Presented by Bantam Strategy Group & Toole Design

ANN ARBOR BIKESHARE MODERNIZATION PLAN

June 2019

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EXECUTIVE SUMMARY

As micromobility expands in Michigan and across the country, the leadership of Washtenaw Area Transportation Study (WATS) started exploring the modernization of this alternative transportation in the Ann Arbor region. Through a competitive selection process, WATS engaged Bantam Strategy Group and Toole Design Group, two experienced planning firms, to facilitate this *Ann Arbor Bikeshare Modernization Plan.*

This plan was directed by a steering committee involving representation from Washtenaw Area Transportation Study, City of Ann Arbor, City of Ypsilanti, Ann Arbor Area Transportation Authority (AAATA), Ann Arbor Downtown Development Authority (DDA), East Michigan University (EMU), University of Michigan (U-M), Programs to Educate All Cyclists (PEAC), Washtenaw County Parks, and Washtenaw County Road Commission. The steering committee met several times over the course of the study thus becoming the local supervisory body to ensure the voice of the community was reflected and to ensure the project progressed as planned to completion. The participation of the taskforce members is not a reflection of individual endorsements of this project.

This study evaluates the readiness of modernizing and expanding a bikeshare system in the two cities and two universities identified in this study, and the probability of both fiscal and use based success. Several sections of this study explore shared micromobility equipment and technology, business models, funding options, and final bikeshare recommendations. A series of public and individual meetings were conducted to understand the local impact, opportunities, and challenges the bikeshare system would have in the Ann Arbor area.

Using a data driven approach and best practices from other jurisdictions, the team developed a proposed system service area and phasing plan for the bikeshare program. This process began with a high-level community analysis to explore the physical conditions, population and demographic trends, land use and economic development trends, and the transportation environment to identify potential opportunities and challenges for the bikeshare program.

A substantial goal for this bikeshare study is to determine a suitable funding structure for this system. A high-level evaluation of different business models was conducted for what could be achievable for both communities and universities. This plan summarizes the different structures, operating models, funding mechanisms and recommendations for the system. Additionally, the team considered the community and political will associated with modernizing and expanding a shared micromobility system in the region, with a primary focus on bikeshare. During the study period, the City of Ann Arbor entered a pilot permit with the e-scooter company, SPIN. The City has a Transportation Commission designated to make recommendations to the Council on various transportation matters, and a micromobility subcommittee has been formed that is actively assessing the topic.

The expansion of a bikeshare modernization and system expansion are feasible in the City of Ann Arbor, City of Ypsilanti, Eastern Michigan University and the University of Michigan. This document fully outlines the results from the analysis, outreach, and full scope of work conducted from January 2019 to June 2019 under the *Ann Arbor Bikeshare Modernization Plan* scope of work.

RECOMMENDATION SUMMARY

This section was designed so major recommendations for the Ann Arbor Bikeshare Modernization Plancan be reviewed with ease and at-a-glance. A complete explanation, analysis, and the methodologies used to draw on these recommendations can be found in the full document.

1. Equipment, Technology, and Fleet Size Recommendation

The project team is recommending a fleet size of between 500 and 1,500 bikes dockless or smart bikes. This recommendation is a significant increase from the system's peak size of 125 dock-based bikes, and it represents a shift in the program's localized focus around the University of Michigan's Ann Arbor campuses to a regional approach that serves both Ann Arbor and Ypsilanti. The proposed fleet size range is based off a phased recommendation with 500 bikes placed in the short term, and the system growing over time to a 1,500-bike fleet. Additional details on the phased approach is provided below in thesection. This recommendation removes the need for larger dock-based stations and kiosks while still providing a functional and easy-to-use program. Though it is still recommended that identifying designated hubs as bikeshare or shared micromobility specific, using geofencing technology can curate a positive user experience. The bikeshare hubs would be more organized in appearance, consistent in location for usage, and could eliminate many ADA issues caused by a free-floating dockless system.

2. Expansion Service Area and Phasing Recommendation

In coordination with the fleet size recommendation of 500 to 1,500 bikes, the project team is recommending expandingthe system's service area further out into more neighborhoods in Ann Arbor and into Ypsilanti. This recommendation is broken into two phases to reflect the significant changes proposed in the system's strategy, operation, and capital investments. The Phase 1 recommendation of 500 bikes prioritizes a service area centered around Downtown Ann Arbor, the University of Michigan, the Old West Side, Huron River connections, Eastern Michigan University, and Depot Town. The Phase 1 service area will replace and expand the existing ArborBike service area and focus on establishing connections between Ann Arbor and Ypsilanti. Moving from Phase 1 to Phase 2 will be a long-term process that responds to early successes and lessons learned during the initial roll out. The goal of 1,500 bikes will only be achieved and maintained if the system has the financial resiliency to properly maintain and operate the bikes, technology platform, equity programming,

and neighbor relations. The system should focus on being nimble, flexible and driven towards sustained growth during this transition period.

3. Funding and Implementation Recommendation

It is recommended that Ann Arbor and Ypsilanti collaborate on a regional shared micromobility system under the Privately Owned and Operated Model. This model will allow the bikeshare system to thrive without the need for government funding but allows for attracting corporate sponsorships if required for long-term sustainability. This also positions the system with high-quality bikeshare equipment and additional micromobility technology that is solely focused on pushing community-driven strategies. This model also ensures an experienced operator is tending to the daily demands of the system which will increase efficiency and effectiveness of the user experience. This model illuminates the concerns associated with the City or University carrying the financial or liability burden of a bikeshare system yet still creates accountability of the operator. It is recommended that Ann Arbor, Ypsilanti, U-M and EMU coordinate a process together for selecting one or two shared micromobility vendors that have multiple assets. This process could involve permitting or a “request for proposals”; regardless, this streamlined path forward could yield a regional micromobility systems serving both municipalities and universities later this year or early next year pending agreements being secured in a timely manner.

Chapter 1:

Introduction

When looking at the modernization of a bikeshare system it is important to define the term “micromobility” which has emerged recently from the use of smaller shared mobility devices. Micromobility has become the umbrella name of several modes of transportation, more specifically docked and dockless bikeshare, electric pedal assist bikeshare, electric scooters, and other smaller shared devices on the horizon to be released over the next several years.[1]

The key features of micromobility include:

1) the scale in size of the device
2) the speed of the device
3) the increased flexibility in routes with a designated service area
4) the ability to access through a shared model
5) the connectivity of the device to smartphone or mobile application

Typically, these vehicles serve individual users (with some advancements coming soon that can serve two users at a time). The speed of each device has also emerged as a key feature, which is typically 30 mph or less with electric or human-powered propulsion. This would mean that most shared micromobility devices are not allowed on certain roadways and are typically used in a designated service area. Additionally, there is some flexibility in the route an individual may elect, since shared micromobility is not on a fixed route. Bothdocked or dockless are forms of micromobility, as each device is used by many different riders, multiple times a day in a shared model. The device is typically accessed by an individual using a smartphone with a QR code, mobile app, or radio frequency identification (RFID) connected to the micromobility system and the user’s credit card for payment upon ending a trip.

We are focusing on bikeshare specifically for this study and for most of the content in this document; however, there will be mentions of scootershare and emerging trends in the shared micromobility space throughout.

Focus on Bikeshare

In more than 250 cities across the United States, bikeshare systems have proven popular and provided residents and visitors a fast, affordable, and easy to-use transportation option to get around the community. Bikeshare is meant for short, point-to-point trips that

[1]National League of Cities, Center for City Solutions. Micromobility in Cities: A Policy and History Overview. Accessed from file:///C:/Users/rlind/Bantam%20Dropbox/Current%20Clients/Ann%20Arbor%20(MI)/Final%20Docs/CSAR_MicromobilityReport_FINAL.pdf on May 1,2019

characteristically range from 30 minutes or less. After that time, most operators charge incremental fees to encourage users to return the bicycles when they are not being used, which encourages turnaround for other users.

Bikeshare has been implemented in varying sized cities and universities across the United States to better connect people to places. The National Association of City Transportation Officials (NACTO) reported that the number of bikeshare bikes in the U.S. have doubled in a 12-month span, from 42,500 bikes at the end of 2016 to 100,000 by the end of 2017.[2] Self-service, automated bikeshare stations or bicycles are typically located throughout the community where users can access bicycles using a mobile app or membership card, with subscription options typically ranging from point-to-point, weekly, monthly, and annual. Most U.S. bikeshare trips are actually between 15 to 20 minutes and between one to three miles.[3] The bicycles are designed to be easy to operate with a step-through downtube, simple integrated components, and adjustable seats.The rental transaction is fully automated and there is no need for on-site staff to man bikeshare hubs or bicycles.

Benefits of Bikeshare

Bikeshare systems across the globe and in various size markets have proven to be successful, affordable for users, fun, and relatively inexpensive to implement. This alternative transportation option boasts a multitude of community advantages such as mobility, economic, health, tourism, and safety benefits. The following goals and objectives were established through the review of feedback captured from local stakeholders during the project meetings and presentations.

Table 1. Summary Goals and Objectives

Transportation/Mobility	➢ Bikeshare complements and expands first mile/last mile connections for individuals that are transit riders, without transportation, parking remotely, or for special events. ➢ Bikeshare can be an option for reducing the monthly expenses of car ownership. ➢ Bikeshare programs tend to be a catalyst for implementing more bicycle facilities like bike lanes, bicycle parking, etc. ➢ Bikeshare quickly and affordably helps to ease parking issues and congestion on campuses and in downtown areas.
Economic	➢ Bikeshare systems increase city vibrancy attracting potential residents and businesses, which supports the recruitment and retention of a skilled workforce. ➢ The bikeshare system itself creates new jobs for local individuals to fill on a full-time, part-time, or seasonal basis. ➢ Many communities see bikeshare as part of a revitalization or assisting with activating their downtown area, along with Complete Streets and Better Block programs.

[2]National Association for City Transportation Officials. Bikeshare statistics report. 2017. https://nacto.org/bike-share-statistics-2017/
[3]Bike Sharing in the United States: State of the Practice and Guide to Implementation. Federal Highway Administration. United States Department of Transportation. September 2012

Tourism	➢ Bikeshare provides visitors with a unique user experience and different view of the community, which encourages greater spending at local retailers and restaurants. ➢ Bikeshare has positively affected how residents, employees, and visitors experience a city. It allows for increased access and connectivity to different parts of the city, replacing single occupancy vehicle trips and promoting an attractive lifestyle. ➢ Bikeshare can support the tourist with a transportation option, but also provide a means of transportation to work for hospitality and service workers.
Safety	➢ Bikeshare systems increase visibility, which can result in greater awareness of bicyclists by drivers. ➢ Bikeshare systems create the opportunity to communicate with bicyclists and drivers about road rules, regulations, and safety tips. ➢ As the number of people biking increases, the risk of a bicyclist being struck by a vehicle decreases.
Health and Environment	➢ Bikeshare is a means to introduce people to the joys of riding a bicycle. ➢ Bikeshare improves physical and mental health, which can reduce healthcare costs. ➢ Bikeshare reduces vehicle emissions and aids in improving air quality. ➢ Bikeshare overall increases sustainability awareness efforts on both the individual and community level.

Chapter 2:

Existing Bikeshare Conditions

ArborBike operated in Ann Arbor from September 2014 to December 2017. During this three-year period the system was owned and operated by the Clean-Energy Coalition (CEC) with support from the Ann Arbor Area Transportation Authority (TheRide), the City of Ann Arbor (Ann Arbor), and the University of Michigan (U-M). At its peak, ArborBike had 14 BCycle smart-dock stations and 125 bikes in operation.

1. History

The ArborBike bikeshare system was launched in 2014 through a partnership of the CEC, TheRide, Ann Arbor, U-M, and the DDA. Funding for the program was acquired through a joint CMAQ application from the CEC and TheRide for capital expenses. Ann Arbor provided $150,000 for the required local match. In addition to the CMAQ grant and matching funds, U-M provided $600,000 to cover the program's expected operational costs for the first three years.[4] From 2014 to 2017, ArborBike secured additional sponsorships from local businesses and organizations including the State Street Area Associations, Kerrytown market and Shops, ZipCar, and Underground Printing to support the program's operations.[5]

The three-year initial term limit of the original agreement between the CEC, TheRide, the City, U-M, and the DDA led to the temporary closure of the system at the end of the 2017 season. During the temporary closure, the CEC ended its ownership and operator role in the program. The CEC's decisions were made in recognition of the changing landscape in bikeshare systems nationally, and of the limited staff and funding resources available for the CEC to effectively update and grow the system.[6]

2. Management

In 2018, TheRide took over ownership of the ArborBike equipment and the lead role in managing the system. In this new role, TheRide facilitated a partnership with U-M, City, and the DDA. They collectively selected Shift Transit [7] through an open request for proposals to serve as the day-to-day operator of the ArborBike system and to oversee the program's marketing, finance, and special projects. Shift's day-to-day responsibilities will include rebalancing stations, maintaining the equipment, operating a 24-hour call center, and providing customer ambassadors. Shift will also operate and maintain the ArborBike web portal and mobile apps to support membership registration and program marketing efforts. Finally, Shift will support ArborBike's inclusive and equitable programming efforts as directed by TheRide. Such inclusive and equitable efforts may include subsidized membership rates for income qualified community members, and non-credit or debit card payment methods.[8]

In April 2019 TheRide, City, U-M, and the DDA facilitated a partnership to support ArborBike. Under the 2019 agreement, TheRide will provide approximately $50,000 in-kind contribution through the system's management and administration, U-M will provide

[4]https://www.mlive.com/news/ann-arbor/2018/03/ann_arbor_bike_share_program_t_2.html
[5]https://www.mlive.com/news/ann-arbor/2018/03/ann_arbor_bike_share_program_t_2.html
[6]https://www.mlive.com/news/ann-arbor/2018/03/ann_arbor_bike_share_program_t_2.html
[7]Shift Transit is a nationally recognized bikeshare and multimodal service operator and was a key player in the launch of the Detroit MoGo bikeshare system.
[8]Shift Transit Technical Proposal to the Ann Arbor Area Transportation Authority, Request for Proposal #2018-09 for Bike Share Management. June 22, 2018.

$100,000, and the City and the DDA will each provide $50,000 towards the system. TheRide's management and administrative responsibilities will include overseeing the system operator, Shift Transit, and serving as the grant management agency for all active and future grant agreements and applications. The agreement requires an annual renewal among all the partner agencies, with the option to renew the agreement on a yearly basis through 2024.

As part of the April 2019 agreement, each of the partner agencies agreed to participate in a Bikeshare Program Committee. The Committee will develop ArborBike's budget, monitor the use of program funds, and support TheRide in an advisory role related to program operations. The Bikeshare Program Committee members will be composed of four members, each individually appointed by their relative agency. The Committee's decisions and actions will require unanimous agreement in order to be adopted and validated by the Committee.[9]

TheRide plans to re-launch the ArborBike program in the summer of 2019 using 12 of the existing stations and 125 of the existing bicycles. In the 2019 agreement between the partner agencies, the agencies recognized the requirements linked to the 2014 CMAQ grant to use the purchased bikes and stations through to the end of their useful life (10 years)).[10]

3. Stations and Service Area

ArborBike launched in late September 2014 with six stations and approximately 50 three-speed Trek bikes. These first six stations were centered around the University of Michigan's central, medical, and north campuses. As part of the 2014 fall "Soft Launch," ArborBike also announced its plans to install eight additional stations and add 75 bikes in the spring of 2015. These additional eight station locations filled in the gaps between the existing campus locations and downtown Library station, and expanded the system's service area into Kerrytown, along Main St. and S. University Ave., and to U-M's Intramural Sports Building and Ross Athletic campus.

4. System Data Overview

From 2014 to 2017, the ArborBike system operated seasonally, typically from late March to early December, during the hours of 5 A.M. to 11 P.M.[11],[12]

Table 2. ArborBikes Ridership 2015-2017[13]

	Users	Bike Trips
2015	2,964	14,197
2016	3,282	17,691
2017	2,749	13,260

[9]http://a2gov.legistar.com/LegislationDetail.aspx?ID=3893930&GUID=F4234863-20A9-47A2-9F32-3B62EF0131FB
[10]http://a2gov.legistar.com/LegislationDetail.aspx?ID=3893930&GUID=F4234863-20A9-47A2-9F32-3B62EF0131FB
[11]In 2017, the system opened on March 29thand closed on December 4th, and in 2016 the system ran from March 25thto December 13th. (source, https://www.facebook.com/Arborbike/)
[12]https://www.mlive.com/news/ann-arbor/2014/09/ann_arbor_bike_share_program_t_1.html
[13]https://www.mlive.com/news/ann-arbor/2018/03/ann_arbor_bike_share_program_t_2.html

4.1 Trips

In total, ArborBike provided over 45,000 trips during its three seasons of operation. The largest number of trips was recorded in 2016, which had approximately 25 percent (almost 3,500) more trips than in 2015. This trip growth was lost in 2017, when annual trips dropped to an all-time low of just over 13,000 trips in one season.

In 2017, the stations at S. University and E. University, and Station and N. University saw the highest number of "checkouts," or trips starting from those stations, as shown in *Figure 1*. On average, the S. University and E. University station saw over seven checkouts per day, and the State and N. University station had an average of five checkouts per day. The stations at City Hall/Justice Center and at Hoover & State had only 1.15 and 1.13 trips per day, respectively.[14]

Figure 1: Bikeshare Trips per Station 2017

[14] 2017 checkout data was not available for the Washtenaw & S. University station.

4.2 Membership

System members had to be at least 18 years of age, and memberships included unlimited 60-minute trips for a day, a month, or a year. Members were charged $3 for each additional 30-minute period over the 60-minute trip time. 24-hour memberships where available for purchase as the station kiosks, while the monthly and annual memberships were available online at ArborBike's website. Annual memberships began at the time of purchase and lasted 12 months, carrying over across bikeshare seasons.[15]

Just under 9,000 users had memberships during the three full years of ArborBike's operations. Membership started strong in 2015 with a reported 2,964 users; however, the system was not able to significantly increase its membership in 2016 nor 2017. In fact, 2017 saw the lowest number of users over all three years.[16] According to membership data from 2017, the most popular membership type was a 24-hour pass purchased from a kiosk (2,256, or 82% of all users), and the monthly pass holders took the greatest number of trips out of all user groups (5,680, or 43% of all trips).

5. Other Systems

While the ArborBike system was dormant in 2018 and early 2019, other bikeshare and bike rental systems and companies continued to operate in Ann Arbor and Ypsilanti. These systems and companies offered bikes on hourly, daily, weekend, monthly and semester-long basis to the general public and specific building residents. One program of note was the approved; but not implemented, pilot bikeshare program between the City of Ypsilanti, Eastern Michigan University (EMU), and the Ypsilanti Housing Commission. In 2018 EMU entered into a Memorandum of Understanding (MOU) with Spin Bike, a private bikeshare operator, to bring 250 bikes by March 2018 to Ypsilanti for a one-year pilot program.[17] The program unfortunately did not launch as SPIN ceased its bikeshare services in 2018 to exclusively focus on scootershare programs. During the study period, the City of Ann Arbor entered a pilot permit with SPIN for e-scooters.

Image 1. U-M Blue Bikes[18]

Image 2. Varsity Gotcha Bike[19]

[15]https://www.mlive.com/news/ann-arbor/2014/09/ann_arbor_bike_share_program_t_1.html
[16]https://www.mlive.com/news/ann-arbor/2018/03/ann_arbor_bike_share_program_t_2.html
[17]https://cityofypsilanti.com/AgendaCenter/ViewFile/Item/1395?fileID=2610
[18]http://sustainability.umich.edu/news/u-m-launches-bike-rental-program-campus
[19]https://gotchabike.com/thevarsitybikeshare/

Table 3. Bikeshare and Bike Rental Operators in Ann Arbor and Ypsilanti

	System Type	Location	Bikes	Pricing
U-M Blue Bikes*	Rentals	Ann Arbor	+30 hybrid mountain bikes	$12/day for the first day and $5 for each additional day $17 for a weekend $85 for a semester
Ypsilanti / EMU / Ypsilanti Housing Commission**	Bikeshare	Ypsilanti	0 step-through up-right "Spin" bikes	N/A
Varsity	Bikeshare	Ann Arbor	5 smart, step-through Gotcha bikes	Free to residents of the Varsity apartment building[20]
Bike Shops	Rental	Ann Arbor + Ypsilanti	Varies by Location	Varies by location, Campus Bike Shop in Ann Arbor offers hourly, daily, weekly, monthly, and semester-long rentals for community members and area visitors.[21]

** The U-M Blue Bikes are available for rent to University of Michigan students, faculty, staff, alumni and community members through the Recreational Sports office. The program launched in 2012 with 30 bikes, and 4 additional bikes were added in 2013.[22, 23]*

*** The Ypsilanti / EMU/ Ypsilanti Housing Commission bikeshare partnership was cancelled prior to its launch due to the ending of bikeshare services from the selected system operator, Spin.*

[20]https://gotchabike.com/thevarsitybikeshare/
[21]https://www.visitannarbor.org/play/campus-student-bike-shop-maynard-avenue
[22]http://sustainability.umich.edu/news/u-m-launches-bike-rental-program-campus
[23]http://sustainability.umich.edu/news/university-continues-promote-alternative-green-transportation-expansion-blue-bikes

Chapter 3:

Community Engagement and Feedback

Various stages of community input have been captured throughout the full study period of January 15, 2019 to May 31, 2019. This document showcases the community and stakeholder outreach that took place specifically to evaluate the recommendations for the Ann Arbor Bikeshare Modernization Plan and to identify consensus among the communities and university.

The public input portion of this study included individual stakeholder conversations, several public presentations and meetings, an online survey with interactive map on the project website, and a mapping exercise with the bikeshare taskforce. During the meetings the bikeshare concept was introduced and open for community feedback, specifically on a) what areas bikeshare could be located in an expanded service area, b) what kind of challenge areas and opportunities exists, and c) what type of bikeshare system could be the best fit for the communities and university.

The overall feedback received through the community workshops, stakeholder meetings, the project survey, and project website indicated that there is support for an expanded bikeshare system in the Ann Arbor region.

1. Stakeholder Meetings and Community Event

The Bantam Strategy Group consulting team is in the process of proactively conducting individual stakeholder meetings. To-date four (4) stakeholder meetings, two (2) group presentations, and two (2) public meeting in March 2019 have been conducted. Three key events were conducted during the in-community visit which typically yield a great deal of interaction and feedback from community stakeholders.

Public Meetings

1. **University-Focused Event** held on March 13, 2019 at Sweetwaters Coffee and Tea Shop (Liberty Street location) where bikeshare experts collected surveys, facilitated a mapping exercise, displayed a looping presentation with live polling software, and showcased various bikeshare technology options. Bikeshare experts were present at a table with displays and print materials explaining the planning goals of this study.

2. **Business and Bikeshare Meeting** was held on March 14, 2019 at the *Ann Arbor* Downtown Development Authority (DDA) office where a formal presentation was hosted, a bikeshare expert was present to field questions and answers, and

live polling using Poll Everywhere software was conducted with the participants. A lively discussion among this group was captured and feedback gathered for the purposes of this study.

3. **Bikeshare Public** Meeting was held on the evening of March 14, 2019 at the Ann Arbor District Library on South 5th Avenue. The bikeshare consultants were present to provide a presentation, to field a Q&A session, to facilitate a live polling exercise, to collect community surveys, and to walk the participants through a series of mapping and input exercise on display boards. Key feedback from participants was collected at the event.

Most of the conversations and questions regarding bikeshare consisted of the makeup of the existing system, potential for a service area expansion *(where bikeshare would be available)*, various bikeshare equipment options, and user experience.

2. Project Website

The Ann Arbor Bikeshare Modernization Plan website (www.arborbikeshareplan.com) officially launched in February 2019. The website consists of eight pages outlining "What is Bikeshare?", the project scope of work, frequently asked questions (FAQs), community input (survey and Wikimap), and information for contacting the project team. Besides the *Home* page, the top three most active pages on the website are the Community *Input* page, *This Project* page, and the *Contact* page. During the period of February 2019 – May 2019 the website had 1,323 unique visits and 2,097-page visits. The average page per unique visit was 1.585 which means they clicked on more than just the Homepage to explore further information. This information will be updated at the conclusion of the project to reflect the most up-to-date data.

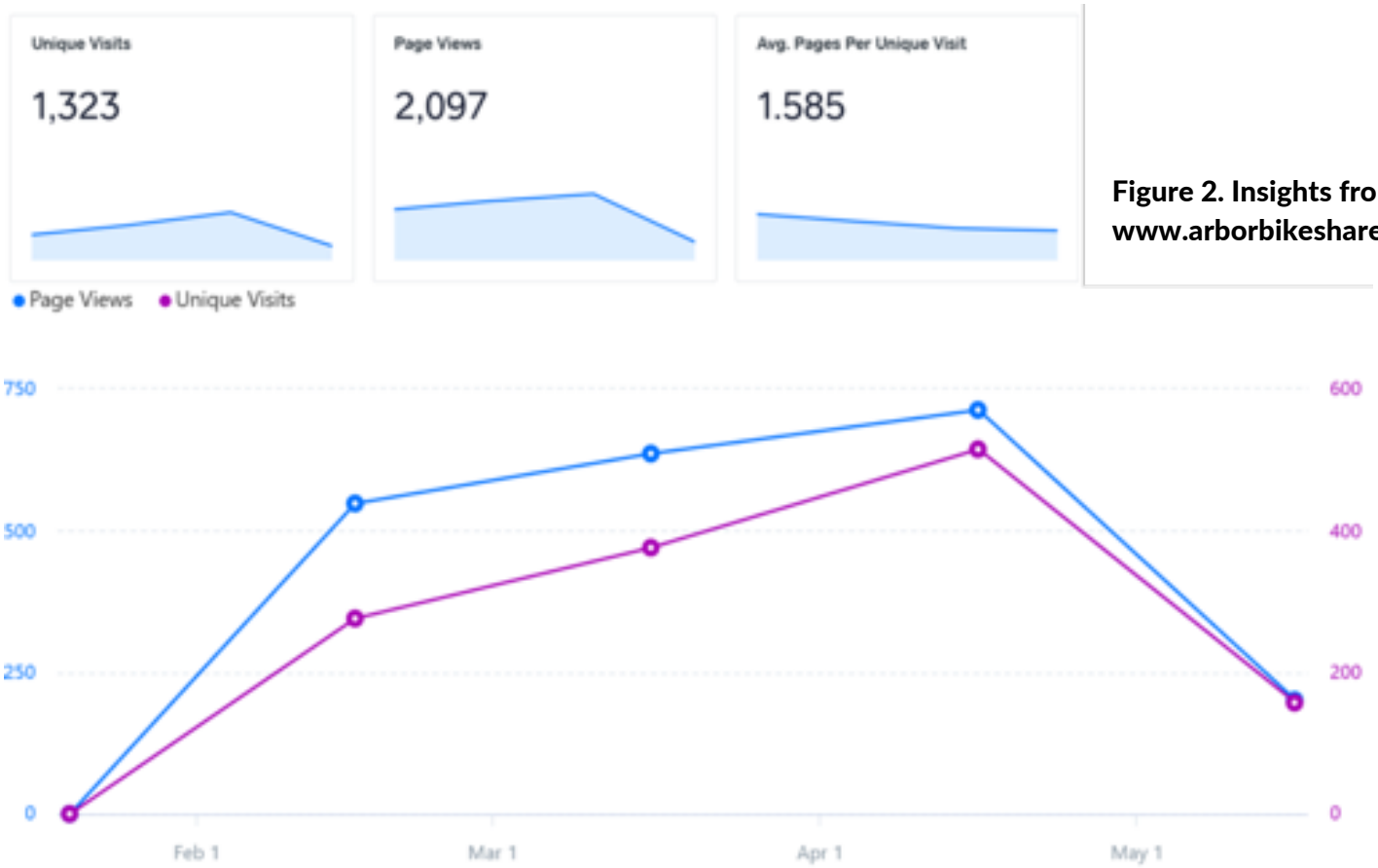


Figure 2. Insights from www.arborbikeshareplan.com (hosted by Weebly)

3. Survey and Wikimap

A community survey link and interactive map were available to the public for feedback from end of February 2019 to early May 2019. 135 data points have been collected through the Wikimapby 40 contributors.

There were 47 survey responses collected during this period. A thirty-three (33) question survey that took roughly 5 to 10 minutes to complete was available on the bikeshare website (www.arborbikeshareplan.com). The survey was curated to direct users to specific questions based on previous answers.

Both the survey and Wikimap were promoted via several avenues including social media outlets, government entities, and local businesses. The survey was designed to evaluate the community's overall mindset towards active transportation (specifically bikeshare and e-scooters) and to gather data on factors to consider for the expansion of a bikeshare system in Ann Arbor and surrounding areas. Though the survey response was very low compared to the population size of the area, a summary of responses received were analyzed below.

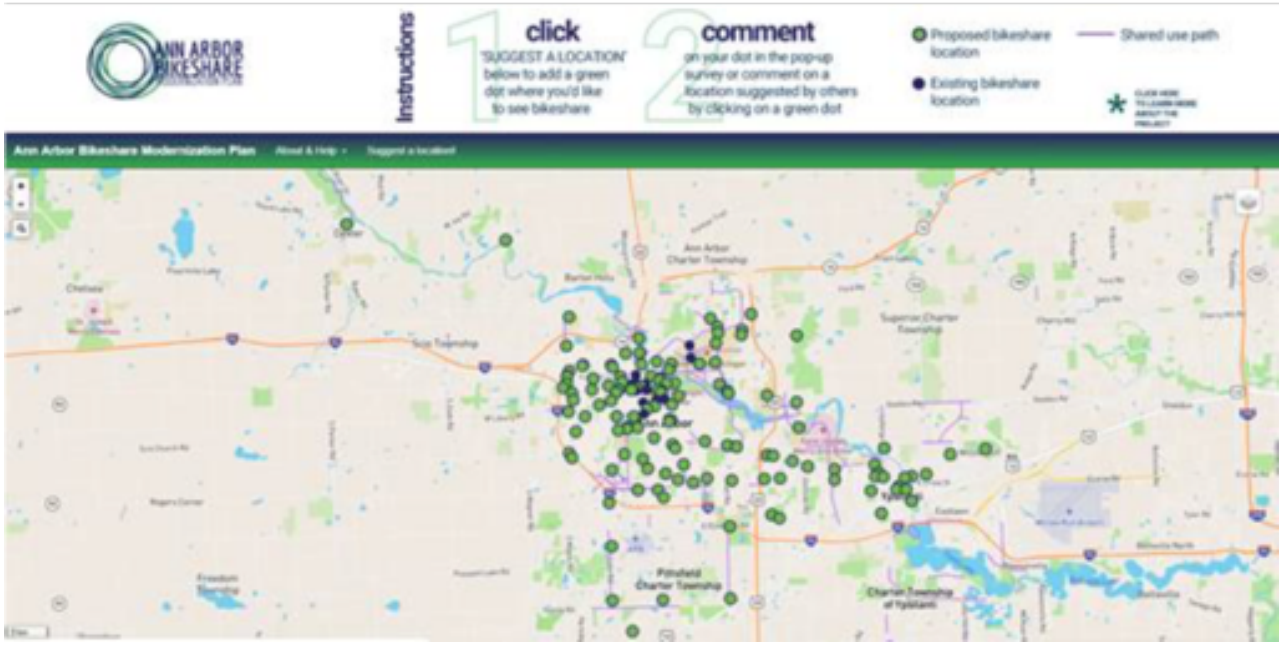


Figure 3. Completed Wikimap Suggestions for State Locations

Both the survey and Wikimap were promoted via several avenues including social media outlets, government entities, and local businesses. The survey was designed to evaluate the community's overall mindset towards active transportation (specifically bikeshare and e-scooters) and to gather data on factors to consider for the expansion of a bikeshare system in Ann Arbor and surrounding areas. Though the survey response was very low compared to the population size of the area, a summary of responses received were analyzed below.

Bikeshare

A majority of responders (60.5 percent) stated they did not use bikeshare or e-scooters in Ann Arbor. Those that have used either mode primarily used the e-scooters (32.6 percent) with roughly 19 percent stating they've utilized bikeshare in Ann Arbor. Nearly 37 percent of the respondents stated they had not heard of ArborBike Bikeshare prior to the project website, public meeting, or survey; however, 63.2 percent were familiar with the system. When asked how respondents feel about having a bikeshare system in Ann

Arbor, 92 percent believe a bikeshare system is a good idea for the community and only 8 percent felt unsure. Roughly 78 percent of respondents stated they would consider using a bikeshare system in Ann Arbor to get to work, school, meetings or other destinations.

Additionally, they would consider using bikeshare for fun with friends/family (61.1 percent), to connect to transit (44.4 percent), to exercise (38.9 percent), and to simply try biking (5.6 percent).

From the respondents that specifically stated they've utilized ArborBike, 55.6 percent of those individuals were riding a few times a year with the other respondents (22.2 percent) citing less than one time per year, and an equal percentage (11.1 percent) riding a few trips per month or less than one trip per week. Nearly half of these survey participants (44.4 percent) stated their ArborBike use replaced a trip they would have walked if bikeshare had not existed, with the other half collectively stated bikeshare replaced a personal bike or car trip.

Image 3. Citizen completing survey during community event in March 2019

Most of the survey participants cited that the reason they were not as likely to use bikeshare is:

87.5 %	There are no bikes located where they want them
25 %	There are not enough bike lanes or trails
25 %	They prefer to ride a personal bike or scooter
25 %	The bikeshare system being only offered seasonally

Scootershare

Almost 36 percent of respondents heard about e-scooters from seeing them in the community. Almost 29 percent heard about e-scooters from the news through TV coverage or an article. The remaining respondents heard about e-scooters because of someone riding an e-scooter (21.4 percent) or from social media (14.3 percent). Compared to bikeshare the usage of e-scooters among respondents was higher, 35.7 percent of respondents used e-scooters a few trips per month with a drop off to less than one trip per year (28.6 percent). Other respondents stated they used e-scooters at least one trip per week (14.3 percent), less than one trip per week (7.1 percent), or a few trips per year (14.3 percent).

When asked how respondents feel about having e-scooters in Ann Arbor, 58 percent believe e-scooters are good idea for the community, while 28 percent do not feel like e-scooters are good for the community and 14 percent feel unsure. 35.7 percent of participants that used e-scooters, sited the main reason for using the system was because they wanted to try it. 21.4 percent cited fun with friends and family for their reason for using e-scooters. Other reasons for using the e-scooters were to get to work or school (14.3 percent), for running errands/going to meetings/or to access other services (7.1 percent), or to go to restaurants or other entertainment (7.1 percent). Many respondents, 71.4 percent, stated they chose the e-scooter because of the electric assist option. Roughly 29 percent stated the electric assist was not the main reason.

Nearly half of these survey participants (42.9 percent) stated their e-scooter usage replaced a trip they would have walked if e-scooters had not existed. 28.6 percent of respondents stated the e-scooter replaced a trip they would have otherwise not taken. The other respondents stated the e-scooter trip replaced either a car trip (14.3 percent), a personal bike/scooter trip (7.1 percent), or a rideshare (taxi, Uber, Lyft, etc.) trip (7.1 percent).

This survey was in place when Bird was deployed in Ann Arbor; nearly 43 percent of respondents felt overall there were too few scooters available. Others felt the right amount was available (21.4 percent), too many overall were available (7.1 percent), and some simply did not know (28.6 percent).

50 percent of respondents' state the scooters were not located where they wanted them which is why they did not use the e-scooter, or it prevented them from using the e-scooters more frequently. 50 percent of respondents also marked "other" and the reasons were:

1. Safety and danger concerns
2. Weather
3. Road conditions

Other respondents believe there aren't enough bike lanes or trails (35.7 percent), it is too expensive (28.6 percent), they don't feel comfortable riding in the existing bike lanes or on trails (28.6 percent), or they prefer to ride their own bike or scooter (14.3 percent). Roughly 20 percent of respondents cited they have either a mobility or medical impairment that limits their ability to access the e-scooter system, they find the scooters difficult or uncomfortable to ride, or they do not see people that look like them riding them.

The three main factors respondents would change with an expanded e-scooter program in Ann Arbor are:

Higher quality scooters (20 percent), improved operator responsiveness (20 percent), and more frequent maintenance (20 percent) were other factors selected by respondents.

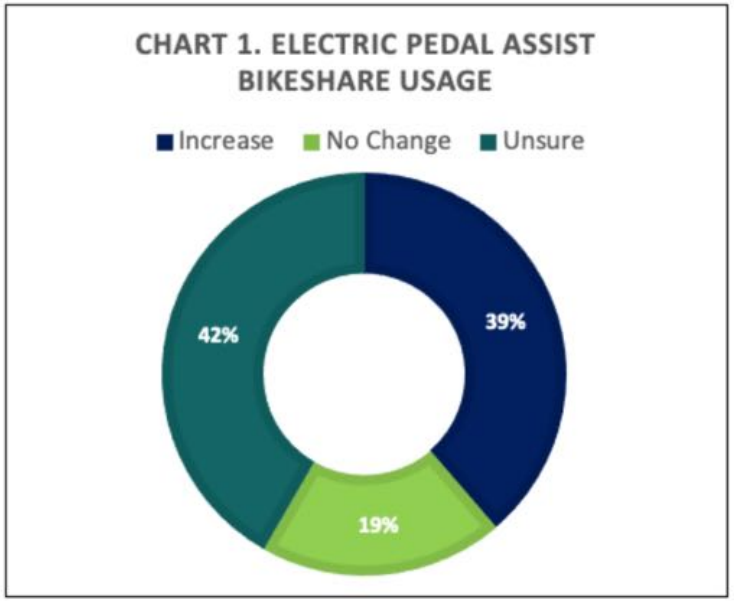
System Modernization Expansion

When evaluating the potential for a bikeshare and scootershare system modernization and expansion the following questions and responses were evaluated.

78 percent of respondents stated they prefer the standard pedal bike, while 70 percent preferred the electric assist bike and 45 percent showed preference for the electric scooter. A small percentage, less than 3 percent, was indifferent towards all three options.

In *Chart 1*, if Ann Arbor added electric assist bikes to the bikeshare system, 42 percent of respondents said they were unsure if they would utilize the system more frequently, while 39 percent stated they would use the system more if this enhancement was available. Less than 20 percent said this would not change their frequency of system use. This may indicate the 42 percent that are uncertain may need to be exposed to the electric assist bike experience to see whether or not they prefer it.

However, an overwhelming majority of respondents (75 percent) did indicate they would utilize the bikeshare system more frequently if it were expanded with modern bike technology that provided more flexibility with pick up or return locations. 17 percent were unsure if this would prompt them to utilize the system at all or more frequently and 8 percent stated a technology change would not be a factor in increased usage.



When looking at the barriers for using a bike or scooter share system, the 3 most popular reasons were 1) there are not bikes and scooters location where I want them (47.4 percent), 2) there are not enough bike lanes or trails (42.1 percent), and 3) I prefer to ride my own bike or scooter (42.1 percent). Other responses included: it is too expensive, I do not feel comfortable riding using existing bike infrastructure, I find the system to be too complicated, it has not been available, or there is a medical or mobility impairment. Additionally, respondents were able to add comments which mainly involved availability, service area, and safety concerns.

The changes participants would like to see with a modern and expanded shared mobility system was primarily more infrastructure to support riding bikes and scooters, such as bike lanes, shared roads, and trails (78 percent). Additional primary changes suggested were more bikes (50 percent) and more flexible parking options (50 percent). Survey participants also indicated electric assist bikes (36.1 percent), more flexible payment options (22.2 percent), and bikes accessible for people with mobility challenges (33.3 percent). Respondents were able to provide comments and suggestions regarding changes they would like to see in a system modernization and expansion, which included:

- *ArborBike needs pedal assist because every area of town is extremely hilly and is a barrier for people biking into town.*
- *More docks, the places I wanted to pick up bikes were never convenient with ArborBike.*
- *Bus routes to go to suburbs of Ann Arbor so the bikes can be used as transportation for commuters.*
- *Bike dock locations in the neighborhoods.*
- *I need bikes further out of the downtown center.*
- *More locations to leave bikes.*

92 percent of respondents self-identified with not having a mobility impairment or medical condition that would prevent them from access a bikeshare or scootershare program. However, from the 6 percent that identified as having an impairment or condition and the 3 percent that preferred not to identify with either way, 100 percent stated that an electric assist bicycle or adult tricycle would accommodate them.

Survey Participant Profile

The average age of the survey participant was 30-39 years of age (39 percent) and a large majority were not university students (83 percent). 33.4 percent of respondents were 40 years of age or older and 28 percent were between 18 and 29 years old. Fewer than 17 percent of respondents identified themselves as students enrolled in a university.

The survey participants stated being primarily Caucasian (80.6 percent), female (58.3 percent), and highly educated (52.8 percent). Also reported was a median household total income of $50,000 - $99,000 (33 percent) and $100,000 - $150,000 (25 percent) annually.
Most of the survey participants, 79 percent, reported using a car as their primary transportation mode while 74 percent walk, 58 percent bike, and 47 percent take transit. Additionally, 16 percent utilize a ride hailing service like Uber, Lyft, or a taxi for transportation.

Chart 2 outlines the percentage of survey participants with access to specific modes of transportation, technology, and payment methods. This evaluation identifies potential barriers to entry for the average survey participant. These barriers seem low for the participants as the responses below indicate high access to transportation options, technology applications, and payment methods generally utilized to access a shared mobility system.

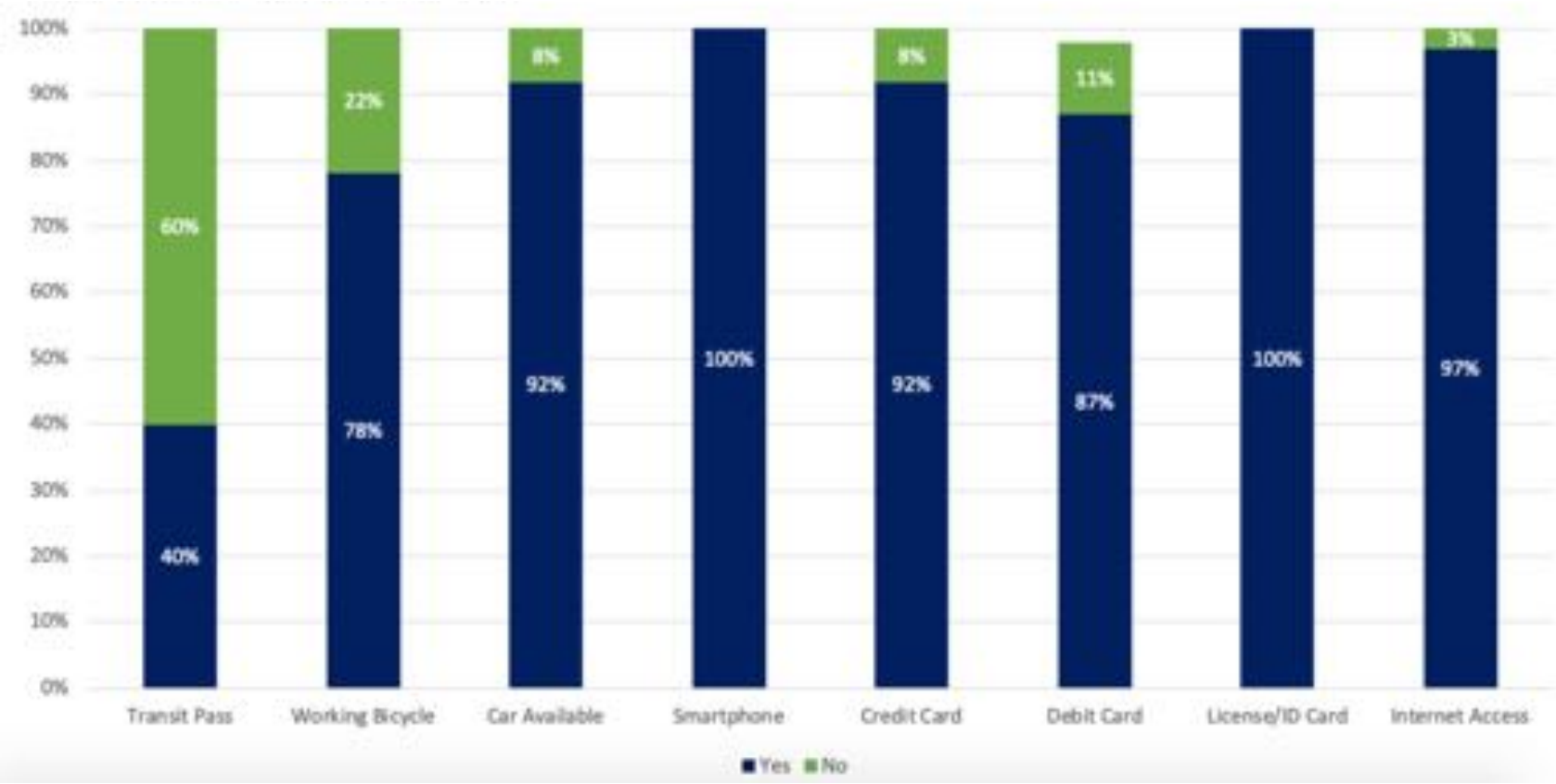


Chart 2. Survey Participant Information

Chapter 4:

Bikeshare Equipment and Technology

The three bikeshare technologies currently implemented in various United States and Canadian markets are 1) *dock-based*, 2) *smart bike*, and 3) *dockless* bikeshare options. The business models and customer pricing structures vary between technologies and communities.

The **dock-based programs** are self-serve, utilizing credit cards and radio frequency identification (RFID) methods for increased user accountability. The following is a description of the elements of a station-based bikeshare program:

- **Station**: collective grouping of the following elements:
- **Kiosk**: electronic terminal where all rental transactions are made.
- **Informational Panel:** a display that can be used to provide maps, information about the system, and space for advertising.
- **Dock**: mechanism that holds the bicycles. Each dock has a mechanized system that locks and releases the bicycles.
- **Platform**: structure that holds the kiosk, information panel, and docks. Most systems utilize wireless technology and solar power so that intrusion into the surface is not necessary. Most systems are modular, allowing various sizes and arrangements.
- **Bicycle**: bicycles are specifically designed for short trips and constructed of customized components to limit their appeal to theft and vandalism.
- **RFID Card:** Radio Frequency Identification technology, usually in the form of a card or fob, allows users to check out a bicycle directly from the dock and speeds up transactions. This also provides an added layer of security and accountability to each transaction.

The **smart bike systems** are those where user accountability and other features are moved onto the bicycles rather than at the stations and the system is accessed either via a QR code, RFID card and/or through the mobile app. The following is a description of the elements of a station-based bikeshare program:

- **Station or Hub**: collective grouping of the following elements (optional with smart bike systems due to geofencing).

- **Informational Panel:** a display that can be used to provide maps, information about the system, and space for advertising. This is optional and typically scaled down on a smart bike system.
- **Rack:** bicycle rack that allows the bicycle to lock to it securely.
- **Bicycle:** bicycles are specially designed with customized components and a built-in locking mechanism to allow it to lock to a bikeshare rack or regular bike rack.
- **RFID Card/QR Code:** Radio Frequency Identification technology or QR code on the bicycle that allows users to check out a bicycle directly from the hub. This also provides an added layer of security and accountability to each transaction.

Dock-based and smart bicycle options are currently the two most widespread technologies in the North American markets and have been utilized by many communities for years. Traditionally, bicycles can be locked at a kiosk or municipal bicycle rack without accruing overtime usage fees if kept under the designated time. A user's time starts over whenever the bike is undocked, which allows for multiple rides throughout the membership access period. The unlimited access to the system encourages system use, but the overtime usage fees discourage someone from taking the bike for extended periods of time which would reduce bicycle access for others.

Image 3. Dock-Based Technology

Source: https://www.motivateco.com/divvys-2016-expansion-adding-over-100-new-stations/

Image 4. Smart Bicycle Technology

Source: BCycle Dash bicycle provided by Bicycle, LLC

Memberships are categorized as either “casual” (short-term) which are 24-hour or 7-day memberships using a credit card at the kiosk or “annual”, which involves a 12-month radio frequency identification (RFID) membership key fob. Typically, casual memberships are $6 - $10 for the day, $20 - $30 for the week, or $75 - $150 for the year. Generally, overtime usage fees are $2 - $6 for additional 30-minute increments. New pricing structures, such as one-way trip fares, are being explored in various cities and by multiple bikeshare vendors. The single ride trips are typically aligned with transit fares and range from $1 - $3 depending on the market. In some markets, temporary holds may be placed on the users account ranging from a couple of dollars to nearly $75, but this varies and is typically determined by the operator.

Figure 4. Example of Payment Options for Bikeshare

Cities that have implemented dock-based systems are utilizing third generation bikeshare technology. These kiosks are typically solar powered with the option to be linked to the electrical grid, utilize wireless communication, and do not usually require site excavation of city sidewalks and plazas to install the system. With this technology, the stations can be relocated, expanded, or reduced in size according to developments and changes in the city’s urban fabric.

There are additional bikeshare technologies such as the ‘smart bike’, that shifts the user access and other features onto the bicycle rather than at the kiosk or dock; examples of this type of bikeshare system are HolySpokes in Charleston, SC; Greenride Bikes, in Burlington, VT; Blue Bikes in New Orleans, LA. Smart bicycles can lock to designated bicycle racks, existing municipal racks, or parking zones that does not even require rack infrastructure. The lock is engaged and disengaged by the user through the mobile app or on-board touchscreen and RFID reader. The smart bike can alleviate some of the demands for system rebalancing that are typical with a station-based bikeshare. Through the mobile app, users can locate and checkout the smart bikes around the community, and return them to any designated bike racks, stations, or parking hubs as pictured above once they have completed their trip.

Image 5. Smart Bike System Parking Zone

A smart bikecan be configured to be returned to purpose-built bikeshare station, existing municipal bike racks, designated parking zones with no locking infrastructure, or a combination of all. For users wishing to return a bike to a non-designated bike rack, they would simply need to secure the smart bike using the locking option. Once locked, the user's trip will close in the bikeshare management software.

Image 6. Geofencing Visual Example

If the user returns the bike to a non-designated bike rack that is within a geofenced return area, no additional charges would be applied. If, however, the user returns the bike to an area that is not designated as a return area or is outside the defined service area, the user may be charged an additional fee for returning the bike in a non-designated area. These fees are configurable by the bikeshare provider and can be customized based on local needs.

These systems are becoming more popular across the country and in varying size markets due to the added flexibility, a 6-year positive track record, and decreased need for large sidewalks and plazas due to a smaller bikeshare parking footprint.Furthermore, some smart bike companies such as JUMP, Gotcha Mobility, and VeoRide are promoting a 'hybrid' type bikeshare that can accommodate the electric pedal assist feature, smart bike locking options, or dockless technology.

Image 7. Unlocking Dockless Bicycle with QR Code

Dockless bikeshare entered U.S. markets most prominently in the summer of 2017 with many systems currently being less than 24 months old. The most prominent dockless bikeshare companies currently in the U.S. are JUMP, Lime, and VeoRide. These companies have secured millions in venture capital funding, which positioned them to expand to more markets in 2018. The dockless bikeshare business model is coming at no up-front capital cost to the municipalities. However, one bikeshare company headquartered in China, ofo, launched several US cities, has filed bankruptcy and no longer operates in any US market. This came after several unsuccessful attempts to change state policy in Florida and Oklahoma regarding preemption for local communities.

The dockless bikeshare 'boom' first overwhelmed China markets with millions of bicycles available to anyone to access via a mobile app or QR code tied to the specific bikeshare company branded on the bicycle, which unlocks a ring-lock located on the back wheel.

The typical consumer cost is $1 per 30-minute or one-hour ride. Jump, the first electric pedal assist dockless bikeshare system to hit U.S. streets, is currently charging consumers $2 per 30-minutes. Small deposits, ranging $5+ dollars, are typically made by the user through the specific dockless vendor's app and incentives in the form of free rides are provided for greater deposit amounts. Each dockless vendor has varying policies regarding the deposits, so users should review this information before accessing the system.

It is important to note that several dockless companies that started solely as dockless bikeshare providers have either eliminated or drastically decreased their bicycle fleets in communities across the country as they push the launch of scootershare programs instead. As examples, Spin and Lime had bicycles in more than 100 communities across the country and over a short span removed their bicycles from virtually all universities and communities, and now they have both rebranded themselves as solely a scooter company. This behavior is trending among multiple dockless companies in the United States.

The dockless bicycles are free roaming and can be parked in any location, which increases consumer convenience specifically when arriving at the desired destination. The larger quantity of bicycles desired for a dockless bikeshare system increases the access and probability that a dockless bicycle will be within a few yards or blocks when a user is searching to utilize bikeshare.

This dockless boom has not come without its challenges and community concerns, specifically regarding right of way, ADA accessibility, and unorganized bicycle placements. U.S. markets are working with dockless providers to pilot and phase-in dockless systems to mitigate some of those challenges up-front, fine-tune permitting requirements, and identify restrictions like specific parking zones to limit right of way concerns. Furthermore, dockless providers are increasing educational actions through the mobile app and outreach efforts to increase messaging to users regarding bicycle parking, safety, and appropriate system use.

See *Appendix A* for a quick review the risks and rewards of each bikeshare equipment and technology options.

Adaptive bicycles are configured and propelled differently than a typical 2-wheeled pedal-driven bicycle. Adaptive bicycles make cycling possible for many people because they resolve barriers to cycling presented by a typical 2-wheeled pedal-driven bicycle. Adaptive bicycles include a variety of forms to best suit the abilities and needs of its users, including additional wheels, seats, connections, and ways to propel. Tandem cycles, handcycles, tricycles, prone cycles, and electric pedal assist are all forms of adaptive bicycles.

Electric-assist ("e-assist") bicycles are another form of adaptive bicycles that enable the user to pedal like a traditional bike, but with electric assistance when needed. The user can turn on the electric assist while biking up hills, when carrying a heavy load, or to enable the user to bike. E-assist bicycles may also be appealing to aging populations or for those with mobility limitations. E-assist bicycles can extend the distance, and the height of the hills that someone can comfortably ride.

E-assist bicycles may be used for part or all of the bikeshare fleet. Birmingham, Alabama was the first city in the U.S. to launch a bikeshare system that includes a quarter or its fleet as e-assist bicycles in late 2015.

Image 8. Adaptive Biketown Bikeshare in Portland, OR (Source: Toole Design)

Communities across the country are trialing mixed fleet solutions and adaptive bicycle fleets, typically of 125 bicycles or less:

- Portland, OR (side by side, recumbent, trike, and hand cycles)
- Detroit, MI (side by side, cargo trike, recumbent, recumbent tandem, hand cycles, and front-loading trailer)
- College Park, MD (side by side, trike, and hand cycle)
- The Ohio State University (side by side, cargo, trike, hand cycle, and heavy duty)
- Carmel, IN (trike)

Chapter 5:

Case Studies

This section gives a brief history of the changing dynamics of bikeshare and micromobility industries in the United States over the past 10-years through a series of case studies that show how cities and public agencies have adapted their roles in delivering these programs. Traditional bikeshare programs are no longer the only model available to communities who wish to increase active transportation and expand mobility. These new, shared transportation programs, which include dockless bikes, e-bikes, and e-scooters, are collectively referred to as micromobility.

1. Traditional Programs

Micromobility has been around in many forms for at least four or five decades, but it is in the last 10-years that these technologies have advanced as a result of credit card, GPS, and other technology developments. The first modern bikeshare systems in the United States launched in 2010 in Denver, Minneapolis, and Washington D.C. From that time, the number of bikeshare systems[24]has steadily increased year-by-year, from four systems in 2010 to 55 systems in 2016.[25]

Many of these early programs were funded through a mix of federal, state, and local funding, sponsorship or advertising partnerships, and user revenues. The dock-based technology used in these programs had a relatively high cost for each station and given the constraints of available funding and the limited flexibility these systems provided to users that had to park at a station, these programs were generally limited in the scale of their deployment.

In some cases, cities and public agencies served as the owners of these programs and managed a contract to oversee a third-party operator, similar to many other transit services. Other programs were operated by specifically formed non-profits that oversaw and operated their programs with city and agencies generally being partners serving to assist with obtaining grants, facilitating approvals and permitting, and serving as technical advisors. In some cases, such as in New York and Miami, these systems were privately owned and funded by large corporate sponsorships with a revenue-sharing arrangement with these cities in exchange for the exclusive use of the public right-of-way.

San Antonio, TX

San Antonio was one of the first cities in the United States to embrace a station-based bikeshare program. The BCycle bikeshare program grew from 14 stations and 140 bikes in 2011 to 61 stations and 535 bikes in 2018. In seven years, the program has served over 500,000 trips and reached over 100,000 users.[26]The program is operated by San Antonio Bikeshare (SABS) a non-profit organization that was formed specifically to manage the bikeshare program and was chosen through a competitive bidding process.

[24]Defined as publicly available systems with at least 10 stations and 100 bikes
[25]Bike Share in the US: 2010-2016. National Association of Community Transportation Officials (NACTO). https://nacto.org/bike-share-statistics-2016/
[26]https://www.sanantoniobikeshare.org/impact-and-reports.html

A contract was signed in June 2010 between SABS and the City of San Antonio's Office of Sustainability. Equipment, including the bikes and stations, is purchased through a variety of funding sources including federal, state, and local grants and then held "in trust" by the non-profit. Operating funds come from a combination of user revenues, sponsorships, and local public subsidies.

Image 9. San Antonio Bikeshare System

In the mid-2010's, bikeshare technology advanced to include "smart bikes" which were the first dockless bikeshare options. These systems moved the check-out and locking technologies to the bike allowing more flexibility for users to park the bikes outside of identified hub locations and bringing down the up-front unit price of each bike. These systems were deployed with similar governance structures and funding models, but the added flexibility allowed the first testing of "dockless" systems with bikes that could be parked anywhere in the system. To limit operating costs, most providers established pricing models to "encourage" users to park in identified hub locations and charged a "convenience fee" for those parking outside these areas.

When SABS started, dock-based systems were the only technology option.Now that more technology and ownership options have become available, San Antonio is exploring whether, and how, to adapt. In the long-term, SABS plans to convert to a dockless system of e-assist bikes but will transition for a number of years using a hybrid of station-based smart-dock equipment and new dockless e-assist equipment purchases, which will allow the system to grow its coverage area with minimal additional operating burden. Further, in Summer, 2018, new mobility options arrived in San Antonio. Several companies placed e-scooters on the streets without permits and although they were allowed to keep operating, the City of San Antonio decided to implement dockless mobility regulations and launch a pilot program to evaluate the new technology. In October 2018, San Antonio City Council approved a six-month pilot program that established a permitting process and clarified the rules around dockless vehicle operations.[27] The pilot permit is available for dockless bikes, e-assist bikes, and e-scooters. San Antonio BCycle and the dockless programs are now operating alongside each other.

[27]City of San Antonio Council Meeting Agenda for meeting conducted on October 11, 2018. File accessed on October 22, 2018 from: https://sanantonio.legistar.com/DepartmentDetail.aspx?ID=22661&GUID=999BA422-A775-4DE3-8ABD-1B4851E69C96

LA Metro, CA

In California during this period of time the regionalization of a number of programs and transit integration on some level became a larger focus of many programs. LA's Metropolitan Transportation Authority administers a bikeshare program in partnership with Bicycle Transit Systems, a third-party operator. The program launched in 2016 and is expanding across the region. Participating cities enter into a Memorandum of Understanding (MOU) with LA Metro to bring bikeshare to their communities. The BCycle program provides services in downtown LA, Port of LA, and Venice Beach and is currently expanding both the central and Venice service areas, plus adding a new system in North Hollywood. The program has more than 1,400 bikes and 140 stations available to users, with new bikes and stations being added through the end of 2019 via the expansions.

One of the largest hurdles for LA Metro has been the introduction of dockless technology – both as a concept and as competition from other companies. The Venice Beach system launched in 2017 with the traditional station-based system that already existed in downtown LA. By the time expansion planning in that area began in late 2017, the system operator had added smart bikes to their toolkit and LA Metro strategized how to use this to their advantage. In early 2019, the Venice Beach system was converted from station-based to smart-bike stations and the system area expanded with new sites in the neighboring communities.

The original downtown LA system and the expansion areas around it are still station-based. At this time, the systems are separated from each other by distance and significant barriers (I.e. Los Angeles River and multiple freeways), but as they both expand, the possibility to connect is likely. LA Metro considers this one of many factors as they plan future expansions. Early ideas to accommodate this include "hybrid corridors," where both smart dock and smart bike stations will be placed adjacent to each other along key streets where the systems border each other.

LA Metro recently introduced a pilot program to test the use of electric-assist bikes. It is too early to determine the results of the pilot; however, initial trends indicate that the electric-assist bikes are more popular than the standard bikes.

Fairfax, VA

Finally, the first traditional bikeshare system in the US, Capital Bikeshare in Washington D.C. has also evolved its technology as it expands into the region. Fairfax County, Virginia launched Capital Bikeshare in 2016 with a small dock-based system in Reston and Tysons Corner. With further expansions planned in nearby areas such as Merrifield and Falls Church (VA), and the advent of micromobility options in the region, several jurisdictions within Fairfax began a bikeshare feasibility study in 2018 to explore future

options along the Route 123 corridor.[28]This bikeshare feasibility study was a collaboration between the City of Fairfax, Town of Vienna, Fairfax County, and George Mason University. The study considered expanding Capital Bikeshare as well as introducing micromobility options available in nearby jurisdictions such as dockless bikes, e-bikes, and e-scooters.

Image 10. Capital Bikeshare and E-scooters (Source: The Columbian)

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. The study recommends expanding the Capital Bikeshare network first to implement dockless mobility in the future. The study included Capital Bikeshare station recommendations in Vienna, Fairfax, and Mason—focusing on the connections to Metrorail and the existing bikeshare system north of downtown Vienna. The feasibility study recommended a small 30-station Capital Bikeshare expansion to be installed over three years, pending funding, local priorities, and other metrics.

For the future dockless system, the study recommended beginning with an e-bike and e-scooter pilot at George Mason University connecting to downtown Fairfax City. This system is intended to be a satellite system serving the university, Fairfax City, Metrorail, and other Fairfax County destinations. This approach is similar to that taken in other parts of the region. Although there was interest in dockless bikes and e-scooters, particularly on the George Mason University campus, local decision makers preferred a gradual approach which focused on expanding Capital Bikeshare first, leveraging existing investment and grant funding opportunities (such as planned stations within the study area at Metrorail stations). The recommended Capital Bikeshare expansion, as envisioned, would be congruent with the existing Fairfax County and West Falls Church system. However, the level of system connectivity would depend on the phasing of implementation.

2. Modern Programs

Dockless bikeshare arrived in the United States in 2017 and expanded quickly to now be in many cities. Some of the early adopters were Seattle, WA, Dallas, TX, and South Bend, IN and these cities set up different regulatory frameworks to manage the operation of

[28]https://www.fairfaxva.gov/government/public-works/transportation-division/cycling-in-the-city/bikeshare-study

of these programs that provided valuable experience to other cities. The dockless industry has seen significant technology changes since its beginning with the introduction of e-assist bikes and e-scooters.

The introduction of e-scooters is more recent and has had a big impact on micromobility. These devices are easy to check out and to operate, have fewer barriers to entry than bicycling, appeal to a broader demographic, and are compact so fit more neatly into the urban environment alleviating some of the urban clutter created by dockless bikes. The success of e-scooters has also changed the focus of the industry. Although there are companies that still offer a full range of dockless bikes, e-assist bikes, and e-scooters, more companies are now either focused on e-scooters or provide only e-scooters.

Seattle, WA

Seattle's Pronto Cycle Share program was launched in 2014 with 500 bikes and 50 stations. The Pronto program was initially owned and operated by a non-profit, Puget Sound Bikeshare (PSBS), and used a smart dock system. Prior to launching the system, PSBS secured critical regional support from local municipalities and transit agencies to win a $1 million CMAQ grant, which went towards the program's initial capital costs. The program's remaining capital and operational costs were supported by a five-year private sponsorship agreement with Alaskan Airlines for $2.5 million, and an additional $75,000 in grant dollars from the Washington State Department of Transportation (WSDOT) and private organizations.[29]While regional support was essential for garnering support and funding for Pronto's launch, the system unfortunately never expanded outside of downtown Seattle. Due to variety of factors, including low ridership and limited service area, Pronto become insolvent within two years of its launch and the City of Seattle purchased the program for $1.4 million in March 2016 under threat of the program's closure.[30]

The city purchased the program with the intention of overhauling and expanding the system and introducing e-assist bikes to boost the program's usability and ridership. In December 2016, the city announced its plans to revamp Pronto by investing in 1,200 electric bikes and 100 new docking systems. The city's plans were cancelled by January 2017 when the U.S. Department of Transportation did not award the city with a $10 million TIGER grant to support Pronto's revamp. Following this news, Seattle's then-Mayor cancelled the Pronto program all-together, and redirected the budgeted $3 million match dollars towards pedestrian and bicycle facility projects. Pronto's final day of operation was on March 31, 2017.[31]

Following the end of the Pronto program the city was faced with a dilemma of what to do with the remaining bikes and stations.

[28]https://www.fairfaxva.gov/government/public-works/transportation-division/cycling-in-the-city/bikeshare-study
[29]http://www.seattle.gov/dpd/AppDocs/GroupMeetings/DCPresentation1Puget-Sound-Bike-Share-AgendaID4341.pdf
[30]https://www.seattletimes.com/seattle-news/transportation/seattle-pronto-bike-share-shutting-down-friday/
[31]http://murray.seattle.gov/city-announces-3-million-bicycle-pedestrian-improvements/

As the program's equipment was purchased by PSBS using CMAQ funds, the city was liable for partial repayment following the closure of the program prior to the end of the equipment's useful life.[32] As of early 2019, the city has the equipment in storage and is in the process of settling the repayment grant dollars. The city did explore the possibility of selling the equipment in 2017 to another smart dock bikeshare program; however, the equipment remained in storage while the city settled the grant repayment process.[33]

Image 11. Seattle Bikeshare Systems 2019 (Source: The Stranger)

There are numerous reasons why the Pronto program was not successful including a limited service area, steep topography, an inability to place docks adjacent to light rail stations, frequent rain, and the region's helmet requirement which all equated to low ridership and revenue figures. Pronto's low ridership figures can be compared to the ridership numbers of Washington D.C.'s Capitol Bikeshare system. Seattle and Washington D.C. have similar population sizes and densities, and both systems used smart docks. Pronto's first year of operation only saw approximately 140,000 trips, while Capitol Bikeshare saw over 7 times as many trips (over 1 million), with only about twice as many stations and bikes (116 stations and 1,100 bikes). In combination with low ridership, limited sponsorships dollars during Pronto's first two years of operation required PSBS to use future, secured sponsorships dollars for pay for immediate program costs. Over the first two years, PSBS was not able to secure enough additional sponsorship funds or ridership-based revenue to recover these spent future sponsorship dollars.[34]

After the closure of Pronto, Seattle became one of the first cities in the country to embrace dockless bikeshare. In July of 2017, the city established a multi-vendor permit program that allowed an open market approach for vendors to bring dockless bikes and e-assist bikes to the city (note: e-scooters are not allowed). The permits establish minimum and maximum bike numbers, service level requirements, and other requirements. At the end of the 12-month pilot the City revised its permit terms for the 2018 - 2019 cycle. Under the new terms only Lime reapplied and two new operators, Jump/Uber and Lyft, have applied for a permit. Lime offers pedal-only and e-assist bikes, and Jump/Uber exclusively offers e-assist bikes. As of April 2019, Lyft has not yet begun operations in Seattle.[35]

[32]https://wisconsindot.gov/Documents/doing-bus/local-gov/astnce-pgms/aid/cmaq-guide.pdf
[33]https://www.seattletimes.com/seattle-news/transportation/seattle-pronto-bike-share-shutting-down-friday/
[34]https://www.citylab.com/transportation/2017/01/seattle-bike-share-pronto-goes-under/513575/
[35]https://www.seattle.gov/transportation/projects-and-programs/programs/bike-program/bike-share

Spokane, WA

In the summer of 2018, the City of Spokane began planning for a dockless bikeshare pilot program to launch in the fall. There was strong interest in a program from the City's leadership and, with Gonzaga University and an active urban core, demand for bikeshare. In September, the City launched a three-month pilot program with Lime as the exclusive vendor.

At this point, there were several catalytic changes within micromobility that were happening parallel to the launch of the pilot program. E-bikes and scooters started entering the market with companies such as Jump, Lime, and Bird leading the technology. Further, big players in the transportation industry such as Uber and Lyft bought out existing bikeshare vendors and operators. With these acquisitions and the realization that e-bikes and scooters are popular transportation options, vendors began to include e-bikes and scooters as available vehicle types within their fleets.

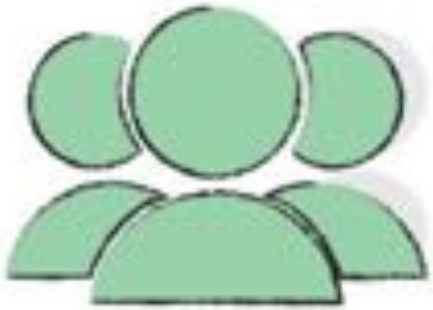
Image 12. Spokane Lime System(Source: The Spokesman-Review)

The intention of Spokane's bikeshare was a dockless bikeshare program; however, Lime launched the program with bikes, e-assist bikes, and e-scooters. This was welcomed by the City, which decided to let the market guide the program. However, the program ended up being primarily e-scooters, rather than bikes and e-bikes. On average there were 425 scooters, 72 e-bikes, and 53 bikes available each day.[36] E-bikes and scooters, as well as standard bikes, have proved to be very effective transportation options for people. In cities across the US, programs are experiencing high ridership levels. In Spokane from September 4, 2018 to November 16, 2018, there were 135,872 trips taken including 108,360 e-scooter trips, 18,831 e-assist bike trips, and 8,681 regular bike trips [37]. While the number of trips taken by e-scooters overshadows those taken by bikes and e-assist bikes, the fleet size of each vehicle type mirrors the number of trips taken. A common metric to normalize the data and evaluate utilization is the number of trips per vehicle per day. The average utilization for the program was 3.1 trips per vehicle per day (all vehicle types combined). This represented: 3.9 trips per vehicle per day for e-scooters, 2.9 e-assist bikes, and 2.4 for regular bikes. E-scooters did have the highest trips per vehicle per day; however, e-scooter fleet was approximately seven times larger than bikes or e-assist bikes.

[36]Spokane Shared Mobility Study Final Recommendations. 2019.
[37]Spokane Shared Mobility Study Final Recommendations. 2019.

Cities with dockless micromobility have transitioned a portion or the entire fleet to e-scooters. In fact, by the end of 2018, Seattle was the only city in the US that has a dockless system exclusively with bikes and e-bikes[38]. It is unknown exactly why micromobility companies have transitioned their whole fleets to e-scooters, but it is presumed that the profit margins are effectively higher for e-scooters. In this new, ever-changing era of micromobility there are methods that cities can employ to guide the programs being implemented in their communities. For example, micromobility policies, permits, or procurement and effective and proactive regulations can ensure desired fleet types and sizes, among other details.

[38]https://nacto.org/shared-micromobility-2018/



Chapter 6:

Bikeshare Demand Analysis

1. Ann Arbor and Ypsilanti Demand Analysis

A demand analysis was performed within the Ann Arbor region using data obtained from the U.S. Census, the Bureau of Labor Statistics, and TheRide. The demand analysis identified areas with the highest potential demand for bikeshare using a heat mapping methodology that allocates "points" to where people live, work, shop, play, and take transit. The heat mapping methodology was adapted from Rixey's bikeshare station-level forecasting model, published in 2013.[39] The results of the heat map will inform the potential bikeshare service area expansion opportunities and other micromobility planning decisions.

Experience from existing bikeshare programs in the U.S. suggests that a mix and density of population, jobs, and other activity maximizes program participation. The following indicators were selected to measure potential demand in the Ann Arbor area:

- **Employment density:** Employment centers were identified from the U.S. Census Bureau's 2015 Longitudinal Employer Household Dynamics (LEHD) – Area Profile Analysis. Employment density is an indicator for commuting and employment-based trips (e.g., traveling to or from work, running errands, or attending meetings during the day). Additionally, from LEHD, Accommodations and Food Service Jobs ("Service Jobs") were measured to identify commercial centers and hotels based on their employment. Service jobs are an indicator of where people work and visit.
- **Population density:** Population density was determined using the number of residents per square mile measured for 2010 U.S. Census block groups in Washtenaw County. Residents may want to use micromobility programs for commuting purposes, to link to transit, or to use bicycles for recreation, personal business, or to access retail and entertainment venues. Some of the densest neighborhoods are in the areas adjacent to the University of Michigan's campuses, including in North Burns Park, Lower Burn Park, and Northside in Ann Arbor and near Midtown in Ypsilanti.
- **Attractions:** Numerous destinations may act as micromobility trip generators. This data is often the least available and the least comprehensive. This analysis used destinations typically included in micromobility demand analyses as well as destinations provided by the study steering committee. Attractions typically included in this type of analysis include tourist attractions, retail centers, parks, community centers, libraries, and social services.
- **Colleges and universities:** Students (as well as staff and faculty) at universities and colleges in the Ann Arbor area are a large potential market for micromobility programs. The colleges and universities included in the demand analysis were University of Michigan, Washtenaw Community College, and Eastern Michigan University.
- **Bicycle network:** The presence of on- or off-street bicycling facilities may influence a person's decision to use the program. A well-connected network of bicycling facilities can encourage bikeshare trips and attract the "interested but concerned" rider that prefers separation from moving traffic. The location of major off-street shared use paths and trails was provided by the City of Ann Arbor and the Washtenaw County Parks and Recreation Commission.

[39]https://nacto.org/wp-content/uploads/2015/07/2012_Rixey_Station-Level-Forecasting-of-Bike-Sharing-Ridership.pdf

The GIS analysis included the above indicators, weighted based on their perceived impact on micromobility demand, as shown below. The demand map was created by aggregating the demographic, employment, transportation, and proximity indicators and applying their respective weightings. The resulting demand map is shown in *Figure 5*.

- **Proximity to employment (10% Service jobs and 15% all jobs):** Locations within ¼-mile of jobs
- **Population density (25%):** Block groups with the highest population density
- **Proximity to attractions (20%):** Locations within ¼-mile of attractions
- **Proximity to colleges and universities (20%):** Locations within ¼-mile of colleges and universities
- **Proximity to transit (5%):** Locations within ¼-mile of transit stops
- **Proximity to bicycle infrastructure (5%):** Locations within ¼-mile of major shared use paths and trails.

Given the density of destinations and the home of two universities, there is high potential demand for micromobility in the Ann Arbor region. Demand is highest near university and college campuses in both Ann Arbor and Ypsilanti. There are also a number of small areas with high demand for micromobility in commercial areas throughout the region that have high densities of population, attractions, jobs, and transit stops or shared use paths.

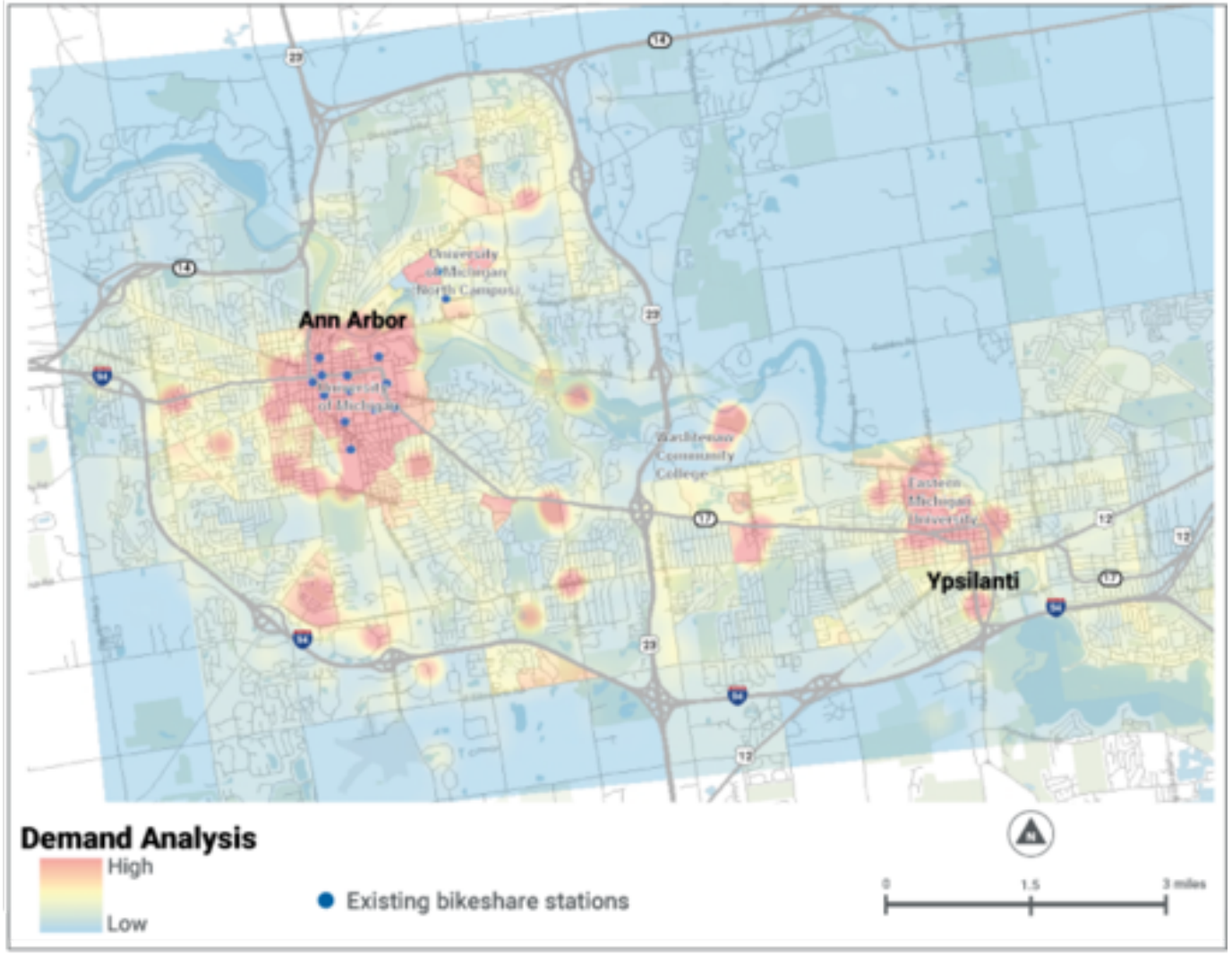


Figure 5. Bikeshare Demand for Ann Arbor and Ypsilanti

2. Ann Arbor and Ypsilanti Equity Analysis

A truly effective bikeshare system that provides a high quality of service requires high station and bicycle densities across all neighborhoods to ensure convenience and reliability.[40]To date, bikeshare stations and bicycles in U.S. cities are disproportionately located in higher-income, predominantly white neighborhoods and their members tend to have a higher representation of wealthier, Caucasian, and higher-educated populations than the cities these programs serve.[41]Low-income neighborhoods consistently have the sparsest density of bikeshare stations and bikes, relegating bikeshare to an inconvenient transportation option for people living in these areas.[42]Further, disparate investment in bicycling infrastructure and programs in low-income areas exacerbate low bikeshare ridership and restrict the pool of riders to only the most confident bicyclists.[43]

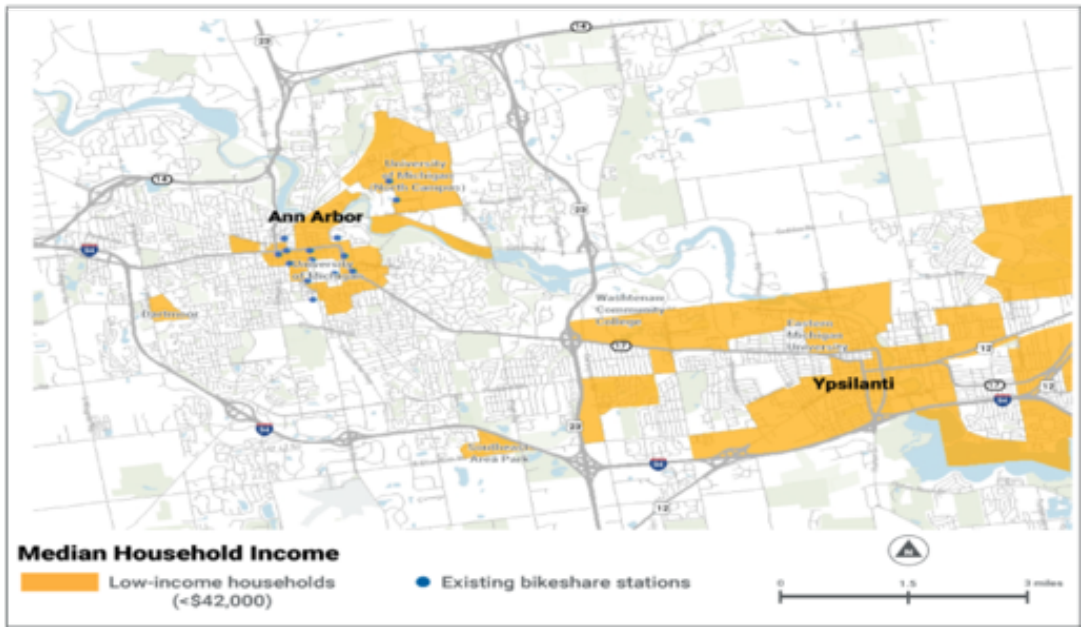


Figure 6. Households in Ann Arbor and Ypsilanti with incomes lower than the median household income

Bikeshare can serve as an important connector to jobs, services, and transit, especially for populations who are low-income and/or people of color. Dockless bikeshare specifically, can help overcome many of the traditional system limitations of unequal bikeshare station distribution, program access, and entry cost to help encourage higher participation from low-income and traditionally underserved communities.

The project team used data from the American Community Survey's five-year estimates (2012-2017) to determine where traditionally underserved communities are distributed throughout the Ann Arbor region. Figure 6 shows the distribution of low-income households throughout the region.

[40]High station density requires approximately 28 stations per square mile to ensure a five-minute walk between stations. For more information, see: National Association of City Transportation Officials (NACTO). 2015. "Walkable Station Spacing is Key to Successful, Equitable Bike Share." https://nacto.org/wp-content/uploads/2015/09/NACTO_Walkable-Station-Spacing-Is-Key-For-Bike-Share_Sc.pdf.
[41]Ursaki, J. 2015. "Quantifying the Equity of Bikeshare in US Cities." University of Vermont Transportation Research Center. http://chi.streetsblog.org/wp-content/uploads/sites/4/2016/03/Bikeshare_TRB_submission.pdf.
[42]NACTO. 2015, p.1.
[43]Geller, R. 2009. "Four Types of Cyclists." https://nacto.org/wp-content/uploads/2015/09/NACTO_Walkable-Station-Spacing-Is -Key-For-Bike-Share_Sc.pdf.

Low-income households were identified by dividing Census block groups into quintiles based on median household income and selecting the block groups in the bottom quintile. The median household income for households in these block groups are less than$42,000. The locations with higher concentrations of low-income households are generally near the university and college campuses and throughout Ypsilanti and near Dartmoor and Southeast Area Park.

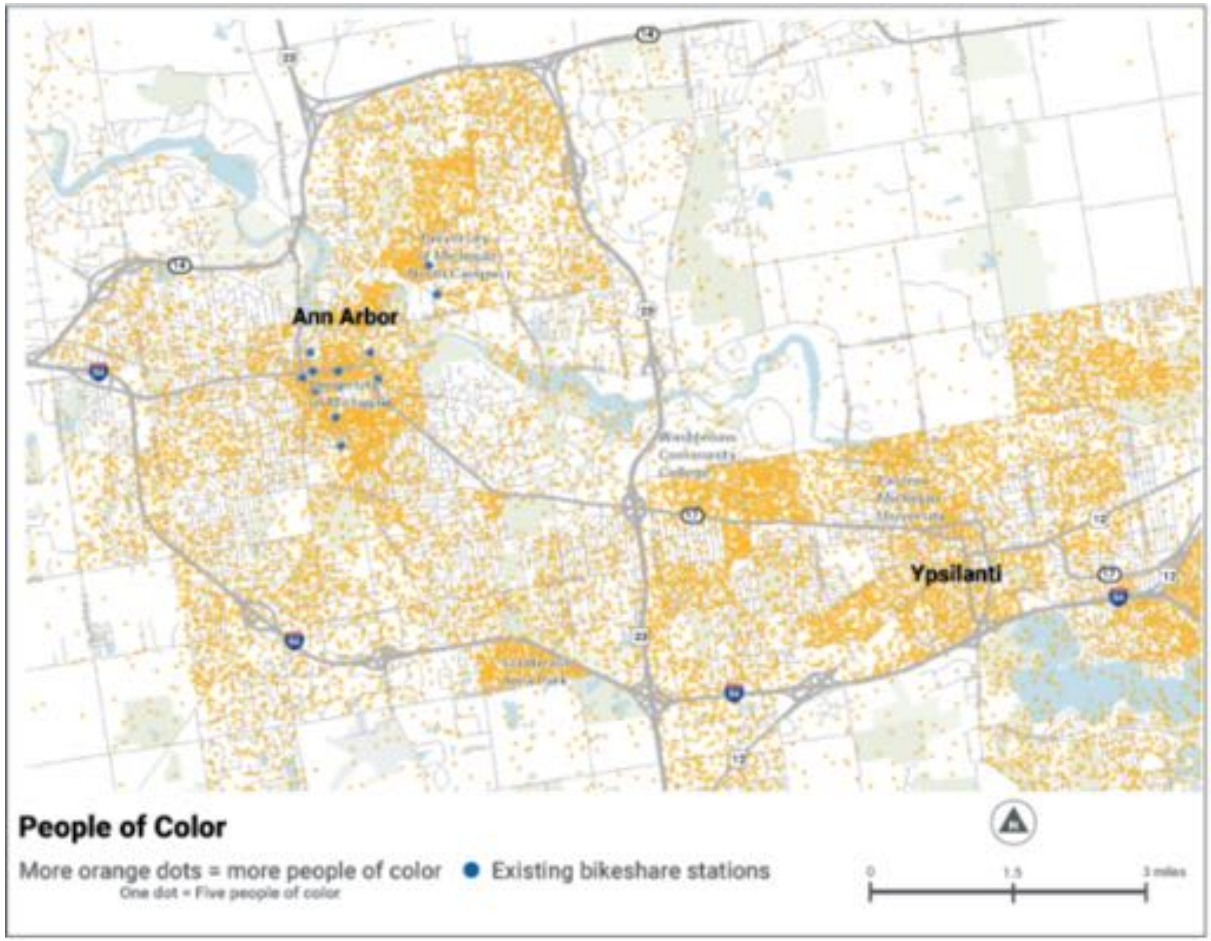


Figure 7. Concentrations of people of color in Ann Arbor and Ypsilanti

Chapter 7:

Bikeshare Gaps and Opportunities Analysis

With the recent technology and management developments in bikeshare and ArborBike's current transition to new management, it is an opportune time to evaluate the current system, identify gaps, and build off its successes.

1. Service Area

The current system's service area is focused around downtown, the central neighborhoods, and the University of Michigan. Using a quarter mile radius from the existing stations, the current service area is approximately 1.7 miles.

The service area does not reach many of community's neighborhoods or destinations outside of the City's downtown area and University of Michigan's campus. As shown in the demand analysis, there are key areas within Ann Arbor with high demand for bikeshare. Those areas include the Burns Park neighborhoods, Old West Side, Northside, and the University of Michigan Medical Center. Further, there are several commercial centers with high demand including Cranbrook Village and Westgate Shopping Center. An expansion into where people are living, shopping, running errands, and going for entertainment would expand the types of people who would use the program. With the system focused primarily around the university, it limits the potential groups of people who would use the system.

The current system does not support the region; however, there is interest in expanding to Ypsilanti. With Eastern Michigan University's presence as an anchor in Ypsilanti, the existing regional transit and active transportations connections, and general community interest in implementing bikeshare, there is high demand and an opportunity to expand the service area regionally. Ann Arbor and Ypsilanti are approximately 7 miles apart. There are destinations in between; however, there isn't a strong hub of destinations or supportive on-street bike facilities. However, the Border-to-Border Trail and the Gallup Park Pathway provide opportunities to connect people between the two cities for a portion of the distance.

2. System Density

Currently there are 13 stations and 125 bikes within 1.7 miles. Using per station metrics, there are approximately 8 stations per square mile and there's an average distance of a quarter mile, or a 5-minute walk, between stations. The stations are located at an average density and the typical station density minimum, which is a quarter mile or 5-minute walk. There are some stations that are closer in proximity than that, but there are also some that are upwards of a half mile or a 10-minute walk.

Using per bike metrics, there are approximately 74 bikes per square mile, which is a high number of bikes per square mile. Looking at the two different metrics, stations per square mile vs. bikes per square mile, you can see the value of having a dockless or more

flexible system to gain greater density or coverage. With smart dock systems there is less flexibility and they require larger stations. In Ann Arbor the average station is around 9 bikes, whereas if it was a smart bike system the stations could be half the size and there could be double the amount of stations and density or coverage. With a dockless system, bikes could travel throughout the city where the demand is.

The service area and bike density are comparable to a university-based system, such as the University of Virginia smart bike system, which has 21 stations and 120 bikes within 1.5 miles.

3. Ridership

From ArborBike's launch in 2014 to when it put its operations on hold in 2017, the program experienced an increase and then a decline in ridership. In 2016 ArborBike had 17,000 trips, but then decreased to 13,000 trips in 2017. It is unknown why this happened, but there have been mentions of operation failures in 2017 causing the system to operate at a level lower than its potential.

The most popular stations, located on the University of Michigan's campus, the S. University and E. University station saw over seven checkouts per day, and the State and N. University station saw five checkouts per day. The lowest performing station at City Hall/Justice Center had only 1.15 trips per day.

A common metric to measure bikeshare usage is to look at the number of trips per bike per day. Some assumptions have to be made to calculate this metric for ArborBike because the raw data for the system is not available. Assuming the system operated for approximately 240 days (April-November) and there were 13,260 trips in 2017, there was an average of 0.44 trips per bike per day. The National Association of City Transportation Officials (NACTO) reviewed 2017 bikeshare data to understand current trends. It was found that U.S. station-based systems produced an average of 1.7 trips per bike per day.

There are several factors that have increased bikeshare ridership nation-wide, that does not exist as part of ArborBike's system:

- **Per Trip Option:** ArborBike has a day pass and an annual pass option, which increase the program's cost and barrier to entry. For people who want to use the program once in a while or for a commute trip, for example, the cost is high as they have to purchase a day or annual pass. Having a "per trip" pass lowers the cost and the commitment. A per trip cost is typically around the cost of a transit trip, approximately $2.00-$3.00.

- **24-Hour Access:** Most bikeshare systems operate 24 hours a day. Arbor Bikes only operated from 5 am to 11 pm, reducing the program's reliability as a transportation option.
- **Year-Long Operations:** ArborBike only operates approximately 8 months out of the year, which is a significant barrier to use as a reliable transportation option. Other bikeshare systems that are located in areas with cold and snowy winters typically keep at least a portion of the fleet in operation throughout the winter.

4. Equity

The equity analysis for Ann Arbor and Ypsilanti shows large concentrations of households below average income and people of color are primarily located in Ypsilanti, in the central neighborhoods of Ann Arbor, and in the north east neighborhoods by University of Michigan's north campus.

The current system does not have stations located in many areas that have been identified as underserved. In addition to stations not being located within underserved areas, there is no equity programming. Equity programming could include discounted fares or marketing and outreach to underserved neighborhoods to ensure everyone access to the program.

5. System Funding

The current management and operations structure of ArborBike requires sponsorship and local funding. As technology has evolved in bikeshare, so has typical operations and management. Recent advances in dockless bikeshare have resulted in private companies operating bikeshare without sponsorship or public funding but this model has proven to not be as sustainable. A corporate sponsorship associated with any bikeshare system is a best practice to mitigate against industry shifts, low ridership and to create system viability. Additionally, a best practice could be to have one vendor with multiple assets, such as bicycles, electric pedal assist bicycles, scooters, etc. which can assist with ridership numbers and revenue. See Chapter 10, Section 5 regarding the business proforma which displays a sustainable no cost system provided by one vendor utilizing a phased approach.

Chapter 8:

System Analysis

1. System Alternative Considerations

When analyzing the various system possibilities based on existing factors from the region and the current state of the industry there were six viable options explored for the Ann Arbor area.

1.1 Current System (14 stations) and Operator for 5-years – no change

There are several advantages to this option. The current structure of the arrangement is solidified with the designated government entity identified (TheRide) to oversee the program for the next 5-years. Furthermore, the current bikeshare BCycle equipment is paid for and Shift Transit provided a proposal which, if successfully implemented, will slowly remove the financial burden from the local government and university partners over the next 5-year period. The disadvantages for committing solely to this model moving forward should be considered as well. Some of those factors are: operational costs have been expensive, requiring a sponsorship to make it sustainable, the system size is currently too small to serve the community demand, government funding would need to be accessed to expand with BCycle equipment due to cost, and a long-term commitment from TheRide to oversee the governmental process and system would be required which may not likely.

1.2 Current system with expansion to BCycle Dash in Ann Arbor and Ypsilanti

This option would provide updated equipment to a smart bike system (BCycle Dash) and the station-based equipment could still be utilized. The Dash can integrate with the station based BCycle equipment. The current BCycle dock-based system would still have to utilize the stations and could not be integrated into a municipal or regular bike rack unless a secondary lock was added which could increase costs. BCycle has launched an electric pedal assist bicycle that could be integrated. The BCycle system is already familiar to the community. There are still substantial costs associated with this system which would require additional governmental funds to purchase the expanded, upgraded equipment. The need for corporate sponsorship dollars to make the operations of the system would also be required. TheRide would be required to continue overseeing the program long-term and champion the process for expansion. This option would likely require more complex phasing which would likely involve a bikeshare site planning expert.

1.3 Move current system to Ypsilanti (14 stations) and launch new DASH system in Ann Arbor with expansion

Under this option the equipment going to Ypsilanti is paid for, yet the site planning, relocation, and re-launch would require some funding to execute. TheRide would be required to continue overseeing the program long-term and champion the complexities of this option. Ypsilanti already falls into TheRide's service area and there is a great interest to serve this

community with transit options. For Ann Arbor to launch a newer Dash system this would require government funds for equipment and installation. This option would ideally be a regional effort so there is a unified membership and system; however, it could create a disjointed system since the bicycles would not be 100 percent integrated between the two cities. The systems in Ypsilanti and Ann Arbor would both need corporate sponsorship to keep the operations sustainable. Operational costs for a system serving two communities, two universities, and with two equipment types will be more expensive. These factors were not considered nor negotiated with the Shift Transit agreement so all parties would have to reevaluate. This option would require a local champion and likely hired site planning consultants to navigate all the complexities on this option. The main unknown for this option is if TheRide would be able to reassign the current station-based equipment to Ypsilanti due to potential restrictions in the original government funds and local match utilized to purchase the equipment years ago.

1.4 Keep current system and RFP or permit for no cost, privatized, regional system in Ann Arbor and Ypsilanti

This alternative presents several positive factors because the current equipment is paid for and no further government funding would be required to expand the system regionally. An RFP or permit process could also bring additional shared micromobility advancements like electric pedal assist bikes, electric scooters, electric trikes, microtransit, etc. This option involves Ann Arbor and Ypsilanti working together for a unified, regional approach which would require a local champion like WATS or TheRide to facilitate. There are multiple challenge areas to overcome for this option to be viable. The current system oversight and 5-year agreements would only apply to the BCycle system due to the oversight provided by TheRide and the agreement with Shift Transit. The system agreements secured through the RFP or permit would likely exist directly between the provider and the municipalities and the universities. This does not remove the need for corporate sponsorships to keep all systems viable long term. If not conducted as a collaborative regional effort, this could create disjointed systems with equipment, operators, user experience, and government oversight. This scenario would also require a long-term commitment from TheRide to continue to oversee the current bikeshare system with limited or no oversight of the other system(s). The largest challenge is this option would create competition for the current BCycle system which was heavily invested in by the city, university, transit authority and other partners. This option would require a local regional champion and likely, hired site planning consultants to navigate all the complexities on this option.

1.5 Ypsilanti and Ann Arbor each release their own RFP or permit separately

This option provides a faster path for each community, but this would likely create a process that will not serve the regional area unless all entities committed to working collaboratively. This option could be easier for Ypsilanti and EMU since there is not an existing bikeshare system serving the municipality or university. This option is not contingent on the BCycle system or the

relationship between TheRide and Shift Transit. This would position both cities and universities to have more oversight of the equipment and operations selected to serve their specific area. An RFP or permit requirement and process would modernize the bikeshare system and make room for more advancements coming out of the shared micromobility industry. This alternative has a greater probability of not working as a cohesive, regional system due to the separate processes from each community. This could create disjointed systems with equipment, operators, user experience, and government oversight within the region. Ann Arbor is a more feasible community to launch shared micromobility from a population and density standpoint, but Ypsilanti is positioned well with no competing systems currently. It is recommended that both municipalities work together on language and system expectations, even if the actual RFP or permit process is siloed between the two entities. Though additional government funds will not be required for this option to be executed, securing corporate sponsorships will likely still be a factor for any vendor if the municipalities want a sustainable, long-term system. This option would require a strong local champion to navigate all the complexities and to encourage regional collaboration.

1.6 Dispose of current dock-based system and release a regional RFP or permit for new provider(s)

This option outlines a path forward that could be implemented reasonably quickly, with no additional government funds, and with more standardization. Currently there are fragmented efforts associated with shared micromobility happening across the various entities in this region. When municipalities and universities collaborate and standardize their shared micromobility efforts, this can be leveraged to ensure a more sustainable, organized, quality system is implemented and serves the citizens, students, and visitors in Ann Arbor and Ypsilanti. This upfront regional collaboration can reduce the long-term hours municipal and university staff are investing currently in this matter. The RFP or permit requirement and process would modernize the bikeshare system and make room for more advancements coming out of the shared micromobility industry, such as scooter, electric pedal assist bicycles, adaptive bicycles, etc. This system would not involve a dock-based bikeshare, rather geofenced parking areas that are conveniently located to origins and destinations throughout an expanded service area would be utilized. The system agreements secured through the RFP or permit would likely be implemented directly between the provider and the municipalities and the universities and would require no cost from these local entities. This option would create the opportunity to expand the system with a dense, larger system serving more people. The potential for a year-round system could also be reevaluated. This may not remove the need for corporate sponsorships to keep all systems viable long term, but the selected vendor will determine and address this factor. There is an opportunity to create a solid transition plan, from the disjointed efforts associated between the current BCycle system and the Ann Arbor e-scooter pilot, over to a system that is unified with technology and expanded service area including Ann Arbor, Ypsilanti, and the two universities. A regional champion, like WATS or TheRide, would have to facilitate this regional coordination which can be difficult and times consuming

to gain consensus. The largest challenge with this scenario would be disposing of the BCycle system. TheRide would need to work with the Federal Transit Authority (FTA) to determine what actions would be required.

2. Planning Principles

Some of the key considerations for a modernization of the system are vendor procurement, permitting, and regulation of un-docked bikes in the public right of way. This section highlights both the traditional and emerging considerations for bikeshare systems. The project team used their experiences from bikeshare programs around the country and case study research to develop the planning principles.

2.1 Procurement and Permitting Processes

One of the most important considerations is determining the type of procurement, contracting, or permitting process that should be used to allow a bikeshare program to operate. Communities have used several different models including requests for proposal (RFP) or requests for interest (RFI), sole source direct contracting, memoranda of understanding (for one or multiple vendors), or a right-of-way or other permit.

A sole source direct contract is one where the City or agency enters directly into a contract with a specific vendor to work with them to provide shared mobility services. The benefit of a sole source contract is that it is a quick, streamlined process. Some challenges may be if an agency has competitive procurement rules around the use of the public right-of-way or if an agency is restricted by the choices offered by a particular vendor.

A Request for Proposal (RFP) or a Request for Interest (RFI) can be used to help determine which vendor is the best fit and offers the right features and services for the location. It may result in a longer process, but it gives the city greater control to find and select the vendor or vendors that best fit their needs and opens up the process to multiple vendors allowing for competition.

A Memorandum of Understanding (MOU) is similar to a contract, except it has less legally enforceable elements. This has been used in quite a few U.S. cities to allow one or multiple vendors to provide service on an expedited timeline. The MOU outlines the expectations for service agreed between the municipality and bikeshare vendor and removes the need for a permit process.

A right-of-way or other permit is the most common form of regulation for dockless bikeshare programs. In this model, a formal

process is established for vendors to apply to operate in the public right-of-way. A permit allows the municipality to outline their regulations and requirements for how the program should operate. For example, many cities specify the minimum and maximum number of vehicles or where they can be parked. It is a way to open the program to the free market and permits can be established for any number of vendors or on a first come first serve basis until the maximum number of vehicles is filled. Typically, there are fees associated with these permits that go towards paying for City oversight of the program. There is a longer time to have a new permit process be drafted, reviewed, and approved by executive staff and City Council.

While each of these range in their level of oversight, time to implement, and flexibility; an RFI or RFP process offers competitive opportunities for vendors to respond to a community's list of desired program features and to showcase the features of their products.

2.2 RFP versus Permit At-A-Glance

Below, Table 4provides a brief outline of the pros and cons associated with selected a request for proposals or permit process to proceed.

Table 4. RFP versus Permit

	Request for Proposal
PROS	▪ Single or limited number of vendors ▪ RFPs are a familiar process for City/University ▪ More operational control and set requirements on programmatic standards outlined by the City ▪ WATS could facilitate a regional, joint RFP process with Cities; Universities could piggyback ▪ Tends to create a stronger relationship with vendor ▪ Capable of expanding scope to include shared micromobility ▪ More likely to encourage adaptive and equity standards ▪ No cost, privatized system can be obtained ▪ Can build in vendor fees or revenue share model
CONS	▪ Can extend timeline ▪ Ties community to one vendor ▪ Community is still subject to vendor's overall success
	PERMIT
PROS	▪ Can be a faster process ▪ Can allow community more flexibility with industry shifts ▪ Allows for multiple vendors ▪ Capable of building in vendor fees to be collected by the City/University
CONS	▪ Decreases the likelihood the process will be regional ▪ Allows for multiple vendors • *Historically, the density and population size of the two communities does not lend to supporting multiple vendors* ▪ Reduces City/university ability to require adaptive or equity programs from private companies ▪ Higher level of oversight required by City and University to manage permit and multiple vendors ▪ Easier for vendors to pull-out of the market or to not resolve bad behavior

3. Number of Vendors

Permitting agencies to choose a single bikeshare vendor, to identify a maximum number of vendors, or to allow multiple vendors to provide bikeshare services. The benefits of having multiple vendors in the system are that they enable the market to dictate demand, allow the system to increase in size quickly, and encourage competition. The benefits of limiting or selecting a single vendor are a generally closer working relationship with fewer points-of-contact that can respond quickly to requests and has a more complete control over system-wide rebalancing efforts. For users, having only one membership plan, one smart phone application and one system to figure out can be easier than having to manage multiple accounts.

Different approaches have been used by cities including selecting or contracting with a single vendor (e.g., South Bend, IN), using a selection process such as an RFI to choose approved vendors, using a permit that caps the number of vendors (e.g., Denver, CO) or provides maximum fleet numbers (e.g., Portland, OR), or opening up the market to multiple vendors (e.g., Dallas, TX and Seattle, WA). Multiple vendors are often required in larger cities to provide the volume of bikes required to serve these locations.

4. Density

Providing bikeshare bikes and parking hubs at high densities maximizes the visibility and convenience of the system and provides users with a reasonable expectation that there will be a bike within walking distance (a quarter-mile) from anywhere in the system area. This may also provide redundancy in the system so that if a bike is broken or out of service, a user can easily walk to another bike. Bike and parking hub density will vary by phase depending on the surrounding land use and expected demand. Limiting the first phase's service area to downtown, university campus areas, and inner core neighborhoods generally launch with higher densities, which reduce as the program expands into fringe and suburban neighborhoods. The bike and parking hub densities will be a function of the fleet size and service area.

5. Fleet Size

A bikeshare system that provides too few bikes will be limited in the number of trips and destinations it serves and therefore have less utility and be less attractive to potential users. However, cities generally must take a measured approach to align maintenance and rebalancing, and right-of-way capacity and may not initially launch with the full system.

Some cities have let vendors and user demand determine the number of vehicles in the system; whereas some provide minimum and/or maximum fleet sizes to better manage availability and ease the public into the program. Many cities also have provisions for growth of the program. Austin TX and Boulder CO have provisions in their regulations to allow sustainable growth of their systems.

In Austin, the initial permit allows a maximum of 500 vehicles per vendor, with expansion in 250 vehicle increments if they are able to meet a utilization rate of 2.0 trips per vehicle per day over a specified time period. Boulder limits each vendor to 100 bikes but allows them to increase the number of bikes in their fleet by 50 if these are accessible or e-assist bikes.

6. Service Area

If there is a large fleet size but the service area is too small, then the system may not provide much utility for bicyclists and may not be an effective alternative to walking. This is particularly relevant for smaller systems. For a more spread-out system, parking hubs at the edges of the system should have additional capacity available (i.e., more bike parking capacity) so that users have greater bike-predictability in areas with less bike coverage.

While most service areas are generally contiguous, cities and regulating agencies can establish parking and riding restrictions at the neighborhood and sub-block level. Neighborhoods and blocks with high levels of pedestrian activity and right-of-way use competition are typically candidates for bikeshare riding and parking regulations via geofencing; additional discussion on parking regulations is provided below in the Management of Parking Behavior section. Contiguous systems do offer a larger number of connections between available bikes and destinations, and it establishes expectations for users on where they can find, use, and park bikes.

Cities and regulating agencies can also establish minimum and maximum fleet coverage areas. Bellevue WA, which launched dockless bikeshare in 2018, allows the program to operate anywhere in the city boundaries, but has identified areas where the vendor must redistribute bikes. Their permit language states that “by 5:00 AM every morning, 75% of the fleet should be located within Activity Centers, 10% should be located within Frequent Bus Stops, and the remaining 15% should be located within Neighborhoods.”

7. Management of Parking Behavior

Hybrid bikeshare program regulations typically include requirements for where and how the bikes can be parked. These regulations typically include parking required on the sidewalk or at a bike corral, in an upright position, maintaining adequate sidewalk clearances, and ensuring bikes do not obstruct key features. Further, these regulations often also set time limits in which companies must relocate non-compliant bikes (typically within 2 hours).

Many cities and regulating agencies do not have any provisions for how bikes themselves should lock or where in the city they can be parked. However, some cities have “lock-to” requirements that require technology providers to have an external lock that

allows the vehicle to be locked to something, e.g., to a bike rack or other sidewalk furniture. Some systems also have designated "hubs" where bikes need to be parked – these can be branded bike racks or geofenced block faces.

Regulations also typically specify where bikes can be parked, e.g., in the pedestrian buffer or the frontage zone and out of the pedestrian zone. There are also requirements not to block certain features such as sidewalks and pedestrian walkways, access points, doorways, utilities, bus stops, and other features. The requirements typically specify how long the operator has to remove a non-compliant bike. As mentioned above, some cities and regulating agencies have used geofencing or painted parking areas to encourage parking in more organized locations, and geofencing to restrict riding or parking in areas. Users who park in a restricted area may be fined a small fee or even lose their right to use the system. Some cities also require vendors to distribute educational materials through their apps, websites, and other media on how and where to park.

8. Equity and Inclusion

Micromobility has the potential to facilitate and improve access to transit, jobs, and other destinations, especially for historically underserved and disconnected communities. Better serving low-income and other underserved communities is a priority for any shared mobility program.

Many cities are requiring bikeshare vendors provide a cash payment option and some do additional equity programming. Washington, D.C. requires all dockless bikeshare permit holders to distribute and maintain bikes in all of the Wards of the District. Cities such as Portland, OR require that at least 20% of the dockless e-scooter fleet be available in underserved communities that are defined in their permit requirements.

Ithaca, NY received a Better Bikeshare grant to collaborate with community partners to hire and train five Ithaca Bike Champions who conducted outreach and education before, during, and after the launch of their dockless bikeshare program in April 2018.[44]In San Francisco, Jump Bikes offers a low-income discount to match Ford GoBike's (San Francisco's docked bikeshare system) Bikeshare for All[45] subsidized membership program. The reduced membership fee program allows qualifying low-income residents to sign up for a $5 annual membership their first year, then pay $5 per month ($60/year) in subsequent years.[46]

[44]Better Bike Share. 2017. http://betterbikeshare.org/grants/
[45]Ford GoBike. 2018. "Bike Share for All." https://www.fordgobike.com/pricing/bikeshareforall.
[46]Jump Bikes. 2018. "Boost Plan." https://jumpbikes.com/cities/san-francisco/boost-plan/.

9. Transit Integration

A successful transit system offers a seamless transition between multiple modes. A permanent shared-mobility program could play an important role in the TheRide transit system and offer a relatively low-cost-to-implement solution to first and last mile travel. In the U.S., shared mobility systems are attempting to better integrate with other transit systems.

Bikeshare and shared mobility programs have integrated with transit in a number of ways including redistributing vehicles to bus stops and transit centers, partly integrating transit cards by allowing someone to pay for transit and bikeshare using the same card (although they are kept as two separate payment accounts), and fully integrating fare payment into one account that can be used to pay for all transit modes.

An example of a semi-integrated fare card includes LA Metro, which incorporated bikeshare into their transit fare card (TAP card) system. When a transit rider purchases a TAP card they can go online or call Metro Bikeshare and/or Breeze Bikeshare to register for a bikeshare membership and add that membership to the TAP card. The TAP card includes an RFID chip that can be programmed with multiple accounts and that can be recognized at the bikeshare station to check out a bike. However, the transit and bikeshare accounts are separate and funds stored on the TAP card for transit cannot be used for bikeshare charges. These are charged directly to the registered credit card.

Transit and bikeshare payment systems that are fully integrated include one account with a single card that can be used to pay for all transit modes. This would be the equivalent of adding bikeshare to the ORCA card in Seattle or the Clipper Card in the San Francisco Bay Area. In the U.S., there are no transit agencies that have fully integrated their fare payment systems to include bikeshare. These systems do exist in other parts of the world such as the “Intelligent Card (IC)” system in Japan. However, in the U.S., there are technical and institutional barriers to overcome including different card reader technologies, security protocols, and the need to develop revenue sharing agreements and decision-making structures between multiple organizations.

The City of Pittsburgh was the first city in the US to pilot free bikeshare fare with a transit membership in January 2018. During the six-month pilot of the linked systems, initial results showed a 4.3% increase in bikeshare ridership, as opposed to previously flat growth.[47]

[47]http://betterbikeshare.org/2018/01/19/pittsburgh-milwaukee-explain-linked-bike-share-transit/

Chapter 9:

Expansion Analysis

There are a number of principles to consider in designing a hybrid bikeshare system. In addition to the key decisions explored in Chapter 8, balancing a breadth of coverage and station density from a station-based bikeshare system to a hybrid system is different.

1. Fleet Size

Based on the above analysis, the project team is recommending a fleet size of between 500 and 1,500 bikes. This recommendation is a significant increase from the system's peak size of 125 bikes, and it represents a shift in the program's localized focus around the University of Michigan's Ann Arbor campuses to a regional approach that serves both Ann Arbor and Ypsilanti. The proposed fleet size range is based off a phased recommendation with 500 bikes placed in the short term, and the system growing over time to a 1,500-bike fleet. Additional details on the phased approach is provided below in thesection.

Establishing the right sized fleet is essential to the ArborBike program's success. Too few bikes make bikeshare systems difficult to use, as would-be riders have less available bike options and may have to travel further distances or wait longer to access a bike. Too many bikes may overwhelm bikeshare systems' maintenance and operational capacities and lead to increasing tensions with other right-of-way users and property owners. Striking the right balance in fleet size produces a reliable, accessible bikeshare system that does not over saturate its operational capacity or overstay its welcome in a community.

ArborBike's recommended fleet size was developed through a comparative analysis of bikeshare systems from around the country. The analysis considered communities' land area, population, and population density and included both communities of similar sizes to Ann Arbor (Sound Bend IN, Camden NJ, and Ithaca NY) and national leaders in bikeshare practices (Seattle WA, Portland OR, and Austin TX). ArborBike's historic peak fleet size of 125 bikes fell well below other bikeshare system. Ithaca NY, for example, has 250 bikes for a population approximately one-fourth the size of Ann Arbor's and Ypsilanti's, and a land area approximately one-sixth of the size of Ann Arbor and Ypsilanti. The comparative analysis determined the best system size for Ann Arbor and Ypsilanti would be between 500 and 3,000 bikes. The project team recommends launching a program with 500 bikes and eventually getting to 1,500 bikes, which is the mid-range system size of other cities in the U.S. Findings from the analysis are highlighted below in Figure 8 and Figure 9.

1.1 Fleet Size by Population

Immediately increasing ArborBike's fleet to 500 bikes will bring the ratio of bikes per 1,000 people on-par with other communities. Considering the population counts of both Ann Arbor and Ypsilanti, a fleet size of 500 bikes will generate a density of approximately 3.5 bikes per 1,000 people. In comparison, San Diego, CA has a density of 2.8 bikes per 1,000 people and

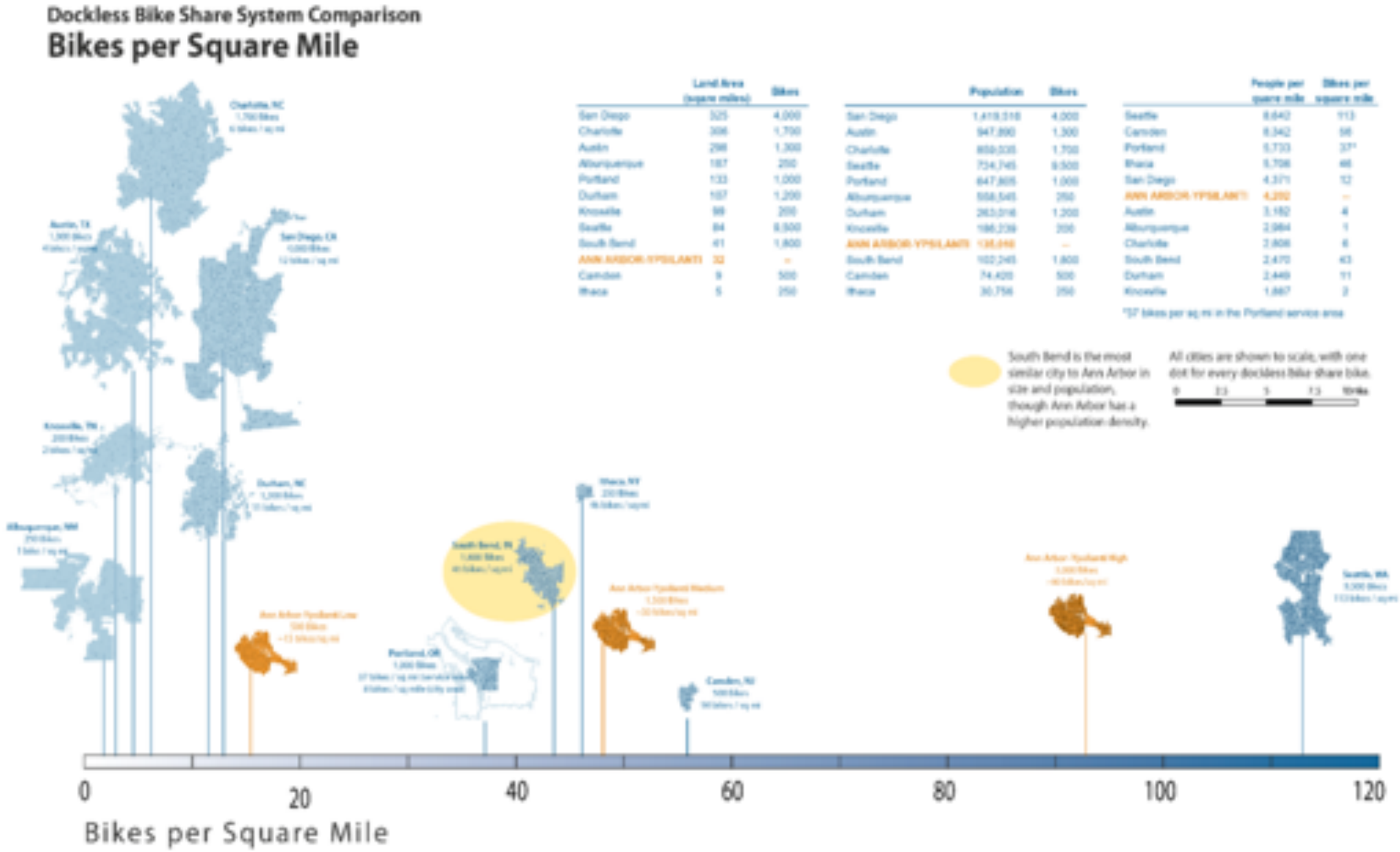
Durham, NC has a density of 4.6 bikes per 1,000 people. Over the long term, increasing ArborBike's fleet to 1,500 bikes will increase the per capital bike ratio to approximately 11 bikes per 1,000 people. This increase will situate the ArborBike between Ithaca's 8.1 bikes per 1,000 people and Seattle's 13.1 bikes per 1,000 people fleet ratios.

1.2 Fleet Size by Land Area

The proposed fleet increase to 500 bikes will shift the ratio of bikes per square mile in Ann Arbor and Ypsilanti to approximately 15. This increase will place ArborBike's density just above Durham NC's and San Diego's systems: 11 and 12 bikes per square mile, respectively. Moving towards the long-term goal of 1,500 bikes, ArborBike's land area density of approximately 50 bikes per square mile will be closer to South Bend, IN's 43 and Ithaca, NY's 46 bikes per square mile. The 1,500-fleet size recommendation will still place ArborBike below Camden, NJ, 56 bikes per square mile, and Seattle, WA, 113 bikes per square mile.

Figure 8. Dockless Bike Share System Comparison: Bikes per 1,000 People

Figure 9. DocklessBike Share System Comparison: Bikes per Square Mile



2. Service Area

In coordination with the fleet size recommendation of 500 to 1,500 bikes, the project team is recommending expanding the system's service area further out into more neighborhoods in Ann Arbor and into Ypsilanti. Using a hybrid smart bike and dockless bike approach, geofencing can be used to encourage and discourage parking at the neighborhood and sub-block levels. Additionally, bike hubs can be established to organize the bikes, generate program awareness, and provide additional bike parking facilities. The bike hubs will replace the earlier ArborBike docking stations and will provide greater flexibility and bike parking capacity, while limiting operational and maintenance costs. Each bike hub will include multiple bike parking racks, pavement paint to delineate the space, and signage about the system. The bike hubs can be placed on the sidewalk or street level (similar to Ann Arbor's existing bike corral program). Bike hubs are typically used in downtown locations where there are many competing uses for limited sidewalk and right-of-way space. Establishing bike hubs along Main Street, E. Liberty Street, N. State Street, on the University of Michigan's campus, and along S. University Avenue will help the City of Ann Arbor and the University of Michigan to manage the dockless bikes and will create predictability for riders to locate the bikes.

The service area would include the existing ArborBike service area the University of Michigan campus, downtown and Kerrytown in Ann Arbor; and expand to new neighborhoods in Ann Arbor and Ypsilanti. The additional neighborhoods will include:

Ann Arbor Expansion Neighborhoods:	Ypsilanti Expansion Neighborhoods:
• Burns Park • University of Michigan Ross Athletic campus • Eberwhite • the Old West Side • Maple Village • Water Hill • Northside • Nichols Arboretum • Arbor Hills • Briarwood Mall • Gallup Park	• Eastern Michigan University Campus • Washtenaw Community College • Heights and Normal Park • Eastside and Prospect Park • Depot Town • Downtown

A detailed map of the expanded service area and proposed bike hubs is provided below in *Figure 10*.

While it is not recommended to geofence where the bikes can be ridden, establishing geofenced parking areas is a helpful tool for managing the system's service area and use of limited right-of-way space. The geofencing tool shows riders where bikes can and cannot be parked using a smart device application (app). Riders can be encouraged to follow the geofencing guidelines using additional service fees and charges for parking outside of the service area or within "no parking" zones.

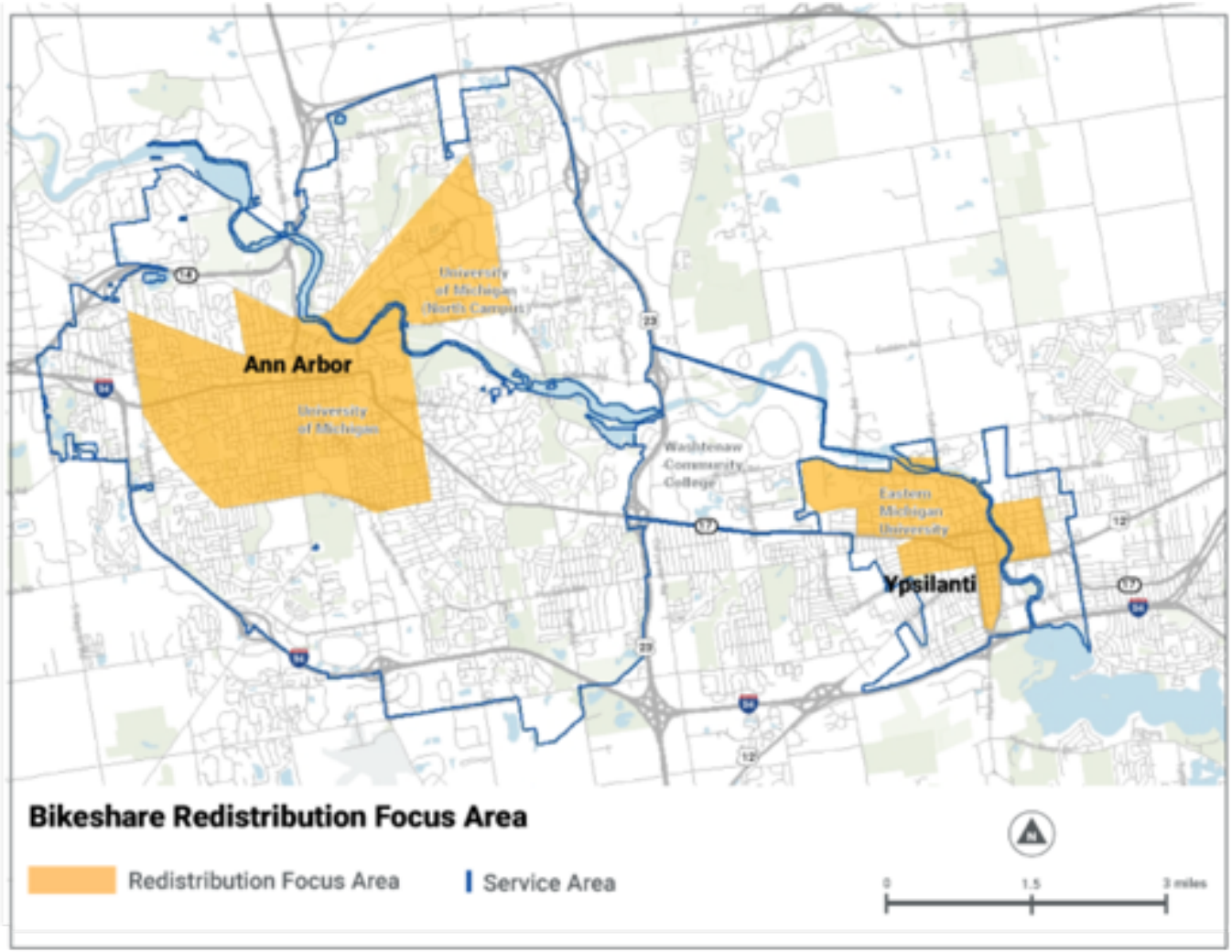


Figure 10. Service Area Proposal

3. Phased Approach

These recommendations are broken into two phases to reflect the significant changes proposed in the system's strategy, operation, and capital investments. Establishing a long-term goal for the system's fleet size will assist the many stakeholders involved to understand what needs to be done to modernize and expand the system and where the system is heading.

The Phase 1 recommendation of 500 bikes prioritizes a service area centered around Downtown Ann Arbor, the University of Michigan, the Old West Side, Huron River connections, Eastern Michigan University, and Depot Town. The Phase 1 service area will replace and expand the existing ArborBike service area and focus on establishing connections between Ann Arbor and Ypsilanti.

Moving from Phase 1 to Phase 2 will be a long-term process that responds to early successes and lessons learned during the initial roll out. The goal of 1,500 bikes will only be achieved and maintained if the system has the financial resiliency to properly maintain and operate the bikes, technology platform, equity programming, and neighbor relations. The system should focus on being nimble, flexible and driven towards sustained growth during this transition period.

Table 5. Phasing Approach Proposal

	Number of Bikes	Land area sq mile	Bikes/sq mile (land)	Population	Bikes per 1,000 people	People per square mile
Phase 1/ Min	500	32	16	135010	3.7	4,202
Phase 2/ Max	1500	32	47	135010	11.1	4,202

Chapter 10:

Implementation Analysis

1. Business Model

There are several factors, such as political climate, system vision, funding, and organizational capacity that influence the final business model of a bikeshare system. Most of the initial bikeshare systems in the United States were based on a public-private partnership which appeared to be the most effective method and has proved to be a sound option over time. In the last 12 months, we have seen a massive increase in bikeshare systems across the country due to a fully privatized model entering the United States with dockless bikeshare, but some of the risks and rewards associated with this model have played out in many communities across the country.

The most commonly utilized operational models are explained below.

PUBLICLY OWNED, OPERATED BY A PRIVATE OPERATOR.
The city or a local government entity owns the capital equipment and is responsible for establishing a sustainable funding strategy, but contracts with a private or non-profit operator to oversee the day-to-day needs of running the system.
Examples: Capital BikeShare (Washington, D.C.), Zyp Bikeshare (Birmingham, AL), Boston Hubway (Boston, MA), and Chattanooga BikeShare (Chattanooga, TN), Gotcha Bike (Baton Rouge, LA)
PRIVATELY OWNED AND OPERATED.
A private entity is secured to provide the system while maintaining control of ownership of the equipment. A private operation offers public agencies less control of system decisions, growth, and staying power. This depends largely on the private operator's ability to generate revenue and their strategy to turn a profit. A local agreement or permit is still required for a bikeshare provider to do business in the city right-of-way.
Examples: DecoBike (Miami, FL), BlueBikes (New Orleans, LA), VeoRide (Multiple medium and small cities in US)
PUBLICALLY OWNED AND OPERATED.
Publicly owned and operated. The public agency — be it a city, county, regional government, etc. — procures and owns the bikeshare capital equipment and manages the day-to-day operations.
Example: Topeka Metro Transit (Topeka, KS)

2. Start-Up Support

There are several implementation phases to consider when launching and operating a new bikeshare system that emphasizes building community, political, and private sector support.

Action 1 - Agreements & Siting. This action involves finalizing agreements, site planning, corporate sponsorship procurement and pre-launch promotion through speaking engagements, demonstrations, and crowdsourcing. Bikeshare providers will provide technical support and collaborate with the City and University on best practices for station siting. The entity that owns the right-of-way that bikeshare hubs are placed has the final approval on site plans. See the Bikeshare Hub Siting section below.

Action 2- Implementation Planning. The bikeshare provider's implementation process begins with hiring local staff or contracting with local bike shops to begin training. A press conference will be held to announce system sponsors. Routine meetings between the bikeshare provider, governmental entities and other stakeholders would be scheduled as needed to continue open communication and transparency of the system's development. Action 2 includes equipment delivery, finalizing station permits, and infrastructure deployment. Promotion of the system will continue during this phase but will shift to consumer-based messaging including a website, app promotion, and system pricing.

Action 3 – System Launch & Ongoing Operations. When the system is available for public use, the bikeshare provider will host a "Launch Day Bike Event" and press conference. The bikeshare provider will then shift to day-to-day bikeshare operations (see Bikeshare Management and Operations review below). The bikeshare operator will establish and execute annual budgets. Ongoing communication and routine meetings between the government entities and other key stakeholders should continue to review performance and expansion strategies.

Table 6. Bikeshare Management and Operations At-A-Glance

Management and Administration *(Legal, Finance, Liability, Human Resources)*	Government & University Affairs	Sponsorship Procurement & Relations	System Marketing and Sales	Equity Program Management	Fleet Operations & Management *(Local Partnerships)*	24/7 Customer Support

3. Bikeshare Hub Siting

The bikeshare provider, through a planning and engineer professional, will provide bicycle hub siting services and work with governmental agencies and stakeholders to refine the final site locations. The provider will work with the owners of the right-of-way to finalize the appropriate information and level of detail for the bikeshare submittal documents where bike hubs need to be installed for system use. While it is expected most stations will follow a similar review or permitting process, some locations may require additional involvement. The combination of desktop analysis (e.g., Google Earth and street view inspection) and field visits are collected information needed for each site.

4. System Funding

For years, funding a bikeshare program has generally come from a combination of public funds, private sponsorship funds, and usage fees from the system. Historically government funding from federal, state, and local sources have been instrumental in launching bikeshare systems of all sizes. However, the trend and need for government funding has declined over the last 12 to 18 months with the introduction of fully privatized bikeshare systems. This has not erased the need for advertising and sponsorship funds collected from private companies interested in marketing/branding opportunities with the bikeshare system. Additionally, the bikeshare equipment operator will collect usage fees from individuals accessing the bikeshare program.

4.1 Government Funding

This section explores the potential eligibility for bikeshare projects under U.S. Department of Transportation surface transportation funding programs. Federal funds accessed for bikeshare systems typically come from the Federal Highway Administration (FHWA) or the Federal Transit Authority (FTA) and are limited to the equipment and installation costs of the system. These are federal government funds appropriated to each state through the Michigan Department of Transportation (MDOT), down to the regional Metropolitan Planning Organization (MPO) then the local governments through grant programs.

The federal and state transportation dollars utilized are generally only eligible to purchase capital equipment and technology for a bikeshare program. In many circumstances, this can be used for site planning and installation of the equipment as well. Bikeshare operations are not covered by federal or state transportation dollars. “Buy America” regulations apply to the equipment purchased using FHWA or FTA funds. This clause ensures that transportation projects utilizes US manufactured products that are at minimum 90 percent made from domestically smelted steel or iron. See Appendix Cfor a review of the federal funding options that may be available.

4.2 Private Funding

An additional aspect of the bikeshare system funding is corporate advertising and sponsorship which generally is applied as part of a local match to leverage government funds or is applied to local operations.

4.2.1 Corporate Advertising and Sponsorship

Typically, customized sponsorship packages are created and multi-year agreements with larger companies are secured in exchange for sponsorship placement on the bikeshare bicycle and stations. Opportunities for smaller businesses or local events to advertise for shorter periods of time are typically available on station panels depending on local signage ordinances and city agreements.

In the corporate sector, bikeshare systems have experienced great success with marketing funds, foundation funds, and in-kind services secured through Healthcare/Health Insurance, Hospital Systems, Financial Institutions, Energy Companies, Food and Beverage Companies, Legal Companies, Wireless/Communications Providers, and Residential and Commercial Developers. For example, Zyp Bikeshare in Birmingham, AL secured 5-year funding commitments from Regions Bank, Blue Cross Blue Shield of Alabama, and Alabama Power.

Bikeshare generates millions of impressions. Most bikeshare users (46 percent) report “first learning” about the bikeshare system by seeing the bike stations or a bike from the system in motion, 35 percent from a friend or family referral, the final 19 percent site various media sources.[48] The wide range of sources indicates success with multiple platforms offered by the bikeshare system and supports the value provided to a sponsor, specifically with brand awareness and loyalty.

Though sponsorship packages can be customized in many ways, it is typical to present initial sponsorship figures in a “per bike/per year” basis. Bikeshare systems normally raise roughly $500 to $800 per bike, per year with a 3-year to 5-year corporate sponsors agreement. Post-launch the bikeshare provider typically maintains the corporate sponsorship and advertising relationships directly. It is a common practice to require the bikeshare provider to provide routine usage reports, sponsorship ‘return on investment’ reports, and financial transparency to ensure the system is being a good steward and ongoing partner.

4.2.2 Sponsorship and Branding Opportunities

Fixed sponsorship and branding opportunities are available on the capital equipment (i.e. the bicycle and hubs), mobile device push notifications, some print materials, advertising panels, and other customized programmatic initiatives. Often the bikeshare system only reserves space for 2 to 3 fixed corporate sponsors on the bicycle, bikeshare hubs, and some programmatic sponsors. A clean, consistent design is established for the whole system to mitigate any visual clutter. More

[48]Zyp Bikeshare user survey conducted 2017 and Capital Bikeshare user survey conducted in 2015

bikeshare providers are moving to even fewer corporate sponsorship logos in exchange for keeping the system naming rights and bicycle color consistent with their national mobility brand and mobile app. Ad panels are sold separately from sponsorships and generally run on a monthly, quarterly, or bi-annual basis.

4.3 User Pricing Structure

The membership cost usually includes a fee between $10 to $25 per month or commonly $50 to $100 per year. Newer 'pay as you go' options have emerged in the last year that typically starts with $1 - $2 to unlock the bicycle and .10 cents to .15 cents per minute of ride time (i.e. to unlock an e-bike for $2 and ride for 30 minutes, would cost a user $5).[49] A fare structure that includes monthly and annual membership pricing with 60-minutes of ride time per day included in the membership is factored into the business proforma below. If a member exceeded the 60-minutes of ride time in a day then $0.10 cents for each additional minute would apply. Also, a 'pay as you go' option would be available with a $2 to unlock fee and $.10 cents per minute fee factored into the model for casual, short trips.

The average bikeshare trip is 20 minutes, so the 60-minute ride time per day during the life of the membership will reduce overtime fees for locals. This initial ride time increment exists so people will not take the bicycle all day which would reduce the likelihood that others could access a bicycle from the bikeshare system. Additional fee and cost-savings features such as out of hub fees, promo memberships, member rebalancing incentives, and/or multi-assets memberships can be explored based on the bikeshare provider selected. Discounted memberships for college students and employers or groups can also be easily set-up on the operations back-office platform.

4.3.1 Ridership Reach and Expectations

The system can be measured in many ways but primarily bikeshare is measured by ridership. The system will track memberships, calories burned, number of trips taken, miles ridden, emissions reduced, and several other key factors. Bikeshare systems are designed with active and passive GPS trackers for security purposes, but also to track the quantitative factors that can evaluated. Backend software is used by the operational personnel for data collection, reports and analysis, and promotional purposes. Bikeshare systems establish several benchmarks for each year such as members and ridership that can be tracked and reported to ensure the success of this program. The bikeshare program with expansion is preparing for roughly 1,000 members for the first year – this does not calculate the pay-as-you-go users. Year 2 and Year 3 experience a significant growth rate, reaching 5,800 total members. A 2% average annual growth over the final 5-year period among annual members is projected assuming additional phases are launched. It is projected that more than 3 million trips will be reached during the first 5-Year period.

[49]Bikeshare systems from across the country were evaluated to determine the cost ranges provided.

5. Business Proforma

A business proforma was created to understand the projected bikeshare costs and revenues for an expanded and modernized system. This proforma considers 5-years of bikeshare operations and the project start-up costs associated with the capital equipment, installation costs, and launch expenses leading up to the bikeshare system becoming live to the public. This reveals potential system funding shortfalls which determines the funding gap that should be filled by corporate sponsorships in order to make the bikeshare system viable.

Some general assumptions in the proforma are that the whole first phase is launched in Year 1 and that Phases 2 and 3 are launched at the beginning of the next two years after the initial launch. A three percent annual inflation on Operational and Maintenance expenses and a projected two percent increase in Revenues each year is accounted for in the table below. This proforma is subject to shifts in funding schedule and timeline.

The start-up costs account for the capital costs and pre-launch expenses associated with the first phase of the bikeshare system, see *Table 7*. This proforma is assuming that 500 smart bicycles with 65 hubs with space for roughly 8 devices at each hub and one condensed signage panel for wayfinding and advertising are implemented. This proforma does account for smart electric pedal-assist smart bicycles. Additional start-up costs include shipping, site planning, marketing, and other fees that may be associated with pre-launch actions and personnel. Table 8accounts for the start-up costs associated with Phases 2 and 3 and outlines $1,017,000 for additional capital equipment, the same smart bicycles and eight rack hubs. These expansions are significant and triple the bikeshare fleet size over a 3-year period. To reduce costs and increase flexibility with system expansion, a smart or dockless bike system with designated parking areas as opposed to station capital may be ideal and should be accomplished with the same Phase 1 bikeshare operator.

Table 7. Projected Start-Up Cost (Phase 1)

Line Items	Expense
Capital Costs (Bicycles, Hubs, Signage)	$508,500
Shipping	$30,000
Installation	$25,000
Marketing/Promotion/Launch Event	$18,500
Public Relations and Brand Ambassadors	$7,500
Launch Travel Support	$7,500
Miscellaneous/Permitting Fees	$5,000
TOTAL	**$602,000**

Table 8. Projected Start-Up Cost (Phase 2 & Phase 3 Combined)

Line Items	Expense
Capital Costs (Bicycles, Hubs, Signage)	$1,017,000
Shipping	$60,000
Installation	$40,000
Marketing/Promotion	$4,500
Public Relations and Brand Ambassadors	$4,500
Launch Travel Support	$6,000
Miscellaneous/Permitting Fees	$8,000
TOTAL	**$1,140,000**

The operating expenses projected are based on personnel, marketing, insurance, warehousing, technology fees, credit card fees, etc. Historically, these costs have been based on a per dock basis due to the fixed nature of that asset; however, the table below is based on a per bicycle basis since the dockless or smart bike is the recommended equipment route. This table is also based on utilizing one vendor for bikeshare equipment and operations which should streamline some of the expenses related to the bikeshare system. All actual costs for equipment and operations will be determined during the procurement process and by the selected provider to align with requests in the proposal and specific local requirements.

Projected revenues are based on the membership and user fees associated with the system. The general estimate associated with the user fees was averaged annually to roughly $4.70, which is a conservative estimate but aligns with projected membership numbers and trip duration. There are a number of pricing structures that vary across bikeshare systems, so the proforma accounted for the user pricing structure recommended in Section 4.3 of this chapter in the study.

Two additional points in Table 9are the trips per bike per day (labeled Trips/Bike/Day in the table) which is used around the world to measure system usage. This proforma predicts an average ridership of 1.42 trips per bike per day[50] over the 5-year period. Figures from other systems range from as low as 0.24 trips per bike per day and as high as 1.54 trips per day per bike.[51]

Table 9. Projected Operating Cost and Ridership

YEAR	YR 0	YR 1	YR 2	YR 3	YR 4	YR 5	TOTAL
Parking Hubs or Zones	-	65	65	65	-	-	195
Bikes	-	500	500	500	-	-	1500
Docks	-	-	-	-	-	-	0
Trips/Bike/Day	-	1.42	1.42	1.42	1.42	1.42	1.42
Number of Trips	-	259,375	518,750	778,125	801,468	817,020	3,174,738
Trip Duration *(Average)*	-	16.25	16.25	16.25	16.25	16.25	16.25
Total Members	-	1000	2200	3600	3672	3672	14,144
Members per bike	-	2	2.2	2.4	2.4	2.4	2.28
Capital and Installation Purchase (Phase 1)	$563,500	-	-	-	-	-	$563,500
Capital and Installation Purchase (Phase 2)	-	$558,500	-	-	-	-	$558,500
Capital and Installation Purchase (Phase 3)	-	-	$558,500				$558,500
System Start-Up	$38,500	$12,000	$11,000	-	-	-	$61,500

[50]Broward County BCycle system provided by Toole Design Group
[51]Salt Lake City GREENBike data provided by Toole Design Group

Total Capital and Start-Up	$602,000	$570,500	$569,500	-	-	-	$1,742,000
General Operations and Maintenance Costs – Phase 1	-	$967,894	$996,931	$1,026,838	$1,057,644	$1,089,373	$5,138,679
General Operations and Maintenance Costs – Phase 2	-	-	$433,894	$446,911	$460,318	$474,127	$1,381,356
General Operations and Maintenance Costs – Phase 3		-	-	$433,894	$446,911	$460,318	$474,127
Total General Operations and Maintenance Costs	-	$967,894	$996,931	$1,907,643	$1,517,962	$1,563,500	$6,520,035
User Revenues – Phase 1	-	$1,363,125	$1,404,019	$1,446,139	$1,489,523	$1,534,209	$7,237,016
User Revenues – Phase 2	-	-	$1,363,125	$1,404,019	$1,446,139	$1,489,523	$5,702,807
User Revenues – Phase 3	-	-	-	$1,363,125	$1,404,019	$1,446,139	4,213,283
Total User Revenues	-	$1,363,125	$2,767,144	$4,213,283	$4,339,682	$4,469,872	$17,153,105
System Shortfall – Phase 1, 2, & 3	($602,000)	($175,269)	$1,200,713	$2,305,640	$2,821,720	$2,906,372	$8,457,176
Total System Shortfall	($602,000)	($175,269)	-	-	-	-	$0
Farebox Recovery – *All Phases**	0%	89%	100%	100%	100%	100%	100%
**Accounts for operations/capital recovered from revenue only.*							

The farebox recovery listed on the last line of Table 9 is the amount of operating costs recovered from user revenues. This percentage is helpful to understand the system funding gaps associated with a bikeshare system. Typically, bikeshare systems have experienced an average farebox recovery of 40 to 60 percent with some systems experiencing 80 to 90 percent. The farebox recovery rates in this table are higher than the historical numbers seen in bikeshare due to recent industry shifts to a more privatized model with streamlined reduced operational expenses and lower capital costs from the reduced station and docking footprint.

6. Implementation Recommendation

It is recommended that Ann Arbor and Ypsilanti collaborate on a regional shared micromobility system under the Privately Owned and Operated Model. This model will allow the bikeshare system to thrive without the need for government funding but allows for attracting corporate sponsorships if required for long-term sustainability. This also positions the system with high-quality bikeshare equipment and additional micromobility technology that is solely focused on pushing community-driven strategies. This model also

an experienced operator is tending to the daily demands of the system which will increase efficiency and effectiveness of the user experience. This model illuminates the concerns associated with the City or University carrying the financial or liability burden of a bikeshare system yet still creates accountability of the operator. It is recommended that Ann Arbor, Ypsilanti, U-M and EMU coordinate a process together for selecting one or two shared micromobility vendors that have multiple assets. This process could involve permitting or a "request for proposals"; regardless, this streamlined path forward could yield a regional micromobility systems serving both municipalities and universities later this year or early next year pending agreements being secured in a timely manner.

See *Appendix A* to review risks and rewards and *Appendix B* to evaluate the breakdown of the various business models.

Appendix

APPENDIX A. Bikeshare Risks and Rewards Analysis

	DOCK-BASED	SMART BIKE	DOCKLESS
REWARDS	Durable, high-quality equipment	Durable, high-quality equipment	No up-front capital costs
	Proven, experienced track-record of success	Proven, experienced track-record of success	Greater bicycle density to serve user demand and larger community footprint
	Predictable station locations for users	Predictable hub locations for users	User convenience when parking at destination
	Bikes parked in designated kiosks	Bikes parked in designated areas and flexible enough to move for special events	Operations & maintenance schedules controlled by vendor
	Operations & maintenance schedules in accordance with performance contract	Operations & maintenance schedules in accordance to performance contract	Advanced timelines for system launch and expansion
	Less opportunity for theft or vandalism	Less opportunity for theft or vandalism	Frees government funding to be used on other infrastructure projects in the area
	Custom-branded system	More affordable than dock-based system and at times no cost *(varies per market)*	Higher user interaction in mobile app with incentives and gaming
	Aggregated data available for planning purposes (i.e. bike lanes, Complete Streets, etc.)	Increased opportunity to expand bicycle rack network for all bicycle users	
		Aggregated data available for planning purposes (i.e. bike lanes, Complete Streets, etc.)	

RISKS	Requires public funding for capital and sponsorships for operations; subject to government funding opportunities	May require some level of sponsorships for operations *(varies per market)*	Cheaper, less durable bicycles
	Longer launch time	Can yield a longer launch time	Unpredictable blockages of public right-of-way and private property
	Less nimble due to station size	Can yield a slower expansion timeline outside of core area *(varies per market)*	More dependent on user to display 'good parking behavior'
	Slower expansion outside of core area (typically due to funding opportunities and decreased right-of-way)		System dependent on success of private company due to privatization (i.e. bikeshare closures or forcing other products such as scooters)
			Less transparency of operational practices
			Potential for overwhelming number of vendors or bicycles (i.e. bike litter)
			Unpredictable locations for bicycle pick-up
			Less proven success and experience in U.S. markets– currently *less defined standards and best practices*
			User data owned by private vendor

APPENDIX B. Business Model Breakdown

Model	Ownership	Operations	Agency Role	Transparency	Risk	Profits	Operating Expertise	Fundraising	Expansion Potential	Staff Capacity
PUBLIC-PRIVATE	Public Agency *(City, Parish, Regional Planning Commission)*	Private Operating Contractor	The public agency is responsible for capital investment, owns the infrastructure and equipment, administers contract with private operator, and drives direction of the program.	This model allows for the greatest amount of agency control. The agency drives the direction of the program and sets the terms with the operating contract. The private operator controls daily operations and business.	Financial risk is taken on by the public agency. Liability exposure is taken on by the private operator.	Private operator	Makes use of private operator's bikeshare expertise.	Agency responsible for fundraising government dollars and grants. Operator responsible for fundraising operational dollars through private sector sponsorships, advertising, and user revenues. Operator will build some of this into start-up costs to the agency.	Expansion (within the City) is contractually simple and depends only on additional funds being raised.	Requires agency staff capacity for initial administration and ongoing oversight but makes use of the private sector experience and transparency of operator.
PRIVATE	Equipment Vendor	Equipment Vendor	The City/Parish is responsible for permitting the equipment vendor which allows them to operate in the public right of way and City ensuring the permits are followed properly.	This model provides the greatest amount of control to the equipment vendor outside of the permit requirements. The equipment vendor drives the direction of the program within the terms of the permit. The equipment vendor controls operations and business.	The equipment vendor takes financial risk and liability exposures. City should require performance bond to reduce other risks.	Equipment vendor	Makes use of equipment vendor's bikeshare expertise.	City is not responsible for any fundraising. City can impose permitting fees to cover administrative costs of oversite. Equipment vendor responsible for fundraising through user revenues and potentially advertisements on the bicycle (if elected). City should impose some restrictions on deposits, fees and selling data.	Expansion (within the City) is simple and depends only on permitting allowances for the City.	Requires agency staff capacity for permitting, creation and ongoing oversight.

Appendix C. U.S. Department of Transportation Bicycle and Pedestrian Funding Opportunities

This table below (last revised August 2018) provides information about the potential eligibility for bicycle and pedestrian projects under Federal Transit and Federal Highway programs. More information can be found under: https://www.fhwa.dot.gov/environment/bicycle_pedestrian/funding/funding_opportunities.pdf

Key: $ = Funds may be used for this activity (restrictions may apply). ~$ = Eligible, but not competitive unless part of a larger project. $* = See program-specific notes for restrictions.

	Pedestrian and Bicycle Funding Opportunities U.S. Department of Transportation Transit, Highway, and Safety Funds															
Activity or Project Type	BUILD	INFRA	TIFIA	FTA	ATI	CMAQ	HSIP	NHPP	STBG	TA	RTP	SRTS	PLAN	NHTSA 402	NHTSA 405	FLTTP
Access enhancements to public transportation (includes benches, bus pads)	$	~$	$	$	$	$		$	$	$						$
ADA/504 Self Evaluation / Transition Plan									$	$	$		$			$
Bicycle plans				$					$	$		$	$			$
Bicycle helmets (project or training related)									$	$SRTS		$		$*		
Bicycle helmets (safety promotion)									$	$SRTS		$				
Bicycle lanes on road	$	~$	$	$	$	$	$	$	$	$		$				$
Bicycle parking	~$	~$	~$	$	$	$		$	$	$	$	$				$
Bike racks on transit	$	~$	$	$	$	$			$	$						$
Bicycle repair station (air pump, simple tools)	~$	~$	~$	$	$	$			$	$						$
Bicycle share (capital and equipment; not operations)	$	~$	$	$	$	$		$	$	$						$
Bicycle storage or service centers (example: at transit hubs)	~$	~$	~$	$	$	$			$	$						$
Bridges / overcrossings for pedestrians and/or bicyclists	$	~$	$	$	$	$*	$	$	$	$	$	$				$
Bus shelters and benches	$	~$	$	$	$	$		$	$	$						$
Coordinator positions (State or local)						$ 1 per State			$	$SRTS		$				
Crosswalks (new or retrofit)	$	~$	$	$	$	$*	$	$	$	$	$	$				$
Curb cuts and ramps	$	~$	$	$	$	$*	$	$	$	$	$	$				$
Counting equipment				$	$		$	$	$	$	$	$	$*			$
Data collection and monitoring for pedestrians and/or bicyclists				$	$		$	$	$	$	$	$	$*			$
Historic preservation (pedestrian and bicycle and transit facilities)	$	~$	$	$	$				$	$						$
Landscaping, streetscaping (pedestrian and/or bicycle route; transit access); related amenities (benches, water fountains); generally as part of a larger project	~$	~$	~$	$	$			$	$	$						$
Lighting (pedestrian and bicyclist scale associated with pedestrian/bicyclist project)	$	~$	$	$	$		$	$	$	$	$	$				$
Maps (for pedestrians and/or bicyclists)				$	$	$			$	$		$	$*			
Paved shoulders for pedestrian and/or bicyclist use	$	~$	$			$*	$	$	$	$		$				$

Key: $ = Funds may be used for this activity (restrictions may apply). ~$ = Eligible, but not competitive unless part of a larger project. $* = See program-specific notes for restrictions.

Activity or Project Type	Pedestrian and Bicycle Funding Opportunities U.S. Department of Transportation Transit, Highway, and Safety Funds															
	BUILD	INFRA	TIFIA	FTA	ATI	CMAQ	HSIP	NHPP	STBG	TA	RTP	SRTS	PLAN	NHTSA 402	NHTSA 405	FLTTP
Pedestrian plans				$					$	$		$	$			$
Recreational trails	~$	~$	~$						$	$	$					$
Road Diets (pedestrian and bicycle portions)	$	~$	$				$	$	$	$						$
Road Safety Assessment for pedestrians and bicyclists							$		$	$			$			$
Safety education and awareness activities and programs to inform pedestrians, bicyclists, and motorists on ped/bike safety									$SRTS	$SRTS		$	$*	$*	$*	
Safety education positions									$SRTS	$SRTS		$		$*		
Safety enforcement (including police patrols)									$SRTS	$SRTS		$		$*	$*	
Safety program technical assessment (for peds/bicyclists)									$SRTS	$SRTS		$	$*	$		
Separated bicycle lanes	$	~$	$	$	$	$	$	$	$	$		$				$
Shared use paths / transportation trails	$	~$	$	$	$	$*	$	$	$	$	$	$				$
Sidewalks (new or retrofit)	$	~$	$	$	$	$	$	$	$	$	$	$				$
Signs / signals / signal improvements	$	~$	$	$	$	$	$	$	$	$		$				$
Signed pedestrian or bicycle routes	$	~$	$	$	$	$		$	$	$		$				$
Spot improvement programs	$	~$	$	$			$	$	$	$	$	$				$
Stormwater impacts related to pedestrian and bicycle projects	$	~$	$	$	$		$	$	$	$	$	$				$
Traffic calming	$	~$	$	$			$	$	$	$		$				$
Trail bridges	$	~$	$			$*	$	$	$	$	$	$				$
Trail construction and maintenance equipment									$RTP	$RTP	$					
Trail/highway intersections	$	~$	$			$*	$	$	$	$	$	$				$
Trailside and trailhead facilities (includes restrooms and water, but not general park amenities; see program guidance)	~$*	~$*	~$*						$*	$*	$*					$
Training						$	$		$	$	$	$	$*	$*		
Training for law enforcement on ped/bicyclist safety laws									$SRTS	$SRTS		$			$*	
Tunnels / undercrossings for pedestrians and/or bicyclists	$	~$	$	$	$	$*	$	$	$	$	$	$				$

Abbreviations:

ADA/504: Americans with Disabilities Act of 1990 / Section 504 of the Rehabilitation Act of 1973
BUILD: Better Utilizing Investments to Leverage Development Transportation Discretionary Grants
INFRA: Infrastructure for Rebuilding America Discretionary Grant Program
TIFIA: Transportation Infrastructure Finance and Innovation Act (loans)
FTA: Federal Transit Administration Capital Funds
ATI: Associated Transit Improvement (1% set-aside of FTA)
CMAQ: Congestion Mitigation and Air Quality Improvement Program
HSIP: Highway Safety Improvement Program
NHPP: National Highway Performance Program
STBG: Surface Transportation Block Grant Program
TA: Transportation Alternatives Set-Aside (formerly Transportation Alternatives Program)
RTP: Recreational Trails Program
SRTS: Safe Routes to School Program / Activities
PLAN: Statewide Planning and Research (SPR) or Metropolitan Planning funds
NHTSA 402: State and Community Highway Safety Grant Program
NHTSA 405: National Priority Safety Programs (Nonmotorized safety)
FLTTP: Federal Lands and Tribal Transportation Programs (Federal Lands Access Program, Federal Lands Transportation Program, Tribal Transportation Program, Nationally Significant Federal Lands and Tribal Projects)