FAIRFAX-MASON-VIENNA BIKESHARE FEASIBILITY STUDY

Business and Implementation Plan

July 15, 2019 | FINAL REPORT

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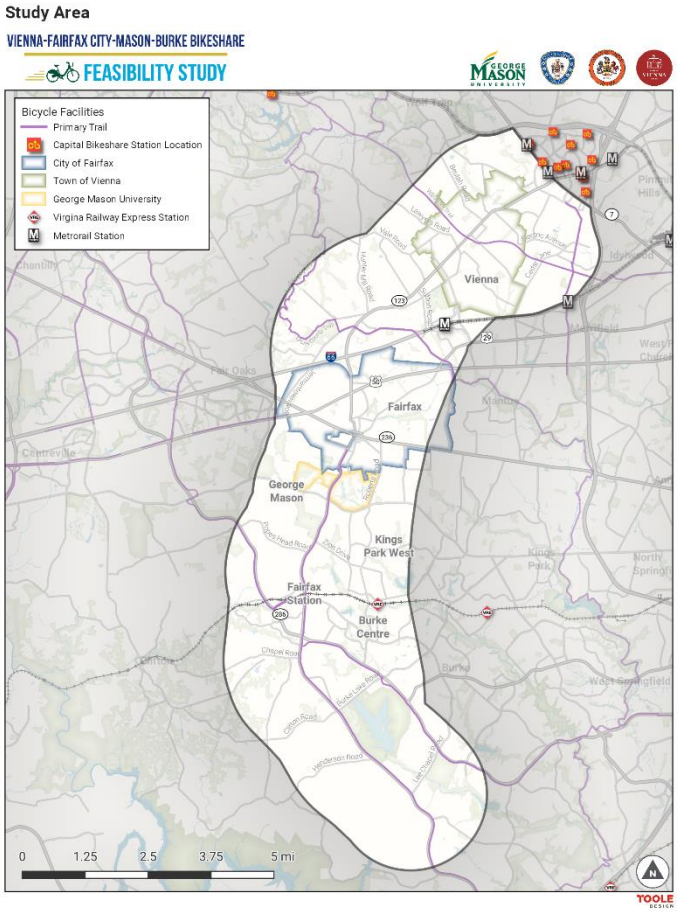
EXECUTIVE SUMMARY

This bikeshare feasibility study outlines implementation recommendations for dockless shared bikes and e-scooters (also known as shared mobility devices or SMDs) and station-based Capital Bikeshare within the Route 123 corridor from Vienna to Burke. The project process included community analysis and stakeholder outreach leading to system development and business plan recommendations.

STUDY BACKGROUND AND GOALS

With two Capital Bikeshare stations located at the Tysons Corner Metrorail station along Route 123, and a bikeshare feasibility study completed by Virginia Tech for the Merrifield area, the next logical step for expanding bikeshare in the region is to expand into Vienna, Fairfax, and George Mason University. The study area runs from Tysons Corner southwest through the Town of Vienna, the City of Fairfax, and George Mason University. Within and between these communities, the Fairfax-Mason-Vienna Bikeshare Feasibility Study's study area have great potential for connecting residents, students, and visitors to transit, trails, and activity centers. A map of the study area is shown at right and in Chapter 3.



The Fairfax-Mason-Vienna Bikeshare Feasibility Study is a collaborative effort by the City of Fairfax, Town of Vienna, Fairfax County, and George Mason University to determine the feasibility of a bikeshare program in the area. Given the different bikeshare technologies available, the study considered Capital Bikeshare, dockless bikeshare, e-bikes, and e-scooters. While this study identified potential interest and opportunities in e-scooters as part of a dockless vehicle program, specific recommendations for implementing this technology are limited given that this is a new and rapidly evolving option.

Moreover, as the shared mobility industry continues to evolve, recommendations in this study may need to be updated periodically to reflect current practices. For example, while dockless bikeshare was a larger industry and dockless e-scooters were still emerging while this study was being conducted, between the end of the study and the publication of this document that balance has shifted. As observed in the 2018 report on shared mobility (published by the National Association of City Transportation Officials, or NACTO), shared scooters had far surpassed dockless bikeshare by the end of the year despite the later introduction of this technology[1]. As a result, many private for-profit dockless bikeshare companies either left the industry or shifted focus to e-scooters since

[1] NACTO Bike Share and Shared Micromobility Initiative, "Shared Micromobility in the U.S.: 2018". https://nacto.org/shared-micromobility-2018/

this study began. Virginia legislation enacted near the end of this study will also impact how dockless e-scooters and bikeshare vendors are regulated[2].

Despite the shifting industry, all the technologies reviewed in this study have the potential to meet some or all of the goals of this project (described in Chapter 1). Goals include:

- Improving livability and economic competitiveness (attracting employers, businesses, and tourism, and increasing connections within and between communities)
- Supporting social and geographic equity (providing affordable access to jobs, transit and recreation, and marketing to all segments of the community)
- Improving quality of life through bicycling (providing a last-mile connection to complement transit, and provide an active transportation option)

TECHNOLOGY EVALUATION, EXISTING CONDITIONS AND PUBLIC INPUT

The study evaluated several bikeshare technology options (Chapter 2), analyzed existing conditions (Chapter 3), and collected public input (Chapter 4).

The evaluation of bikeshare technologies identified opportunities and challenges with each technology. For example, a publically-owned docked bikeshare system such as Capital Bikeshare requires a larger public investment than a dockless system operated by private, for-profit companies. However, a publically-owned system allows the partner agencies more control over the system than a privately operated system. A docked system is also typically more organized (since bikes must be returned to specific locations), but a dockless system allows users more flexibility and reduces barriers to growth and change within the system. Based on observations of programs within the Washington, DC region and around the country, it is likely that a shared mobility system could include both docked bikeshare and dockless bikes and scooters.

Existing conditions evaluted in this study include topography, demographic and employment factors, current levels of bicycle commuting, multimodal transportation services and infrastructure (such as transit and bicycle routes), and potential destinations (such as schools, retail, community destinations, and tourism destinations). Limited bicycle and transit connectivity is currently a key challenge. However, there are opportunites in the region as well: demographic characteristics indicate a potential market for bikeshare users, and the presence of several regional trails and activity hubs with higher employment and destination densities may benefit from and support demand for bikeshare.

Public input was gathered through a series of in-person outreach events and through an online survey and crowdsourcing map. Overall, the outreach showed community interest in bikeshare. There was some variation in technology preferences within the study – participants at the Mason outreach event showed somewhat more interest in dockless bikeshare and e-scooters compared to other events, while residents in other communities tended to prefer docked bikeshare.

RECOMMENDATIONS

Based on public input and analysis of existing conditions and technology options, the study recommends that project partners implement both Capital Bikeshare and dockless mobility in the study area. This approach is similar to that taken in other parts of the region. The technologies may be implemented in phases or in parallel,

[2] HB 2752 of the 2019 Virginia General Assembly Session. http://lis.virginia.gov/cgi-bin/legp604.exe?191+ful+CHAP0780

depending on funding availability, capacity to develop and implement local policies and manage operations, and local priorities. Recommendations for system planning and management are detailed in Chapter 5.

Chapter 6 provides a financial analysis to determine the program's likely funding needs. Capital funding for a 30-station Capital Bikeshare system would be approximately $1.8 million. Funding for capital equipment typically comes from public grants and private funding. Approximately $830,000 would be required to cover the first three years of operations across the participating jurisdictions, depending on how quickly new stations were added to the system and assuming approximately 50% of operational revenues could be covered by user fees. Funding for operating costs typically comes from a combination of user revenues and other sources, such as sponsorship of the system's assets. In addition to user revenues, other sources of funding such as advertising and other mechanisms should be explored further.

Compared to a docked system such as Capital Bikeshare, dockless mobility does not typically require as much public funding to cover capital and operating costs, as private operators primaily bear these costs. However, it is estimated that a dockless program would require $300,000 in capital costs to pay for supportive infrastructure such as bicycle parking, and approximately $150,000 for administrative and program costs over the first three years of operations. Depending on the fee structure and program use, these operating costs could be partially offset by a per-trip fee, a per-bike fee, or other permit fees. Based on assumptions about fleet sizes and demand, typical permit fees could cover approximately 35-45% of the operational costs (based a low estimate) or could generate a small amount of income for the program (based on a higher estimate of ridership and assuming a per-trip fee).

Using the factors analyzed in the existing condtions, a list of criteria were developed to identify and prioritize potential locations for bikeshare stations. These criteria were used to identify an initial set of locations for bikeshare implementation. The criteria and initial locations are shown in the table and map below and discussed in more detail in Chapter 5.

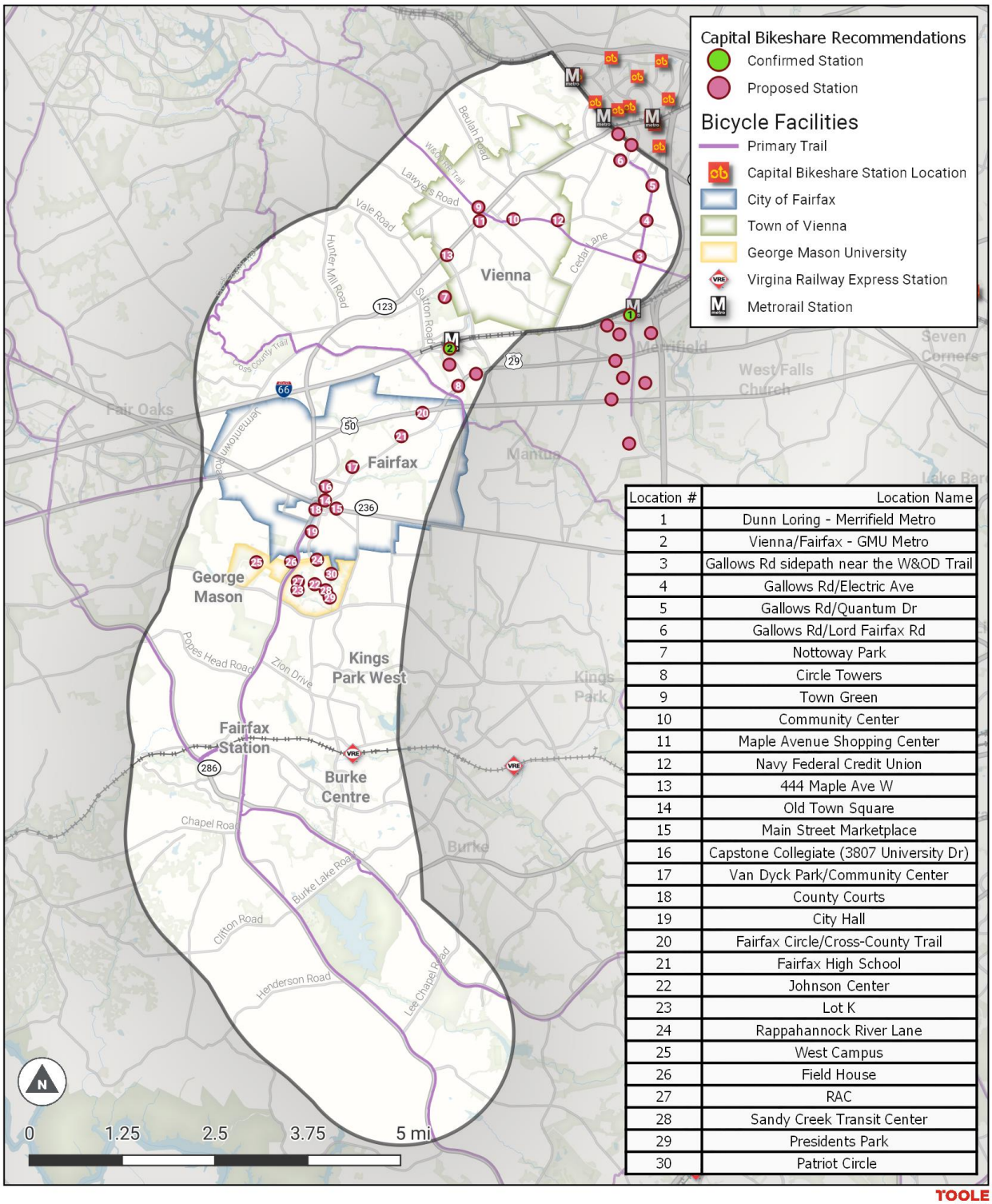
It may also be useful to consider these criteria and locations when planning for a dockless mobility program. While the dockless mobility options provide more flexibility and do not necessarily require fixed infrastructure, there may be benefits to prioritizing some parking or other supportive infrastructure to develop these locations as "mobility hubs", either for a dockless system on its own or in a hybrid system that includes both docked and dockless options.

Finally, Chapter 7 summarizes the recommendations and system needs and identifies a number of questions that may need further consideration when the recommendations are implemented.

Prioritization Criterion	Metric
Transit Proximity	Metrorail station within 2 miles
Destinations	Density of destinations near station location
Bicycle Network	Density of bicycle facilities near station location
Capital Bikeshare Network	Capital Bikeshare station within 0.5 miles (recalculate as station expands)
Development Opportunity	Station adjacent to new development
University	Station within or near a university campus area
Local Priority	Station preferred by community feedback or available funding

Capital Bikeshare Implementation Recommendations: Study Area

VIENNA-FAIRFAX CITY-MASON-BURKE BIKESHARE FEASIBILITY STUDY



Location #	Location Name
1	Dunn Loring - Merrifield Metro
2	Vienna/Fairfax - GMU Metro
3	Gallows Rd sidepath near the W&OD Trail
4	Gallows Rd/Electric Ave
5	Gallows Rd/Quantum Dr
6	Gallows Rd/Lord Fairfax Rd
7	Nottoway Park
8	Circle Towers
9	Town Green
10	Community Center
11	Maple Avenue Shopping Center
12	Navy Federal Credit Union
13	444 Maple Ave W
14	Old Town Square
15	Main Street Marketplace
16	Capstone Collegiate (3807 University Dr)
17	Van Dyck Park/Community Center
18	County Courts
19	City Hall
20	Fairfax Circle/Cross-County Trail
21	Fairfax High School
22	Johnson Center
23	Lot K
24	Rappahannock River Lane
25	West Campus
26	Field House
27	RAC
28	Sandy Creek Transit Center
29	Presidents Park
30	Patriot Circle

TOOLE DESIGN

CHAPTER 1
PROJECT GOALS AND OBJECTIVES

CHAPTER 1: GOALS AND OBJECTIVES

The project's goals and objectives were developed and refined through discussions with the Town of Vienna, Fairfax County, the City of Fairfax, and George Mason University. These goals frame the purpose of pursuing a bikeshare program in the study area, which aims to improve livability, economic competitiveness, equity, and quality of life.

Livability and Economic Competitiveness

Develop an innovative transportation system that improves livability and economic competitiveness in the Town of Vienna, Fairfax County, the City of Fairfax, and George Mason University.

- Optimize the number of destinations that can be served by a bikeshare system with a focus on connecting neighborhoods, transit, and destinations.
- Design a system that incorporates recent bikeshare technology advancements (e-bikes, shared scooters, dockless bikeshare) as desired by stakeholders.
- Attract and retain talent for the study area's employers and raise the attractiveness of the study area for business investment and tourism.
- Improve public health outcomes by maximizing ridership and increase the share of community residents and visitors who bicycle and walk as part of a healthy lifestyle.
- Implement a bikeshare system that connects with other regional transportation systems and that is sustainably funded and operated.

Social and Geographic Equity

Provide a system that is accessible to a broad cross-section of the population in the Town of Vienna, Fairfax County, the City of Fairfax, and George Mason University.

- Ensure that bikeshare is an affordable transportation option for all users.
- Provide a system that engages and serves all income levels and the full breadth of the community to help improve access to jobs, transit, and recreation.
- Use existing partnerships to leverage programmatic outreach and marketing services to all segments of the community.

Improve Quality of Life through Bicycling

Enhance quality of life by supporting bicycling as a healthy, convenient, affordable, and environmentally-friendly transportation mode that helps relieve congestion and enhances suburban mobility.

- Implement a system that connects to existing trails and bike facilities and can serve as a catalyst for increased investments in bicycle infrastructure in the study area.

- Create a positive image for bikeshare and bicycling in the area, remaining sensitive to the local community context.
- Create a system that enhances suburban mobility and relieves traffic congestion by enabling bicycling for work, shopping, and recreation and that complements local and regional transit by serving as a first and last-mile option.
- Increase bicycling in the study area by providing easy access to bicycles for people who may be interested in riding a bicycle but do not have access to one.
- Provide residents, students, and visitors with a transportation option that promotes safety and active and healthy living and that increases awareness and visibility of bicycling as a viable transportation mode, especially for short trips.

CHAPTER 2
OPPORTUNITIES AND CHALLENGES

CHAPTER 2: OPPORTUNITIES AND CHALLENGES FOR BIKESHARE TECHNOLOGIES

There are several bikeshare technology options: smart dock systems, smart bike systems, and dockless bikeshare systems. Electric-assist bicycles ("e-bikes") are available with any of these bikeshare platforms, although the ways that e-bikes' batteries charge varies depending on the system type. There are also electric-powered scooters ("e-scooters"), a recent addition to the shared mobility industry that operates similarly to dockless bikeshare. Collectively these are often referred to as "dockless shared mobility devices" (SMDs). There are advantages and disadvantages to each of these technologies, and the approach should be dictated by funding and interest from the public and private sectors as well as demand factors based on conditions in the study area (detailed in Chapter 3). Additionally, a bikeshare technology or platform's opportunities and challenges may differ based on the jurisdiction within the Fairfax-Mason-Vienna study area, so it is critical to evaluate all bikeshare technology options and how they may operate independently or together in this environment.

The following pages summarize the typical costs, advantages, disadvantages, and operational considerations for various bikeshare technology options. This section summarizes information typical to the industry and, except where specifically stated, does not refer to specifics for the existing technology in the study area (i.e., Capital Bikeshare or existing dockless pilot programs).

SMART DOCK

Capital Bikeshare in Arlington County and Tysons Corner, VA.

Smart dock systems are organized into stations. Each station has a computerized terminal to process transactions and information and a series of docks that lock the bikes. The technology for tracking and locking/unlocking the bikes is contained in the dock rather than on the bike. Although some systems include an additional lock on the bike to allow for mid-trip stops, the user must return the bike to a station to end their trip. E-bikes are available from several smart dock vendors and can reduce some barriers to access, including steep terrain or hot weather conditions.

In the National Capital region, Capital Bikeshare operates a regional smart dock system, with seven partner jurisdictions: the District of Columbia, Arlington County, the City of Alexandria, Montgomery County, Prince George's County, Fairfax County, and the City of Falls Church. The system has over 500 stations, including more than 30 stations in Fairfax County (primarily in Tysons Corner and Reston). The City of Falls Church is the most recent jurisdiction to join the system, with stations opening in May 2019. Capital Bikeshare piloted e-bikes for a short period, but has temporarily removed the e-bikes from the system to improve the equipment.

Capital Cost (Public option only)*

$4,000 to $6,000 per bike[3] (purchase)
$5,000 to $6,500 per bike[1] (purchase – e-bikes)

Operating Cost (Public option only)*

$1,200 to $2,700 per bike per year[4]

Vendors

8D, BCycle, Motivate, PBSC

Liability Concerns

Liability is typically covered by the contract with an (often private) operator, with detailed user agreement and safety information provided at membership purchase or trip start.

Interoperability

Bikes would be interoperable with the greater DC region if the study area joined Capital Bikeshare. Smart dock systems may include e-assist bicycles. Currently, Motivate prototypes are in development for an interoperable dockless bicycle (but not interoperable across vendors).

Pros

- Established system in the National Capital area
- Stations are visible and iconic
- Organized
- Proven and tested technology
- Reliable for users to find a bike

Cons

- Siting requires long contiguous space (e.g., 42-feet for a 15-dock station)
- More expensive technology compared to other bikeshare technologies
- Relies on more components
- More time to implement
- Station capacity limitations (e.g. less flexibility to add more bikes quickly)

**Note that costs in this table reflect average industry ranges, reflected as "per-bike" costs to facilitate comparisons across different technologies. Actual costs, cost calculation methods, and available technologies in the National Capital region may be different (see Chapters 5 and 6).*

[3] Includes the cost of the stations and assumes stations are located in public space on a hard, stable surface (i.e., these costs do not include any ROW purchases or concrete pad installation costs).
[4] These costs include third-party operating expenses such as parts, repairs, maintenance, rebalancing, administration, other operating needs, and staff. The range reflects the variation in operating contracts that have different service level expectations. These ranges are drawn from multiple sources, and different services included, e.g., some include marketing costs, which may account for the wide range.

DOCKLESS BIKESHARE

Biketown in Portland, OR; Multiple dockless vendors in Washington, D.C.

Dockless systems incorporate the check-out technology and the locking mechanism on the bike itself, making docking stations unnecessary and introducing more flexibility to the system. There are two types of dockless systems that can incorporate a range of supportive infrastructure or operational approaches:

- **Smart bike systems** generally use a more robust bicycle design (similar to docked bikeshare bikes), have a built-in cable or U-lock that allows bikes to be locked to a bike rack or other street furniture, and are checked out using a pre-purchased membership or account. They also often use branded “hubs” with groups of customized bike parking racks (such as the example from Portland, OR above) or geofenced bike parking areas to create virtual stations and encourage users to return bikes to centralized locations. These systems are often referred to as “lock-to” technology.
- **Self-locking systems** use bikes with a wheel-lock that allows the bike to be locked to itself but that does not allow it to be locked to a bike rack. Users scan a Quick Response (QR) code to rent a bike. Some vendors have created preferred parking areas using paint or other sidewalk designation to encourage bike return to these locations.

In the D.C. region, several jurisdictions have dockless mobility pilot programs including Montgomery County, Arlington County, the City of Alexandria, and Washington, D.C. These dockless mobility programs permit private companies to rent shared dockless mobility devices; no jurisdictions in the region currently own or operate their own dockless mobility devices. However, the Capital Bikeshare system is also considering the addition of dockless bikes.

Since this study began the private dockless mobility industry has changed significantly. As the e-scooter industry emerged and overtook dockless bikeshare, many dockless bikeshare vendors left the market or shifted their business focus to renting dockless e-scooters. As of summer 2019, only a handful of companies still offered dockless bikes or e-bikes in the region.

Capital Cost*
$2,500 to $4,500 per bike (public purchase option)
$1,800 per bike per year (public lease option)
Cost of installing additional bike racks/parking areas (for-profit company option)

Operating Cost*
$1,200 to $2,700 per bike per year (public-owned option)[5]
Administrative costs (for-profit company option).

Vendors
BCycle, GotchaBikes, JUMP, Motivate, NextBike, Zagster[6]

Liability Concerns
Liability is typically covered by the contract with an (often private) operator, with safety information and a detailed user agreement provided at membership purchase or trip start. Most cities require that dockless companies possess liability insurance to participate in their programs.

Interoperability
Motivate is currently developing a smart bike prototype that would be interoperable with Capital Bikeshare. Otherwise, smart bike systems are typically not interoperable across vendors. Interoperability across the region depends on jurisdictional coordination (e.g. setting similar service standards and permitting vendors to operate in neighboring jurisdictions).

**Note that costs in this table reflect average industry ranges, reflected as "per-bike" costs to facilitate comparisons across different technologies. Actual costs, cost calculation methods, and available technologies in the National Capital region may be different (see Chapters 5 and 6).*

[5] These costs include third-party operating expenses such as parts, repairs, maintenance, rebalancing, administration, other operating needs, and staff. The range reflects the variation in operating contracts that have different service level expectations. These ranges are drawn from multiple sources and the different services included, e.g., some include marketing costs (which may account for the wide range).
[6] Dockless bikeshare is a rapidly changing industry with companies frequently entering and exiting the market or changing their offerings.

Pros and Cons Comparison

Lock-to Technology (Hub-based systems)

Pros

- Flexible, modular, and easier to site
- Flexible for users to park a bike
- Scalable and good for small or large systems
- Easy to access and use
- U-lock or cable lock is integrated and encourages locking the bike to a bike rack
- Hubs are organized and can be made visible and iconic
- Can be more reliable for users to find a bike

Cons

- Higher capital cost (if public agency wants to own the equipment)
- Requires space to place racks required for hubs
- Moderately expensive technology (publicly owned option)

U-Lock-to Technology (Without Hubs)

Pros

- Flexible on where users can park a bike
- Scalable and good for small or large systems
- Easy to access and use
- U-lock or cable lock is integrated and encourages locking the bike to a bike rack
- Proven and tested technology (U-lock systems)

Cons

- Less organized; it is less obvious where bikes should be parked and they can be left anywhere
- Can be less reliable for users to find a bike
- Less agency control (if a for-profit business model is selected)
- Difficult to impound or remove incorrectly parked bikes due to the “lock-to” mechanism

Wheel Lock Technology

Pros

- Flexible for users to park a bike
- Scalable and good for small or large systems
- Easy to access and use
- Inexpensive technology and potentially very low cost to cities (For-profit company option)

Cons

- Less proven and tested technology
- Less organized; bikes cannot be locked to anything but themselves and can be left anywhere
- Can be less reliable for users to find a bike
- Less agency control (if a for-profit business model is selected)

E-SCOOTERS

A Lime E-scooter in Washington, D.C.

E-scooters are a more recent mobility technology. E-scooters systems are similar to dockless bikeshare systems, except that they use electric-powered scooters instead of bikes. The scooters are equipped with a GPS unit and a self-locking mechanism, and users can locate them or check them out using a smartphone app by scanning a QR code. E-scooters can be picked up and dropped off anywhere within its given service area, although some companies encourage the use of designated parking locations through geo-fencing or photo verification. Depending on local regulations, e-scooters may be required to only ride on the street or only on the sidewalk, but in practice riders tend to ride where they feel most comfortable, which can introduce conflicts with other modes. Vendors are considering how to regulate maximum speeds using geo-fencing, which could allow slower maximum speeds in locations where e-scooters are allowed or expected on sidewalks.

E-scooters are generally owned and operated by third party, for-profit companies. Some of these also offer dockless bikes and e-bikes, but some specialize in scooters only. Anecdotally, e-scooters seem to be attracting new demographics, and early ridership trends are positive and generally higher than regular bikeshare. This may be due in part to the greater number of scooters provided and scooter companies' lower capital costs. It may also be due scooters' different demographic appeal and use characteristics (e.g., scooters can be easier to ride in all types of clothes, do not require bike riding ability, and can easily extend a pedestrian trip). E-scooters are allowed as part of the dockless mobility programs in a number of jurisdictions including Washington, D.C. Arlington County, and the City of Alexandria. Within the study area, dockless mobility options are emerging. The City of Fairfax developed a pilot program and permitted three companies to operate e-scooters beginning in July 2019. Fairfax County, George Mason University, and the Town of Vienna are all considering potential programs.

Additionally, legislation passed by the Virginia General Assembly in 2019[7] clarified the definition of e-scooters and identified regulations for the use of e-scooters. As part of the same legislation, jurisdictions were granted authority to regulate shared mobility devices, but were given a deadline to develop their regulations. Shared mobility operators will be permitted to operate without regulation as of January 2020. These legal changes are an important factor for jurisdictions in the Commonwealth, including the study partners.

[7] HB 2752 of the 2019 Virginia General Assembly Session. http://lis.virginia.gov/cgi-bin/legp604.exe?191+ful+CHAP0780

Capital Cost
Cities may wish to invest in scooter parking zones, similar to dockless bikeshare supportive infrastructure

Operating Cost
Cities may incur costs to administer the program, respond to complaints, provide designated parking areas, etc. This is similar to dockless bikeshare costs.

Vendors
Bird, Lime, Spin, Skip, Razor USA[8]

Liability Concerns
Liability is typically covered by the contract with an (often private) operator, with detailed user agreement and safety information provided at membership purchase or trip start. Most cities require that dockless companies possess liability insurance to participate in their programs.

Interoperability
E-scooters provided by different vendors are not interoperable, however overlapping systems can operate in the same space and locating scooters may be combined in a single app. Interoperability across the region depends on jurisdictional coordination (e.g. setting similar service standards and permitting vendors to operate in neighboring jurisdictions).

Pros

- Flexible for users to park an e-scooter
- Easy and fast to implement
- Scalable and good for small or large systems
- Inexpensive technology and may be no or very low cost to cities
- Easy to access and use
- May be used by a different set of people than bikes

Cons

- Less organized
- No basket for carrying items
- Less agency control (potentially evolving with the quickly changing industry)
- Less proven and tested vehicle technology and business model
- Less reliable for users to find a scooter
- May introduce issues such as users riding and parking on sidewalks, which can lead to conflicts with pedestrians and accessibility needs

[8] Dockless bikeshare and e-scooter share is a rapidly changing industry with companies frequently entering and exiting the market or changing their offerings.

POTENTIAL FINANCING OPPORTUNITIES

Bikeshare systems operate under several different business models. Traditionally, most bikeshare programs have been funded through capital grants and operated using a combination of user fees, sponsorship, and local public funds, similar to a transit system. These systems are most often owned by a public agency or a nonprofit organization created specifically for this purpose, and operated by either the owner or a private third party.

The newer smart bike and dockless programs are generally operated by third-party companies supported by venture capital funding or large urban mobility companies that take on the financial risk for the program.

There are advantages and disadvantages to each of these business models, and the appropriate model depends on the local funding environment, staff capacity, and interest from the public, non-profit, and private sectors. Another consideration is desired level of governmental control and oversight, as there is generally more control if the system is owned by a governmental organization.

AGENCY OR NON-PROFIT OWNED

Most docked and some smart bike programs in the United States are overseen by government agencies or non-profit organizations. These organizations are responsible for identifying funding and procuring the system. Similar to many transit systems, these organizations may operate the program themselves or they may contract to a third party for operations. This model requires more effort and time to secure funding, procure the system vendor, and launch the program; it also requires staffing capacity and often some level of upfront and ongoing public funding. However, it gives the agency full control over the program and decisions surrounding its implementation and operation.

Capital Bikeshare uses this funding model. The local agencies have an informal partnership to collaborate on common decisions affecting the program, but each local jurisdiction oversees their part of the system and has a contract with the system provider, Motivate, to provide equipment and operate the system.

Requirements

- A capital funding source to purchase equipment – this is often obtained through federal and/or state grants or local public funding. The size of the system is often dictated by the amount of funding available;
- An ongoing funding source to sustain operations. Usage fees are likely to make up only a portion of operating costs (20% to 40% in small communities and up to 74% in Arlington County) and so will require sponsorship, grants, or public funding to make up the shortfall (similar to other transit services); and
- Staff time to identify funding, procure the vendor, administer the contract, oversee and monitor the program, respond to public comment, publicize the system, and implement complementary programs.

Examples

- Capital Bikeshare – Washington D.C. Metropolitan Area (agency-owned and third-party operated by Motivate);
- University of Maryland mBike – College Park, MD (university-owned and third-party operated by Zagster);
- RVA Bike Share – Richmond, VA (agency-owned and third party operated by Bewegen).

THIRD-PARTY OWNED AND OPERATED

Some traditional, docked bikeshare programs and most of the new dockless programs are owned and operated by third-party vendors. Early on, vendors bid for the right to operate bikeshare in a city, often obtaining exclusive rights to the use of public right-of-way. Dockless bikeshare implementation has changed this dynamic and now

many cities offer competitive opportunities for multiple vendors to establish systems through a multiple-selection procurement process, a memorandum of understanding, or a permit system.

Requirements

- Interest from a third-party vendor;
- A mechanism to allow and regulate the use of the public right-of-way; and
- Staff time to monitor the program, respond to public comment, publicize the system, and implement complementary programs.

Examples

- Washington, D.C. and Montgomery County, MD dockless bikeshare pilot programs (JUMP, Lime, Mobike, Spin, Bird, etc.).

OPPORTUNITIES AND CHALLENGES FOR REGIONAL BIKESHARE COORDINATION

Given that multiple bikeshare technologies are represented in the D.C. metropolitan area, it will be important to consider the regional effects of bikeshare implementation in the Fairfax-Mason-Vienna corridor. These may include the following:

- The study area could extend the reach of and fill in a missing gap in the large and established regional Capital Bikeshare system. In joining this program, the participating jurisdictions would benefit from the additional utility provided by the existing system and enhance connections to transit by allowing users to ride the same system at each end of their transit trip. Capital Bikeshare is well known and there are likely Capital Bikeshare members already living in the study area.
- The study area is reasonably close to existing or future dockless bikeshare and e-scooter pilot programs in Washington D.C., Montgomery County, Alexandria, and Arlington County. A dockless bikeshare or e-scooter program in the study area could become part of a future network of regional dockless mobility options. A dockless program could also work alongside the Capital Bikeshare program, as it does in other parts of the region.
- There may be some risks for this program if Fairfax, Vienna, or Mason select a bikeshare technology that is not interoperable with the existing systems, such as a smart dock technology that is not provided by Motivate or a smart bike system that is not compatible with either the existing smart dock or dockless programs. For example, the system may be less efficient or less appealing to users if an incompatible system has less utility.
- Coordination issues between participating jurisdictions could arise. For example, there are cost and revenue sharing arrangements required to join Capital Bikeshare. There is also the challenge of resolving complaints about other agencies' bikes in dockless systems. It is recommended that the partner agencies make a mutual decision on the program moving forward and continue to collaborate through regional bikeshare coordination meetings.
- Most importantly, participating jurisdictions must consider the necessary resources to support the chosen type(s) of technology. Should the participating jurisdictions choose to join Capital Bikeshare, they will be required to find the necessary funding to purchase equipment and maintain operations, and they will need staff capacity to implement and oversee the contract with Motivate. For a dockless system, they would

need staff capacity to establish the contracting mechanism, oversee the program, work with the vendors, respond to public comments and complaints, and implement any supporting programs. National practices suggest that a jurisdiction may need a half- or full-time staff person to manage a dockless program, particularly during the first few months after launch. Staff needs also depend on the size of the system and number of companies participating in a pilot program.

CHAPTER 3
COMMUNITY ANALYSIS

CHAPTER 3: COMMUNITY ANALYSIS

An important aspect of determining the feasibility of a bikeshare system is understanding local context and conditions. This analysis helps identify opportunities for the program and challenges that need to be addressed as well as informing the scale of a potential bikeshare system.

STUDY AREA

Figure 1 shows a map of the project study area. The study area follows Route 123 (also referred to as Maple Avenue, Chain Bridge Road, or Ox Road depending on the exact location) from Leesburg Pike to south of Burke Lake. The study area includes the Town of Vienna, the City of Fairfax, George Mason University, and parts of Fairfax County. The study area includes an area approximately 1.5 miles on each side of Route 123.

Study Area

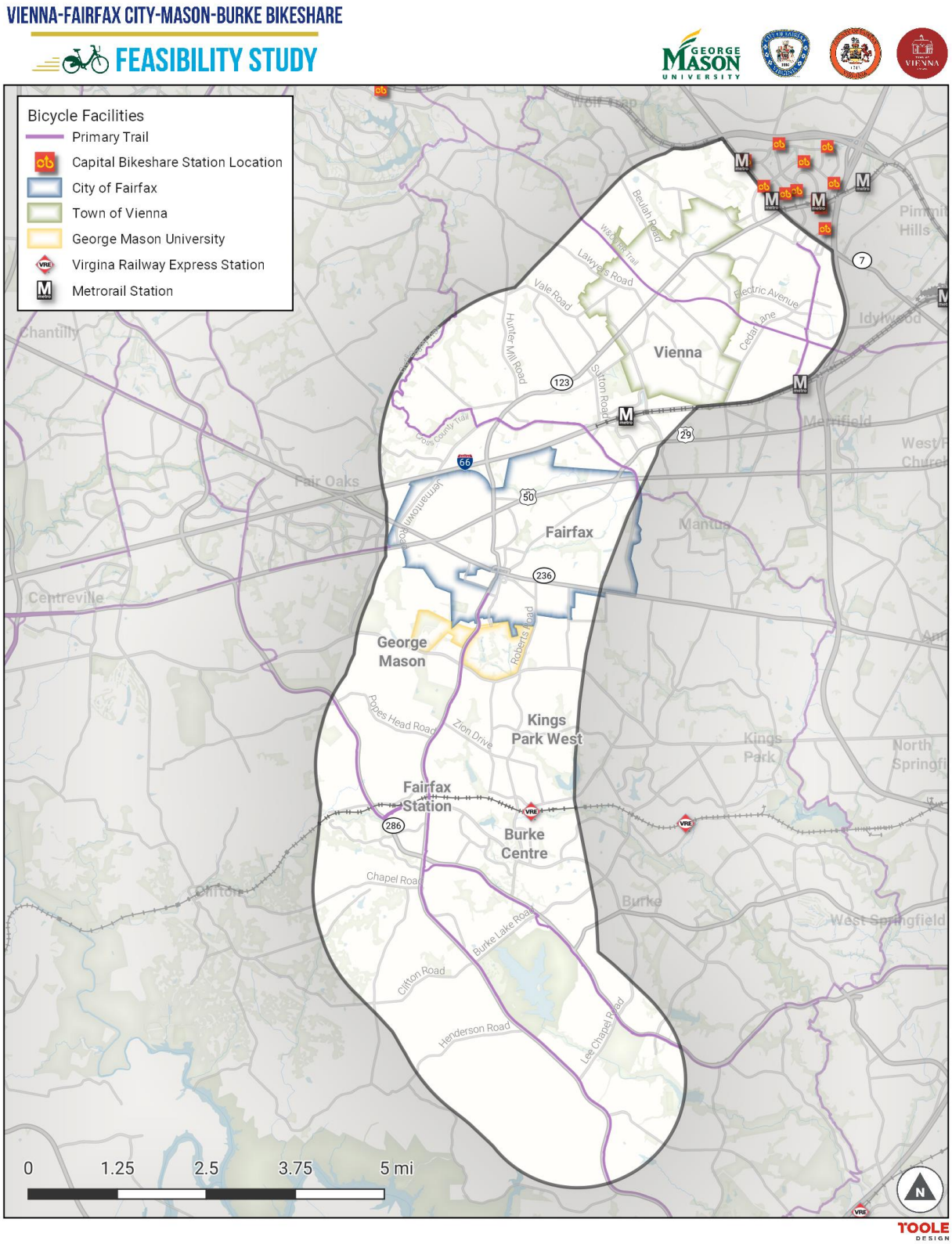


Figure 1: Study Area

GENERAL CONDITIONS AND TOPOGRAPHY

The study area is divided by several major highways (e.g., I-66), rail lines (e.g., the VRE and WMATA), and major roads (e.g., Route 123, Main Street, and Fairfax Boulevard). The area's street pattern follows a traditional post-World War II suburban configuration with good internal connectivity within developments, but a lack of connectivity in certain areas between developments.

Local streets frequently do not connect across arterials, forcing bicyclists onto arterial streets that tend to be higher speed and higher volume streets. There are significant topography challenges in the southern and western portions of the study area, near Burke Lake, Popes Head Creek, and other hydrographical features, all of which contribute to a disconnected street network. The steep slopes in these areas also present challenging riding conditions, but other portions of the study area include places with more moderate slopes, such as the Town of Vienna and the City of Fairfax (see Figure 2).

The study area experiences all four seasons. According to the National Oceanic and Atmospheric Administration (NOAA), the average high temperature at the Ronald Reagan National Airport is 88 degrees in July and 43 degrees in January (1981-2010 Climate Normals).[9] Research suggests that the optimal temperature range for bicycling is between 77- and 82-degrees Fahrenheit. Studies also show that heavy rain (greater than 0.39 inches daily rainfall) decreases the level of bicycling, as does humidity greater than 60 percent. The Washington, D.C. area generally does not experience significant snowfall, but does experience about 40 inches of rainfall per year.[10]

CHALLENGES

- Topography will make bicycling challenging in certain parts of the study area, especially in the southern part near Burke Lake or west of Fairfax Station. Consider the use of e-assist bicycles or e-scooters.
- The street grid is discontinuous in places, concentrating traffic along certain corridors and reducing routing options for bicyclists. Encourage the development of a network of connected comfortable bicycling facilities.

OPPORTUNITIES

- Areas with generally flat topography will be most conducive to bicycling and are located in the Town of Vienna and in parts of the City of Fairfax. Other areas with relatively flat terrain include parts of George Mason University and connecting areas between the Town of Vienna and the City of Fairfax. Consider prioritizing areas with flat topography first.

[9] https://www.currentresults.com/Weather/US/washington-dc-temperatures-by-month-average.php
[10] https://www.currentresults.com/Weather/Virginia/average-yearly-precipitation.php

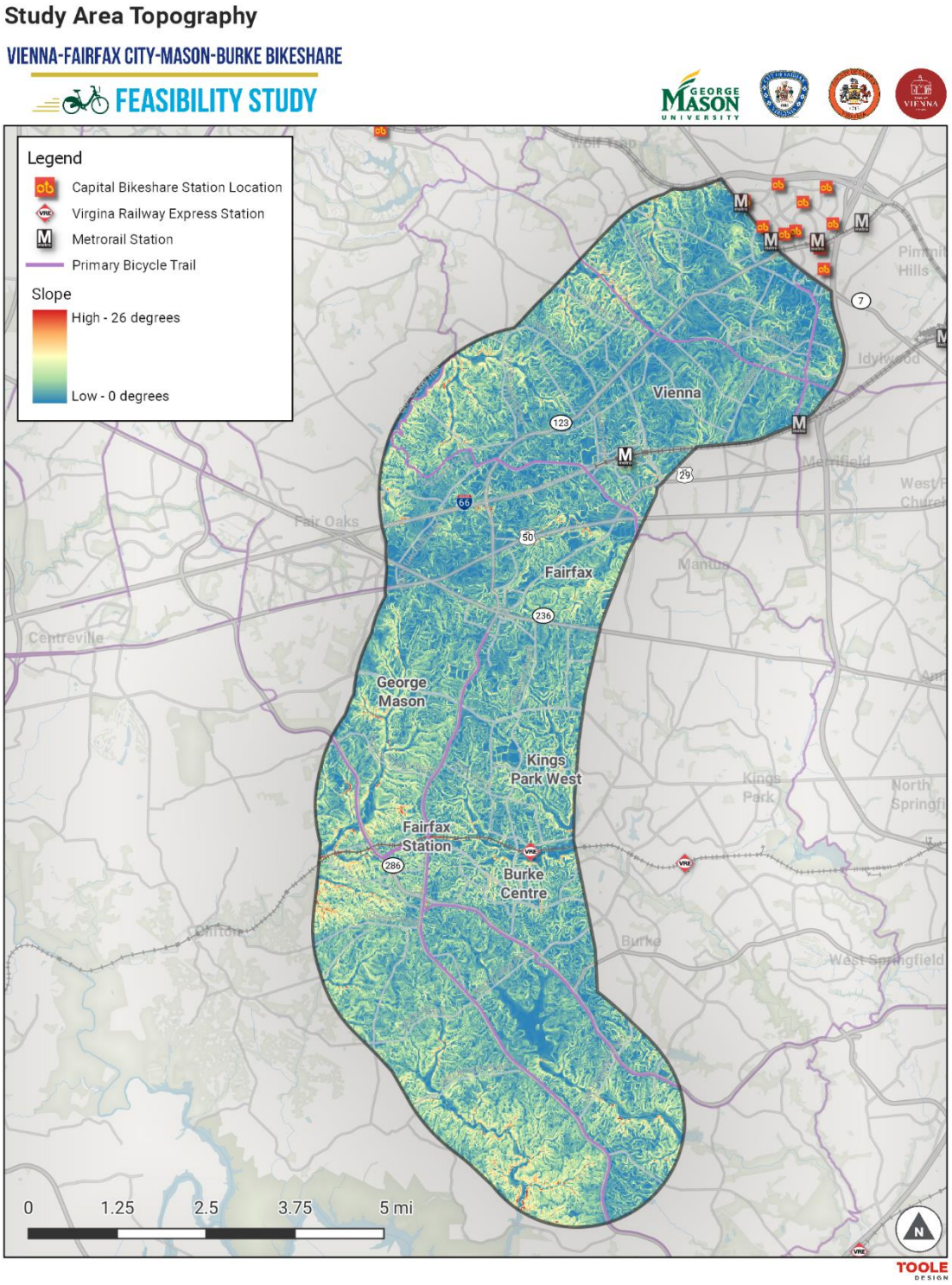


Figure 2: Study Area Topography

DEMOGRAPHICS

This section reviews demographic trends for the entire study area, though it should be noted that there may be diverse characteristics in different communities within the study area. According to 2016 data from the U.S. Census Bureau, the population of the study area is just over 200,000 people, with a population density of 3,870 persons per square mile. This density is lower than Rockville, MD; Alexandria, VA; and Washington, D.C. – all of which are part of Capital Bikeshare. Most of the low-density land use in the study area is south of Braddock Road and west of Route 123, which are areas with primarily low-density single-family housing. The overall population density in the study area is fairly low, but portions of the study area may be more comparable to densities of existing bikeshare systems. These higher-density areas are in the eastern and northern portions of the study area.

Table 1: Characteristics of Comparable Jurisdictions

	Land Area (sq. mi.)	Population	Density (pop./sq. mi.)[11]
Route 123 Study Area	53.4	206,663	3,870
Rockville, MD	13.6	68,401	5,029
Washington, D.C.	61.1	693,972	11,357
Alexandria, VA	14.9	160,035	10,740
Palo Alto, CA	11.99	64,403	2,808
Columbus, OH	217	787,033	3,960
Greenville, SC	28.7	58,409	2,360

(Data Source: US Census Bureau Quick Facts)

Figure 3 shows the distribution of population across the study area. The highest densities are found in the City of Fairfax and Mason, adjacent to the Vienna Metro, adjacent to the Burke VRE station, and between I-66 and Route 123 near Oakton. The demographics in the study area show that:

- A large portion of the population—approximately 32 percent—is between 20 and 44 years old (Figure 4).[12] Nationally, this age group is one of the most likely to use bikeshare; e.g., 80 percent of Capital Bikeshare members surveyed in 2014 were younger than 44 years old.[13]
- The Fairfax County median household income is $114,329[14] and the City of Fairfax median household income is $104,065 (see Figure 5). Early adopters of bikeshare tend to be more affluent.[15] For example, half of surveyed Capital Bikeshare members in 2014 had household incomes greater than $100,000. [16]
- 68 percent of residents in the study area (Figure 6) have earned at least a bachelor's degree.[17] This is comparable to users in other U.S. bikeshare cities, where 60 to 80 percent hold a four-year college degree or higher.[18]

[11] Census Quick Facts. Washington, D.C., Rockville, MD, and Alexandria, VA.
[12] US Census Bureau. 2016 American Community Survey 5-Year Estimates. B01001
[13] http://www.capitalbikeshare.com/assets/pdf/cabi-2014surveyreport.pdf, 16
[14] US Census Bureau. 2016 American Community Survey 5-Year Estimates. B19001
[15] The Bike-Share Planning Guide. Institute for Transportation and Development Policy. December 2013
[16] http://www.capitalbikeshare.com/assets/pdf/cabi-2014surveyreport.pdf, 16
[17] US Census Bureau. 2016 American Community Survey 5-Year Estimates. B19001
[18] The Bike-Share Planning Guide. Institute for Transportation and Development Policy. December 2013

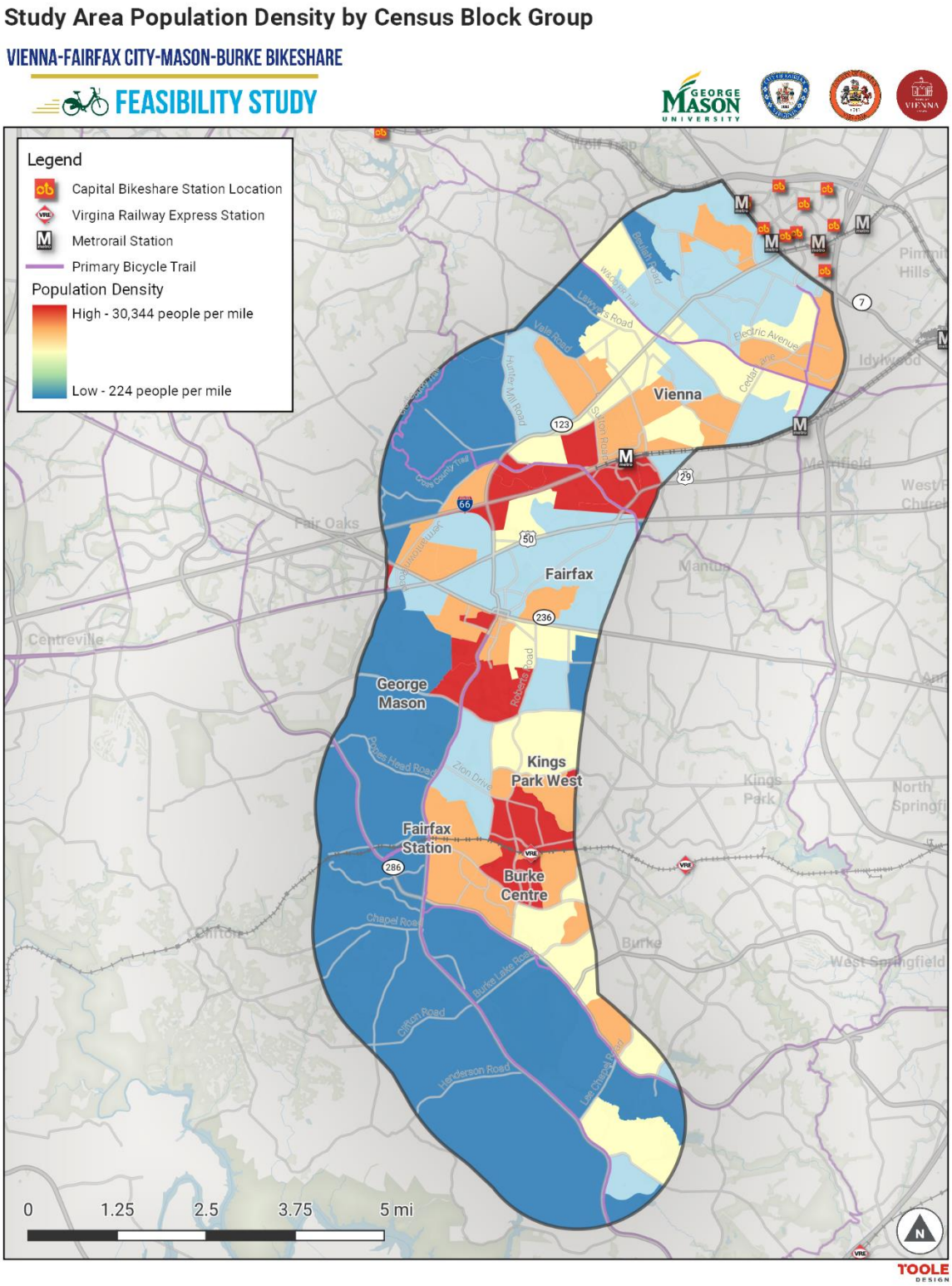


Figure 3: Population Density by Census Block Group

Figure 4: Study Area Population by Age and Sex (by number of people)

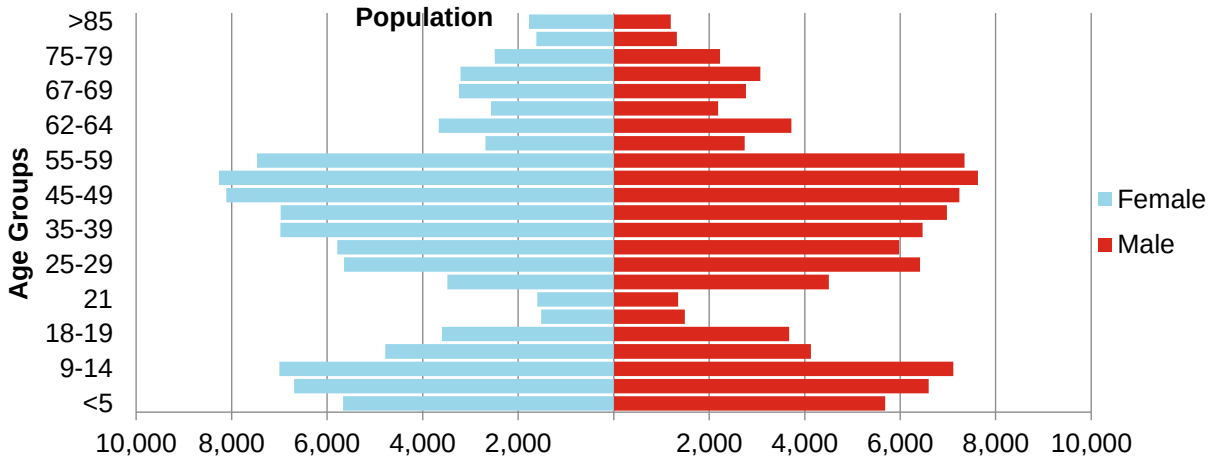


Figure 5: Study Area Household Income

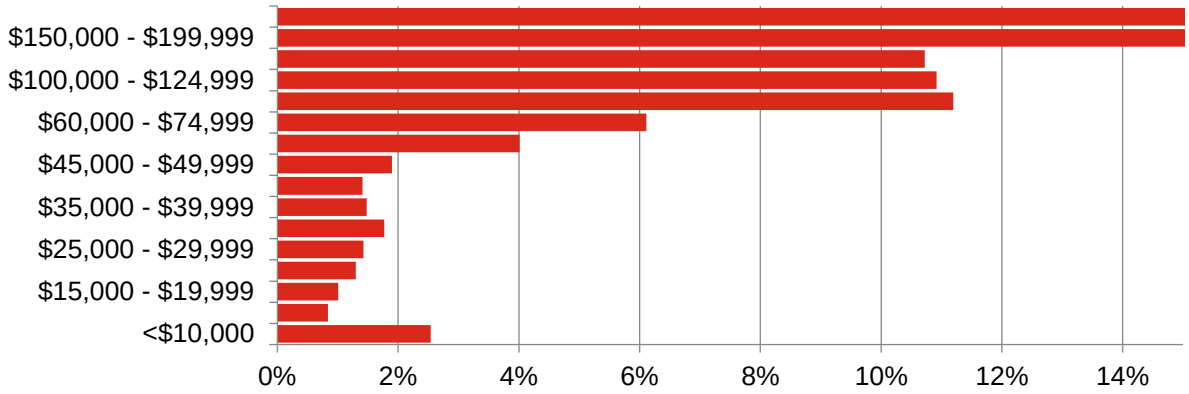
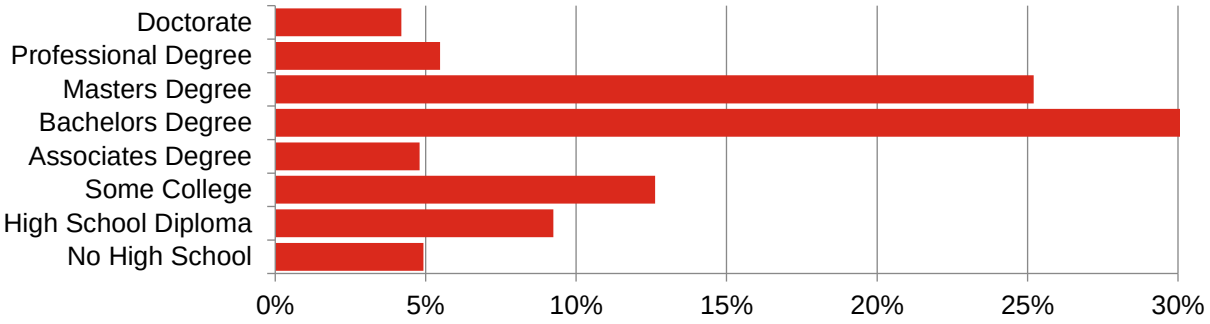
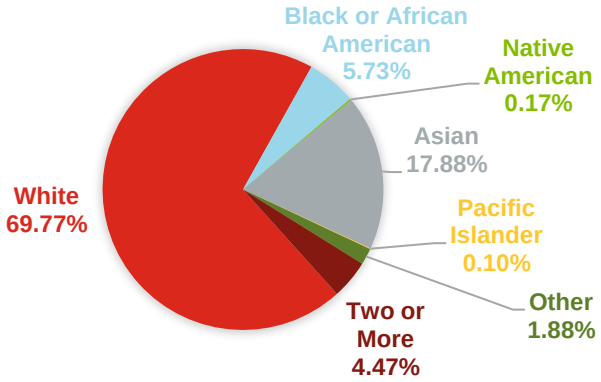


Figure 6: Study Area Educational Attainment



Approximately 70 percent of residents in the study area identify as White; 18 percent identify as Asian; 6 percent identify as Black or African-American; and 4 percent identify as two or more races (see Figure 7).[19] This is somewhat comparable to data from a recent survey of Capital Bikeshare that shows that membership is 84 percent White, 5 percent Asian, 5 percent Hispanic/Latino, 3 percent African-American, and 3 percent other or two or more races.[20] Experience in other cities shows that non-White populations tend to be underrepresented as bikeshare users and so additional outreach efforts may be needed to effectively engage these populations.

Figure 7: Study Area Race and Ethnicity



Zero-vehicle households, where no family member owns a motor vehicle, represent 3 percent of households in the study area.[21] Bikeshare could serve as an added mobility option for these households, however, this effect is expected to be stronger in other parts of the region (that have higher percentages of zero-vehicle households and more reliance on active and public transportation). For example, in Washington, D.C., 34 percent of households are zero-vehicle households, 10 percent in Alexandria, and 11 percent in Rockville.[22]

Figure 8 illustrates areas where additional efforts might be potentially be needed to engage traditionally underrepresented populations to meet equity goals. The “equity index” combines the proportions of low-income, non-White, or zero-vehicle households to indicate areas where there is a larger proportion of one or more of these populations compared to the rest of the study area. Each variable was weighted five points, for a total weight of 15 points within the overall demand analysis. As such, the “high” and “low” ratings of Census block groups is based on these combined scores.

The demographic characteristics of the study area present both challenges (e.g., a more established car culture and fewer zero-car households) and opportunities for bikeshare success (e.g., demographics that support early adoption of bikeshare). Given that local residents tend to be younger, well educated, and have higher household incomes, there could be a strong early ridership base. However, efforts should be made to engage a diverse population, including low-income residents, people of color, older adults, and people with disabilities. Other cities are similarly attempting to better engage these demographics. For example, Philadelphia launched the Indego bikeshare system in 2015 with a focus on having at least 30 percent of stations in low-income and predominantly non-White neighborhoods. Along with dedicated programmatic efforts, this has generally increased the representation of these populations as bikeshare members compared to other bikeshare systems without these interventions.

[19] US Census Bureau. 2016 American Community Survey 5-Year Estimates. B02001
[20] http://www.capitalbikeshare.com/assets/pdf/cabi-2014surveyreport.pdf, 17.
[21] US Census Bureau. 2016 American Community Survey 5-Year Estimates. B08301
[22] Census Reporter http://censusreporter.org/data/table/?table=B08201&geo_ids=05000US11001,16000US5101000,16000US2467675&primary_geo_id=05000US11001

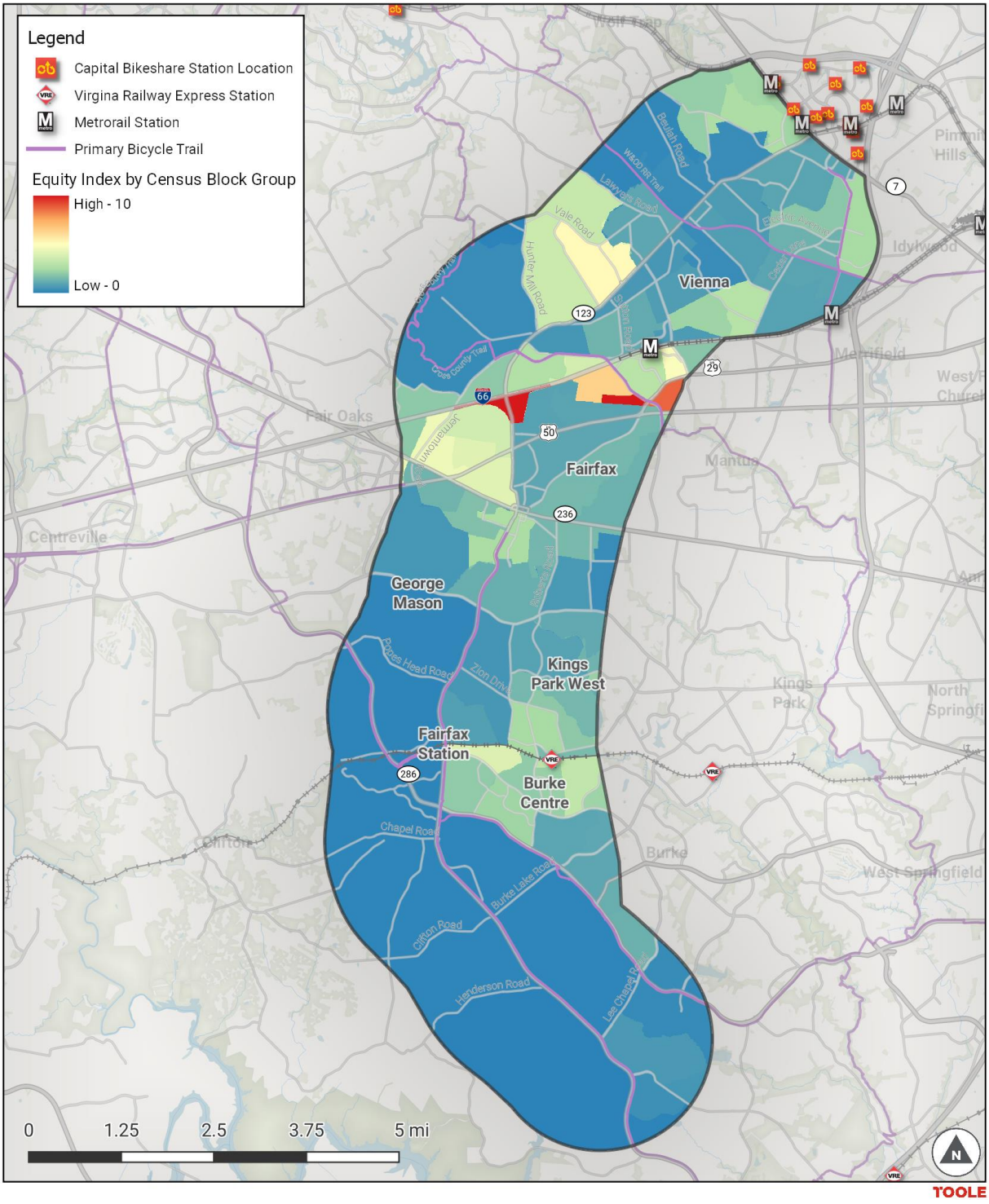


Figure 8: Equity Index (Zero-Vehicle Households, Low-Income Households, and Minority Populations)

CHALLENGES

- While population density is high in some parts of the study area, many areas have lower densities that may not be as conducive to bikeshare and may experience lower bikeshare ridership. These are primarily in the southern and western portions of the study area. These may need to be incorporated into later phases of the program.
- Concerted efforts will be required to maximize engagement of low-income and non-White populations, including locating stations in neighborhoods with substantial concentrations of these populations as well as programs targeted towards these neighborhoods.

OPPORTUNITIES

- Areas with higher population density have higher potential for bikeshare demand. Population density is often a proxy for bicycling demand due to the concentration of people and destinations in these areas.
- The area includes a number of indicators that there will be early adopters of the bikeshare program, including a younger, more affluent, and well-educated population. Students at George Mason University should also be a target demographic, as students tend to also be early adopters of bikeshare.
- Bikeshare could be an effective transportation option for people in zero-vehicle households, especially to connect to the Vienna Metrorail station.

EMPLOYMENT DENSITY

The number and concentration of jobs are also indicators of potential bikeshare demand. Bikeshare can act as a first- and last-mile connection to transit and offers workers an easy way to get around during the day. Locating bikeshare stations in areas with relatively high employment density will help serve these users.[23,24]

The employment density map (see Figure 9) shows the parts of the study area with greater concentrations of employment (in red) than others (in blue). There are several major employment centers in the study area including George Mason University, which has over 6,000 employees, as well as the City of Fairfax and Fairfax County government buildings. There is also significant employment in the Town of Vienna and along Leesburg Pike. The “high” and “low” units on the map refer to the relative density of jobs per square mile within the study area (the maximum employment density is 18.9 jobs per square mile).

According to the U.S. Census Bureau, over 85,000 people were employed within the study area in 2015. Of these, almost 21,000 (24 percent) worked in professional, scientific, and technical services, and almost 9,000 (10 percent) worked in each of the fields of health care and social assistance, retail, and educational services.[25]

[23] http://www.pedbikeinfo.org/pdf/Programs_Promote_bikeshareintheus.pdf , page 15
[24] Cost Recovery Ratio. This is the ratio of fare revenue to total operating costs, and is a key indicator of financial performance.
[25] 2015 U.S. Census LEHD data.

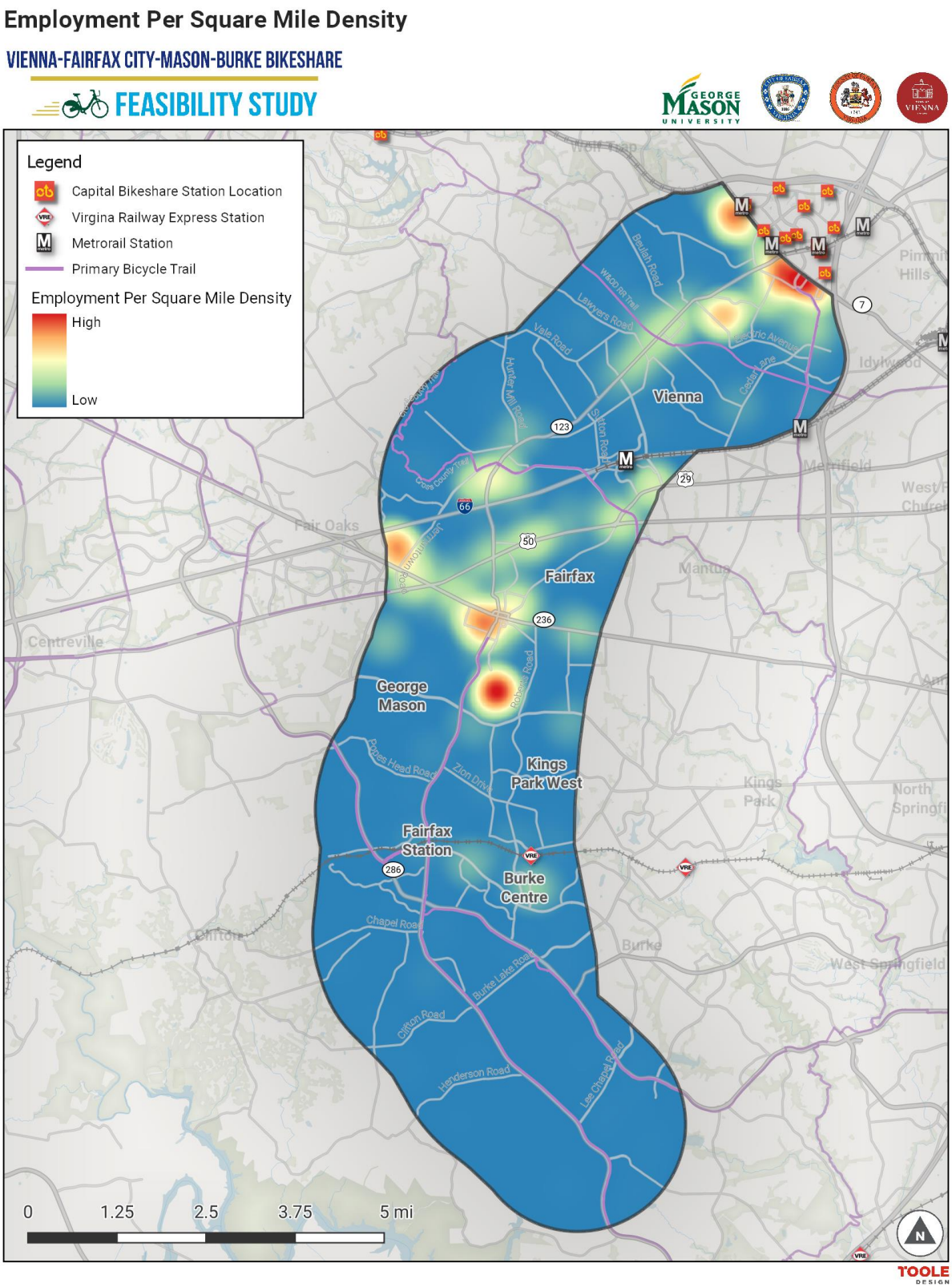


Figure 9: Employment Density

CHALLENGES

- Ideally, bikeshare stations should be spaced approximately one-quarter mile apart. However, with localized employment nodes, stations may need to be more strategically located and connected with local transit services.

OPPORTUNITIES

- Bikeshare could be used as a primary mode of transportation to and from work, or at either end of a longer transit trip (e.g., Vienna Metro, Burke VRE, or local and regional bus services), or by employees to get around the local area during the day.
- Major employers, such as George Mason University, Fairfax County, and the City of Fairfax, could purchase or encourage group bikeshare membership. Other large employers in the area could be interested in station sponsorship or providing membership to their employees as part of a wellness or transportation demand management program.
- Transportation demand management in new real estate development is an opportunity for implementing bikeshare stations in coordination with new developments and changes in land use and travel patterns, including housing, office, and other uses. Other jurisdictions, including Montgomery County and Washington, D.C., typically require developers to fund Capital Bikeshare stations as part of their transportation demand management strategy.

COLLEGE AND STUDENT POPULATIONS

Bicycling can be an attractive mode of transportation for college students, as they tend to take many short trips throughout the day and many do not own automobiles. Additionally, colleges tend to have housing, entertainment, and recreation destinations within a short bike ride of the campus. This land use pattern has been a key origin/destination of bikeshare trips in other communities.[26]

The George Mason University campus is located just south of the City of Fairfax. In the Fall 2018 semester, 26,192 undergraduates and 10,524 graduate students were enrolled.[27] There are also over 6,500 employees at George Mason University including salaried, non-student wage, and adjunct faculty members.

Locating bikeshare stations on and off campus could help George Mason University students, faculty, and staff move easily between campus buildings, parking garages, transit stations, retail and entertainment destinations, and the City of Fairfax. It could also provide a first- and last-mile connection for those living or working off-campus to access public transit services such as the Fairfax CUE or Mason Shuttles.

CHALLENGES

- Certain areas on campus may not be considered appropriate for bikeshare stations. Be sensitive to pedestrianized areas and other locations where bicycling is not permitted.

OPPORTUNITIES

- Students are often early adopters of bikeshare.

[26] http://www.pedbikeinfo.org/pdf/Programs_Promote_bikeshareintheus.pdf , page 17
[27] https://irr2.gmu.edu/New/N_EnrollOff/EnrlSts.cfm

- Bikeshare can connect destinations on campus to services and destinations off-campus. It can also provide a connection to transit for students, faculty, and staff that commute to campus.

VISITORS AND TOURISM

In some cities, such as Minneapolis and Washington, D.C., a significant amount of user-generated revenues (approximately two-thirds) come from tourists, visitors, or other casual users.[28] This provides an important revenue stream to help fund the operation of the program. Tourists and visitors are less cost-sensitive and are generally more willing to pay additional fees to extend their trip time. For example, in 2014 the GREENbike program in Salt Lake City, UT generated a net revenue per trip from casual users of $4.01, compared to $1.20 for annual members.[29]

The study area is not expected to have the same amount of visitors and tourists as the examples above. However, there are several popular tourist attractions in the study area, including Old Town Square, Historic Blenheim, the Cold War Museum, the Fairfax Station Railroad Museum, and others. There are also several entertainment destinations, including the EagleBank Arena and Mason's Center for the Performing Arts. Additionally, the study area includes major regional trails, such as the Washington & Old Dominion (W&OD) Trail and the Gerry Connolly Cross County Trail (CCT), which attract recreational riders and provide connections to business districts.

Figure 10 shows the areas with the highest concentration of attractions, including the venues noted above, parks, community centers, and other community amenities. The "high" and "low" units on the map refers to the relative density of attractors within the study area.

CHALLENGES

- There are not as many visitors and tourists in the study area as in other parts of the region and so there may be less revenue-generating potential compared to other parts of the Capital Bikeshare network. Bridging any shortfall may require additional funding from sponsorship, public, and other sources. However, there are some locations with large hotels (such as in Tysons) that attract tourists and business travelers who may be interested in using bikeshare.

OPPORTUNITIES

- Special events may increase usage and revenues from short-term users and can be tied to special membership deals or short-term passes that introduce people to the system.
- Regional trails, such as the W&OD Trail, could attract recreational bikeshare riders from the region that are less price-sensitive.
- Park coordinators and managers of major tourist destinations may be good partners for implementing bikeshare, e.g. providing space for stations or co-marketing the system. However, many parks close at dusk; stations located near parks should be located along public roads where they can be accessed 24 hours a day.

[28] https://www.niceridemn.org/_asset/wcwbuh/NRMN_annual-report_2014_web.pdf,
[29] https://configuringgreenbike.bcycle.com/docs/librariesprovider32/default-document-library/2014-annual-report.pdf?sfvrsn=2 17

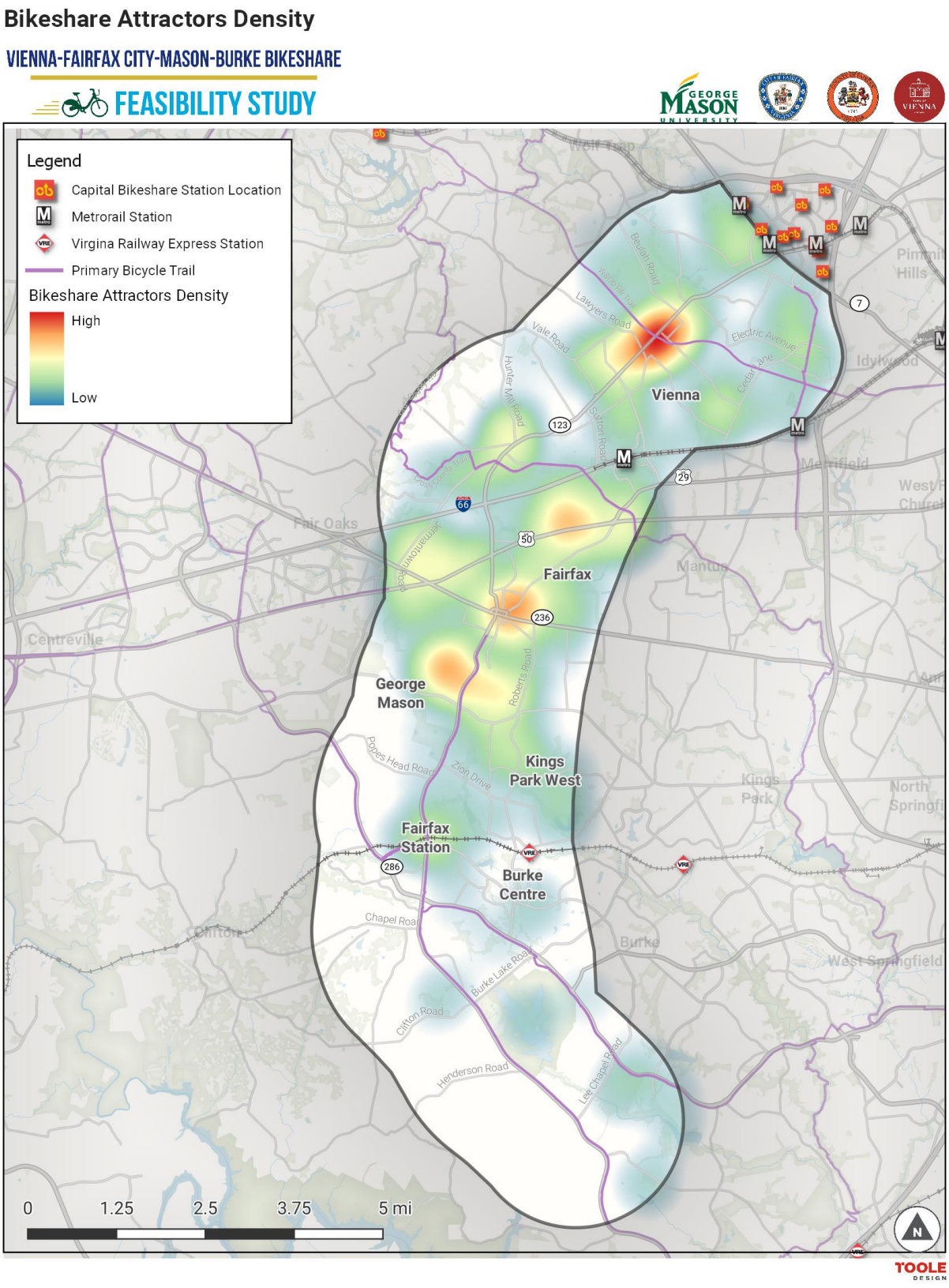


Figure 10: Density of Bikeshare Attractors

TRANSPORTATION - TRANSIT, CAR SHARE, AND REGIONAL MOBILITY

Bikeshare is not usually the sole mode of travel for residents and visitors—in fact that is increasingly true of all modes, with people having a larger variety of travel modes available to select to suit their specific trip needs. There is a great opportunity to offer bikeshare as a complement to walking, public transportation, carsharing, rideshare and taxi services, and other modes. Overall, increasing the variety of travel options would help the region become less car-dependent.

Transportation options in the study area include Metrobus, Metrorail, the VRE, Fairfax CUE bus, Fairfax Connector bus, George Mason University shuttles, carshare, vanpool, and rideshare services. Bikeshare can enhance transit services by extending the reach of the system (i.e., improving first- and last-mile connections), filling in gaps in the transit network or service schedule, or providing an alternative for overcrowded routes. Biking can sometimes also be faster than buses with many stops, circuitous routes, or infrequent service.

Figure 11 shows a map of the study area transit density. For bikeshare to serve the above-listed functions, it will be important for the system to cover the areas with the highest transit density. The “high” and “low” units on the map refers to the relative density of high capacity transit options within the study area.

CHALLENGES

- Long headways or gaps in the transit service schedule can make it difficult to rely on public transportation in the study area. Bikeshare could help fill in gaps in the service.

OPPORTUNITIES

- Bikeshare offers a first- and last-mile connection to and from transit and should connect the major transit stops and park-and-ride lots to nearby destinations.
- Major nodes of the study network, such as George Mason University and the City of Fairfax, which are close to Metrorail, may benefit from bikeshare as it may be able to provide an additional commute option.

Transit Density

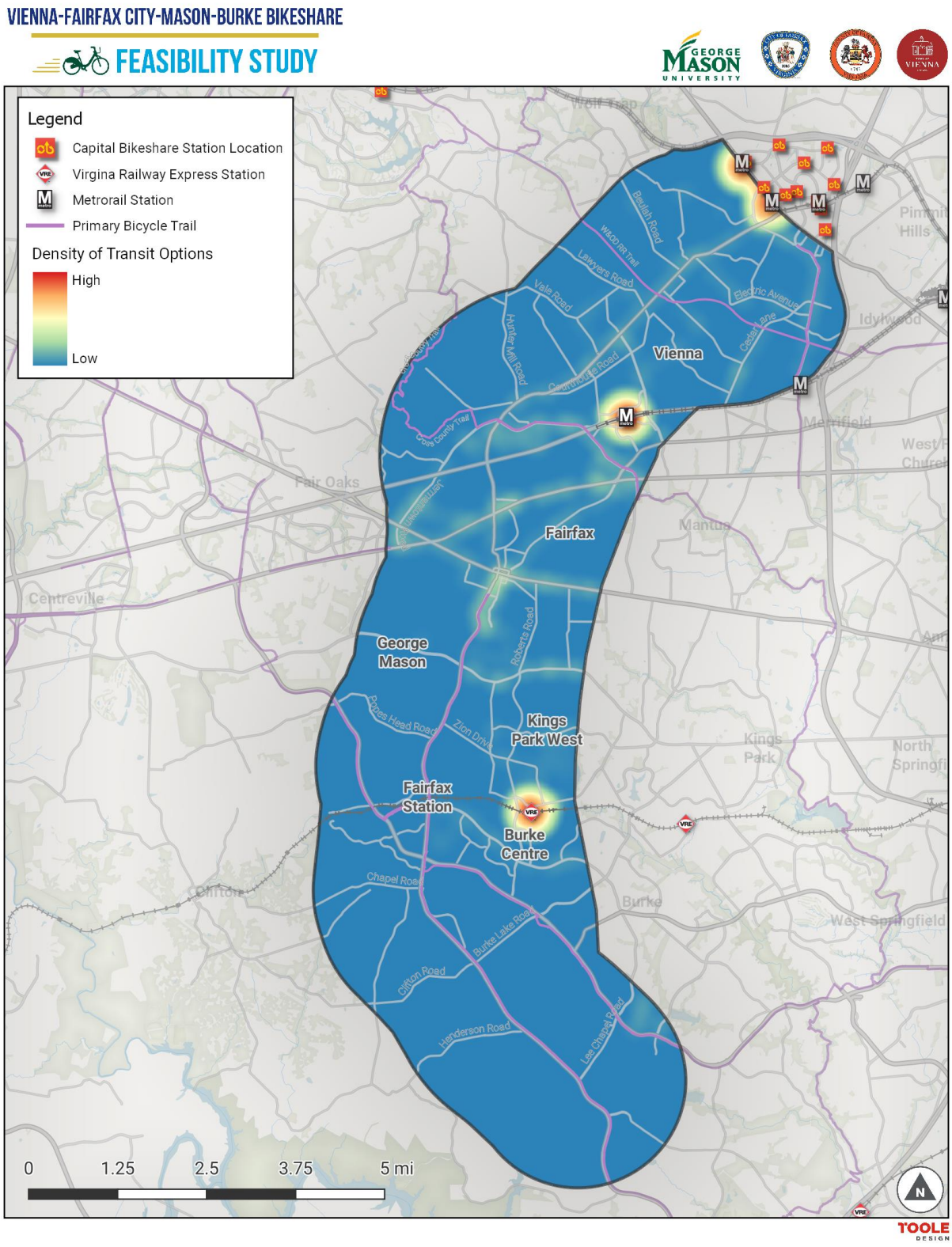


Figure 11: Transit Density

BICYCLING MODE SHARE AND BICYCLING INFRASTRUCTURE

Bicycling is a relatively popular mode of transportation in some parts of the study area. While the average bicycle commuting mode share in Fairfax County is only 0.3 percent, there are several areas within the study area with higher bicycle commute mode shares, such as the City of Fairfax, Town of Vienna, Pimmit Hills, and Fairfax Station, where bicycle commuting nears or exceeds 4 percent. In comparison, the bicycle mode share in Arlington County is 4 percent, and in Washington, D.C. it is approximately 5 percent. See Figure 12 for bicycling mode share in the study area per square mile. As shown, there are areas of high and moderate bicycle commuting near Tysons Corner and Mason/Fairfax.

There are significant trail facilities in the study area. The W&OD Trail runs across the study area and connects the Town of Vienna to the City of Falls Church and Washington, DC to the east and Reston to the west. The CCT also connects with the W&OD trail west of Vienna and runs north to the Difficult Run River.

There is limited on-street bike infrastructure in the study area, but the network does include bike lanes along Gallows Road, Courthouse Road, and Old Courthouse Road, and on Patriot Circle surrounding George Mason University. There are also a number of shared use paths and trails throughout the study area, including the Route 123 (Ox Road) Trail, the Fairfax County Parkway Trail, and the Gallows Road Trail. The County has identified a network of bikeable sidewalks, and the County's bike map includes a ranking of roads by level of comfort. Figure 12 shows the density of bike infrastructure including trails, bike lanes, and low-stress routes, which typically include local roads with low speeds and volumes of motor vehicles. Low-stress routes are an important part of the bicycle network, as quiet residential roads connected by neighborhood trails enable bicycle travel through the study area even where dedicated facilities are not provided.

Figure 13 shows the density bicycle infrastructure in the study area, including trails and on-street routes. The "high" and "low" units within the legend denote the relative density of bicycle infrastructure within the study area.

While there has been little academic research regarding the link between the provision of bicycle facilities and bikeshare ridership, there is a significant volume of research that shows a positive relationship between the provision of facilities and general levels of bicycling. [30,31,32] For example, Buehler and Pucher found that cities that made a 10 percent increase in bicycle facilities saw a 2 to 3 percent increase in bicycle commuting compared to cities with no change. Absent robust bicycle count data, bicycle commuting is often considered a proxy for overall bicycling demand. However, commuting is a small percentage of overall travel, meaning that actual bicycling activity is likely as much as 80% greater. This relationship may be especially strong among minority and low-income individuals: 59 percent of minorities[33] and 60 percent of low-income people responding to a 2012 survey conducted by the League of American Bicyclists stated that the provision of more bicycle facilities would encourage them to ride more often.[34] In addition, in 2013, 56 percent of Capital Bikeshare members responding to a general survey about their riding preferences stated that a lack of dedicated bicycle lanes or paths was a barrier to using Capital Bikeshare.[35]

[30] http://www.pagnet.org/documents/2012LABfeedback.pdf
[31] Buehler, R. & Pucher J. (2012). Cycling to Work in 90 Large American Cities; New Evidence on the Role of Bike Paths and Lanes.
[32] Dill, J. & Carr, T. (2003). Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them.
[33] Minorities defined as Hispanics, African Americans, Asians, Native Americans, mixed, or other race.
[34] http://bikeleague.org/sites/default/files/equity_report.pdf
[35] http://www.capitalbikeshare.com/assets/pdf/CABI-2013SurveyReport.pdf

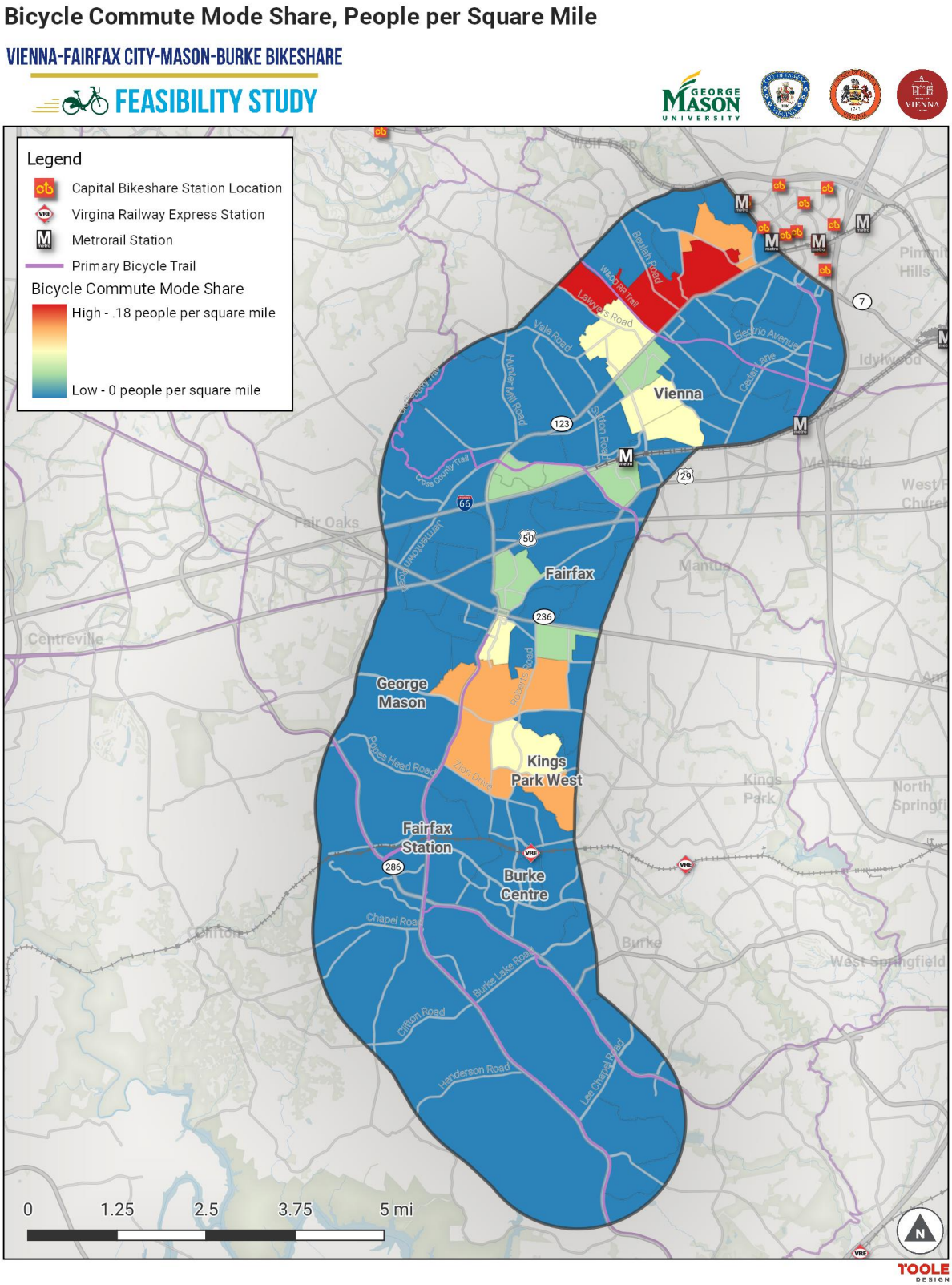


Figure 12: Bicycle Commute Mode Share Per Square Mile

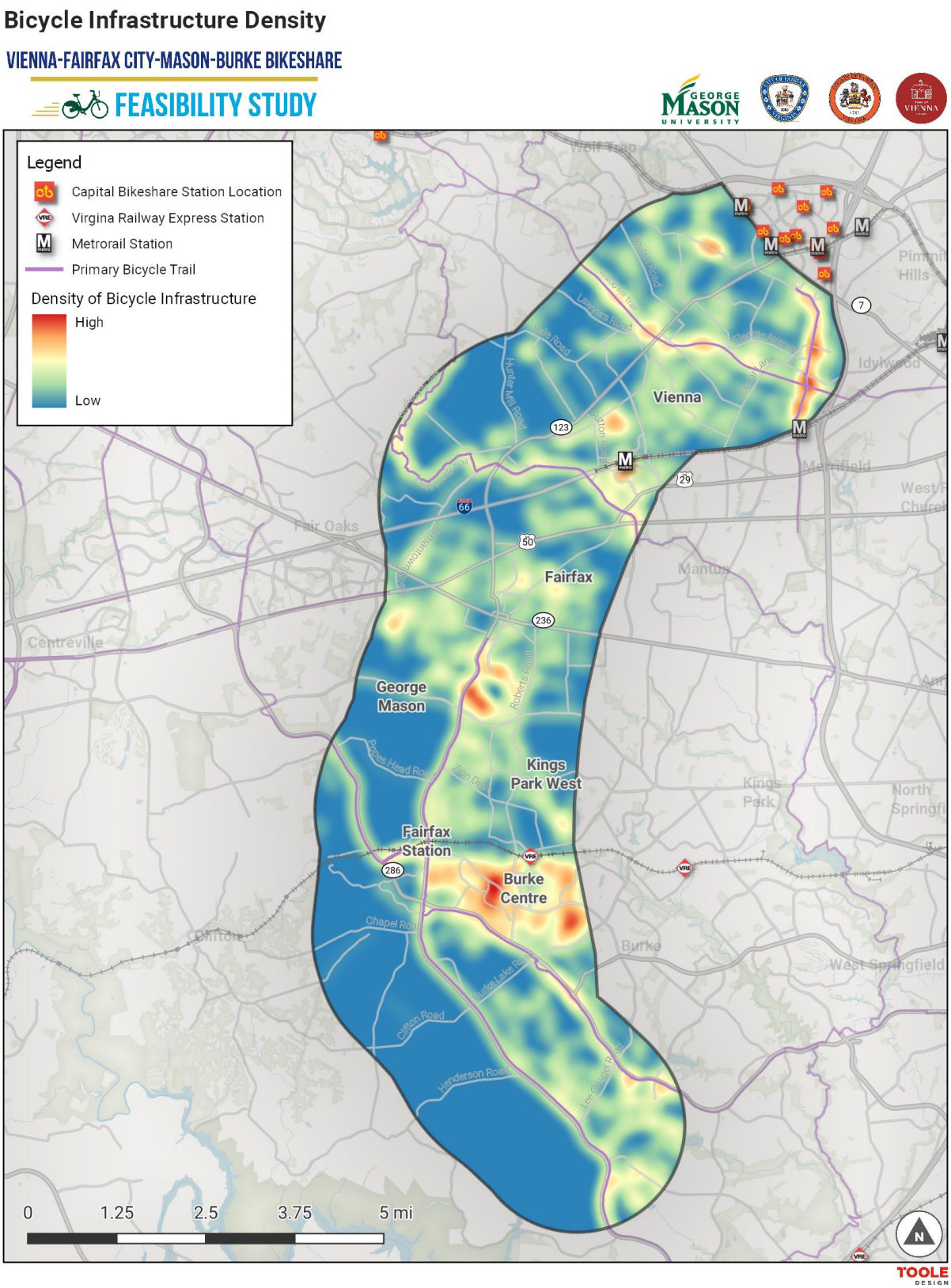


Figure 13: Bicycle Infrastructure Density

CHALLENGES

- While a complete network of on-street bicycle facilities is not entirely necessary for the implementation of a bikeshare system, additional bicycle facilities would help fill in the gaps between on-street and off-street bike facilities and encourage more ridership in the study area.
- Without a network of low-stress bicycle connections between origins and destinations, potential bikeshare users may be dissuaded from using the system because they may feel uncomfortable bicycling on streets in the area. Bicycle facilities are especially needed to help cross barriers such as highways, railroad tracks, or bodies of water. Consider the development of bicycle facilities in parallel with the development of a bikeshare program.

OPPORTUNITIES

- The trail system, including the W&OD Trail and the CCT, provide a resource to focus the bikeshare system around and connect regionally to the City of Falls Church, Reston, and the rest of Fairfax County. However, it will be important to have frequent connections into adjacent neighborhoods and commercial nodes.
- Trails in the study area have the potential to flourish as a bikeshare superhighway, providing a low-stress connection for users between their homes, work, school, local businesses, and regional amenities. Future trails that will increase bicycle connectivity are planned through the study area, such as the I-66 Trail and George Snyder Trail. This will further expand opportunities for bikeshare use.

SUMMARY OF OPPORTUNITIES AND CHALLENGES

While there are challenges to bikeshare implementation in the study area, its population density, transit access, bicycle facility network, and demographic base indicate that bikeshare implementation may be feasible in some of its locations. The study area exhibits many characteristics important for a successful bikeshare program.

The primary challenges to a successful bikeshare system in the study area include:

- A disconnected local street network that relies on high-speed, high-volume arterial streets for longer-distance connections. These routes have limited on-street bike facilities and major arterial crossings can be difficult. These conditions may dissuade or limit some people from using bikeshare or limit the areas that people would use it.
- Bikeshare works most effectively in conjunction with other modes such as walking, public transit, and ridesharing. There are parts of the study area that have very few of these transportation options and a greater reliance on automobiles.
- Although there is room for multiple technology solutions, if the technologies chosen are incompatible with each other or the existing Capital Bikeshare system, they will be less efficient and provide less utility for study area residents.

Key indicators that bikeshare will be successful in the study area include:

- With many regional transit nodes within biking distance of neighborhoods, bikeshare could make using public transit more convenient. There is a significant amount of commuting in and out of the study area, and those residents and employees could use bikeshare as a first-and last-mile option to get between home and work.
- The large number of students, staff, and faculty who commute to George Mason University provide significant opportunities for on-campus connectivity between buildings, parking garages, and transit stations as well as connections to the City of Fairfax, Burke VRE, and Vienna Metro.
- Population density in parts of the study area is similar or higher than in many communities that have successfully implemented bikeshare.
- The existing trail network provides bikeshare users with low-stress connections to the bikeshare network in the larger region, including the planned expansion of Capital Bikeshare into the City of Falls Church and the existing system in Tysons, Reston, Arlington, and Washington, DC. Having access to the rest of the Capital Bikeshare network would provide greater utility to residents of the study area, allowing bikeshare in these areas to benefit from economies of scale and provide area residents access to the larger regional system (if a decision is made to join Capital Bikeshare). The presence of Capital Bikeshare in the larger region also increases the awareness of bikeshare in general, and there are likely already Capital Bikeshare members living in the study area.

Bikeshare station locations along the W&OD, the CCT, and planned trails such as the I-66 trail, as well as along the Route 123 corridor, could provide a convenient option for residents and visitors looking to access regional destinations and amenities. Some potential bikeshare users may include:

- George Mason University students, faculty, and staff running midday errands off-campus or enhancing commuting options by using bikeshare

- Study area employees running midday errands, travelling to local meetings, or enhancing commuting options by using bikeshare
- Study area residents commuting, travelling to entertainment options, running local errands, exploring recreational opportunities, travelling regionally using the trail system, or connecting to the Vienna Metro, Burke VRE Station, and other transit options
- Study area visitors exploring historic and recreational amenities

As noted above, it is important that the City of Fairfax, Fairfax County, George Mason University, and Town of Vienna continue improving on-street bicycle conditions in the study area in tandem with the further expansion of bikeshare in Fairfax County. With these opportunities and challenges in mind, **it will be feasible to implement a bikeshare system in the study area**.

BIKESHARE LOCATION SUITABILITY ANALYSIS AND METHODOLOGY

Based on the review of existing conditions, a suitability analysis (or "heat mapping" analysis) was performed to determine were bikeshare would be most successful. The analysis used GIS data provided by Fairfax County and from publicly available sources including the U.S. Census. Because bikeshare tends to be most successful where there are a variety and density of land uses the analysis was created by aggregating data sets that included population density, employment density, community and visitor attractions (e.g., libraries, community centers, sports venues, etc.), transit and regional transportation, level of traffic stress (LTS) and existing bike infrastructure, factors that reflect equity, and topography.

Category weights were determined based on the established goals and objectives of the bikeshare system. The resulting scores for each category were then summed to give a total "suitability" score.[36] The weighting used for each variable is described in Table 2, and the results of the analysis are shown as a heat map in Figure 14. The "high" and "low" range denoted on the map refers to the relative total potential demand score based on the bikeshare suitability analysis (from zero to 100 points possible). According to this analysis, the most suitable locations for bikeshare are shown in the red shades on the map, and include the City of Fairfax, the Town of Vienna, George Mason University, the Burke VRE station, the Vienna Metro station, the Spring Hill Metro station, and the Greensboro Metro station. These outputs were combined with public and stakeholder input to define a recommended bikeshare service area and station location recommendations.

[36] For example, the cell with the highest employment density would receive 20 points. For factors that were point or line data, such as attractions, transit, and LTS, the factors used a 0.25 or 0.5-mile radius around the geometry to score the cells according to weight. Raw scores were classified into 9 classes, using the equal interval classification method.

Table 2: Demand Map Variable Weighting

Data Item	Factors	Proximity Factor		TOTAL POINTS
		0.25 Miles	0.5 miles	
Employment Density	20			20
Population Density	20			20
Attractions		10		10
Tourist attractions		-		
Parks		-		
Malls		-		
Libraries/Schools		-		
Transit		17		17
Metro Stations / VRE			12	
Bus Stops		5		
LTS (Level of Traffic Stress)		15		15
LTS		5		5
Trails and Bike Lanes		10		10
Equity	15			15
Minority	5			
Low-Income Households	5			
Zero-Car ownership	5			
Public Comments		yes		3
Topography		-3	-3	-3
TOTAL				**100**

Potential Bikeshare Demand

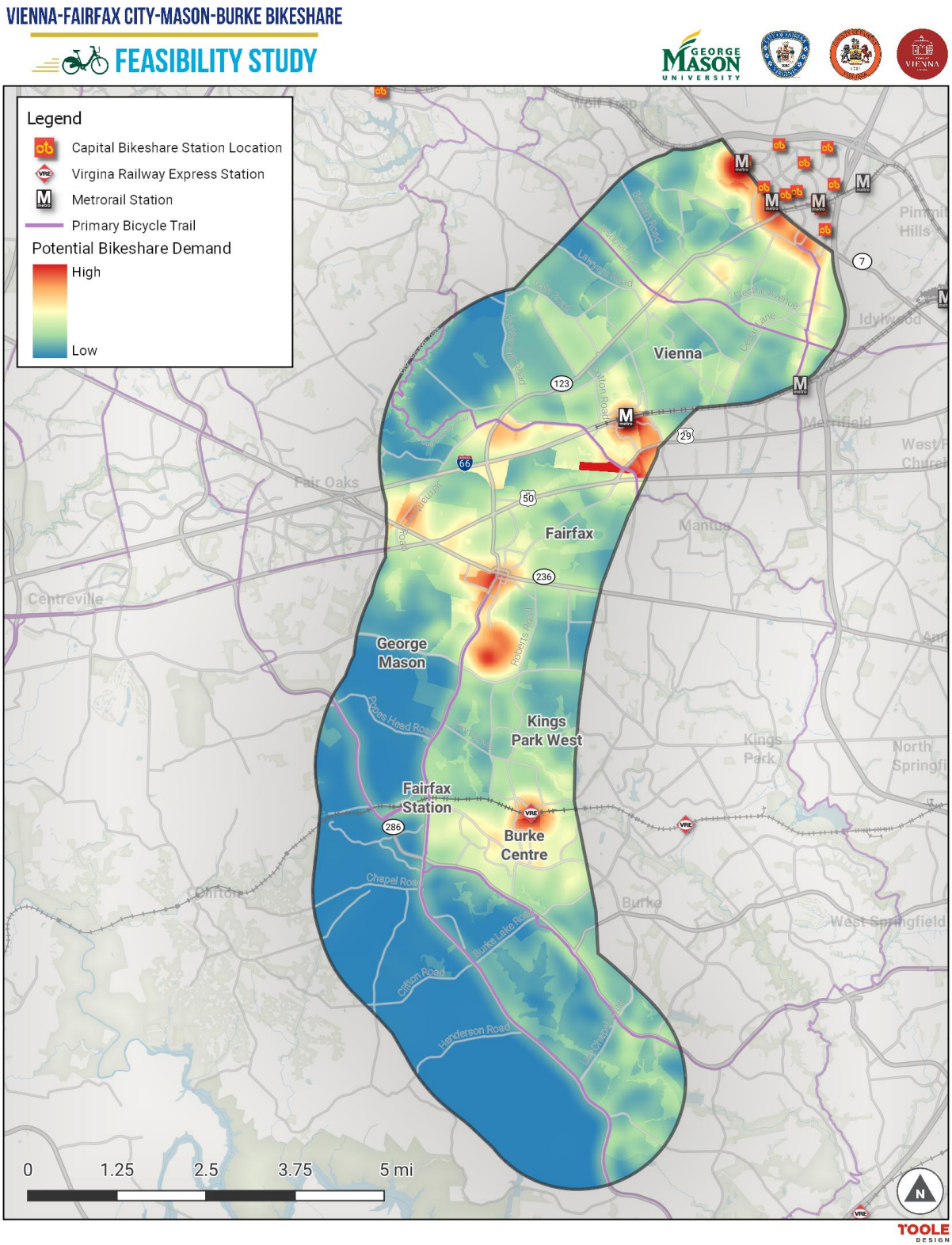


Figure 14: Potential Bikeshare Demand

CHAPTER 4
STAKEHOLDER ENGAGEMENT

CHAPTER 4: PUBLIC OUTREACH

The project team conducted online and in-person outreach at community events in the Town of Vienna, the City of Fairfax, Fairfax County, and at George Mason University to collect input on the public's view of bikeshare and to promote the online survey and station suggestion map. Outreach was also conducted at local events in the spring and summer of 2018 (prior to the study kickoff) to collect preliminary public input, including at Bike to Mason Day, Bike to Work Day, Rock the Block, and the Fairfax Saturday Community Farmer's Market. Agency staff also conducted public outreach later in the process at the Fairfax Fall Festival to solicit additional input and support education efforts.

In-person public outreach events included:

- George Mason University's GetConnected Fair: Wednesday, September 5, 2018, 11 AM – 2 PM
- Fairfax Community Farmer's Market: Saturday, September 15, 2018, 8 AM – 1 PM
- Vienna Farmer's Market: Saturday, September 29, 2018, 8 AM – 12 PM
- Burke VRE Station: Monday October 1, 2018, 4 PM – 7 PM
- Vienna Metrorail Station: Tuesday October 2, 2018, 4 PM – 6:30 PM

The project team staffed a table at each of these events and encouraged participants to stop and find out more information about bikeshare, ask questions of the project team, and provide input either online or using the project boards. Public input was recorded as follows:

1. Online input: Participants were offered an information card that had the project website address where they could access the survey or Wikimap.
2. Project boards: All events had boards that gave information on different bikeshare technology options, maps of the project study area and the outreach event's surrounding area, and specific outreach questions. Respondents were asked to indicate on the study area maps where they would like to see a bikeshare location, what type of trips they would make, what would motivate them to use bikeshare, and what type of bikeshare technology they would prefer. Examples of these boards are shown on Figure 15, Figure 16, and Figure 17.

Note that participants could provide multiple responses to many of the questions in the survey or on the project boards. For example, many people said they would like to make several kinds of trips using bikeshare or would like to see multiple types of bikeshare technology. Participants could also make multiple location suggestions on the map.

VIENNA-FAIRFAX CITY-MASON-BURKE BIKESHARE

FEASIBILITY STUDY

What is bikeshare?

Bikeshare is a transportation system ideal for short one-way or round-trip journeys. Traditionally, users pick up a bike at any self-serve bikeshare station and return it to any other station within the system. New advances in technology now allow for stationless and e-assist bikeshare. See below for more information on different bikeshare options!

Docked Bikeshare

Docked bikeshare systems include a kiosk where transactions and information are processed to release and lock the bikes at a system of docks. In these systems, the locking mechanism and all technology is provided at the dock. Although some systems offer independent locks for mid-trip stops, to complete a rental, the user must return the bike to a station. Docked bikeshare systems are typically publicly owned and privately operated.

Dockless Bikeshare

Dockless bikeshare systems do not have stations or docks as all technology is embedded on the bike, including a wheel lock that locks to itself. They use a smart phone app and a QR code to rent a bike. Dockless systems are typically owned and operated by a third party for-profit company.

Electric-Assist Bikeshare

Electric-assist ("e-assist") bikes provide a boost while pedaling and can reduce some barriers to access. They may be appealing where there is steep terrain, hot weather conditions, aging populations, or for those with health concerns. E-assist bicycles can extend the distance that someone can comfortably ride. They can also be both docked or dockless.

Shared Electric Scooters

Shared electric scooters are a self-propelled dockless technology that allows users to rent a scooter with a smart phone app by scanning a QR code. Shared electric scooters include a throttle and a brake. Shared electric scooter systems are typically owned and operated by a third party for-profit company.

Figure 15: Project Information Board Displayed at Public Events

Figure 16: Bikeshare Technology Types Board Displayed at Public Events

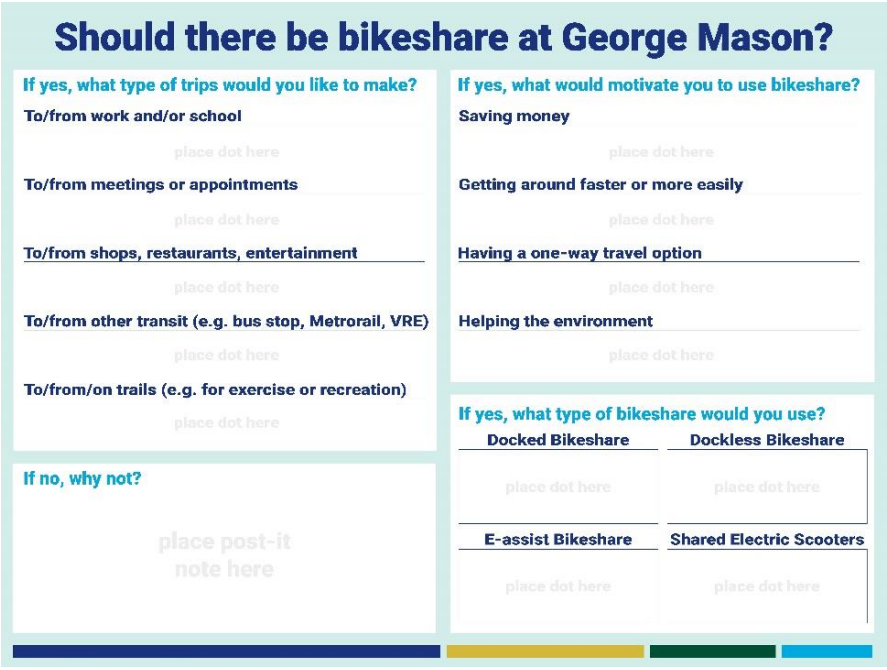


Figure 17: Public Input Board Displayed at Public Events

GEORGE MASON UNIVERSITY GETCONNECTED FAIR

The project team attended the George Mason University GetConnected Fair on Wednesday, September 5, 2018 from 11 AM to 2 PM and shared a table with George Mason University Parking and Transportation. The event was held on campus at Wilkins Plaza and offered students a way to learn more about getting involved in various student organizations, recreational opportunities, and departments. During the event, staff spoke with approximately 65 people. Most were George Mason University students, but several staff and faculty also shared their opinions.

While many students had heard of bikeshare, some had never used it or were unfamiliar with the different technology types. A number of people provided input on the project boards, dropped pins on the study area maps, or took project information cards with a link to the survey and map to fill out later. Most people that were interviewed supported bikeshare, even if they were unfamiliar with the concept at first.

Figure 18: Table and Outreach Materials at George Mason University's GetConnected Event

School and work-related trips were the most common trip type that respondents thought they would make using bikeshare. Saving money was listed as a top motivation and getting around faster or more easily was also a

popular motivation, with many respondents indicating that bikeshare would facilitate movement between parking garages, transit centers, class, and the west campus area. Many respondents were interested in docked bikeshare or a shared electric scooter system. Some expressed concern over the use of scooters in crowded pedestrian areas but still thought the option sounded fun and useful.

Table 3: Summary of Bikeshare Trip Types (Mason)

Trip Type	Votes	Percentage
To/from work and/or school	21	41%
To/from meetings or appointments	10	20%
To/from shops, restaurants, or entertainment	8	16%
To/from other transit (e.g. bus stop, Metrorail, VRE)	6	12%
To/from/on trails (e.g. for exercise or recreation)	6	12%
Total	**51**	

Table 4: Summary of Motivations for Using Bikeshare (Mason)

Motivation Type	Votes	Percentage
Saving money	13	30%
Getting around faster or more easily	13	30%
Having a one-way travel option	6	14%
Helping the environment	11	26%
Total	**43**	

Table 5: Summary of Desired Bikeshare Technology (Mason)

Technology Type	Votes	Percentage
Docked Bikeshare	11	35%
Dockless Bikeshare	6	19%
E-Assist Bikeshare	4	13%
Shared Electric Scooters	10	32%
Total	**31**	

FAIRFAX COMMUNITY FARMERS' MARKET

The project team attended the Fairfax Community Farmers' Market on Saturday, September 15, 2018 from 8 AM to 1 PM. A tent and table were set up in the parking lot opposite the Fairfax County Courthouse. Bicycling materials from the City of Fairfax and Fairfax County were displayed alongside the bikeshare information. Staff spoke with approximately 35 people throughout the event and received input on the project boards.

Most people who spoke with the project team had heard of bikeshare. While there was support for bikeshare, many were uncertain over how it would succeed in a suburban setting and were concerned about the lack of bicycling infrastructure within the study area. Many people provided input on the project boards, placed stickers on the study area maps, or took project information cards with a link to the survey and online interactive map to fill out later.

Figure 19: Table and Outreach Materials at the Fairfax Community Farmers' Market

Table 6: Summary of Bikeshare Trip Types (Fairfax Farmers' Market)

Trip Type	Votes	Percentage
To/from work and/or school	4	14%
To/from meetings or appointments	2	7%
To/from shops, restaurants, or entertainment	10	36%
To/from other transit (e.g. bus stop, Metrorail, VRE)	6	21%
To/from/on trails (e.g. for exercise or recreation)	6	21%
Total	**28**	

Table 7: Summary of Motivations for Using Bikeshare (Fairfax Farmers' Market)

Motivation Type	Votes	Percentage
Saving money	4	17%
Getting around faster or more easily	5	21%
Having a one-way travel option	8	33%
Helping the environment	7	29%
Total	**24**	

Table 8: Summary of Desired Bikeshare Technology (Fairfax Farmers' Market)

Technology Type	Votes	Percentage
Docked Bikeshare	9	39%
Dockless Bikeshare	5	22%
E-Assist Bikeshare	5	22%
Shared Electric Scooters	4	17%
Total	**23**	

TOWN OF VIENNA FARMERS' MARKET

The project team attended the Town of Vienna Farmers' Market on Saturday, September 29, 2018 from 8 AM to 12 PM. The project team set up a tent and table in the parking lot of the Vienna Community Center. Staff spoke with approximately 40 people throughout the event, received input on the project boards, and distributed project information cards with a link to the survey.

Most people were familiar with bikeshare and were supportive of the idea. Several people indicated that bikeshare would help to increase access to the W&OD Trail, which passes through the Town of Vienna and is adjacent to the Community Center. Many people suggested a station downtown near the Town Green, the Community Center, and by the Navy Federal Credit Union headquarters, which are adjacent to the trail. Similar to the City of Fairfax Saturday Farmers' Market, there was concern over both the lack of bicycling infrastructure in the region and how successful bikeshare would be in a suburban setting.

Nearly half of respondents indicated that they would use bikeshare to connect to transit, such as the Vienna Metrorail Station, which is approximately a 15-minute bike ride from the Community Center. Many people mentioned that they had a personal bike but would be interested in having a one-way travel option that would allow them to connect to the Metro or Downtown Vienna. E-assist bikeshare and shared electric scooters were the most popular technology options, and those who voted for e-assist bikeshare mentioned it would help to reduce the effort to reach destinations that are more spread out.

Table 9: Summary of Bikeshare Trip Types (Vienna Farmers' Market)

Trip Type	Votes	Percentage
To/from work and/or school	2	10%
To/from meetings or appointments	2	10%
To/from shops, restaurants, or entertainment	5	25%
To/from other transit (e.g. bus stop, Metrorail, VRE)	9	45%
To/from/on trails (e.g. for exercise or recreation)	2	10%
Total	**20**	

Table 10: Summary of Motivations for Using Bikeshare (Vienna Farmers' Market)

Motivation Type	Votes	Percentage
Saving money	1	7%
Getting around faster or more easily	3	20%
Having a one-way travel option	7	47%
Helping the environment	4	27%
Total	**15**	

Table 11: Summary of Desired Bikeshare Technology (Vienna Farmers' Market)

Technology Type	Votes	Percentage
Docked Bikeshare	3	18%
Dockless Bikeshare	4	24%
E-Assist Bikeshare	5	29%
Shared Electric Scooters	5	29%
Total	**17**	

BURKE VRE STATION

The project team visited the Burke VRE Station on Monday, October 1, 2018 from 4 PM to 7 PM. The project team set up posters outside of the station and spoke with people departing from the train station or waiting to pick up riders. Staff spoke with approximately 15 people. Participation was limited because the visit occurred during evening commute hours. As a result, the project team relied on distributing project information cards and encouraging people to complete the online survey and interactive map when convenient for them.

While there was support for bikesharing in general, people doubted the suitability of bikeshare around the Burke VRE station. One common theme was that with the directionality of the commuter trains, docks would fill up quickly in the morning and empty quickly in the evenings. Many others indicated that they lived close enough to walk and thus would not use bikeshare.

Table 12: Summary of Bikeshare Trip Types (Burke VRE)

Trip Type	Votes	Percentage
To/from work and/or school	0	-
To/from meetings or appointments	0	-
To/from shops, restaurants, or entertainment	1	50%
To/from other transit (e.g. bus stop, Metrorail, VRE)	1	50%
To/from/on trails (e.g. for exercise or recreation)	0	-
Total	**2**	

Table 13: Summary of Motivations for Using Bikeshare (Burke VRE)

Motivation Type	Votes	Percentage
Saving money	0	-
Getting around faster or more easily	1	25%
Having a one-way travel option	1	25%
Helping the environment	2	50%
Total	**4**	

Table 14: Summary of Desired Bikeshare Technology (Burke VRE)

Technology Type	Votes	Percentage
Docked Bikeshare	0	-
Dockless Bikeshare	1	33%
E-Assist Bikeshare	1	33%
Shared Electric Scooters	1	33%
Total	**3**	

VIENNA METRORAIL STATION

The project team visited the Vienna Metrorail Station on Tuesday, October 2, 2018 from 4 PM to 6:30 PM. The project team set up posters and a table on the north side of the station near the Kiss-and-Ride lot. This location was close to the parking garage, CUE bus stops, George Mason University shuttle drop-off, and other transit services. Staff spoke with approximately 25 people at this location.

Most participants said they would like to connect to transit using bikeshare. Participants included professionals, students, and faculty at George Mason University, and local residents. Another common theme was the challenge of launching bikeshare in the area due to the lack of bicycle infrastructure. Several people mentioned that e-assist bikeshare would help reduce the time needed to reach suburban destinations.

Figure 20: Table and Outreach Materials at the Vienna Metrorail Station

Table 15: Summary of Type of Bikeshare Trip Types (Vienna Metrorail)

Trip Type	Votes	Percentage
To/from work and/or school	2	18%
To/from meetings or appointments	2	18%
To/from shops, restaurants, or entertainment	3	27%
To/from other transit (e.g. bus stop, Metrorail, VRE)	4	36%
To/from/on trails (e.g. for exercise or recreation)	0	0%
Total	**11**	

Table 16: Summary of Motivations for Using Bikeshare (Vienna Metrorail)

Motivation Type	Votes	Percentage
Saving money	3	23%
Getting around faster or more easily	3	23%
Having a one-way travel option	4	31%
Helping the environment	3	23%
Total	**13**	

Table 17: Summary of Desired Bikeshare Technology (Vienna Metrorail)

Technology Type	Votes	Percentage
Docked Bikeshare	3	23%
Dockless Bikeshare	3	23%
E-Assist Bikeshare	4	31%
Shared Electric Scooters	3	23%
Total	**13**	

FAIRFAX FALL FESTIVAL

The project team visited the Fairfax Fall Festival on Saturday, October 13, 2018 from 10 AM to 4 PM. The project team set up a booth with boards and conducted a demonstration of bicycles and e-scooters for community members. Staff spoke with many people throughout the day as they passed the booth on the way into the south end of the festival, assisted approximately 10 people with testing the Capital Bikeshare bikes, and collected bikeshare study input from approximately 30 people. Additionally, Bird staff (conducting the e-scooter demo) assisted dozens of festival visitors with testing the e-scooters and collected feedback on a brief e-scooter survey from approximately 65 visitors.

Based on results from the mapping boards, attendees at the festival would like to see bikeshare in downtown Fairfax, around the Mason campus, at the community center, and near Jermantown Road. The most common trips that attendees would like to make included traveling to/from work or school, and to/from shopping or entertainment. The most popular technology type was docked bikeshare. Among visitors who tried the e-scooters or completed the survey after speaking with scooter staff, the majority had a favorable opinion of e-scooters. Visitors who tried the e-scooters were frequently uncertain at first but commented on how easy and fun they were to ride after trying them.

Table 18: Summary of Type of Bikeshare Trip Types (Fall Festival)

Trip Type	Votes	Percentage
To/from work and/or school	6	26%
To/from meetings or appointments	2	9%
To/from shops, restaurants, or entertainment	6	26%
To/from other transit (e.g. bus stop, Metrorail, VRE)	5	22%
To/from/on trails (e.g. for exercise or recreation)	4	17%
Total	**23**	

Table 19: Summary of Motivations for Using Bikeshare (Fall Festival)

Motivation Type	Votes	Percentage
Saving money	1	7%
Getting around faster or more easily	4	29%
Having a one-way travel option	3	21%
Helping the environment	6	43%
Total	**14**	

Table 20: Summary of Desired Bikeshare Technology (Fall Festival)

Technology Type	Votes	Percentage
Docked Bikeshare	9	53%
Dockless Bikeshare	3	18%
E-Assist Bikeshare	2	12%
Shared Electric Scooters	3	18%
Total	**17**	

Figure 21: Bikeshare Table and Scooter Demo at the Fairfax Fall Fest

ONLINE PUBLIC INPUT

Public engagement included several online engagement tools. The project team developed a project website at www.fairfaxva.gov/bikeshare to provide information about the project, upcoming project milestones and events, and links to an online survey where people could share their opinions about bikeshare and an online crowdsourcing map (Wikimap) that allowed users to suggest potential bikeshare stations and "like" or "dislike" other people's suggestions.

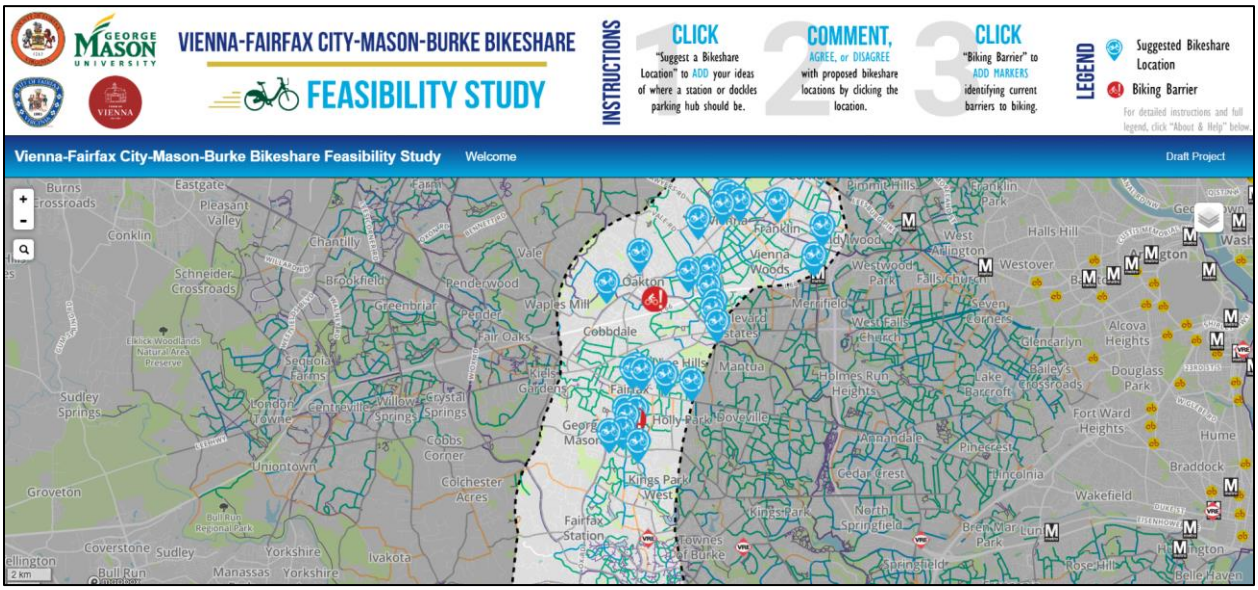


Figure 22: Screenshot of the Study Wikimap

The online survey was available beginning March 27; results summarized in this report include responses provided through October 15, 2018, while the online interactive map includes responses provided from September 1 to October 15, 2018 (note that prior to launching the Wikimap, the community was directed to Capital Bikeshare's "suggest a station" map to make online station suggestions[37]; data from that map has been incorporated into station location recommendations in Chapter 5). The survey captured 180 responses and the Wikimap had 11 unique users that suggested 29 potential bikeshare station locations.

ONLINE SURVEY

The online survey garnered a total of 180 responses, with respondents including 33 current members of Capital Bikeshare and 103 people who owned their own bike. The intent of the survey was to better understand whether there was support for bikeshare in the study area and understand what type of technologies respondents thought would be most effective.

Most respondents to the online survey indicated that they strongly support bikeshare (151 responses, 84 percent). There were 12 people (7%) that said they strongly oppose bikeshare in the study area.

[37] https://www.cabistations.com/

Support for Bikeshare in the Study Area (n=180, single response)

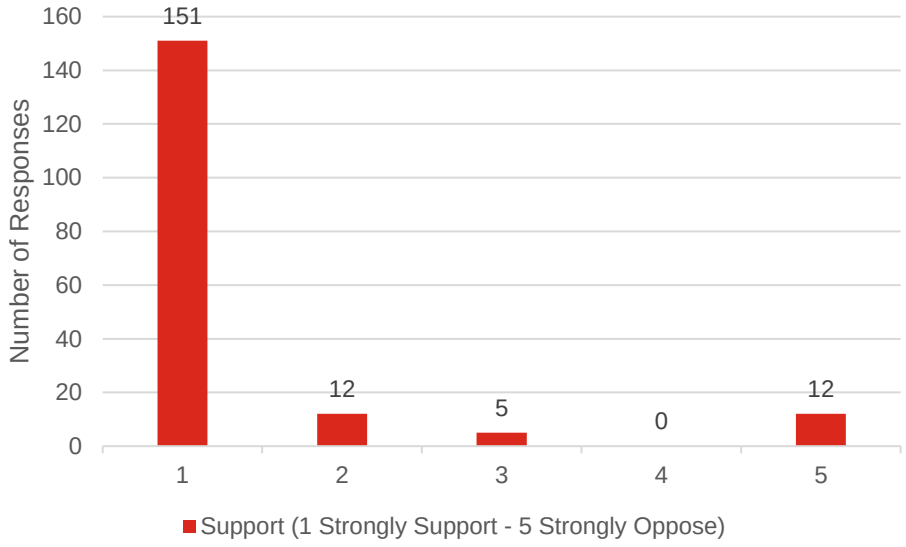


Figure 23: Support for Bikeshare in the Study Area

Likely Use of Bikeshare in the Study Area (n=180, single response)

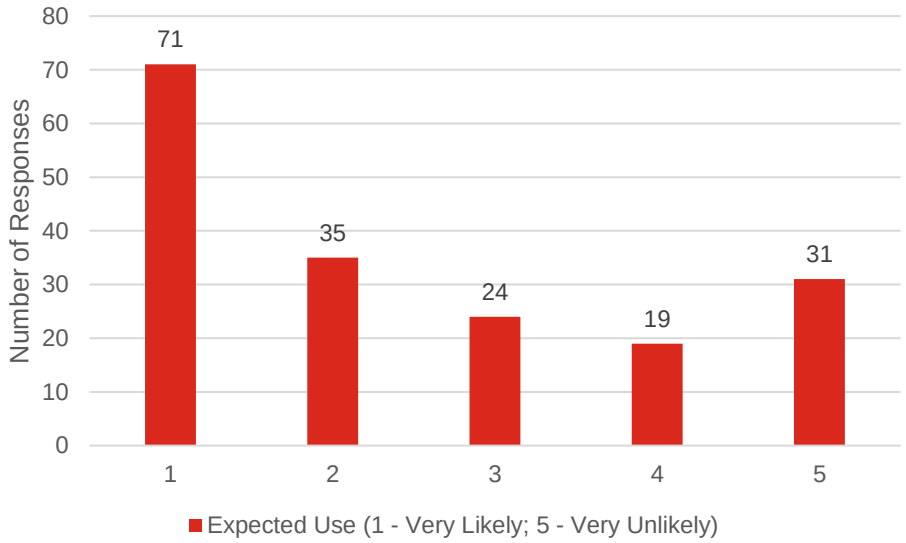


Figure 24: Likely Use of Bikeshare in the Study Area

While the support for bikeshare was strong, the expected use among respondents was less pronounced. Nearly 60 percent stated they were likely to use a bikeshare system, while 31 people (17 percent) indicated that they were very unlikely to use bikeshare and another 19 (11 percent) indicated they were somewhat unlikely to use bikeshare.

Respondents indicated a slight preference for docked bikeshare, with many citing their existing Capital Bikeshare memberships as part of their reason for wanting this type of system. There was also strong support for dockless

bikeshare and e-assist bikeshare. The online survey did not ask about support for e-scooters, as this option was discussed later in the study process.

Bikeshare Technology Preference (n=324, multiple responses)

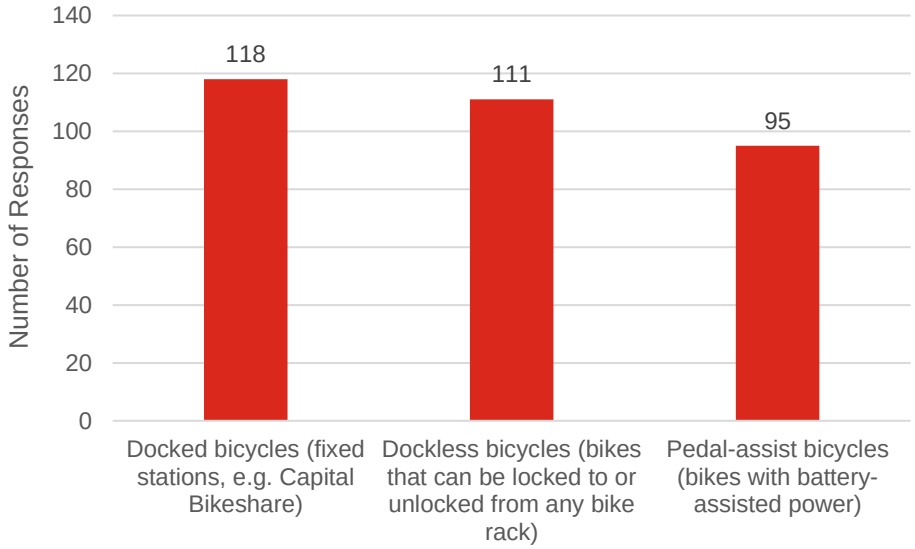


Figure 25: Bikeshare Technology Preference

Existing Bicycle Access (n=180, single response)

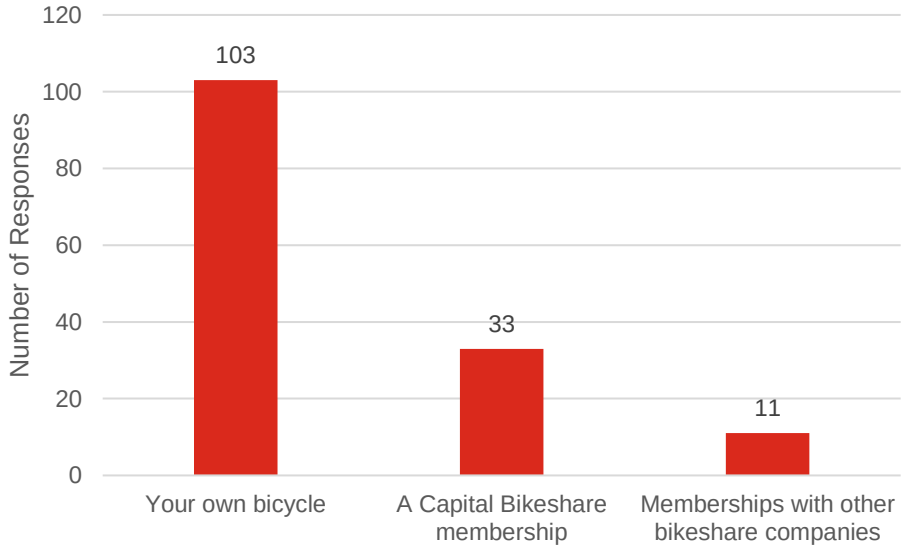


Figure 26: Existing Bicycle Access

57 percent of respondents indicated that they own a bicycle while another 18 percent indicated they have a Capital Bikeshare membership. 11 respondents indicated that they had a membership with another bikeshare company, with some citing dockless companies that are no longer in the Washington, DC region (Mobike, Ofo, and Spin). Five respondents had memberships with Lime and another three had memberships with Jump.

The two most popular possible trip types were taking trips to/from shops, restaurants, or entertainment and to/from transit. Connecting to or from the Vienna Metrorail Station was mentioned several times by respondents as a prime factor in the location of bikeshare.

Desired Trip Types (n=522, multiple responses)

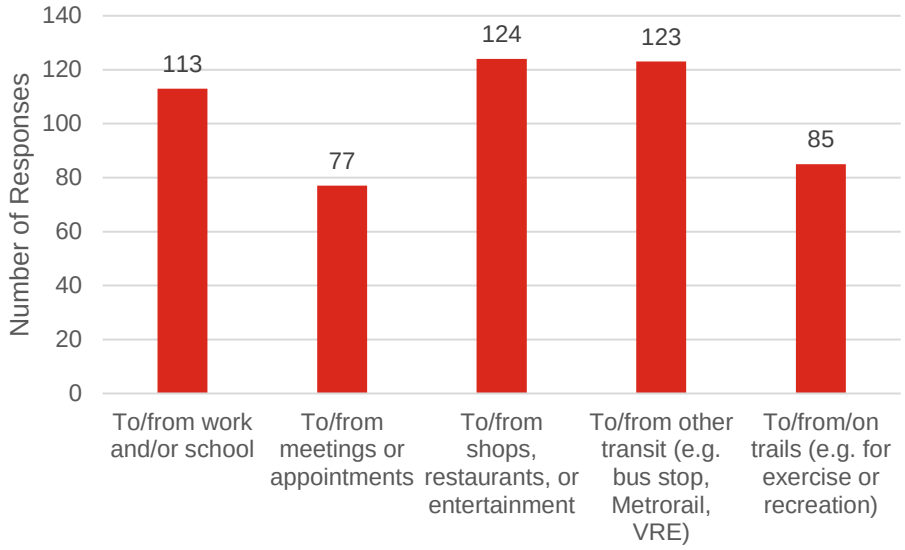


Figure 27: Desired Trip Types

The most popular motivation for using a bikeshare system was getting around faster or more easily, although environmental consciousness was also a prevalent motivation.

Bikeshare Trip Motivation (n=448, multiple responses)

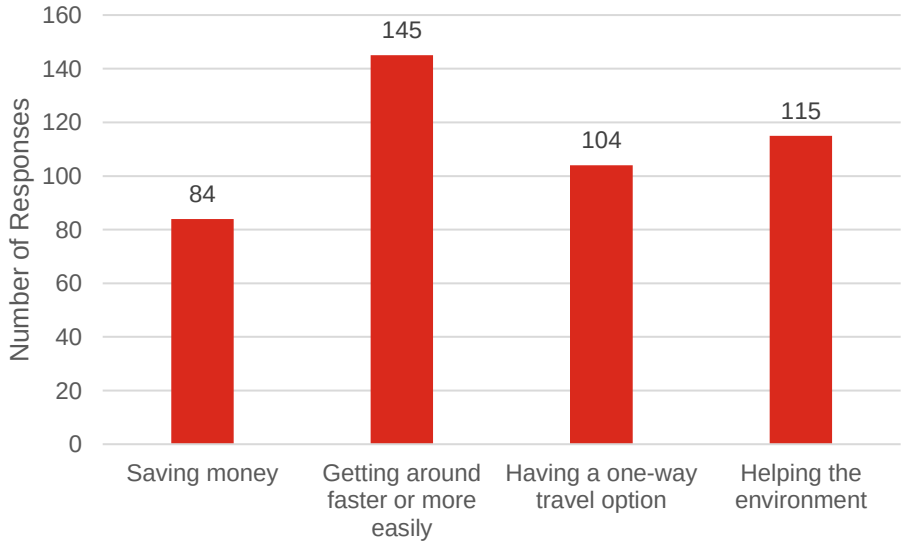


Figure 28: Trip Motivation

ONLINE INTERACTIVE MAP

A total of 11 people provided input on the Wikimap, suggesting 29 possible station locations. Sixty-four percent of these respondents indicated that they own a bike, while only 15 percent had a Capital Bikeshare membership.

Users could also agree or disagree with a station that had been suggested by others. The net “support” for each station was calculated by adding the number of agrees for the station and subtracting the number of disagrees. The full comments and scoring for the suggested stations can be found in Figure 29 and Table 21.

Previous studies conducted by Toole Design show that station ridership is well correlated to crowdsourcing results and as such this should be an important input into new station or station relocation decisions. The most popular station location was at the Vienna Metrorail Station. Other popular locations were on the George Mason University campus, where the W&OD Trail crosses Maple Avenue in Vienna, and along the W&OD by the Caboose and the Community Center. Other suggested locations were along Main Street in the City of Fairfax. The only location with a negative support score was a station suggested at Madison High School. One of the comments for this location expressed concern over vandalism to the bikes.

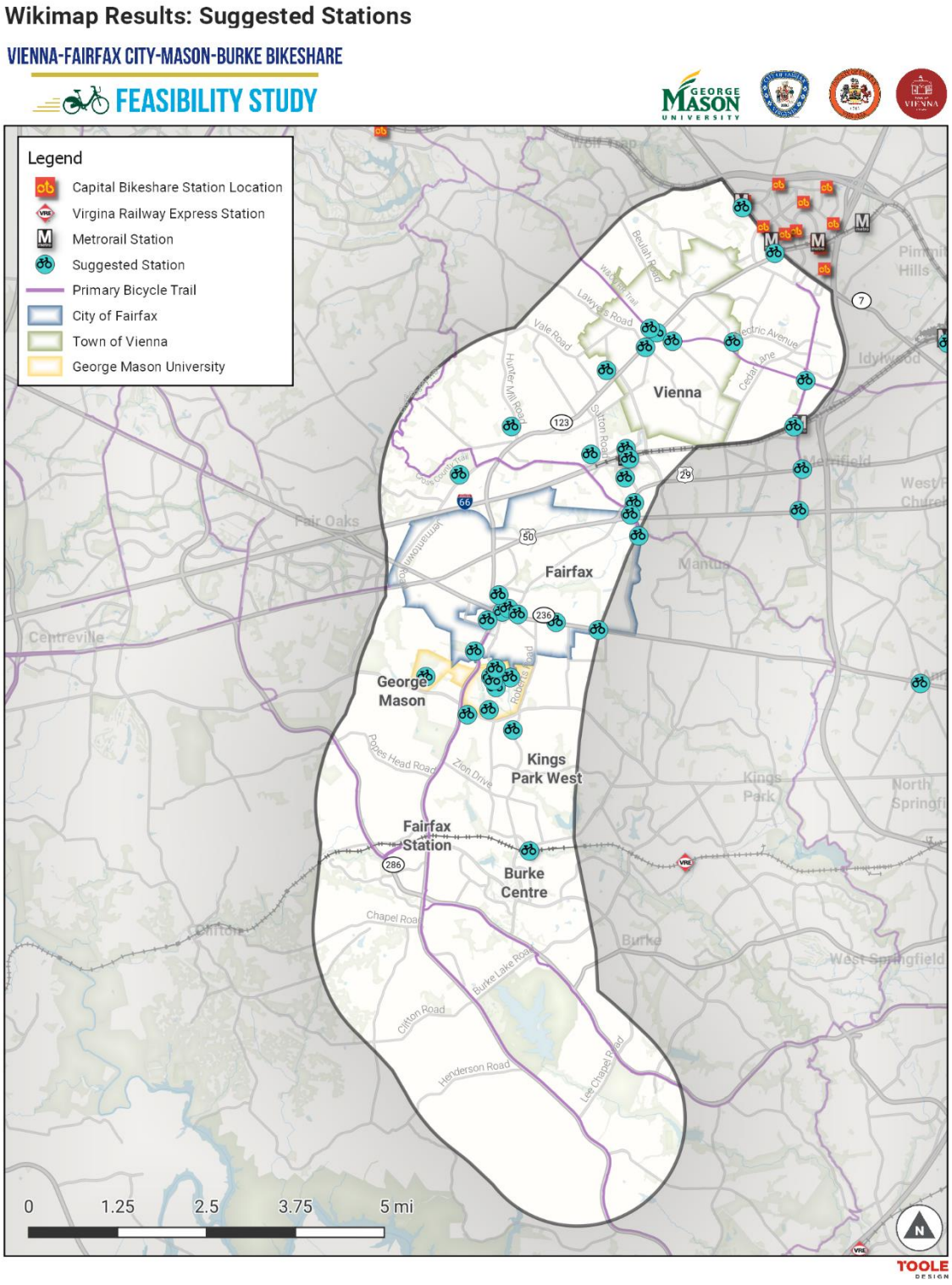


Figure 29: Distribution of Wikimap Responses

Table 21: List of Bikeshare Location Suggestions (from South to North)

Map ID	Location	Score	Comments
0	University Mall	2	
1	Masonvale	0	Masonvale
2	Library/Student Union	1	
3	Lot C	0	Students can park and ride to class.
4	Johnson Center	2	Center of campus would need a bike location.
5	Roberts Rd and Gainsborough Rd	2	Where students park who do not have a campus parking pass
6	WO&D Trail and Maple Avenue	2	WO&D Trail and Maple Avenue
7	Main St/Woodson High School	1	A great location with Woodson HS nearby and accessible trails and bike friendly side roads in the vicinity.
8	Downtown Fairfax/ University Dr	1	Fairfax City is a wonderful location for Bikeshare. Businesses galore and bike friendly roads.
9	Vienna Metro	3	Bikeshare at Vienna Metro is a no brainer.
10	Oakton Library	0	The Oakton library is a good destination. I visit there regularly for meetings.
11	Circle Towers	0	Circle Towers has a large number of residents. Also a good point between Vienna Metro and CCT along Connector Trail.
12	Fairfax Circle	0	New Fairfax Circle development will need bikeshare access. Also will be on Arlington Blvd. Trail.
13	Mantua Park	0	This location connects CCT to the connector trail up to metro. You should look along CCT in Mantua neighborhood to provide more connections from neighborhood.
14	Fairfax Library	0	Fairfax library would be another good location.
15	Downtown Fairfax/Main Street	0	Bikeshare connections to the shops here and potentially for Daniels Run trails and nearby neighborhoods.

Map ID	Location	Score	Comments
16	Oak Marr Park/Rec Center	0	Bikeshare here would connect to Rec Center and CCT.
17	Main Street Shopping	0	Bikeshare here would connect shops/restaurants and nearby neighborhoods.
18	W&OD and Gallows Rd	0	Good location on WOD and along Gallows SUP.
19	Dunn-Loring Metro	0	Good spot for access to metro, shops and restaurants, Gallows SUP and future I66 trail.
20	Oakton High School	0	Besides H.S. students, this would be a good spot for people accessing sports and community events at the school.
21	Navy Federal Credit Union	0	Navy Federal Credit Union (Vienna's largest employer. (They have/had a private fleet of bicycles available to employees)
22	Vienna Community Center	1	Vienna Community Center At the W&OD
23	Maple Ave Shopping Center	0	Maple Ave Shopping Center (the addition of several new restaurants has made this an activity center. It's also accessible from Cottage St. and Courthouse Rd, both bikeable routes)
24	Providence District Government Center	0	Providence District Government Center
25	Vesper Trail at Springhill Metrorail Station	0	Vesper Trail at Springhill Metrorail Station (Vesper Trail is scheduled to be completed by the end of this year providing direct pedestrian and bicycle access to the Springhill station from NW Vienna neighborhoods)
26	Madison High School	-1	a station outside of Madison high. Will help high schooler transfer between activities.
27	Tysons Corner	0	Tysons Corner! A SLEW of bikes needed there!
28	W&OD Trail (Caboose)	0	Next to the caboose would be a good open space to place a dock station and right next to the trail as well

SUMMARY OF PUBLIC OUTREACH

The in-person outreach events, online crowdsourcing map, and online community survey provided valuable input on potential bikeshare locations, opportunities, challenges, and technology preferences. Overall, the outreach showed community interest in different types of bikeshare, including Capital Bikeshare, dockless bikeshare, e-bikes, and scooters. Mason participants showed more interest in dockless bikeshare and scooters compared to other participants, while other residents showed more enthusiasm for Capital Bikeshare than other options. This input was used later in the study to inform system planning.

CHAPTER 5
SYSTEM PLANNING

CHAPTER 5: BIKESHARE SYSTEM PLANNING

The project team evaluated the characteristics of the study area and surrounding communities, gauged public interest in bikeshare, and assessed available technology options to develop recommendations and an implementation plan for bikeshare in the study area. This chapter summarizes the results of those evaluations and offers specific recommendations for bikeshare locations and business models for the study area.

BIKESHARE IN THE REGION

There is a relatively long history of bikeshare operating in the Washington, D.C. and Northern Virginia region. Capital Bikeshare was the first docked bikeshare system in the U.S. and launched in 2010 in Washington, D.C. and Arlington, Virginia. It has grown to include over 500 stations and approximately 4,300 bikes in Washington D.C., Montgomery County, Prince George's County, Arlington County, the City of Alexandria, Tysons Corner and Reston in Fairfax County, and the City of Falls Church. In 2019, Fairfax County plans to expand its Capital Bikeshare program to serve West Falls Church, Merrifield, and the Vienna Metro station area.

However, the landscape of the bikeshare industry in the region is changing. Dockless mobility launched in the National Capital region in September 2017, offering dockless bicycles and e-scooters for point-to-point travel without needing docked stations. Currently, dockless bikeshare and e-scooter share pilot programs operate in Washington D.C., Montgomery County, the City of Alexandria, and Arlington County, with fleet sizes, operating requirements, and regulations varying by jurisdiction. The City of Fairfax established a pilot program and issued permits to three companies to operate dockless shared e-scooters. As previously mentioned the Virginia General Assembly passed legislation in 2019 revising and clarifying regulations for e-scooters and for shared mobility companies throughout the Commonwealth.

BIKESHARE MANAGEMENT

As discussed in Chapter 2, there are various bikeshare technologies, management approaches, and business models that the study team may select from. There are advantages and disadvantages to each of these, and the appropriate model depends on local funding, staff capacity, and interest from the public, non-profit, and private sectors. The history and current status of bikeshare in the broader region should also be considered as a factor of regional interoperability. This section reviews the technology options under consideration in the study area.

Most docked bikeshare programs in the United States are overseen by government agencies or non-profit organizations. These organizations are responsible for identifying funding and procuring the system. Similar to many transit systems, these organizations may operate the program themselves or they may contract to a third party for operations. This model requires more effort and time to secure funding, procure the system vendor, and launch the program. It also requires staff capacity and often some level of upfront and ongoing public funding. However, it gives the agency full control over the program and over decisions surrounding its implementation and operation. In contrast, most dockless models are privately owned and operated, with little need for public funding for capital and operating costs. However, even these models require agency oversight to ensure that the companies comply with program performance measures, such as responding to public complaints.

BIKESHARE TECHNOLOGY AND MANAGEMENT MATRIX

The appropriate bikeshare program type depends on the interest of the community, the funding available, and where there is capacity to take on the program. Table 22 below summarizes some of the characteristics of the two programs operating currently in the region. The majority of dockless bikeshare characteristics are similar for dockless e-scooters.

Table 22: Implementation System Comparison Matrix

	Capital Bikeshare	*Dockless Bikeshare*
Service Area	The service area and coverage of a smart dock system such as Capital Bikeshare is often limited by the cost of stations. Stations should be ideally less than a ¼ to ½ mile apart to ensure that a station is within an easy walk of a person's origin or destination.	The service area of a dockless system is flexible and can provide coverage to a much larger area, though it can be difficult to enforce service area boundaries where needed. However, if there are too few vehicles or they are not redistributed properly, the vehicles may not be available when needed. As with smart dock systems, parking hubs should be located close together and in areas where bike parking is encouraged.
Equity	Capital Bikeshare provides a discounted membership program through health and social service organizations. Equity factors should also be considered in station locations, as locations with high demand potential do not always overlap with traditionally underrepresented communities.	Some private vendors have discount programs, such as Limebike's partnership with PayNearMe, which unlocks rides through text message. Some jurisdictional programs require vendors to consider equity in the distribution and rebalancing of bicycles in different neighborhoods.
Inter-operability	Capital Bikeshare is interoperable throughout the region and already operates in multiple jurisdictions.	Dockless bikeshare is interoperable if the different jurisdictions allow the same dockless bikeshare companies to operate.
Procurement	Agency procurement and contracting is required to join Capital Bikeshare. Each agency contracts with Motivate separately.	Most dockless programs in the region are regulated by a Memorandum of Agreement or permit to use the public right-of-way, which can be a more streamlined regulatory process. An agency may also establish operating contracts through a more formal procurement process (e.g., with an RFP).
Implementation	Implementation of a smart dock system can be time intensive. Implementation includes contracting with the vendor and operator, determining and permitting station locations, time for manufacturing of equipment, and installing the stations.	Dockless bikeshare can typically be implemented quickly. Implementation includes establishing a MOA or permit process but does not require any other infrastructure (though complementary infrastructure such as parking hubs may be recommended).
Oversight	The regional Capital Bikeshare program uses a board for ongoing coordination, with representatives from the participating jurisdictions.	Requires program oversight to monitor performance, respond to complaints, and manage right-of-way concerns. Oversight issues include safety standards, data sharing, rebalancing requirements, and other elements.

	Capital Bikeshare	*Dockless Bikeshare*
System Cost and Revenue	Capital Bikeshare requires a commitment to fund both the capital (equipment) and operations. Capital Bikeshare has the potential to generate revenue through regional sponsorship currently under discussion.	A third-party, private dockless bikeshare company covers all costs for equipment and operations. Administrative costs for system oversight are covered by the agency. Private vendor programs may generate revenue through fees, depending on administrative costs.
Parking	Bikes must be returned to and parked at a station. This can be somewhat less convenient for users but prevents sidewalk clutter.	Bikes or scooters are not required to be parked at a station. Because the vehicles can be locked to themselves, this can result in sidewalk clutter. Some cities have required bikes be "locked-to" bike racks or sign posts. Others have designated parking areas to encourage order.
Reliability and Flexibility	Smart dock systems are reliable for the user, and bikes are rebalanced so that users can always locate a bike. However, these systems are less flexible because users must check out and return bikes to the stations.	Dockless bikeshare may be less reliable because there are no stations where users might expect to find bikes or scooters. However, a higher density of bikes increases reliability, at the risk of increased clutter. Conversely, dockless systems offer greater flexibility because the vehicles can be parked anywhere.

BIKESHARE IN THE STUDY AREA

Capital Bikeshare and dockless bikeshare are available in different parts of the D.C. region, and it would be beneficial to provide a compatible and integrated system along the Route 123 corridor. For example, jurisdictions in the study area could connect to the regional Capital Bikeshare system, which would leverage past investment in the system and continue to grow the membership in Fairfax County, while at the same time launching programs in Fairfax City and at Mason. Additionally, individual dockless bikeshare programs could launch and use the same technology as other dockless programs in the region. While dockless bikeshare can be more efficient in areas with dispersed destinations, there are activity centers within the Route 123 corridor that may work well for Capital Bikeshare.

It is possible to pursue Capital Bikeshare and dockless implementation at the same time, and other jurisdictions have shown that Capital Bikeshare and dockless systems can operate in the same space effectively. Early reports of Capital Bikeshare usage in Washington, D.C.[38],[39] and intercept surveys in Montgomery County[40] suggest that dockless bikeshare may not affect Capital Bikeshare ridership substantially. These results may indicate that people use these systems for different purposes, such as for commuting versus more casual trips.

Building on general considerations for bikeshare technology and management, the study team analyzed existing conditions and gathered community feedback to inform the future bikeshare system.

[38] https://ddot.dc.gov/publication/dockless-vehicle-sharing-demonstration-phase-i-evaluation
[39] https://ralphbu.files.wordpress.com/2018/05/dc-dockless-bikeshare_a-first-look_may_10_2018_publication.pdf
[40] https://www.montgomerycountymd.gov/dot-dir/Resources/Files/commuter/Bikesharing/MCDOT-Exec-Summary-20181029-Toole-Design-v3.pdf

COMMUNITY ANALYSIS KEY FINDINGS

As detailed in Chapter 3, the community analysis identified opportunities and challenges for the program. The analysis suggests that the most feasible areas for bikeshare include major town centers, areas around the Metro stations, areas near recreational opportunities that use the trail network, the Mason campus, and other higher-density areas. The bikeshare demand analysis found that the most suitable locations include the City of Fairfax, the Town of Vienna, George Mason University, the Burke VRE station, the Vienna Metrorail station, and Tysons Corner. Challenges for bikeshare in the area include topography, limited bicycling infrastructure, and limited public transit options.

PUBLIC ENGAGEMENT KEY FINDINGS

As described in Chapter 4, the most popular stations were the Vienna Metrorail Station, George Mason University, the W&OD Trail at Maple Avenue, and along the W&OD Trail by the Caboose and the Community Center. Public engagement also found that there were different bikeshare technology preferences for different areas. For example, docked bikeshare was more popular than other technologies at the Fairfax Farmer's Market, while Mason students were more interested in e-scooters than outreach participants at other locations. These findings suggest that it may be appropriate to tailor implementation recommendations for different areas within the Route 123 corridor to match differences in demand and local preferences.

BIKESHARE IMPLEMENTATION RECOMMENDATIONS

As in other parts of the D.C. region, the project team recommends expanding the Capital Bikeshare system into the study area and considering the establishment of a dockless mobility program. The implementation details and schedule for both systems will depend on the availability of funding, capacity to establish and manage a program, and local priorities.

Local priorities identified during the community outreach process showed a preference for Capital Bikeshare in the northern part of the study area, where Capital Bikeshare is already expanding into Merrifield, West Falls Church, and along the Metrorail Orange line. It is recommended that Fairfax County and the Town of Vienna extend Capital Bikeshare into those areas. The City of Fairfax should join the Capital Bikeshare system and connect to the Metrorail as funds and opportunities become available. Also as funding and opportunities allow the system to expand to the south, Mason can act as a sponsor of Capital Bikeshare on its Fairfax Campus, as it currently does on its Arlington Campus.

Dockless bikeshare and e-scooters were more popular options at the George Mason University campus and could connect the campus to the City of Fairfax. Dockless bikeshare could provide a better opportunity to cover lower density areas with more dispersed destinations. Additionally, longer distances between destinations and topography bring a strong desire to electrify the fleet with e-bikes and e-scooters. The evolving nature of the dockless mobility industry has generated additional public and private interest in the study area, and the new regulatory landscape in the Commonwealth of Virginia impacts local priorities. As a result, the City of Fairfax has begun a dockless mobility pilot program, and the other study partners are considering dockless program options. It is recommended that the study partners continue to coordinate and to define and revise their programs based on best practices that continue to emerge.

Implementation of both Capital Bikeshare and a dockless program will require coordination with VDOT, WMATA, and other property owners; station location refinement and site planning; and regulatory steps to allow for e-bike and e-scooter pilot programs including coordination with neighboring jurisdictions.

DEFINING THE RECOMMENDED PROGRAM

The maps below (Figure 30 - Figure 33) show the recommended locations for Capital Bikeshare stations within the Route 123 study area. The recommended locations on these maps could also inform locations for dockless parking infrastructure or for “mobility hubs” with infrastructure that supports multiple transportation modes. For greater context, the maps also show parks, bicycling trails, and existing and proposed Capital Bikeshare stations in Fairfax County outside of the study area. The locations suggested on these maps and in the following sections are based on current conditions and input from this study, but as site conditions are evaluated in more detail and as conditions change over time, locations may be modified or added. The study team may roll these stations out over time, informed by demand and as funding and opportunities allow. Prioritization criteria are provided in Table 23 to further refine this roll-out and guide which recommended stations or mobility hubs should be implemented first, as well as to inform future location recommendations.

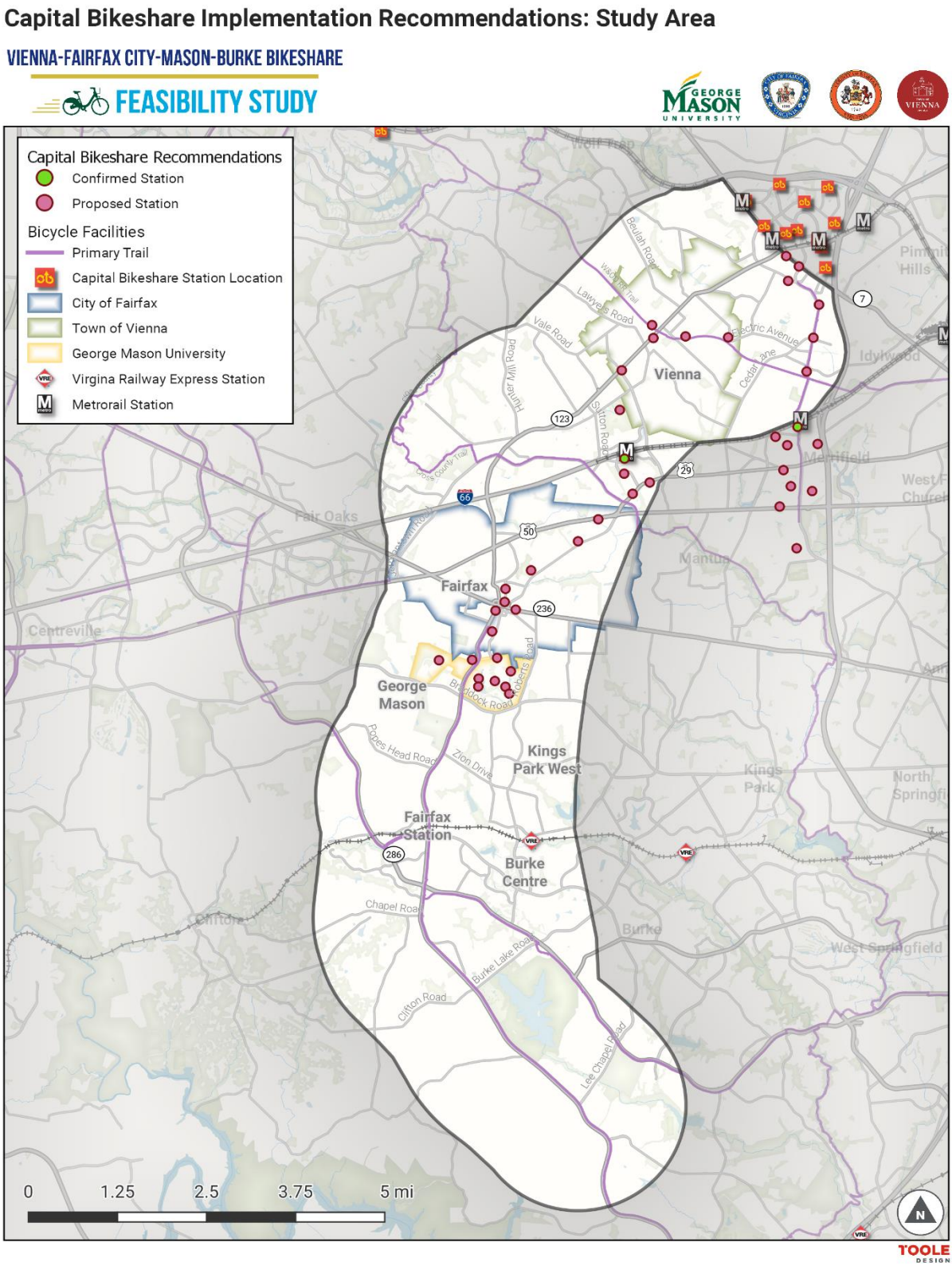


Figure 30: Recommended Capital Bikeshare and Dockless Bikeshare Implementation

Town of Vienna/Metro Stations Capital Bikeshare Recommendations

The northern part of the Route 123 study area includes the Town of Vienna and two WMATA Metrorail stations. Given that the existing Capital Bikeshare system is expanding westward into West Falls Church, Merrifield, Tysons Corner, Fairlee, and Pimmit Hills, the next extension of the program should be along the W&OD Trail to the Town of Vienna and south to the Dunn-Loring and Vienna Metrorail stations. Capital Bikeshare stations at the Dunn-Loring and Vienna Metrorail stations would provide first- and last-mile connections to transit for regional commuters and these locations are confirmed with planned installation in spring 2019. Commuters could connect to the system via the W&OD Trail, but Capital Bikeshare would also serve recreational riders wishing to access Vienna town center and nearby attractions. In addition to stations proposed as part of this study, the map shows additional proposed Fairfax County stations in Tysons Corner, Fairlee, and Merrifield, which are being prioritized and planned in a separate process.

Recommended Locations

Connect to existing and expanding Capital Bikeshare system, the City of Fairfax, and nearby Metrorail stations:

- Fairfax County proposed locations:
    1. Dunn Loring – Merrifield Metro
    2. Vienna/Fairfax – GMU Metro
    3. Gallows Rd sidepath near the W&OD Trail
    4. Gallows Rd/Electric Ave
    5. Gallows Rd/Quantum Dr
    6. Gallows Rd/Lord Fairfax Rd
    7. Nottoway Park
    8. Circle Towers
- Town of Vienna proposed locations:
    9. Town Green
    10. Community Center
    11. Maple Avenue Shopping Center
    12. Navy Federal Credit Union
    13. 444 Maple Ave W (redevelopment project)

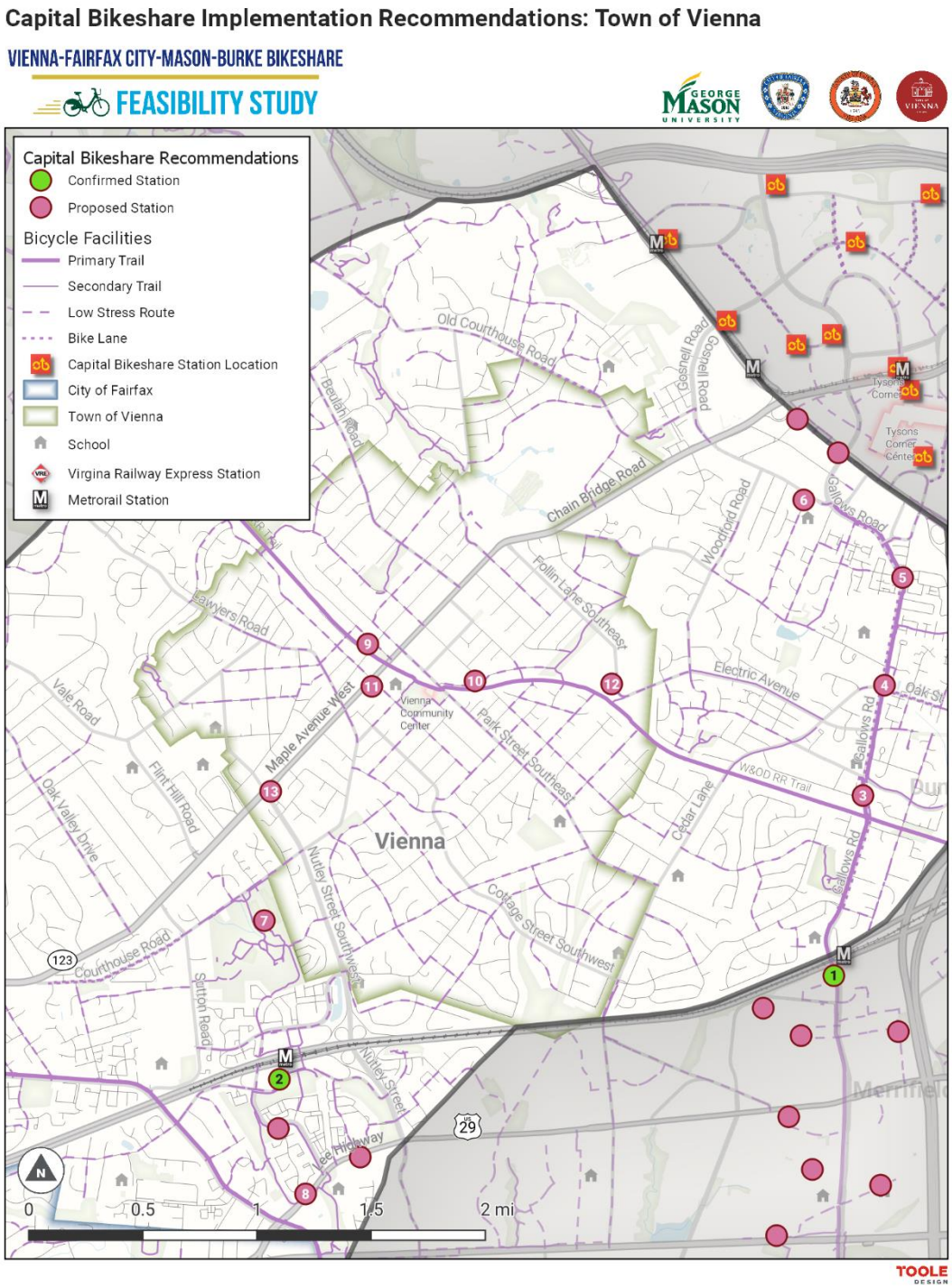


Figure 31: Recommended Bikeshare Implementation - Vienna

City of Fairfax/Mason Capital Bikeshare Recommendations

Destinations within the City of Fairfax and the Mason campus would provide connections between the University and the City and would also serve as natural extensions of the Capital Bikeshare system once it is expanded into the Vienna area and to the Metrorail stations to the north. These locations include Old Town, City and County of Fairfax government buildings, and shopping centers. In the future, this area would have large potential for dockless bikeshare and e-scooters as well, including the possibility of a hybrid system with Capital Bikeshare in the City of Fairfax and the University. A dockless system would increase travel options in the City of Fairfax while strengthening the connection to the Mason campus. Future Capital Bikeshare stations and dockless hubs could also connect to activity centers in the City of Fairfax as they are redeveloped and link to future trails such as the I-66 trail.

Mason is expected to have high demand for bikeshare, and there is interest in strengthening connections between the campus and the City of Fairfax. Community outreach in the area emphasized the need for cross-campus travel opportunities and an interest in e-scooters. However, dockless implementation at Mason will need to carefully consider the available bicycle routes, sidewalk space, and operating speed of these devices. The dockless program could connect students, faculty and staff between East and West campus and from student housing, transit, and parking structures.

The first phase of the program would expand Capital Bikeshare to the City of Fairfax and Mason campus. Future phases could create a dockless bikeshare and e-scooter program in the City of Fairfax and on the campus. As a first step, we recommend that Mason begin the process of pursuing funding and addressing procurement requirements for allowing Capital Bikeshare on the campus.

Recommended Locations

- Connect the City of Fairfax and the Mason campus to the Town of Vienna and Vienna Metrorail station Capital Bikeshare stations as funding is available, with stations at:
    - City of Fairfax stations:
        14. Old Town Square
        15. Main Street Marketplace
        16. Capstone Collegiate (3807 University Dr)
        17. Van Dyck Park/Community Center
        18. County Courts
        19. City Hall
        20. Fairfax Circle/Cross-County Trail
        21. Fairfax High School
    - Mason Fairfax Campus stations:
        22. Johnson Center
        23. Lot K
        24. Rappahannock River Lane
        25. West Campus
        26. Field House
        27. RAC
        28. Sandy Creek Transit Center
        29. President’s Park
        30. Patriot’s Circle (near Staffordshire Lane)

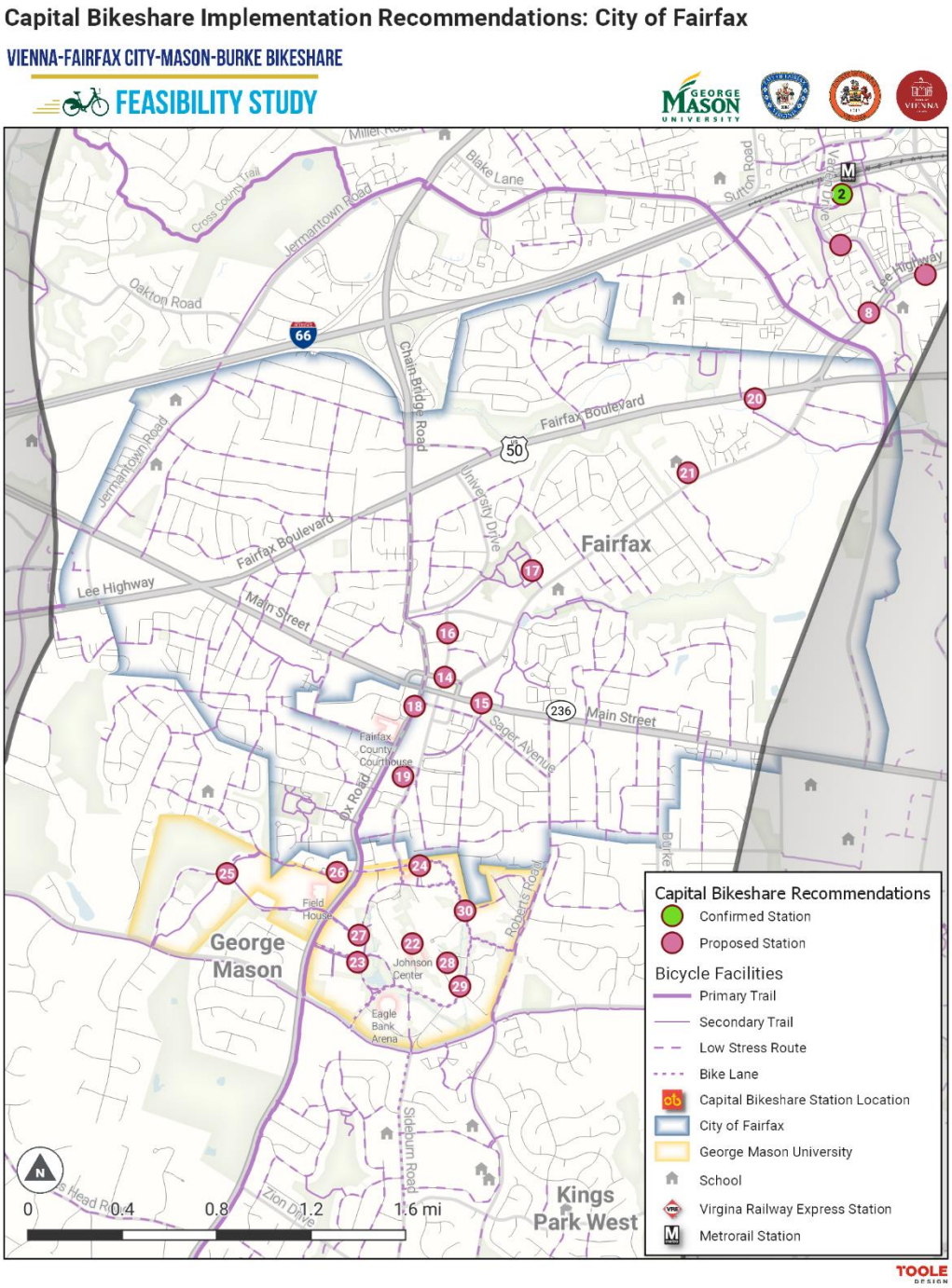


Figure 32: Recommended Bikeshare Implementation - Fairfax

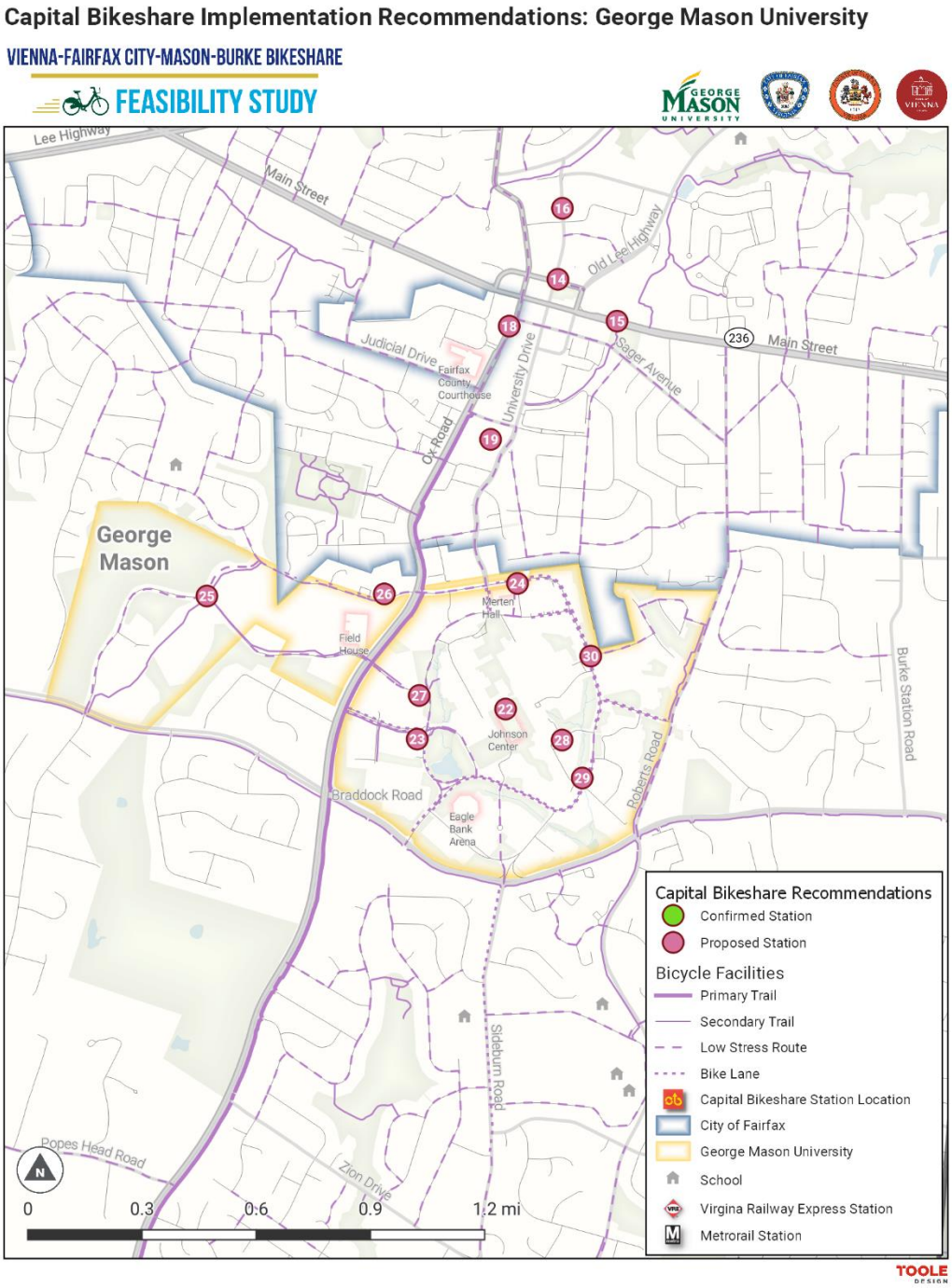


Figure 33: Recommended Bikeshare Implementation - George Mason University

Burke VRE

The area around the Burke VRE station was not as prominent in the demand analysis, stakeholder engagement, or the community analysis. However, there may be some demand for one-way trips to the VRE station or other destinations in the area, such as lakes or trails. We recommended considering a dockless bikeshare program in the Burke area in the future.

Other Destinations and Future Locations

The demand analysis also suggested that expanding the dockless service area to include Oakton and the Jermantown Road shopping district (near Fairfax Boulevard) would be a viable expansion of the system in the future, particularly as bicycling infrastructure increases in the area. In the future, other destinations may become viable for Capital Bikeshare stations as new development and infrastructure become available. For example, as the City of Fairfax develops its activity centers with higher density uses (as described in the City's Comprehensive Plan), there may be additional demand and opportunity for bikeshare. There may also be additional demand for bikeshare as bicycling infrastructure is expanded, including:

- Planned trails (such as the I-66 Trail)
- Shared-use paths along active corridors (such as along Jermantown Road)
- On-street bike facilities (such as bike lanes and protected cycle tracks proposed for many locations throughout the study area).

Bikeshare Location Prioritization Framework

Bikeshare implementation depends on the availability of funding and opportunities to identify viable sites for station installation. In addition, station or hub locations should be prioritized so that the network of stations aligns with the best opportunities for attracting ridership. A preliminary set of criteria based on known demand factors are shown below to illustrate a method for prioritizing the station locations proposed in this report. These criteria are suggested for the study partners to consider in selecting which locations with higher demand potential. Different criteria may be more or less important in each partner's jurisdiction. The following criteria are recommended when evaluating a proposed bikeshare station location. While each criterion is somewhat subjective, the following consideration should be used:

- **Metrorail within 2 miles:** Bikeshare has proven to be a complementary mode for connections to and from high capacity transit. Bikeshare bikes in proximity to Metrorail stations tend to be used more frequently.
- **Destinations:** Bikeshare tends to be used more frequently in locations with a greater mix and higher density of destinations, such as in retail shopping areas, public facilities such as libraries and community centers, and higher density residential development.
- **Bicycle Network:** Proximity and access to comfortable bicycle facilities that connect to other destinations or larger regional networks can support bicycling and bikeshare.
- **Capital Bikeshare:** Proximity to existing bikeshare stations will help support and expand bikeshare networks.
- **Development Opportunities:** As properties are redeveloped with higher densities of uses (such as retail, residential, or mixed-used developments) there are opportunities to have developers provide bikeshare stations as part of their transportation demand management strategies.
- **University:** Rates of bicycling tend to be higher on and near university campuses. Similarly, bikeshare systems often see higher usage on and near university campuses.
- **Local Priority:** Localities understand their context in a way that is difficult if not impossible to model. This may be expressed as significant community demand or support for a bikeshare station, future development or redevelopment projects that would support bikeshare, locations that support equity or other community goals, or similar factors.

These criteria can be used to evaluate stations proposed under this plan, alternate locations for a proposed bikeshare station, or new stations proposed in the future. Table 23 shows these criteria.

Table 23: Bikeshare Prioritization Criteria

Prioritization Criterion	Metric
Transit Proximity	Metrorail station within 2 miles
Destinations	Density of destinations near station location
Bicycle Network	Density of bicycle facilities near station location
Capital Bikeshare Network	Capital Bikeshare station within 0.5 miles (recalculate as station expands)
Development Opportunity	Station adjacent to new development
University	Station within or near a university campus area
Local Priority	Station preferred by community feedback or available funding

CHAPTER 6
FINANCIAL PLAN AND ANALYSIS

CHAPTER 6: BIKESHARE FINANCIAL PLAN

The project team prepared a financial analysis to compare expected program costs and revenues for the Fairfax-Mason-Vienna bikeshare program and determine the expected funding gap. The funding plan looks at how bikeshare has been funded in the Washington, D.C. region and includes recommendations for how Fairfax County, the Town of Vienna, the City of Fairfax, and George Mason University could fund their programs.

The financial analysis assumes a three-year operating period; a typical contract length for bikeshare in the U.S. may last from three to five years. The financial analysis also assumes a roll-out of an expansion of Capital Bikeshare in Fairfax County, the City of Fairfax, and George Mason University, as well as a dockless vehicle share pilot, with an assumed number of bikes and stations added each year. The study partners tentatively propose to target the initial roll-out ("Year 1") in 2021; however, the actual roll-out schedule may change based on available funding and implementation timeline constraints.

CAPITAL COSTS

Capital costs for Capital Bikeshare would include the cost of purchasing bikeshare equipment including bikes, docks, kiosks, and map panels. Capital costs can vary greatly depending on the type of technology, the vendor, the size of the system, and any special features such as additional gearing, e-assist bicycles, custom colors, etc. For this financial analysis, the capital costs assume a medium-sized station with typical features of a system like Capital Bikeshare.

There are generally minimal capital costs to implementing a dockless bikeshare program. For the purposes of this financial analysis, assumed costs include purchasing and installing bike parking racks and designating bike parking areas.

Table 24 includes a comparison of different technology costs based on quotes and information provided to other cities. In general, dockless bikeshare systems are less expensive because they are privately operated and do not require the purchase of bicycles or stations, and smart dock systems (Capital Bikeshare) are more expensive given they must have docks and electronic kiosks at each station.

Table 24: Comparison of Capital Costs for Different Bikeshare Technologies

Technology Type	Cost Range	Pro-Forma Assumption	Notes
Capital Bikeshare	$40,000 to $60,000 per station	$58,842 per station	Cost assumes a typical station with 15 docks and 10 bikes per station. This figure is derived from a vendor quote[41] plus inflation to 2019.
Dockless Bikeshare	Varies	$200 per device	Cost covers installation of bicycle parking racks and dockless vehicle parking areas.

[41] Motivate's Bay Area Bikeshare station cost estimates, 2016.

Table 25, Table 26 and Table 27 show the installation schedule assumed in the financial analysis. For a Capital Bikeshare expansion, it is recommended that the project partners install approximately 30 stations over the course of the three-year schedule. For the dockless program, the analysis assumes 500 vehicles are available for the first year of the program, and that the number of vehicles is increased by 25% each year of the program (similar to increases allowed by other jurisdictions based on performance). The analysis assumes two scenarios for dockless ridership, a low estimate of 1 trip per vehicle per day (Table 26), and a high estimate of 4 trips per vehicle per day (Table 27). This reflects the fact that ridership may be higher or lower depending on the program details (such as pricing, vehicle mix, and deployment locations).

Table 25: Installation Schedule: Capital Bikeshare[42]

	Installation Schedule		
	Year 1	**Year 2**	**Year 3**
New Elements			
Stations	11	15	4
Docks	165	225	60
Bikes	110	150	40
Cumulative System			
Stations	11	26	30
Docks	165	390	450
Bikes	110	260	300
Estimated Trips*	3,300	7,800	9,000
**Assumes 20 trips per dock per year (based on 2017 ridership in Tysons)*			

Table 26: Operating Schedule: Future Dockless Bikeshare Program Low Estimate

	Operating Schedule		
	Year 1	**Year 2**	**Year 3**
New Elements			
Dockless Vehicles	500	125 additional available	150 additional available
Estimated Trips*	182,500	45,625	54,750
Cumulative System			
Dockless Vehicles	500	625	775
Estimated Trips*	182,500	228,125	282,875
**Assumes 1 trip per day per vehicle (averaged over the year)*			

[42] This scenario assumes stations with 15 docks and 10 bikes each.

Table 27: Operating Schedule: Future Dockless Mobility Program High Estimate

	Operating Schedule		
	Year 1	**Year 2**	**Year 3**
New Elements			
Dockless Vehicles	500	125 additional available	150 additional available
Estimated Trips*	584,000	182,500	219,000
Cumulative System			
Dockless Vehicles	500	625	775
Estimated Trips*	584,000	912,500	949,000
**Assumes 4 trips per day per vehicle (averaged over the year)*			

OPERATING COSTS

Operating costs include those costs incurred to operate, maintain, and promote the system. This includes staff and equipment to administer the program, perform bike and station maintenance, rebalance the system, provide customer service, provide marketing and outreach, and direct expenses related to professional services, insurance, rent, utilities, software maintenance, etc.

Operating costs are influenced by a number of factors, including what services and functions can be leveraged from project partners (e.g., administrative, legal, planning, outreach, and other existing governmental functions) and the service level expectations (e.g., how long stations are allowed to remain full or empty). Nevertheless, it is recognized that project partners may need to add or reassign staff capacity to oversee and operate the program.

Operating costs for Capital Bikeshare include staff and direct expenses required to keep Capital Bikeshare operational, including rebalancing, bike and station maintenance, customer service, marketing, promotions, and outreach, software support, reporting, insurance, and all other day-to-day operations. These costs vary depending on the use of the program and the performance standards negotiated between the program owner and the bikeshare operator. These costs would be negotiated with the vendor at the beginning of each contract period and remain constant for the duration of the contract.

Pro-forma operating costs for Capital Bikeshare were based on per-dock-per-month costs incurred by other programs of similar size. This metric is used because docks are a relatively stable element of infrastructure with costs that do not vary on a daily basis due to repairs, rebalancing, and seasonality, unlike bicycles. A $130 per-dock-per-month operating cost was applied per year of operations. This rate includes personnel costs, direct expenses, and some allowance for spare parts and bicycle replacement (due to theft, vandalism, and regular wear and tear). Additionally, a half-time staff person is assumed to administer the contract with Capital Bikeshare operators and oversee the program.

There are no direct operating costs to the project partners for a dockless bikeshare program, beyond staff time to administer the program. Operating costs should typically be part of a private vendor's business model, and the project partners may wish to set expectations for operational standards when permitting private vendors to operate a dockless program. Based on current best practices, these bikeshare programs would require at least one half-time staff person for administration and oversight (approximately $50,000 per jurisdiction managing a bikeshare program); this position could be combined with a Capital Bikeshare program staff position depending on the size of each system.

Table 28: Comparison of Operating Costs for Different Bikeshare Technologies

Technology Type	Operating Cost	Staff Time	Notes
Capital Bikeshare	$130 per dock per month	$50,000 per year	Operating cost is based on an operator quote with inflation to 2019. Staff time assumes one half-time staff position.
Dockless Bikeshare	None	$50,000 per year	Staff time assumes one half-time staff position (could be combined with Capital Bikeshare manager).

PROJECTED REVENUES

Under the traditional pricing scheme adopted by bikeshare programs in the United States, there are three basic drivers of system revenue: annual (or monthly) membership, casual membership (such as day passes), and usage fees. Fairfax-Mason-Vienna Bikeshare Feasibility Study's analysis projected an average docked bikeshare revenue per bike based on 2018 revenue for Fairfax County's Capital Bikeshare program (the third year of the current Fairfax program, which is assumed to represent average revenues after the initial ramp-up).

Based on national current practices for dockless bikeshare fees, this analysis includes estimates for either a per-bike fee or a per-trip fee. Many dockless pilot programs collect these fees from the private dockless vendors permitted to operate in the jurisdiction, and the funds are typically used to offset the costs of administering the program and providing supportive infrastructure. Other options include establishing flat permit fees or using a hybrid of fees (not included in this analysis)

Table 29: Capital Bikeshare and Dockless Bikeshare Revenue Assumptions

Technology Type	Revenue Assumption	Notes
Capital Bikeshare	$110 per bike per month	Calculation is based on 2018 Capital Bikeshare revenue in Fairfax County.
Dockless Bikeshare	Option A: $30 per vehicle per year Option B: $0.10 per trip	Program would need to determine whether a per-vehicle or per-trip fee is preferred.

A comparison of expected system costs and revenues is included in Table 30, Table 31 and Table 32. This shows that over the three-year operating period, Capital Bikeshare revenues are expected to recoup approximately 50 percent of system operating costs. This will leave a funding shortfall of approximately $830,000 over three years. Revenues and the resulting shortfall may vary depending on how much and how quickly system use ramps up. Capital costs are expected to total approximately $1.8 million for 30 stations installed over three years, which may be distributed across the partner jurisdictions.

For the dockless program, we have calculated two revenue scenarios depending on ridership. For the low ridership estimate (Table 31), Revenue Option A would result in an operating shortfall of approximately $93,000 over three years, while Revenue Option B would result in an operating shortfall of approximately $80,000 over three years. For the high ridership estimate (Table 32), Revenue Option B would result in an operating surplus of

approximately $95,000 over three years. There are other funding models that could also be considered, such as a flat permit fee. Revenues and the resulting shortfall (or potential surplus) may be more or less depending on interest from vendors, program size, and the level of use of the system, which influences both the number of bikes available and number of trips made per bike. Capital costs are expected to total approximately $300,000 over the course of three years; again, this may be distributed across the partner jurisdictions and is dependent on the number of bikes permitted to operate and other program details.

Table 30: Capital Bikeshare Financial Pro-Forma

	Year 1	Year 2	Year 3	3-Year Total
Capital Costs per Station	*$58,842*			
Number of Stations Added	11	15	4	30
Total Capital	**($647,000)**	**($883,000)**	**($235,000)**	**($1,765,000)**
Operating costs per Dock	*$1,560 / year ($130 / month)*			
Cumulative Number of Docks	*165*	*390*	*450*	*450*
Operating Cost	*($260,000)*	*($610,000)*	*($700,000)*	*($1,570,000)*
Staff Cost	*($50,000)*	*($50,000)*	*($50,000)*	*($150,000)*
Total Operating Costs	**($310,000)**	**($660,000)**	**($750,000)**	**($1,720,000)**
User Revenue per bike	*$1,320 / year ($110 / month)*			
Cumulative Number of Bikes	*110*	*260*	*300*	*300*
Total User Revenue	**$150,000**	**$340,000**	**$400,000**	**$890,000**
Operating Shortfall	**($160,000)**	**($320,000)**	**($350,000)**	**($830,000)**

Table 31: Dockless Bikeshare Financial Pro-Forma (Low Estimate)

	Year 1	Year 2	Year 3	3-Year Total
Capital Costs per Vehicle	*$200 (for added bike parking and supportive infrastructure)*			
Cumulative Number of Bikes	*500*	*625*	*775*	*775*
Total Capital	**($100,000)**	**($100,000)**	**($100,000)**	**($300,000)**
Operating Cost	*$0*	*$0*	*$0*	*$0*
Staff Cost	*($50,000)*	*($50,000)*	*($50,000)*	*($150,000)*
Total Operating Costs	**($50,000)**	**($50,000)**	**($50,000)**	**($150,000)**
User Revenue A - per bike	*$30 per bike per year*			
User Revenue - Option A	**$15,000**	**$18,750**	**$23,250**	**$57,000**
Operating Shortfall - Option A	**($35,000)**	**($31,250)**	**($26,750)**	**($93,000)**
User Revenue B - per trip	*$0.10 per trip (assumes 1 trip per day per vehicle)*			
Cumulative Number of Trips	*182,500*	*228,125*	*282,875*	*693,500*
User Revenue - Option B	**$18,250**	**$22,813**	**$28,288**	**$69,350**
Operating Shortfall - Option B	**($31,750)**	**($27,188)**	**($21,713)**	**($80,650)**

Table 32: Dockless Bikeshare Financial Pro-Forma (High Estimate)

	Year 1	Year 2	Year 3	3-Year Total
Capital Costs per Vehicle	*$200 (for added bike parking and supportive infrastructure)*			
Cumulative Number of Bikes	*500*	*625*	*775*	*775*
Total Capital	**($100,000)**	**($100,000)**	**($100,000)**	**($300,000)**
Operating Cost	*$0*	*$0*	*$0*	*$0*
Staff Cost	*($50,000)*	*($50,000)*	*($50,000)*	*($150,000)*
Total Operating Costs	**($50,000)**	**($50,000)**	**($50,000)**	**($150,000)**
User Revenue A - per bike	*$30 per bike per year*			
User Revenue - Option A	**$15,000**	**$18,750**	**$23,250**	**$57,000**
Operating Shortfall - Option A	**($35,000)**	**($31,250)**	**($26,750)**	**($93,000)**
User Revenue B - per trip	*$0.10 per trip (assumes 4 trip per day per vehicle)*			
Cumulative Number of Trips	*584,000*	*912,500*	*949,000*	*2,445,500*
User Revenue - Option B	**$58,400**	**$91,250**	**$94,900**	**$244,550**
Operating Shortfall - Option B	**$8,400**	**$41,250**	**$44,900**	**$94,550**

The results of the financial analysis show that additional funding will be necessary to support the Capital Bikeshare program operations. For dockless bikeshare, the analysis shows that a per-trip fee would result in a smaller operating shortfall (and would have other benefits compared to a per-bike fee, such as tracking dockless bikeshare trips and incentivizing increased trips rather than a reduced number of bikes/scooters). This financial analysis assumes 1-4 trips per device per day and costs were estimated for the program overall.

PUBLIC FUNDING

Federal, state, and local funds are all important sources of funding for bikeshare. Federal funds typically come from the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) and are limited to capital and equipment, meaning they cannot be used to fund operations. The FTA and FHWA maintain a list of grants eligible for bikeshare capital expenses at https://www.fhwa.dot.gov/environment/bicycle_pedestrian/funding/funding_opportunities.cfm.

Different restrictions apply depending on which federal agency provides the funds. For example, FTA funds may only be used for docks, stations, and other equipment but not for the bicycles themselves. In addition, bikeshare projects are only eligible for FTA funds if they are within a three-mile radius of existing transit stops. FHWA funds have fewer restrictions and can also be used to purchase the bicycles.

Both FHWA and FTA funds are subject to Buy America regulations, which ensure that transportation projects are built with American-made products. The requirements stipulate that the product must be produced with at least 90 percent domestically made steel or iron content; the FTA also requires each end product and its components to be assembled in the United States.

Two popular federal grant programs for funding bikeshare capital are the Congestion Mitigation and Air Quality (CMAQ) program and the Transportation Alternatives Program (TAP). CMAQ is available to communities that do not attain air quality performance levels, and the study partner jurisdictions may qualify for CMAQ funding that is administered by MWCOG.

TAP is an initiative of the Fixing America's Surface Transportation Act (FAST Act) that apportions funds to the states to carry out the program. The Virginia Department of Transportation (VDOT) is responsible for administering the program in Virginia and allocates the funds to the state's MPOs and other Local Public Agencies (LPAs) outside of an MPO. Eligible projects include bicycle and pedestrian projects, and bikeshare has been a TAP-eligible project in Fairfax County. In FY 2018, Fairfax County received a $400,000 grant for a Capital Bikeshare program in Tysons Corner and Merrifield.[43] More information is available at: http://www.virginiadot.org/business/prenhancegrants.asp.

In addition to federal funding sources, there are several local sources of funding for bikeshare capital and operations. For example, the I-66 Commuter Choice Grant Program has provided funding for Capital Bikeshare programs within the corridor, including the ongoing expansions in Fairfax County and West Falls Church (a grant was awarded for 2018 for nearly $500,000 for Capital Bikeshare in Merrifield and Vienna). This grant program is funded by I-66 toll revenues and aims to support multimodal transportation projects in the I-66 corridor. Eligible projects include public transit or multimodal transportation projects to encourage non-auto commuting in the I-66 corridor. All jurisdictions and public transportation providers are eligible to apply for this funding source, including Fairfax County, the City of Fairfax, and the Town of Vienna.[44]

Additionally, project partners may use local funding within their general or transportation budgets to fund the bikeshare program. These funds may be used for administrative costs, ongoing operations funding, or as a local match for regional or federal grant funding opportunities.

PRIVATE FUNDING

Private funding sources are various and include grants from private foundations, private gifts and donations, and private sector investment. These sources are used in many U.S. cities that have non-profit owned bikeshare systems. In Minneapolis and St. Paul, Boulder, and Denver, donations make up 5 to 10 percent of revenues.

Other private funding sources may include:

- Bulk membership commitments from large employers.
- Mason Transportation Department funds.
- Developer proffers or incentives to encourage direct station purchase or collection of development charges to go towards bikeshare stations near their development.
- Private operations/capital funding provided by for-profit bikeshare operators such as dockless bikeshare companies or by Transportation Network Companies (such as Uber or Lyft).

SPONSORSHIP AND ADVERTISING

Sponsorship and advertising are important funding streams used in most U.S. bikeshare programs. In most cities, sponsorship on the bicycles themselves is generally well accepted as they are free to circulate and are not fixed street furniture (similar to wraps on city buses). Currently, the Capital Bikeshare regional partners are discussing future sponsorship opportunities through a cooperative procurement. Arlington County is currently developing a private sponsorship policy.[45] Other cities have brought in substantial funding through sponsorship, including $2.5 million per year in Chicago and $6.8 million per year in New York City.

[43] http://www.virginiadot.org/business/resources/transportation_enhancement/FY18_TAP_Final_Allocations.pdf
[44] http://www.novatransit.org/i66commuterchoice/about/
[45] https://www.washingtonpost.com/local/virginia-politics/advertising-may-be-coming-to-capital-bikeshare-bikes/2017/06/20/557291be-5612-11e7-a204-ad706461fa4f_story.html?utm_term=.f5ccc8af5e1b

System-wide sponsorship is currently under discussion among Capital Bikeshare member jurisdictions. For those system assets that are available for sponsorship, there are numerous ways to divide the offerings including:

- Title sponsorship: where a sponsor pays a premium price to be the exclusive sponsor of the program. The title sponsor gets to brand the program and all its assets using its corporate colors, name, and messaging.
- Presenting sponsorship: allows the system to retain branding and naming rights to the program, but offers large sponsorship opportunities to one or multiple sponsors. This often includes a sponsor purchasing system-wide logo placement on, for example, all the bicycle fenders. Most systems retain some sponsorship opportunities at the station or on the bicycle baskets to provide smaller and local sponsors with an opportunity to be involved in the program.
- Individual sponsors: individual assets are sold to sponsors. For example, a company might sponsor 10 bike fenders or have their logo on 5 map panels. Each deal must be negotiated and requires staff time to identify and secure multiple sponsors.

The first two types of sponsorships would be system-wide and would require coordination with the Capital Bikeshare regional partners. Individual sponsorships may be negotiated by individual jurisdictions. Typically sponsorships in individual Capital Bikeshare jurisdictions involve negotiations with large employers and developers to provide space and funding for bikeshare stations on their properties as a benefit to their employees and tenants and to advance transportation demand management goals.

CHAPTER 7
IMPLEMENTATION RECOMMENDATIONS

CHAPTER 7: IMPLEMENTATION RECOMMENDATIONS

As noted in Chapter 5, it is recommended that the project partners expand the Capital Bikeshare system in the study area as funding and opportunity allow, and to consider a dockless system based on local priorities. This chapter outlines implementation considerations for both systems.

CAPITAL BIKESHARE

Capital Bikeshare operates a regional smart dock system, including a 30-station system in Fairfax County. Smart dock systems are organized into stations. Each station has a computerized terminal to process transactions and information and a series of docks that lock the bikes. The user must return the bike to a station to end their trip. E-bikes are available on a pilot basis in the Capital Bikeshare regional system, and it is recommended that this Capital Bikeshare expansion join the e-bike pilot.

In the Washington, D.C. region, Capital Bikeshare infrastructure, including docks, bicycles, and station kiosks, is owned by the partner jurisdictions and operated by contract by a third party company (Motivate, Inc). Under the current structure, Capital Bikeshare jurisdictions have negotiated a contract and oversight mechanisms to ensure that the operator meets its obligations. Through this agreement, operator responsibilities include redistribution of bicycles, maintenance of equipment, customer service, and insurance requirements. Given that Fairfax County has an existing program, steps would include Mason, the City of Fairfax, and the Town of Vienna joining the system, and Fairfax County continuing to expand their Capital Bikeshare program.

SYSTEM NEEDS

Based on current information, it is anticipated that the Town of Vienna would join Fairfax County's existing Capital Bikeshare program. Mason is expected to join as a sponsor within either the County's existing program or the City's new program. The City of Fairfax would need to initiate a Capital Bikeshare program and address these steps below as part of that process:

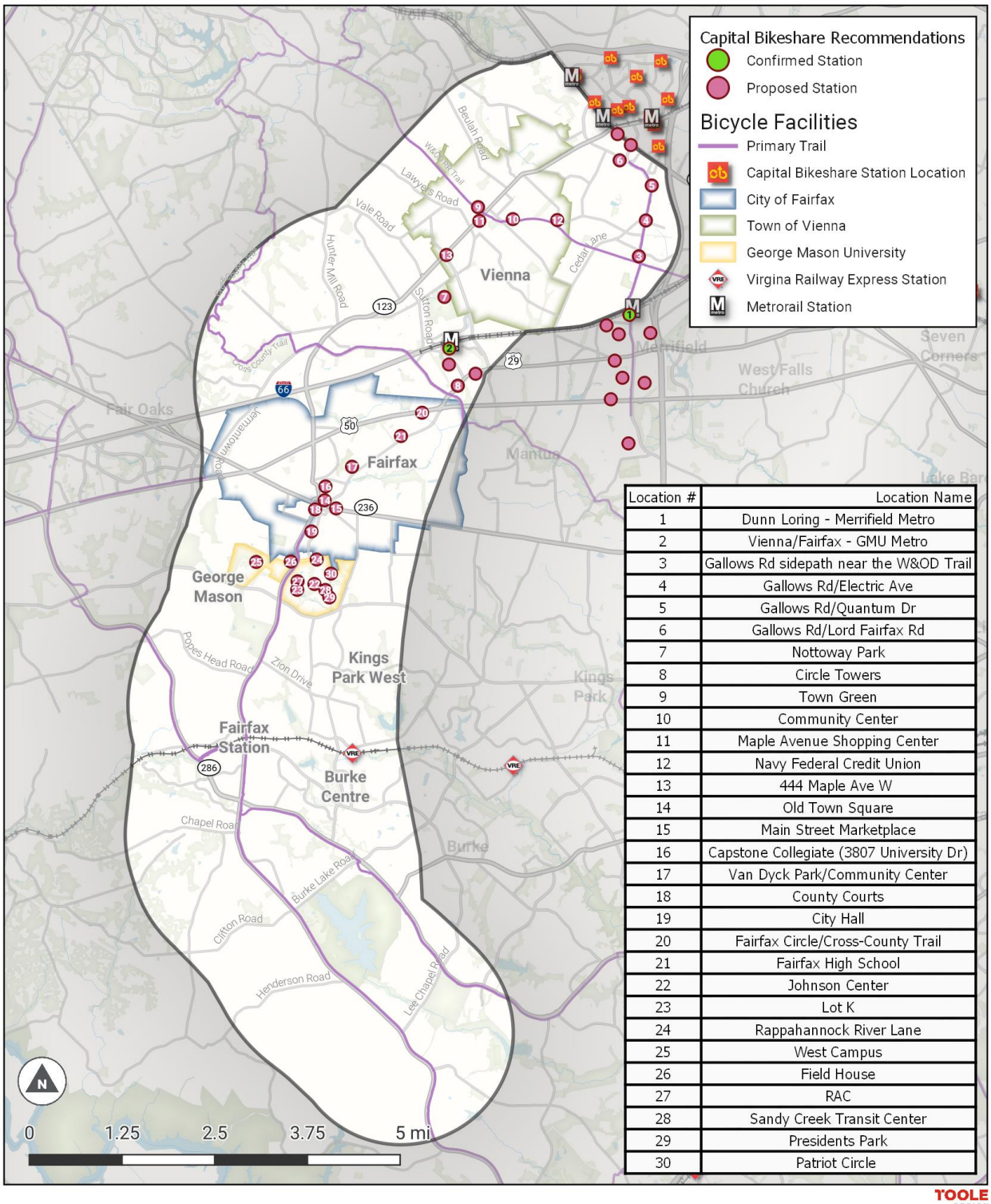
- Identify funding sources to support capital and operations costs.
- Negotiate and enter into a contract with Motivate to provide and install the equipment and operate the program.
- Dedicate staff time to oversee and monitor the program, manage the contract, plan and design for system expansion, and participate in the regional board.
- Collect user fees to help fund the program.

SYSTEM PLAN

Fairfax County is currently continuing to expand the Capital Bikeshare system by installing stations near Tysons Corner and the Town of Vienna. The City of Fairfax and George Mason University should prioritize connecting to this system as funding and opportunities allow. This system plan, described in detail in Chapter 5, connects residents and visitors to key destinations and the existing bicycle network and builds on the Fairfax County Capital Bikeshare system expansion to Tysons Corner, West Falls Church, and Merrifield. The map below shows the recommended Capital Bikeshare expansion (see Chapter 5 for more details).

Capital Bikeshare Implementation Recommendations: Study Area

VIENNA-FAIRFAX CITY-MASON-BURKE BIKESHARE FEASIBILITY STUDY



Location #	Location Name
1	Dunn Loring - Merrifield Metro
2	Vienna/Fairfax - GMU Metro
3	Gallows Rd sidepath near the W&OD Trail
4	Gallows Rd/Electric Ave
5	Gallows Rd/Quantum Dr
6	Gallows Rd/Lord Fairfax Rd
7	Nottoway Park
8	Circle Towers
9	Town Green
10	Community Center
11	Maple Avenue Shopping Center
12	Navy Federal Credit Union
13	444 Maple Ave W
14	Old Town Square
15	Main Street Marketplace
16	Capstone Collegiate (3807 University Dr)
17	Van Dyck Park/Community Center
18	County Courts
19	City Hall
20	Fairfax Circle/Cross-County Trail
21	Fairfax High School
22	Johnson Center
23	Lot K
24	Rappahannock River Lane
25	West Campus
26	Field House
27	RAC
28	Sandy Creek Transit Center
29	Presidents Park
30	Patriot Circle

TOOLE DESIGN

BUSINESS MODEL

Capital Bikeshare is an agency-owned and managed system, which is the model for some of the largest docked bikeshare systems in the U.S. Under this model, a government agency (i.e., the Department of Transportation, Department of Public Works, etc.) is financially responsible for the program and owns the system infrastructure including the stations and bicycles. The model allows for the agency to select which other functions it takes on and which it contracts to a third party (e.g., operations, marketing, promotions, etc.).

Through this model, the agency maintains control of the system, including where stations are placed and the system's density and scope. However, this model is dependent on agency interest and capacity to take on this role, as dedicated staff would be required to manage the program. As public entities, this model affords agencies access to federal funding in the form of grants (i.e., CMAQ) for capital expenditures. In most cases, agency-owned bikeshare systems employ a private contractor to operate the system.

This model depends on local and outside funding, as well as user revenues, to support the capital costs and ongoing operating costs of the system. Typical funding sources for Capital Bikeshare include TAP grants, I-66 Commuter Choice grants, user fees, and other local sources. (See Chapter 6 for more details.)

KEY QUESTIONS

The following questions need to be answered to move forward with a Capital Bikeshare program/expansion:

- How will the project partners coordinate on expanding/joining the Capital Bikeshare system? Who will manage/oversee Capital Bikeshare on the George Mason University campus?
- Do current policies and regulations define or restrict the use of e-assist bikes? Are policy changes required to allow e-bikes?
- What funding sources will project partners pursue to support program initiation and operations? What coordination is needed, and how will Mason join funding applications?
- What are the preferred program boundaries and station locations?

DOCKLESS BIKESHARE

Dockless mobility systems currently include dockless bikes, e-assist bikes, and e-scooters checked out using a smartphone. They can be ridden and parked anywhere on public property and within a defined service area. Depending on the technology, the devices may have a built-in U-lock or cable lock that allows them to lock to fixed objects, or a wheel lock that allows them to be locked to themselves.

A regulated dockless mobility program in one or more jurisdictions would be operated by a third party or multiple third parties and would provide the most comprehensive coverage and the most flexibility for where users can pick up and park a device. This would best accommodate the population and development patterns outside of the densest areas in Fairfax, Vienna, and Mason area, provide a flexible transportation option to complement or fill gaps in a docked bikeshare system, and provide an on-demand option to supplement existing transit and fill in the gaps in coverage and service times.

DOCKLESS BIKESHARE IN THE STUDY AREA

Toward the end of this study process, several companies in the dockless e-scooter industry expressed increased interest in operating in the study area (no dockless bikeshare companies expressed similar interest). Additionally, Virginia legislation was enacted that defined and clarified regulations for e-scooters in general and for shared mobility company operations. A summary of the proposed Virginia legislation relating to dockless bikes and scooters is included below:

- House Bill 2752: Clarifies the regulation of e-scooters or skateboards, including a maximum speed of 20 miles per hour; allows for operation on sidewalks; clarifies operation on roadways; and requires lights and hand signals. The bill allows for local jurisdictions to prohibit operation on sidewalks if it is provided for by ordinance (effective 2020). This bill also allows for local regulation of e-bikes and e-scooters provided that a pilot is in place by January 1, 2020. http://lis.virginia.gov/cgi-bin/legp604.exe?191+sum+HB2752

The jurisdictions in the study area are beginning to develop policies to regulate dockless shared mobility companies based on regional and state practices. The City of Fairfax has established a pilot program with regulations similar to those established in other parts of the region, and the other study partners are considering similar options. Policies in each jurisdiction should be coordinated with neighboring jurisdictions to the extent possible since dockless riders frequently cross city, county, and state boundaries.

In addition to coordination among jurisdictions, each study partner should continue to monitor best practices. This industry (and associated technology) continues to be in a rapid state of evolution, and it is not uncommon that the existing regulatory structures have a difficult time keeping up with innovation in this emerging market. The following sections detail system needs and potential questions that the system should address as the study partners develop and refine their policies and programs.

SYSTEM NEEDS

A dockless mobility system should consider:

- Interest from third-party vendors to establish a program.
- A contract, memorandum of understanding, or permitting mechanism to allow these programs to operate in the public right-of-way and regulate operating practices.
- Staff time to oversee and monitor the program.
- Permit fees to help fund staff time or bicycle improvements.
- Policy changes to define the use of e-bikes and e-scooters as needed.
- Policy changes to allow permitting and contracting of dockless e-bikes and e-scooters on the right-of-way in Fairfax County, in the City of Fairfax, and on the Mason campus.

SYSTEM PLAN

A dockless mobility program is intended to be flexible and responsive. Riders use a smartphone application to locate and check out the devices and ride them to their destination. The system needs to be sized to provide an adequate number of devices so that there is one available or within a short walk. Based on a comparison of dockless systems in other comparable cities, the system in Fairfax-Vienna-Mason should establish an initial maximum number of devices per operator in the study area, with usage and other performance criteria to determine when more vehicles can be deployed (or if the number of vehicles should be reduced). For example, in Washington, D.C, Arlington, and Alexandria, operators may increase their fleet sizes contingent on performance evaluations or evidence of sufficient demand.

The system plan recommends that dockless mobility implementation starts in a service area that includes the George Mason University campus, downtown Fairfax, and the Vienna/Fairfax-GMU Metrorail station. Later phases would extend the dockless system to include the Town of Vienna and the Burke VRE area. Individual agreements will be needed between the agencies and the operators, but as previously discussed it would be useful to coordinate policies; potentially a master agreement of common provisions could be developed to ensure consistency throughout the study area.

The project partners should work with the operator(s) to establish a practical system boundary that limits use to the higher demand areas and that reduces the burden for operators to chase devices for maintenance, recharging, and redistribution. Hubs could also be established at popular locations such as destinations in

downtown Fairfax, downtown Vienna, and Mason to encourage bikes to be returned to these locations. It may be advantageous to co-locate dockless mobility hubs with planned Capital Bikeshare station locations to encourage use of both systems in popular areas.

BUSINESS MODEL

A dockless mobility program is dependent on interest from third-party vendors to provide this service. Several vendors are currently operating in the region, including Lime, Bird, JUMP, and Spin, and would likely be interested in operating in the study area. Nearby jurisdictions, such as Arlington County and the City of Alexandria, already manage dockless bikeshare and scooter-share pilot programs. It is recommended that a minimum and maximum number of vehicles be considered for a dockless program in the study area based on the size of the service area, the number of vendors anticipated, and desired performance outcomes (2 trips per bike per day is typical as a performance metric).

A minimum number can ensure that enough vehicles are available (particularly if emphasizing distribution to support equity goals), and a maximum number can help mitigate clutter. Additionally, the program should consider a mechanism for changing the cap based on performance measures, such as trip per vehicle per day, or compliance with agreement provisions. The program should also consider the desired mix of vehicles (e.g., e-bikes, and e-scooters) and consider how to achieve that given what the current market offers. The market conditions in the region are continuing to evolve, with many private companies focusing on e-scooters instead of bikes, which may influence how the program is designed.

The project team will need to assess existing policies and regulations to determine if and how e-bikes and e-scooters can operate in the study area. They should consider:

- Where updates are needed in existing policy and regulation;
- Assessing the potential impacts of introducing scooters, including greater participation from certain (primarily younger) demographics, safety considerations, and where the e-scooters should be operated with potentially a greater demand for on-street bicycling infrastructure if sidewalk riding is not permitted;
- The desired share of scooters, e-bikes, and pedal bicycles to be included in the program, as well as local and vendor preferences; and
- Current permitting language and policies used elsewhere in the region, which may be a model for a future dockless program in the study area.

Although the vendor (or multiple vendors) is responsible for the full cost and operation of the program, some staff time will be needed to update necessary policies, create a permit or regulatory framework, respond to citizen concerns, and oversee and monitor the program. Many cities are recouping the cost of staff time by charging permit or per-trip fees assessed on the operator. Two example fee structures are described below:

Revenue Option A:

- **Number of devices**: 500
- **Fee**: $30 per vehicle per year
- **Revenue potential**: $15,000 per year

Revenue Option B:

- **Number of devices**: 500
- **Fee**: $0.10 per trip
- **Ridership**: Assumed 1-4 trips per vehicle per day
- **Revenue potential**: $18,250 per year (lower ridership scenario) or $58,400 (higher ridership scenario)

KEY QUESTIONS

The following questions need to be answered to move forward a dockless mobility program:

- How will the project partners solicit interest from private vendors?
- Do current policies and regulations define or restrict the use of e-assist bikes and e-scooters? Are policy changes required to allow these devices?
    - Virginia has enacted legislation to regulate the usage of e-bikes and e-scooters in public right-of-way. This legislation also establishes local authority to regulate shared mobility companies and sets a deadline for localities to develop regulations.
- What sort of regulatory mechanism will be used to allow dockless vendors to operate in the public right-of-way? What is the process for establishing this framework?
    - Within the DC region and nationally, there have been a variety of regulatory mechanisms used to regulate dockless vendors, include Memoranda of Agreement, public space permits, and RFP processes. The type of regulation depends on the local regulatory environment, nature of a pilot or permanent program, and need for expediency.
- Will vendors be charged to operate the program or apply for a permit? What format will this take?
    - Many dockless bikeshare pilot programs charge a fee for the permit application and/or operation of the program. As noted above, the most common fee structures include a flat permit fee, fee per vehicle, or fee per trip. In the DC region, Arlington County and the City of Alexandria require an up-front flat fee ($8,000 and $5,000, respectively); while the District of Columbia requires a flat permit fee, technology fee, annual fee, and per vehicle fee.[46]
- How will revenues be used to offset staff time and fund bike improvements that will assist the program?
    - Fee revenues are typically used to cover administrative costs and fund related bicycle improvements, such as striping hub locations and installing additional bicycle parking capacity.
- What are the preferred program boundaries and hub locations?
    - These elements depend on local conditions, but many jurisdictions include a citywide program boundary. Although there are few examples of countywide dockless programs, Arlington County allows for operation throughout the County, while Montgomery County began a more limited pilot in Downtown Silver Spring and Takoma Park, MD.

[46] https://ddot.dc.gov/sites/default/files/dc/sites/ddot/page_content/attachments/Dockless%20Permit%20Application%20Instructions%20-%202019%20-%20Deadline%20Extension.pdf