPECTATIONS BEING MANAGED WELL FOR BOTH RIDERS AND NON-RIDERS?</td>
<td>N/A</td>
<td>N/A</td>
<td>YES - Decrease in complaints and successful outreach events, more to be done.</td>
</tr>
</tbody>
</table>
| ARE ADEQUATE RESOURCES BEING DEVOTED TO THE MANAGEMENT OF SMD DEPLOYMENT & OPERATIONS? | YES - Arlington County Staff worked on addressing all operational challenges and 20% of non-riders get their information from Arlington County’s website | YES - Analysis shows that SMD corrals were deployed in areas of high utilization with positive results | YES - Complaints have decreased significantly over time  
NO - Community feedback reflects some lack of awareness or understanding of SMDs that could be remedied by more active County outreach. |
Based on these results, the research team developed the following eight recommendations for Arlington County:

I. **Accelerate infrastructure investments to address rider and community safety and comfort concerns; focus on available route detail data**
   - Evaluate the possibility of increasing the share of protected bike lanes in key SMD corridors with the Rosslyn-Ballston corridor as a high priority given high ridership and elevated vehicle and pedestrian traffic.

II. **Continue working on innovative ways to address parking**
   - Communicate more stringent parking restrictions for operators – if addressable through technology – such as systematic restrictions by operators from parking at or near an intersection, outside residential or commercial entrances, in the middle of a sidewalk or near handicap parking space.
   - Provide operators with map of desired deployment areas in each neighborhood and conversely of no-parking areas.
   - Monitor and enforce operator response time in addressing parking complaints, where applicable.
   - Examine further potential for SMD-specific parking infrastructure such as corrals or lock-to devices.

III. **Create, monitor, and refine equity expectations, go beyond geography**
   - Monitor and enforce as required proportional deployment in specific target areas.
   - Perform more detailed equity and access analysis to ensure SMDs are being deployed in lower-income areas.
   - Aim to assess equity from three standpoints (1) accessibility (in terms of location and the need for a smartphone to unlock the mobility service), (2) existence of equity programs, and (3) payment methods (e.g. needing a credit card).

IV. **Focus on and invest in communicating the rules and regulations to the public, including riders and non-riders**
   - Establish clear guidelines and messaging that is consistent across county resources and operator information platforms (websites, apps, and devices).
   - Monitor operators’ messaging to ensure rules, regulations and rider resources are clearly communicated.
   - Suggest or mandate creative ways in which operators can better communicate rules and regulations including, more innovative methods such as quizzes.
   - Clearly state when rules are different from neighboring jurisdictions such as Washington, DC.

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28. Any such initiative should be done while balancing the importance of the convenience to riders so as not to negatively impact demand and the overall rider experience.
- Continue to conduct community outreach events, soliciting feedback and communicating how the county is addressing key community concerns flagged in this evaluation.

V. **Continue monitoring operations and requiring complete and robust data from operators**

SMDs are growing significantly while still at an early stage in terms of technology, best practices, and operational guidelines, making close monitoring a critical requirement for their continued operation.

- Require operators to comply with the data template and to submit additional operational data that they have not submitted yet (e.g. idle time, thefts and vandalism, broken SMDs, vehicle-specific trip and incident-level data).
- Require unified data (in terms of variables provided and format) from operators, allowing easier processing and cleaning of the data, which would leave more room for research and analysis.
- Monitor the difference between Washington DC and Arlington in terms of the service level (SMDs per 1,000 people).
- Monitor the difference between SMDs and Capital Bikeshare bikes in terms of the service level (SMDs per 1,000 people).
- Monitor incident rates such as broken SMDs and crashes with a specific focus on systematic or operator-specific patterns pointing to structural challenges.

VI. **Share results and county initiatives with the public, make the integration of SMDs into Arlington an inclusive and interactive conversation**

- Share key SMD-related studies with the public including how the County is thinking about sidewalks, the rationale behind opening them up to SMD ridership and how it envisions the coexistence between SMDs, pedestrians and bikers.
- Inform the public on how the County is dealing with speed limitations without compromising on safety, including how speed limits, if applicable, are monitored and how operators are held accountable.
- Address perceptions of lack of safety, a key challenge to SMD popularity or even acknowledgment. This could include undertaking a specific study on SMD safety, exploring alternatives available (e.g. helmets, bike lanes) and misconceptions, and share findings with the public.
- With assistance from Arlington law enforcement, provide insight into the SMD enforcement process and potential deterrents for infractions.
- Share the results of this pilot evaluation as well as experiences from pilots in other cities to provide comparison and benchmarking, which are critical with early-stage technologies.
VII. Collect or compile more robust data within and outside the SMD program and mandate periodic evaluation of SMD trends

A broader array of data sources could enable more accurate analysis of SMDs in Arlington. This could include:

- Daytime population for Arlington using more granular measures than county-wide can help with a better comparison of (1) who actually is demanding SMDs at any point and (2) between areas that receive higher levels of commuters/workers (e.g. North vs. South Arlington).
- More detailed income data than above or below median household incomes could help examine equity concerns more accurately.
- Request crash data from law enforcement and health services to start differentiating between scooters and other modes when dealing with incidents to improve tracking.
- Repeat SMD evaluations to assess SMD trends and truly characterize the service and its long-term evolution (e.g. crashes).

VIII. Undertake additional research or studies including more detailed analysis of specific issues of interest flagged in the pilot evaluation

This evaluation provides a valuable starting point in terms of flagging the most critical issues but has foregone detailed focus on specific issues in the interest of a holistic assessment of the SMD pilot. Several more detailed analyses could be undertaken with available data and separate longer-term studies and/or surveys incorporating learnings from this evaluation could help improve SMD system performance, rider experience and community responses, including:

Short term studies with available data

- Examining key results (e.g. perceptions) by sample segment including perception and experience by gender, primary mode, and frequency of use.
- Examining trip characteristic differences by corridor.
- Looking at trip characteristics by time of the day and weekends versus weekdays.
- Examining geographic distribution of operational problems – are incidents concentrated in one or more areas in Arlington? Do they correlate with elements of the infrastructure or land use?
- Taking a closer look at “late night travel”, potentially complemented with an intercept survey to characterize such trips and their link to accessibility.
- Examining the community’s reaction to the pilot before and after the installation of corrals - did complaints, operational challenges and trip change after the installation of corrals?
- Performing more sophisticated modeling of SMD behavior using attitudinal and demographic variables in order to understand the determinants of satisfaction, frequency, trip purpose etc.
- Conducting more sophisticated analysis of the Mobility inbox data.
• Conducting more sophisticated correlation analysis based on bivariate maps obtained and discussed in this report.

**Long-term studies with additional data**

• Studying the impact of e-scooters on accessibility and comfort for people with disability.
• Collaborating with other pilot programs and leveraging findings from Arlington utilization rates to estimate an “adequate” level of service that planners should aim for in designing SMD programs. This would be a similar effort to the ITDP bike share planning.
• Evaluating acceptable levels of broken SMDs for new technologies or a new mobility service.
• Evaluating communication techniques for best retention rates within apps (tests, games etc.).
• Examining travel behavior from the perspective of mode substitution between cars/TNCs and SMDs.
• Developing a scoring system/service standard for performance measures to rank and evaluate operators, mandating a minimum service level for continued operation in Arlington County.

The results and the recommendations of this report should be read within the context of Arlington County and the data collected during the pilot. The limited time SMDs have been in operation and the corresponding limited data and research means that the characterization of SMDs and how cities manage them will continue to evolve. This makes it important for local policymakers to continue monitoring and collecting data in order to derive structural and systemic trends, accurately characterize these services and ensure their integration into the Arlington County transportation landscape yields desired benefits while mitigating negative externalities.
ACKNOWLEDGEMENT

The research team would like to thank:

- Elizabeth Hardy and her team at Arlington County for providing population data.
- Christine Sherman and her team at Arlington County and Lieutenant Dan Murphy for providing crash data.
- Henry Dunbar and his team at Bike Arlington for providing Capital Bikeshare data.
- The micro-mobility ordinance working group for providing feedback on the preliminary analysis.
- Melissa McMahon and Gideon Berger for thoroughly reviewing this document and Paul DeMaio for reviewing section 1 of chapter 4.
- Louie Al-Hashimi for generating the word cloud from the Mobility Inbox as well as picking quotes for the analysis and Erin Potter and Alex Held for their write-up of the results of the outreach activities.
1Arlington County 2019:  https://transportation.arlingtonva.us/scooters-and-dockless-bikeshare/
2Arlington County 2019:  https://transportation.arlingtonva.us/scooters-and-dockless-bikeshare/
5Arlington County 2017:  https://projects.arlingtonva.us/plans-studies/transportation/master-transportation-plan/
6ESRI 2019:  https://www.arcgis.com/home/item.html?id=ede1a9cebaf74c11bd1556db9618715a
13Portland BOT 2018:  https://www.portlandoregon.gov/transportation/article/709719
16Arlington 2019:  https://transportation.arlingtonva.us/scooters-and-dockless-bikeshare/
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33Portland BOT 2018:  https://www.portlandoregon.gov/transportation/article/709719