HOWARD COUNTY BIKE SHARE DEMAND ANALYSIS

PART 1

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CONTENTS

INTRODUCTION

Bike share systems have successfully been implemented in cities of all sizes throughout the United States for the past six years. In the Baltimore Washington region, Capital Bikeshare (launched in 2010) was one of the first and continues to be one of the most successful systems in the United States. However, to date there have been very few systems implemented in lower-density suburban areas such as Howard County, although there has been increasing interest in expanding bike share into suburban areas. The unique nature of such a system provides an opportunity and a challenge to this study, as there are few similar systems around the country for comparison.

This feasibility study follows on a preliminary analysis undertaken in 2012 and incorporates additional indicators that have historically been linked to increased bike share demand. The preliminary analysis indicated potential demand for a bike share program in four areas:

- Central Columbia (Howard Community College, Howard General Hospital, Downtown Columbia, Oakland Mills)
- East Columbia (Gateway and Dobbin Road Areas)
- Johns Hopkins Applied Physics Lab/Maple Lawn
- Route 1 Corridor

The document reviews and refines the analytical methods in the preliminary analysis and proposes a refined analysis of existing conditions.

During the development of the project, the County and CA developed the following goals for a potential bike share program:

1. Improve access to transit systems and expand transportation options for County residents.
2. Increase the convenience of bicycle use for short distance trips so cycling can more readily become a daily transportation mode.
3. Enhance public health by reducing air pollution and promoting active lifestyles.
4. Enhance the quality of life for Howard County residents by supporting bicycling as a fun and convenient transportation mode.

This study evaluates the potential feasibility of a bike share program in the context of these goals.

Report Organization

This report is divided into seven sections:

Section 1 introduces the concept of bike share and its benefits.

Section 2 provides a context for bike share implementation by providing examples of existing bike share programs in jurisdictions with similar characteristics.[1]

Section 3 evaluates existing conditions in the County and presents the opportunities and challenges for Howard County related to geography, employment, demographics, bicycle infrastructure and transit mode share.

Section 4 examines existing policies and regulations that may have an effect, positive or negative, on the implementation of such a bike share program.

Section 5 reviews local public and stakeholder sentiment towards bike share implementation.

Section 6 details how the demand analysis was developed.

Section 7 provides an overall evaluation of the feasibility on implementing a bike share system.

1 It is important to note that to date, no bike share program has been implemented in jurisdictions that exhibit characteristics of a suburban environment, such as those present in Howard County.

1. BACKGROUND

WHAT IS BIKE SHARE?

Bike share is a mobility option that allows users to access a fleet of public bicycles throughout a community. Bike share is an ideal mode of transportation or recreation for short trips that allow users to make as many trips as often as they like, without additional charges, provided they check the bicycle back in within the 30 to 60 minutes "free period." Following the free period, most operators charge incremental fees to encourage turnover of the bicycles. This in turn promotes high turnaround of available spaces for other users to park their bicycles. Most systems also require low-cost subscription fees, ranging from a few dollars for one-day access to $50 to $100 for annual membership.

CHARACTERISTICS

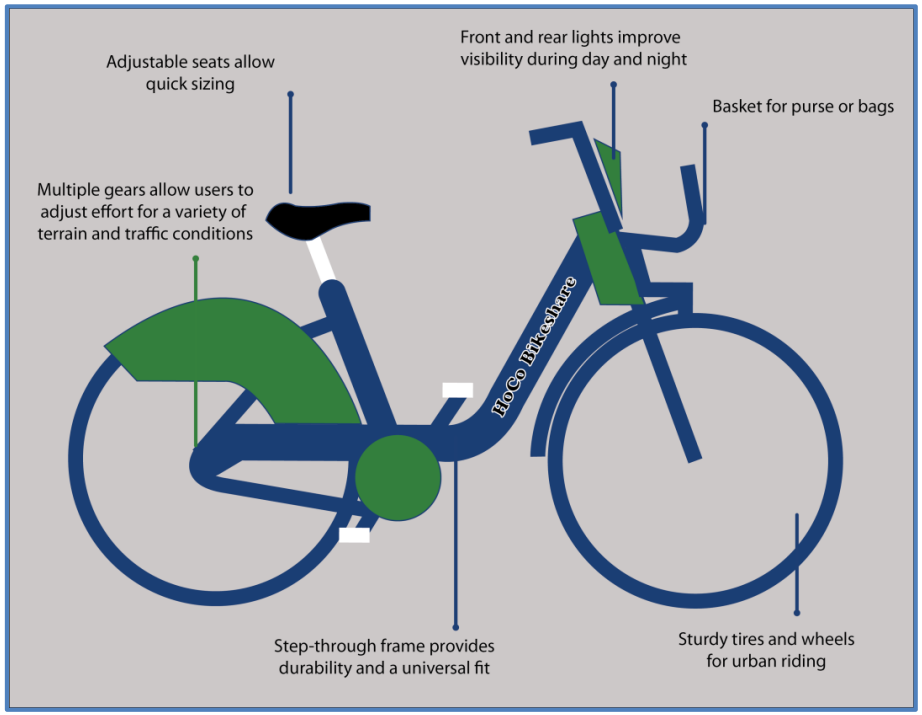


Figure 1 - Characteristics of a bike share bicycle

Most bike share systems are oriented to short-term, point-to-point trips. The majority of reported U.S. bike share trips have averaged between 15 to 35 minutes and one-to-three miles in length.[2] The structure of bike share differs from typical bicycle rentals; bike share systems encourage short trips and high turnaround of bicycles through the use of incremental fees; and in the types of bicycles available to users. Bike share bicycles and stations are designed to be easy to operate with simple, durable components, adjustable seats, and easy to understand instructions.. Figure 1 provides a description of some of the features found on bike share bicycles.

ELEMENTS OF BIKE SHARE

Currently most U.S. bike share programs have utilized automated and self-service kiosks to access bikes, however, as bike share implementation has evolved, many cities are considering systems that have technology on the bicycle itself.

Following is a discussion of the elements of each technology:

SMART DOCK

Smart dock or "station-based" technology includes a fixed station, either solar-powered or hard-wired, that houses all secured bicycles and facilitates rentals.
Figure 2 presents the elements of smart dock technology, which include:

- **Station**: a 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 are modular, allowing various sizes and arrangements.

2 Bike Sharing in the United States: State of the Practice and Guide to Implementation. Federal Highway Administration. United States Department of Transportation. September 2012.

- **Bicycle**: bicycles are specifically designed for short trips and constructed of customized components to limit their appeal to theft and vandalism.
- **RFID Card/Fob**: 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.

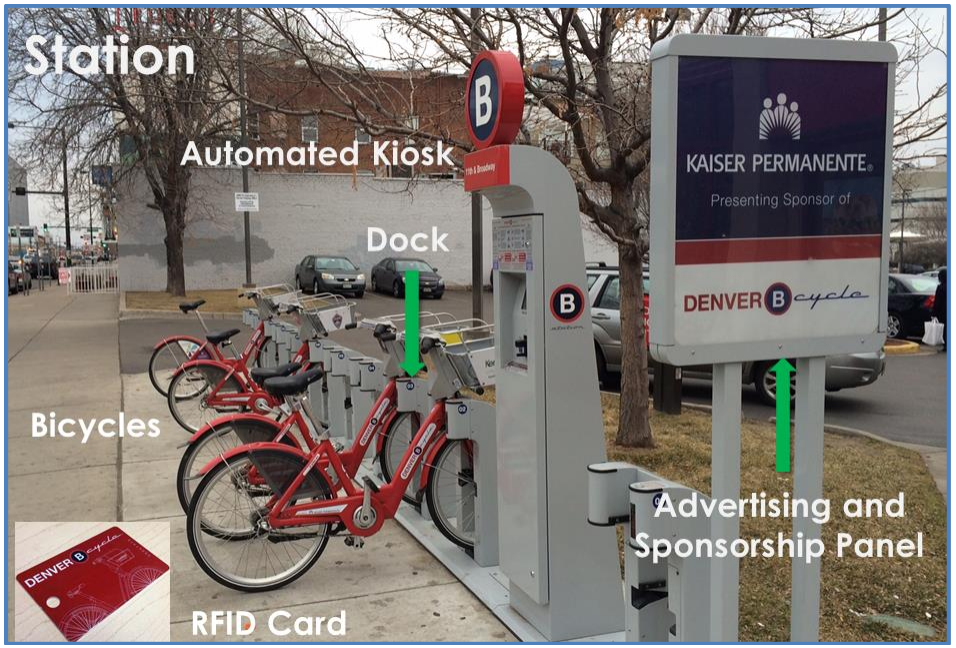


Figure 2 - Elements of Smart Dock Bike Share Systems

SMART BIKE

An emerging technology that has only been introduced in a limited fashion in the U.S. to date is the "smart-bike" system where all features (i.e., locking mechanism, GPS, lockbox) are placed on the bicycles rather than at each individual station throughout the system. Smart bike systems, which are significantly lower-priced compared to smart dock systems, have the potential to provide increased flexibility for the user in terms of parking, however remain untested in large scale implementation to date. **Figure 3** presents the elements of a smart-bike system.

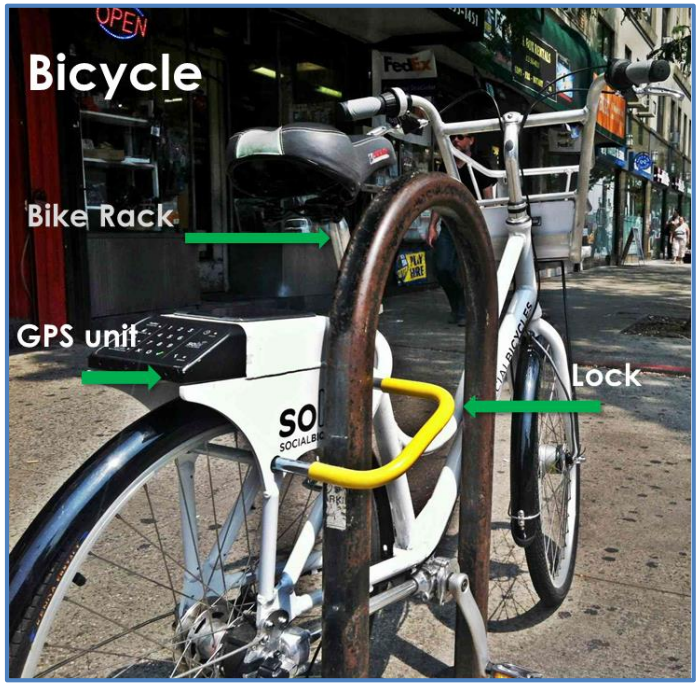


Figure 3 - Elements of Smart-Bike Bike Share Systems

The main components of smart bike systems include:

- **Bicycle**: similar to the smart dock systems, bicycles are specifically designed for short trips and constructed of customized components to limit their appeal to theft and vandalism.
- **Lock**: The lock is a hardened-steel shackle that allows the user to lock and unlock utilizing a code.
- **GPS Unit or Lockbox**: The lockbox is securely welded to the frame and it has a simple keypad interface where users can enter a PIN code, place the bicycle on hold and flag a repair. The unit also has real-time GPS and wireless communication technology.
- **"Dumb Dock" or regular rack**: this is the point to which the bicycle is locked, and contains no technology. Depending on the technology, it could be a bike rack that has no proprietary parts or it could be a steel post that is designed to host the bike share bicycle.

BENEFITS OF BIKE SHARE SYSTEMS

As compared to other transportation programs, bike share systems remain a relatively inexpensive and quick-to-implement transportation option that can deliver a variety of health, economic and transportation benefits.[3] For Howard County and Columbia Association, bike share may help:

- Promote physical health and reduce health care costs.
- Reduce greenhouse gas emissions.
- Expand and enhance existing transit services.
- Reduce dependence on automobile transportation.
- Provide an economic uplift to local businesses.
- Reduce overall household transportation expenditure.

The ensuing section further explores these benefits.

HEALTH BENEFITS

The health benefits of cycling are well documented and include helping address preventable diseases including obesity, heart disease, and diabetes.[4].

Bike share represents an opportunity for residents to incorporate active transportation into their daily routines and help lower medical and health care costs. Bicycling for 30 minutes a day can reduce the risk of heart disease by 82% and reduce the risk of diabetes by up to 58%.[5,6]

Recognizing the benefits to health outcomes, the Centers for Disease Control and Prevention (CDC), has provided funding to several different bike share systems and several private health insurance companies have underwritten bike share programs. For example, Blue Cross Blue Shield recently partnered with Divvy (Chicago) committing a $12.5 million, five-year sponsorship investment to support, strengthen and expand the bike share system.[7]

ENVIRONMENTAL BENEFITS

Bike share can also have an impact on curbing and reducing greenhouse gas emissions by promoting bicycling as an alternative to single occupancy vehicles. When combined with transit, ridesharing, and other alternatives, bike share programs can help reduce dependence on single occupancy vehicles (SOV's), reduce congestion and increase environmental consciousness.

In jurisdictions with existing bike share programs, member surveys have shown that approximately 20 to 40% of annual member bike share trips replace what would have been a single-occupancy vehicle trip. For example, Capital Bikeshare members replaced approximately 4.4 million vehicle miles in 2011, representing a four % decrease in the city's annual driving mileage.[8] Similarly, since its inception, San Antonio Bike Share users have ridden over 400,000 miles resulting in a reduction of over 380,000 lbs. of carbon dioxide emissions.[9]

Bike share has also helped increase consciousness about environmental issues in various communities. For example, most bike share systems offer member logins where people can track the amount of greenhouse gas emissions avoided through their bike share trips. Additionally, employers have been known to use this data to help track the company's greenhouse gas emission reductions and to promote contests among employees for distance ridden, carbon offset and even calories burned.

MOBILITY, TRANSPORTATION, AND COMMUNITY BUILDING BENEFITS

Bike share has helped mobility and connectivity in communities across the U.S. by increasing the number of transportation options available to residents, workers and visitors. Bike share provides a faster and more manageable option for trips too far to walk or too short to wait for transit. Bike share has also helped provide the following mobility, transportation, and community engagement benefits:

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.
4 Lindström, J. et al. The Finnish Diabetes Prevention Study: Lifestyle intervention and 3-year results on diet and physical activity. Diabetes Care, December 2002, vol. 26 no. 12 3230-3236. Accessed online at http://care.diabetesjournals.org/content/26/12/3230.full on December 13, 2013.
5 British Medical Association (1992). Cycling Towards Health and Safety. Oxford University Press.
6 Lindström, J. et al. The Finnish Diabetes Prevention Study: Lifestyle intervention and 3-year results on diet and physical activity. Diabetes Care, December 2002, vol. 26 no. 12 3230-3236. Accessed online at http://care.diabetesjournals.org/content/26/12/3230.full on December 13, 2013.
7 Mayor Emanuel, Blue Cross and Blue Shield of Illinois Announce Partnership to Support Divvy Bike Share System. Press Release, City of Chicago. Obtained from http://www.cityofchicago.org/city/en/depts/mayor/press_room/press_releases/2014/may/mayor-emanuel--blue-cross-and-blue-shield-of-illinois-announce-p.html on May 15, 2014.
8 Federal Highway Administration, Highway Statistics 2011: Urbanized Areas – 2010 Miles and Daily Vehicle – Miles Traveled. Accessed online at http://www.fhwa.dot.gov/policyinformation/statistics/2011/hm71.cfm on December 27, 2013.
9 San Antonio Bike Share website. http://sanantoniobikeshare.org/.

Increase the reach and capacity of a community's existing transit system.[10]

A bike share system can complement existing transit services by providing first- and last-mile connections, effectively extending the reach of fixed-route services, and by helping relieve crowding on transit routes that are at capacity.[11] In the Washington DC area, over half (54 %) of respondents to Capital Bikeshare's member survey stated that at least one of their bike share trips in the previous month had started or ended at a transit station (i.e., Metro station) and about a quarter (23 %) of respondents used bike share to access the bus in the previous month.[12]

- **Encourage active transportation by lowering barriers to entry.**

  Bike share has proven one of the most effective ways to quickly and affordably introduce new riders to bicycling, introduce residents to bicycling as viable mode of transportation, and help support further investment in active transportation.

  Bike share's ability to reduce some of the common barriers to bicycle use, including allowing new users to try bicycling without needing to own or store a bicycle, has had a significant impact in attracting new riders. In Minneapolis for example, 33% of new members surveyed in 2010 by Nice Ride Minnesota had ridden less than once per month before joining.[13]

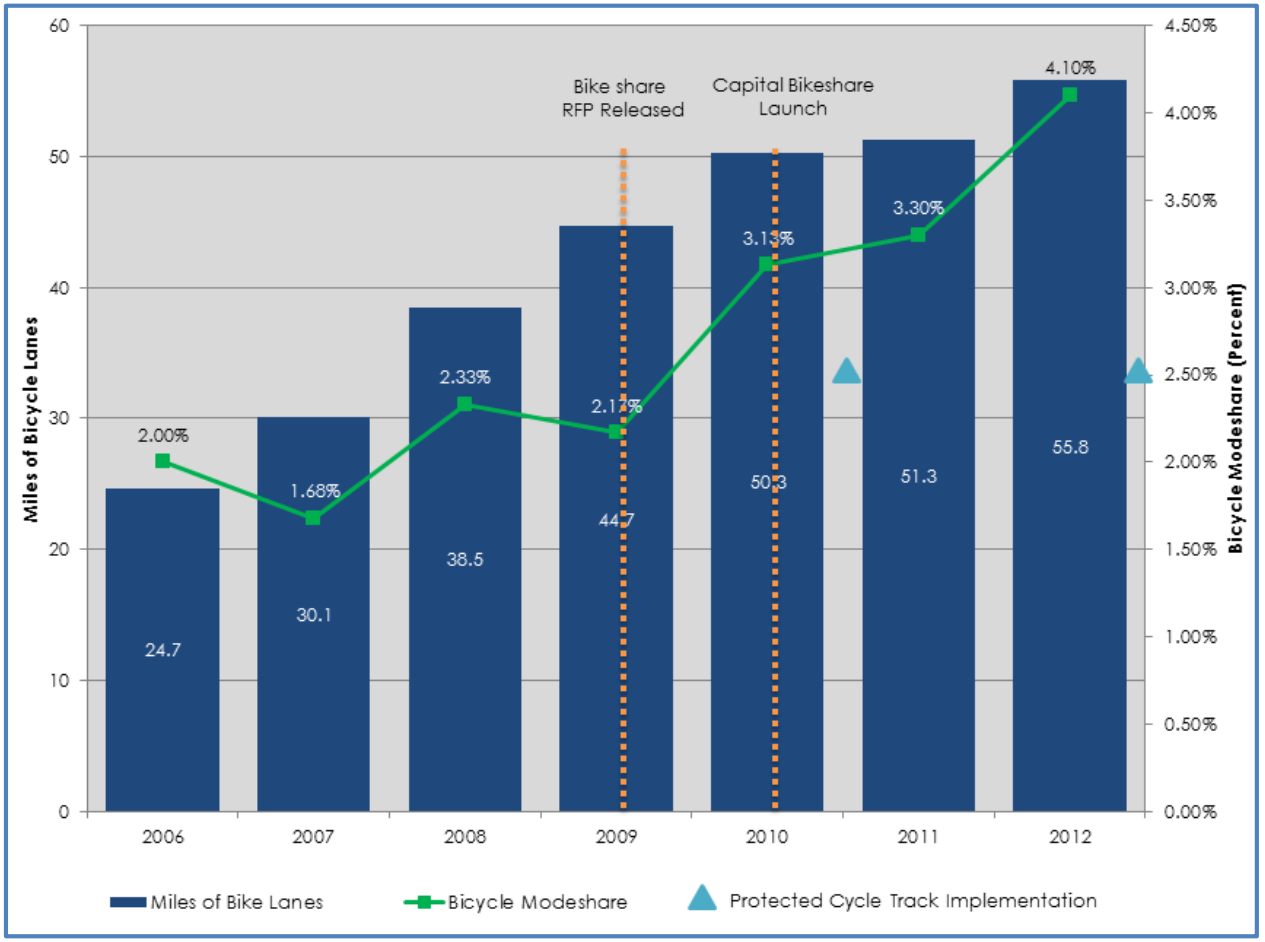


Figure 4 - Increase in bicycle lanes installation, mode share and implementation of Capital Bikeshare in Washington DC

- **Provide an impetus for increasing investment and implementation of bicycle friendly facilities**

  Jurisdictions with bike share systems have also experienced an increase in funding and implementation of bicycle friendly facilities. For example **Figure 4** features the increase in the amount

10 "Look Ma, No Spandex: Once-Reluctant Rider Won over by Ease of Capital Bikeshare." Accessed from http://www.washingtonpost.com/local/trafficandcommuting/the-spandex-shy-can-relax-once-reluctant-rider-won-over-by-ease-of-capital-bikeshare/2014/04/14/d7bba564-bc11-11e3-9c3c-311301e2167d_story.html on April 16, 2014

11 Bike Sharing in the United States: State of the Practice and Guide to Implementation. Federal Highway Administration. United States Department of Transportation. September 2012.

12 LDA Consulting (2013). 2013 Capital Bikeshare Member Survey Report. Accessed online at http://capitalbikeshare.com/assets/pdf/CABI-2013SurveyReport.pdf on December 13, 2013.

13 Two-thirds of members also said they had increased their amount of bicycling since joining Nice Ride. Figures taken from Nice Ride 2010 Annual Report.

of on-street bicycle lanes juxtaposed with the increase in bicycle mode share. Also shown are the implementation and launch dates for Capital Bikeshare.[14] While this correlation remains to be studied in depth, there was an increase in bicycle facilities, investment and mode share prior to the launch of Capital Bikeshare, and that increase, particularly of mode share, has continued since implementation. Capital Bikeshare may have helped increase the public's desire for more comfortable facilities and may help drive an increase in dedicated investment for expanding the existing network of bicycle friendly facilities.

- **Contribute positively to people's attitude towards the Jurisdiction**. Jurisdictions that have already experienced bike share implementation have also found there has been a shift in the way residents and visitors feel about their community. For example, 95% of Nice Ride Minnesota users surveyed in 2011 agreed or strongly agreed that bike share had made the Twin Cities a more enjoyable place to live.[15] Furthermore, residents in various cities have felt that bike share stations create additional public spaces for people to gather, as evidenced with the installation of bike share stations in New York City, where it was observed that the stations created an additional social space where people meet and gather as well as acting as conversation starters.[16]

ECONOMIC BENEFITS

Bike share systems have been known to provide economic benefits at the community, business and individual levels:

- At a **community** level, bike share is recognized as a means for attracting or retaining workforce talent and in providing visitors with a unique way to experience the community. Various communities have showcased their bike share systems as part of efforts to help revitalize or activate their downtown area(s). In addition, bike share has helped to provide new and different ways for tourists to experience a place, while attracting their spending power. Finally, bike share systems help create a small number of local jobs through the operations and maintenance of the system.

- For **businesses**, bike share may support increased revenues for local businesses. In cities with existing bike share programs, businesses located near bike share stations have seen an economic uplift. A 2013 study of the Nice Ride Minnesota bike share system (Minneapolis / St. Paul) found that bike share users spent an additional $150,000 at local businesses over the course of one bike share season compared to the prior year before bike share was implemented.[17]

  Bike share also represents a mechanism for businesses to promote their brand as one that supports sustainable transportation practices. Most bike share programs offer sponsorship or advertising opportunities on the stations and bicycles. This can range from one large system sponsor to many smaller station-based sponsors. In some communities, sponsors become involved in bike share promotions, for example by offering discounted goods or services to bike share members.

- For **individuals**, bike share has reduced the costs of transportation and health care, which combined make up over 22% of annual average household expenditures in the United States, according to one study[18] Compared to the cost of operating an automobile, a bike share membership is relatively inexpensive with most programs costing between $50 and $100 per year. In comparison, the median cost of annual car ownership is approximately $9,100.[19] In the Washington DC area for example, 87% of annual members reported having saved money on weekly travel costs by using Capital Bikeshare. This resulted in an average of $800 per year saving on personal transportation costs for these users. [20]

14 Darren Buck. Capital Bikeshare program associate. District Department of Transportation. Email. (Tue 6/10/2014 1:53 PM)
15 Nice Ride Minnesota Annual Report 2011. Accessed online at: https://www.niceridemn.org/_asset/9n2z8n/
16 Nelson, David M. and David Leyzerovsky. The Social Life of CitiBike Stations. Project for Public Spaces. http://www.pps.org/blog/the-social-life-of-citibike/. December 3, 2013.
17 Schoner, J.E., Harrison, A. and Wang, X. (2012). Sharing to Grow: Economic Activity Associated with Nice Ride Bike Share Stations. Humphrey School of Public Affairs, University of Minnesota.
18 U.S. Department of Labor, Bureau of Labor Statistics, Consumer Expenditure Survey, 2010.
19 For comparison, the median annual cost of car ownership is approximately $9,100 based on information from www.consumerreports.org accessed on December 12, 2013.
20 LDA Consulting (2013). 2013 Capital Bikeshare Member Survey Report. Accessed online at http://capitalbikeshare.com/assets/pdf/CABI-2013SurveyReport.pdf on December 13, 2013.

SAFETY BENEFITS

The safety of cycling in a community is a significant concern to bike share users. Although still relatively new, bike share has an extremely impressive safety record. To date, no system in the United States has recorded a fatality and the rates of injury crashes are typically lower than private bicycling, as evidenced by **Figure 5**.[21] [22]

The safety benefits of bike share include:

- **Introducing more riders to a community for a "safety in numbers" effect.**
  Along with the high visibility of distinctive bicycles and stations, the high volume of riders result in greater awareness of bicyclists by drivers. In fact, the "safety in numbers effect" is well established. A study published in the journal *Injury Prevention* in 2003 showed that the "likelihood of a person walking or bicycling being struck by a motorist varies inversely with the amount of walking and bicycling".[23] This injury rate reduces exponentially with the number of cyclists using the road system (in this case using journey to work mode share as a proxy for the overall amount of cycling).[24]

- **Exposure of riders to road rules and safety tips through safety messaging at bike share stations and websites.**
  Bike share provides a unique opportunity to communicate with cyclists about road rules and regulations and safety tips. Means of communicating safety messages have included website, social media, at the bike share station during registration, on the bicycle handlebars and stem, and on the map panels in stations. Such communication leads to more educated and safer riders who typically take fewer risks than the traditional, private bicyclist.

- **Increased use of safer bicycles that are in good repair and feature permanent lighting systems.**[25]
  The strong safety record of bike share is also impacted by the introduction of bicycles with a number of safety features (see

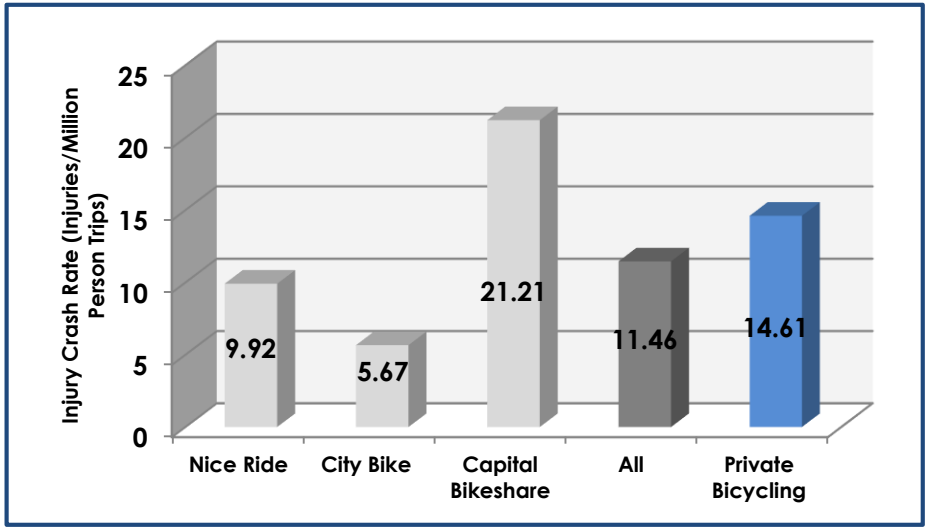


Figure 5 - Comparison of Injury Rates for Bike Share and Private Bicycling

Figure 1) including front and back lights, brakes, and reflectors, an upright position of the rider; and a heavier bicycle (typically 40-45 lbs.) with wide handlebars where riders generally keep slow speeds and do not weave in traffic.

Despite early concerns about limited helmet use amongst bike share users, safety statistics suggest that bike share programs have experienced very low crash rates compared to crashes among bicyclists riding their own (non bike share) bicycles.[26]

Finally, as many more bike share systems have come into being, jurisdictions have contractually required that bike share operators undertake regular maintenance of the bicycle fleet to ensure the safety of riders.

21 Only Capital Bikeshare has a higher injury crash rate than private bicycling. It is uncertain why the injury crash rate is higher in Capital Bikeshare than in other systems and higher than the private bicycling rate.
22 Injury rates for private bicycling obtained from: Beck, L. et al. (2007). Motor Vehicle Crash Injury Rates by Mode of Travel, United States. Published in the American Journal of Epidemiology.
23 Jacobsen, P.L. (2003). Safety in Numbers: More Walkers and Bicyclists, Safer Walking and Bicycling. Injury Prevention 2003;9:205-209.
24 Jacobsen, P.L. (2003). Safety in Numbers: More Walkers and Bicyclists, Safer Walking and Bicycling. Injury Prevention 2003;9:205-209.
25 Atlanta Bicycle Coalition (2013). Atlanta – Decatur Bike Share Feasibility Study. Accessed online at: http://issuu.com/atlantabike/docs/atl-dec_bikeshare_book_lowres# on January 2, 2014.
26 Bike Sharing in the United States: State of the Practice and Guide to Implementation. Federal Highway Administration. United States Department of Transportation. September 2012.

2. COMPARABLE PROGRAMS

Bike share implementation in the U.S. is in its infancy, with most programs in large or mid-sized cites. To date, there are few examples of programs in lower density suburban areas and most have been operated for less than a year. Four existing U.S. bike share programs were selected based on their demographic, economic and geographic similarities to Howard County as well as the bike share system's operational and ownership model. The selected programs included:

- **Capital Bikeshare – Montgomery County** (Washington, DC Area)
- **Bay Area Bike Share - South Bay Satellites** (San Francisco Bay Area)
- **Greenville B-cycle** (Greenville, SC)
- **Spartanburg B-cycle** (Spartanburg, SC)

The profiles below present a summary of shared characteristics for each of the aforementioned programs.

CAPITAL BIKESHARE

www.capitalbikeshare.com

(Montgomery County Only)

Montgomery County launched its Capital Bikeshare system in September 2013, becoming the forth jurisdiction to join the regional bike share program after Washington DC, Arlington County, and Alexandria. The system in the county is comprised of three nodes:

- Friendship Heights and Bethesda
- Silver Spring and Takoma Park
- Rockville and Shady Grove

The Bethesda/Friendship Heights and Silver Spring/Takoma Park portion of the system serve high density Metro-adjacent neighborhoods in Montgomery County with population densities of approximately 7,000 people per square mile.[27] The Rockville system is unique as it was funded by a federal grant designed to facilitate reverse commutes to major employment centers in the area outside walking distance to Metro. The land uses in Rockville are lower density than the Down-county system (approximately 3,000 people per square mile), with large distances between some stations.

As the system has been in operation for less than a year, usage and member statistics are unavailable or incomplete. Ridership data is currently only available for 8 months and does not include most of the spring and summer months, which tend to have higher ridership.

Source: Capital Bikeshare

According to the system program manager, the low initial ridership was projected, and system utilization is expected to improve substantially during the spring and summer.

System Characteristics

Equipment:	PBSC Urban Solutions (Bixi)
Equipment Type:	Solar/modular
Equipment Ownership:	Jurisdictional
Operator:	Alta Bicycle Share
Operations:	Year-round (365 days)

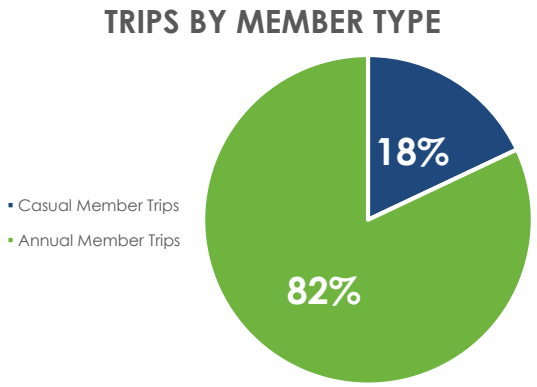
System Size

Bikes:[28]	365 bikes
Stations:	48
Docks:	729
Service Area (Sq. Mi.):[29]	13 sq. mi.
Station Density:[30]	3.8 stations / sq. mi.

27 Average density in the two Downcounty Areas. The figure is high largely because stations are located at high density metro adjacent development such as Friendship Heights and Bethesda.
28 Approximation of Montgomery County fleet as of May 2014 based on number of active docks
29 Service area is calculated as a quarter mile from the outer station of the three system nodes
30 Stations per square mile in service area.

Demographics

System Population:[31]	143,286
Metro Area Population:[32]	5,582,170
Estimated Annual Tourists:	Not available. Tourists seem to be a major ridership driver in Washington, DC but less so in suburban jurisdictions
Average Population Density:	4,822[33]



Membership and Ridership[34]

Casual Subscriptions:	Not available
Annual Members:[35]	1,107
Casual Subscriber Rides:	2,447
Annual Member Rides:	9,038
Total Rides:	11,485
Rides per annual membership:[36]	8.6
Rides per casual subscription:	Not available
Population per bike:	589
% population with annual membership:	0.8%
Casual subscriptions per station:	Not available
Tourists per casual subscription:	Not available

Revenue Model

Sponsorship, membership and usage fees are reinvested into the system through a collaborative agreement of the regional jurisdiction members. In the current agreement, jurisdictions pay a flat per-dock fee to the operator.

Capital Funding Sources[37]

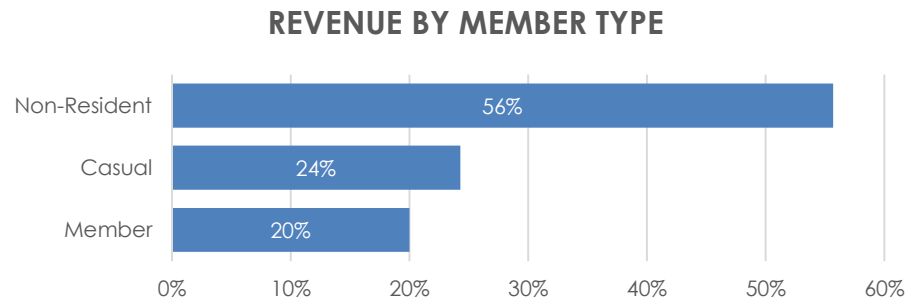
Initial System *(450 Bikes, 50 Stations)*

JARC Grant	$1.30 million
Private Contributions	$0.25 million
MDOT Grant	$ 1.00 million
Total Capital	$2.52 million

Membership Fees & Usage Fees

Annual:	$75
Annual Corporate:	$50
Annual Discounted:[38]	$84
Monthly:	$25
72 Hours:	$15
24 Hours:	$7
Usage Fees- Annual	First 30 minutes free. Then forth $1.50 (1 hr.); $4.5(1.5hrs); $6 (per 30 min); max per day of $70.50
Usage Fees- Casual	$2 (1 hr.); $6 (1.5 hrs.); $8 (per 30 min); max per day of $94

Breakdown of User-Generated Revenue[39]



Operating Costs[40]

Operating expense per dock per month:	$117
Operating expense per ride:[41]	~$59
Fare box recovery:[42]	40% recovery ratio

31 Population of census block groups overlapping service area
32 Washington-Arlington-Alexandria MSA, Census 2010
33 Density for all Montgomery County
34 Capital Bikeshare Monthly Reports, September 2013– April 2014 (8 months)
35 New memberships since Sept. 2013. Approximately 600 existing Capital Bikeshare members resided in Montgomery County before system launch.
36 Only represents trips taken in Montgomery County
37 Capital Bikeshare website
38 Or $84 in monthly installments of $7.
39 Capital Bikeshare Monthly Report- April 2014
40 Interview with program manager
41 Only includes eight months of ridership data available (September – April).
42 Projected rate for FY2014

BAY AREA BIKE SHARE

(South Bay Satellites Excluding San Francisco)

www.bayareabikeshare.com

Source: VTA.org

Bay Area Bike Share is a regional bike sharing system that was launched in August 2013 and currently is in its pilot stage. The system consists of 70 stations, of which 34 are located outside San Francisco in Palo Alto, Redwood City, Mountain View, and San Jose. Bay Area Bike Share is envisioned as a last-mile solution for connecting riders to the CalTrain commuter rail line, and much of the suburban system is clustered around CalTrain and nearby destinations.

The system is administered by multiple partners. The participating communities had initially all pursued public funding independently for bike share; these grant requests were eventually unified and submitted by the Bay Area Air Quality Management District which today is the equipment owner. Valley Transit Authority oversees day-to-day operations in Santa Clara County, while Redwood City oversees the system within its boundaries in San Mateo County.

As the system pilot is less than a year old, conclusive performance data are still not available for the system. Initial ridership in the South Bay satellite cities is low compared stations in San Francisco. Officials involved with the program attribute low ridership to the dispersed layout of the system (spans approximately 50 miles) and suburban land uses. Bay Area Bike Share is still working to expand to major employment sites and destinations such as Stanford University and the corporate campuses of major Silicon Valley technology firms.

System Characteristics

Equipment:	PBSC Urban Solutions (Bixi)
Equipment Type:	Solar/modular
Equipment Ownership:	Bay Area Air Quality Management District
Operator:	Alta Bicycle Share
Operations:	Year-round (365 days)

System Size

Bikes:[43]	278 bikes
Stations:	34
Docks:	556
Service Area (Sq. Mi.):[44]	7.50 sq. mi.
Station Density:[45]	4.53 stations / sq. mi.

Demographics

System Population:[46]	135,330
Metro Area Population:[47]	6,172,302
Estimated Annual Tourists:[48]	Not Available. Tourists seem to be a major ridership driver in San Francisco but less so in suburban jurisdictions
Average Population Density:	8,092 / sq. mi.[49]

Membership and Ridership[50]

Casual Subscriptions:	1,227
Annual Members:	425
Casual Subscriber Rides:	3,250
Annual Member Rides:	10,912
Total Rides:	14,162
Rides per annual membership:	26
Rides per casual subscription:	2.65
Population per bike:	487
% population with annual membership:	0.31%
Casual subscriptions per station:	96
Tourists per casual subscription:	Not available

Capital Funding Sources

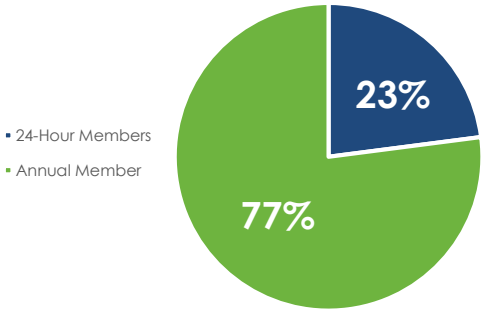
Initial System *(700 bikes, 70 stations)*[51]

CMAQ	$7.1 million
Air District Funds	$2.8 million
Local Match	$1.3 million
Total Capital	$11.2 million

The funds will cover capital, launch, and operating during pilot phase (2-3 years)

43 Approximation of Bay Area Bike Share fleet as of February 2014 calculated as 50% of dock count
44 Service area is calculated as a quarter mile from the outer station of the three system nodes
45 Stations per square mile in service area.
46 Population of census block groups that overlap service area
47 US Census 2010, combined population of the San Francisco-Oakland-Hayway MSA and San Jose-Sunnyvale-Santa Clara MSA.
48 VTA believes system attracts few tourists outside San Francisco
49 High density caused by clustering of stations in small areas that have multifamily housing.
50 Six Months of Data. Bay Area Bike Share (08-28-13 through 02-28-14)
51 Entire system, including San Francisco stations

TRIPS BY MEMBER TYPE



Revenue Model

As the system is still in its pilot phase, Bay Area Bike Share is funding the system solely through its capital grants. Operating revenue will be used to fund operating shortfalls once eligible grant funding is exhausted during the pilot phase. User revenue is not disaggregated to local jurisdictions and all expenses are paid through regional grants. The only jurisdiction contributions to date are local matching grants.

Bay Area Bike Share is still in its pilot phase. At the conclusion of the pilot, the system will likely transition to a different revenue model and even possibly ownership model. Operation costs are tied to bike utilization rates, with a minimum and maximum annual operating cost.

Membership Fees & Usage Fees

Annual:	$88
Annual Corporate	$75
3-Day:	$22
24-Hour:	$9
Usage Fee:	First 30 minutes free. 30-60 min: $4; additional 30 minutes: $7

Operating Costs[52]

Operating expense per dock per month:[53]	$98
Operating expense per ride.[54]	$5.56 system wide, approximately $23 for suburban trips
Fare box recovery:[55]	N/A

GREENVILLE B-CYCLE

greenville.bcycle.com

Greenville B-cycle is a six station bike share program focused on Greenville, South Carolina's downtown and adjacent neighborhoods. The system is managed by Upstate Forever, a community non-profit, and was launched in April 2013. Greenville B-Cycle plans to expand over the next four years to 10 stations. Greenville is notable as one of the smallest cities in the United States to feature a bike share system. While the metropolitan region has a high concentration of major universities, including Clemson University and the University of South Carolina Upstate, the city of Greenville itself is not a college town. The city's downtown has benefited from decades of smart planning that has resulted in a walkable streetscape and a thriving retail sector, and today downtown is a major regional destination. A 17.5 mile multi-use trail passes through downtown. The system was developed to encourage physical activity / recreation opportunities and is sponsored by Greenville Health System. The system also hopes to promote improved job access for lower-income households through bike share; currently only one station is located outside the downtown core and that station experiences very low utilization.

System Characteristics

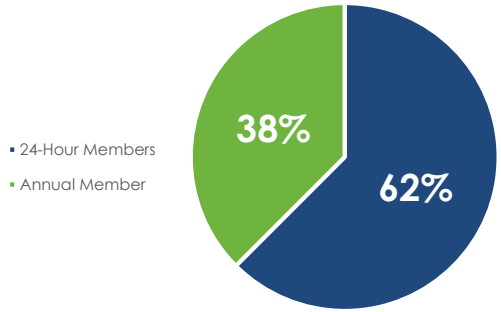
Equipment:	B-cycle
Equipment Type:	Solar/modular
Equipment Ownership:	Non-Profit
Operator:	Upstate Forever and contractors
Operations:	Year-round (365 days)

System Size

Bikes:[56]	28 bikes
Stations:	6
Docks:	52
Service Area (Sq. Mi.):[57]	1.16 sq. mi.
Station Density:[58]	5.1 stations / sq. mi.

52 Operated costs are for entire system; costs are not available by jurisdiction. Projected costs.
53 Varies by ridership. This figure assumes fewer than 1.5 trips per bike per day in first year.
54 Average across entire system for first six months. Suburban cost estimated by assuming suburban operating costs are 42% of total costs (proportion of suburban docks in system). Figure may be inflated as low ridership may reduce operating costs.
55 Cost recovery data not yet available
56 Approximation of Greenville fleet as of May 2014 based on number of active docks
57 Service area is calculated as a quarter mile from the outer station of the three system nodes
58 Stations per square mile in service area.

TRIPS BY MEMBER TYPE



Demographics

System Population:[59]	7,964
Metro Area Population:[60]	850,965
Estimated Annual Tourists:[61]	Not available
Average Population Density:	2,059 / sq. mi.

Membership and Ridership[62]

Casual Subscriptions:	2000
Annual Members:[63]	245
Casual Subscriber Rides:	2,000
Annual Member Rides:[64]	~1,200
Total Rides:[65]	~3,200
Rides per annual membership:	10
Rides per casual subscription:	1
Population per bike:	284
% population w. annual membership:	3.1%
Casual subscriptions per station:	333
Tourists per casual subscription:	Not available

Capital Funding Sources[66]

Initial System *(28 Bikes, 6 Stations)*

JARC Grant	$130,000
Local Match	$ 222,000
Total Capital	$352,000

Revenue Model

User fees cover about 1/3 of system costs. Greenville Health System sponsorship and small scale sponsorships provide another 1/3 of revenue. Grant contributions from various local partners cover the remaining costs. Upstate Forever manages the system with operating assistance from local businesses with extensive reliance on in-kind contributions to reduce operating costs.

Membership Fees & Usage Fees

Annual:	$60
Weekly:	$15
24-Hour:	$5
Usage Fee:	First 60 minutes free. $4 per extra hour. Max of $75 / day

Operating Costs[67]

Operating expense per dock per month:	$96
Operating expense per ride:	$18.75
Fare box recovery:[68]	Approximately 33%

SPARTANBURG B-CYCLE

spartanburg.bcycle.com

Spartanburg B-cycle launched in July 2011 and became the first bike share program in the Southeast with 2 stations and 20 bicycles. Spartanburg B-cycle is an initiative of Partners for Active Living and is a part of a community-wide collaboration called Bike Town

Source: Spartanburg B-

Spartanburg, which is dedicated to sustaining and improving Spartanburg's national designation as a Bicycle Friendly Community by the League of American Bicyclists.

System Characteristics

Equipment:	B-cycle
Equipment Type:	Solar/Wired modular
Equipment Ownership:	Nonprofit

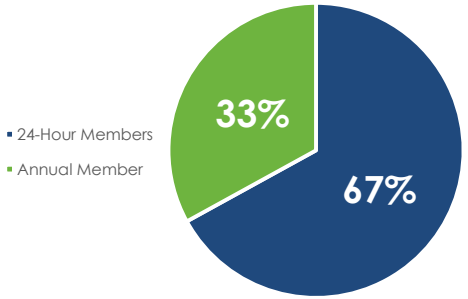
59 Population of census block groups overlapping service area
60 U Greenville-Anderson-Mauldin MSA, US Census 2010
61 Precise statistics are not available but Upstate Forever see tourists as the largest user group
62 Provided by Upstate Forever. Represent first year of operations (April 2013 to March 2014)
63 Approximately 50% of members never activated their membership
64 Figures provided were rounded up by Greenville B-cycle program managers
65 Figures provided were rounded up by Greenville B-cycle program managers
66 http://www.greenvillesc.gov/RideGreenlink/forms/JARC/FY2012JarcProjects.pdf. Local contribution includes funds from Greenville Health System ($60,000 a year for capital and operations)
67 First year of operations- Costs per bike inflated by initial ramp-up of operations
68 Fare box revenue is the percent operating costs recovered from annual memberships, casual subscriptions, and usage fees

Operator:	Partners for Active Living
Operations:	Year-round (365 days)

System Size[69]

Bikes:	40
Stations:	4
Docks:	517
Service Area (Sq. Mi.):[70]	0.78
Station Density:[71]	5.12

TRIPS BY MEMBER TYPE



Demographics

System Population:[72]	37,401 (2012)
Metro Area Population:[73]	1,362,073. (2012)
Estimated Annual Tourists:	Not Available
Population Density:	1,892 people / sq. mi

Capital Funding Sources[74]
Initial System *(40 Bikes, 4 Stations)*

Sponsorship	$455,000
Grants	$124,000
Total Capital	$579,000

Membership and Ridership[75]

Casual Subscriptions:	1,384
Annual Members:	97
Casual Subscriber Rides:	1,521
Annual Member Rides:	755
Total Rides:	2,276
Rides per annual membership:	7.8
Rides per casual subscription:	1.1
Population per bike:	935
% population w. annual membership:	0.26%
Casual subscriptions per station:	346
Tourists per casual subscription:	Not available

PROGRAM COMPARISON[79]

Revenue Model
Sponsorship, membership and usage fees are all reinvested into the system. No profit sharing with the jurisdiction. Jurisdiction helps by providing in-kind services in the form of electricity and staff time for reviewing proposed locations.

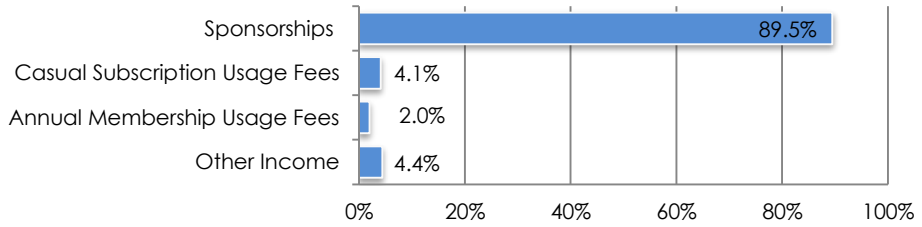
Membership Fees & Usage Fees

Annual:	$30 First 60 minutes free
Annual Student:	$20
	Additional 30 minute increments:
Monthly:	$15 - Annual: $1 (1 hr.); (max $35/day)
24 Hours:	$5

Operating Costs[76]

Operating expense per dock per month:	$15.6
Operating expense per ride:	$42.52
Fare box recovery:[77]	32%

Breakdown of Revenue[78]



69 As of July 2013
70 Service area is calculated as the area encompassing every station plus a ¼ mile buffer around each station.
71 Stations per square mile in service area.
72 2012 US Census Estimates. State & County QuickFacts.
73 US Census Estimates. Figures include Greenville-Spartanburg-Anderson CSA population
74 Anne Piacentino. Active Lifestyles Coordinator. Partners for Active Living
75 Anne Piacentino. Active Lifestyles Coordinator. Partners for Active Living (September 2012-September 2013)
76 Partners for Active Living 2011 IRS Form 990.
77 Fare box revenue is the percent operating costs recovered from annual memberships, casual subscriptions, and usage fees
78 Partners for Active Living 2011 IRS Form 990.
79 Most recent data available. (Reported 2012 or 2013)

	Montgomery County, MD	South Bay Cities San Francisco Bay Area	Greenville, SC	Spartanburg, NC
System Name	Capital Bikeshare	Bay Area Bike Share	Greenville, B-Cycle	Spartanburg, B-Cycle
Start Date	September 2013	August 2013	March 2013	July 2011
Number of Bikes	450 bikes (365 in deployment)	278	28	40
Number of Stations	50 (48 in deployment)	34	6	4
Bikes per station	7.6	16.3	4.7	10
*Service Area (Sq. Mi.)**	13 sq. mi.	7.5 sq. mi.	1.16 sq. mi.	0.8 sq. mi
*Station Density***	3.8 stations / sq. mi.	4.53 stations / sq. mi.	5.1 stations / sq. mi.	5.0 stations / sq. mi.
Casual Membership	-	1,227	~2,000****	1,384
Annual Membership***	387	425	245	97
Annual Member Trips***	6,786	10,912	~1,200****	755
Annual Casual Trips***	1,488	3,250	~2,000****	1,521
Total Annual Trips	8,274	14,162	~3,200****	2,276
Annual Trips per Bike	47	102	114	56.9
Average Trips per Bike per Day	0.13	0.28	0.31	0.16
Equipment ownership	Owned by county	Owned by regional air management district	Non-Profit Owned	Non-Profit Owned
Business Model	Multiple jurisdictional owners with unified vendor operations	Regional ownership with vendor operations	Non-profit owned and managed with some operating functions contracted	Non-Profit Managed

Table 1 - Existing Programs in Comparable Cities

* Service area refers to the area of the city in which bike share stations are located
** Number of stations per square mile within the service area
*** Less than a year worth of data available for Montgomery County (8 months of data) and Bay Area Bike Share (6 months of data)
**** Figures provided were rounded up by Greenville B-cycle program managers

3. COMMUNITY ANALYSIS

The implementation of a bike share program is highly dependent on the existing conditions within a jurisdiction. It is therefore important to fully understand the context under which a potential bike share program could be implemented. The following chapter provides a summary of existing physical, demographic and political conditions within the County. Each subsection includes a review of challenges and opportunities which could have an effect on bike share implementation.

GEOGRAPHY AND EXISTING ROADWAY CONDITIONS

Howard County is located in central Maryland between the cities of Baltimore and Washington DC. With a total area of approximately 250 square miles, Howard County is bounded by Anne Arundel County and Prince George's County in the south and east, Montgomery County in the west and south, and the Patapsco and Patuxent rivers in the northeast and southwest respectively.

Several aspects of the geography create challenges for a potential bike share system. Howard County's topography is marked by rolling hills, which make bicycling throughout some parts of the region challenging (see **Figure 6**). Existing research indicates that while slopes at a grade of five percent or higher are considered a major barrier for bicyclists, slopes between one through five percent can also serve as a deterrent to bicycling.[80] Road conditions vary throughout the County, with many roads in the Central and Eastern areas of the County experiencing poor cycling conditions due to high traffic volumes and speeds and/or lack of space on the roads.[81]

Howard County is home to various unincorporated areas including Columbia, Elkridge and Ellicott City, all of which have varying development patterns and street connectivity. While most large arterial roadways have poor cycling conditions (due to large traffic volumes and high speeds), many collector roads and neighborhoods streets have good cycling conditions. An additional bicycling issue includes the barriers to connectivity in the form of major highways with few bicycle-friendly crossings, railroad lines, large natural areas and stream valleys with steep topography such as the Patapsco River.[82]. A relatively connected network of pathways and trails connects the more populated areas in the eastern part of the County (see **Figure 16** for more details). Coupled with the temperate climate, the existing network of pathways and trails facilitate a year-round active lifestyle for residents.

Challenges:

- Difficult topography makes bicycling challenging in some parts of the County.
- Street connectivity is difficult in some areas due to barriers, such as highways, railroad lines and existing topography

Opportunities:

- Relatively well connected network of pathways and trails throughout eastern parts of the County.
- Older communities have a more interconnected street grid.
- Temperate weather throughout the year.

DEMOGRAPHICS

The implementation of a bike share program is highly influenced by the population and employment characteristics of a particular region. Bike share systems are most successful where there is a high concentration of jobs, people and activities in the same area.

POPULATION DENSITY

Located between the metropolitan areas of Baltimore and Washington, Howard County has a population that is highly marked by trends in these two greater metropolitan areas.

80 Midgely, Peter. "Bicycle Sharing Systems: Enhancing Sustainable Mobility in Urban Areas." Background Paper No. 8. United Nations Commission on Sustainable Development. Pg. 7-8. May 2011. Retrieved from http://www.un.org/esa/dsd/resources/ res_pdfs/csd-19/Background-Paper8-P.Midgley-Bicycle.pdf on August 25, 2014.

81 BikeHoward. Howard County Bicycle Master Plan Draft. May 2014. Obtained from http://bikehoward.files.wordpress.com/2012/06/bike-howard-draft-may-20141.pdf

82 BikeHoward. Howard County Bicycle Master Plan Draft. May 2014. Obtained from http://bikehoward.files.wordpress.com/2012/06/bike-howard-draft-may-20141.pdf

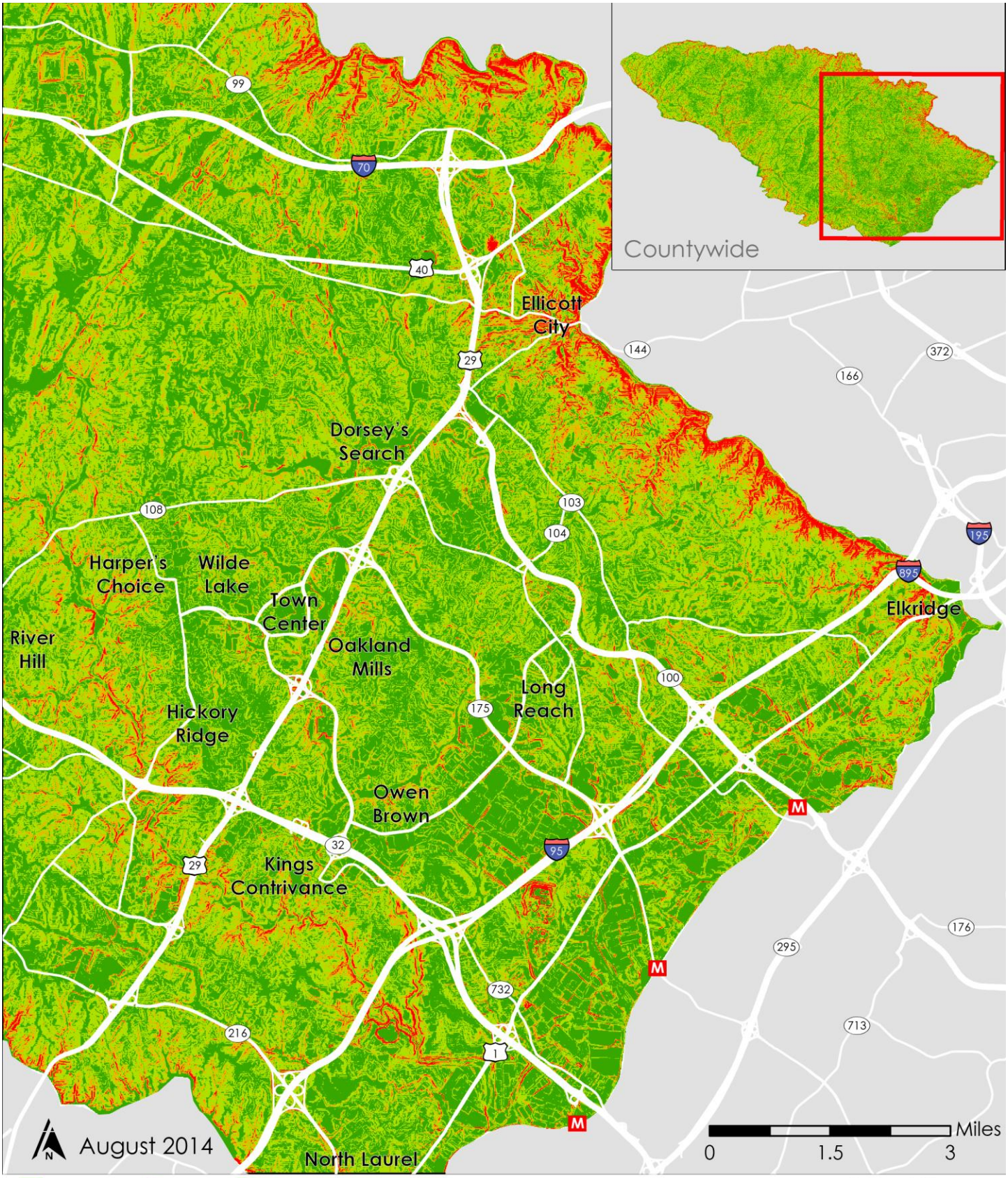


Figure 6 - Howard County Topography

Table 2 - Select Population Characteristics[83]

	Area (Sq. mi)	Population	Density (People / Sq. Mi.)
Howard County	**250.75**	**288,754**	**1,152**
Columbia[84]	28.26	83,430	2,951
Elkridge	12.77	12,773	2,245
Ellicott City	29.89	59,830	2,001
Route 1 Corridor	22.18	43,954	1,981
Laurel	8.01	21,886	2,733
Greenville	28.67	60,709	2,117
Bay Area (not including San Francisco)	231.83	1,204,708	5,196
Spartanburg	19.8	37,401	1,891
Montgomery County	491.25	1,004,476	2,044

At just over 288,000 people (based on the most recent Census estimates) the County as a whole has a density of approximately 1,151 people per square mile. However, the population density is higher in certain population centers in the County, as shown in **Table 2**. The residential densities are similar to those presented in **Table 2** from comparable jurisdictions with existing bike share programs. **Figure 9** presents the population density in Howard County. Note that Columbia Town Center and Ellicott City both have lower population densities compared to other surrounding areas (refer to **Table 2** and **Figure 9** for more details).

AGE, GENDER AND INCOME

Figure 7 presents the age and gender distribution of Howard County.[85] The median household income is $107,821, making it one of the wealthiest counties in the State of Maryland. The high average income level represents an opportunity for bike share implementation, as historical data has shown that early adopters of bike share systems tend to be more affluent.[86] On the other end of the income spectrum, however, the percentage of residents under the poverty level ($35,000 for a family of four) is just over 10%. Bike share represents an opportunity for Howard County to provide a transportation option to low-income residents (who may have difficulty in connecting to jobs and activity centers. **Figure 8** presents the complete income distribution for Howard County residents.[87]

The age demographic, average of 38.9, presents a challenge, as it is older than the average bike share member.[88]

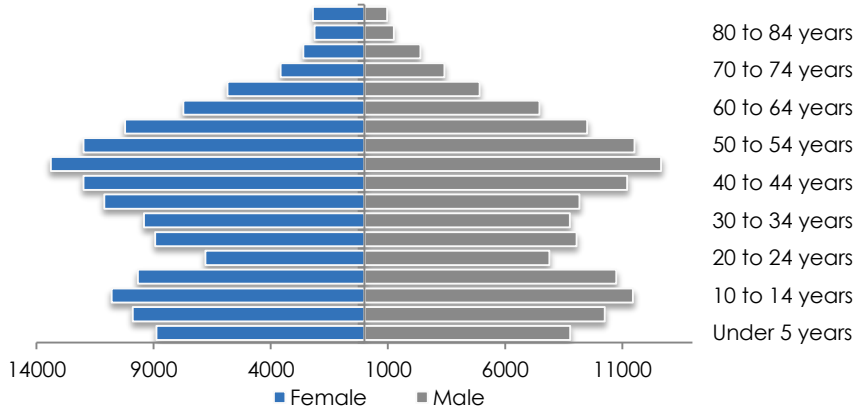


Figure 7 - Gender and Age

MEDIAN HOUSEHOLD INCOME $107,821

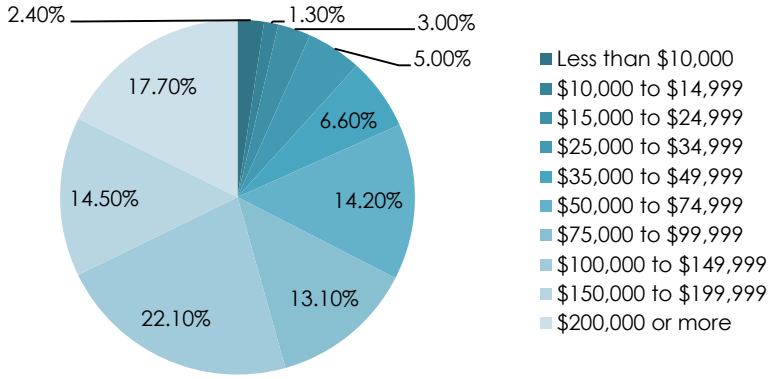


Figure 8 - Income Distribution

83 Area, population and density are based on City sizes not on bike share system size
84 As calculated by Census Tracts.
85 US Census Bureau. 2008-2012 American Community Survey 5-Year Estimates. S0101 Age and Sex.
86 Bike Sharing in the United States: State of the Practice and Guide to Implementation. Federal Highway Administration. United States Department of Transportation. September 2012.
87 US Census Bureau. 2008-2012 American Community Survey 5-Year Estimates. DP03 Selected Economic Characteristics
88 Average age of bike share members is 28 years of age, according to the Federal Highway Administration.

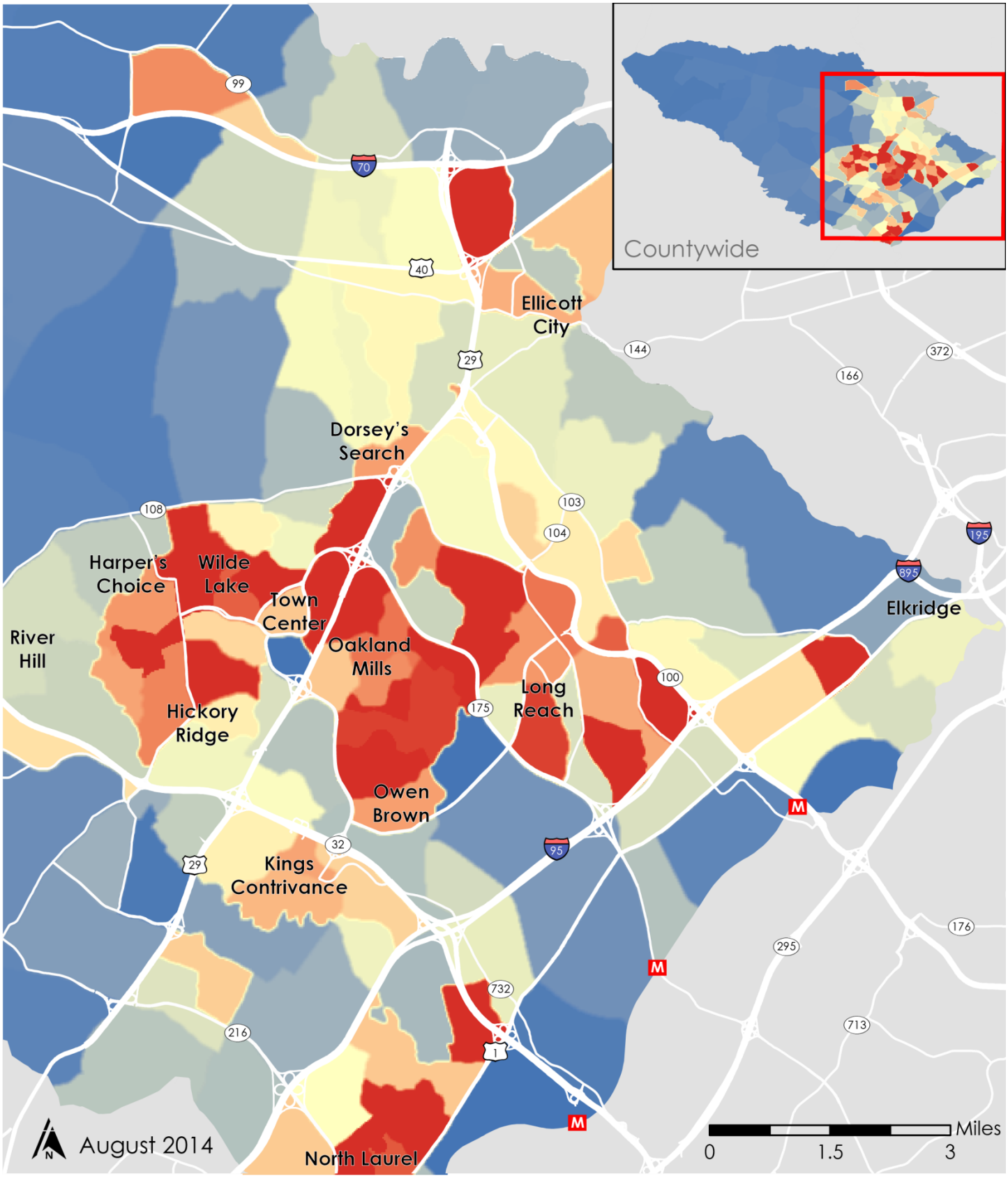


Figure 9 - Howard County Population Density

The racial and ethnic composition of the County as shown on **Figure 10** below is comparable to the overall Maryland population: approximately 62% White, 17% African American, 14% Asian and 6% Hispanic/Latino. To date, the majority of bike share riders have been middle- to upper-class Caucasians in bike share systems around the U.S.[89] Recognizing this pattern, communities have increasingly focused on bringing a more diverse rider base to bike share. **Figure 11** shows the geographic distribution of low-income and minority populations, demonstrating high density in Jessup, North Laurel, Oakland Mills, Owen Brown, Harpers Choice and North Ellicott City. As these areas are near areas of high population and employment density, and public transit, there may be an opportunity to provide an affordable transportation option for these communities.

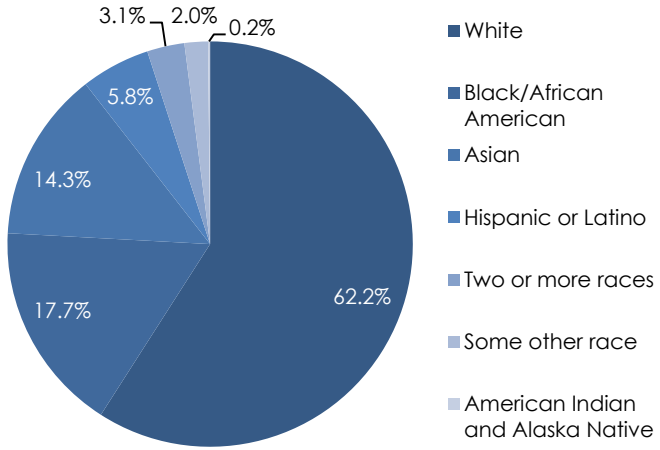


Figure 10 - Demographic Distribution

EMPLOYMENT

The density of jobs in a particular area impacts usage patterns of bike share systems by expanding potential transportation options for commuting and daytime trips.

Approximately 30% of Howard County residents are employed in Howard County, 30% employed in the DC metropolitan area, 30% employed in the Baltimore Area and 10% in other areas, including Anne Arundel County and employment related to Fort Meade and NSA.[90]

The major employers in the area are depicted in **Table 3**. **Figure 12** provides a representation of areas of the County (areas in red and orange) that exhibit the highest concentrations of employment. Columbia, Ellicott City and some other locations in the eastern part of the County display the highest employment concentrations.

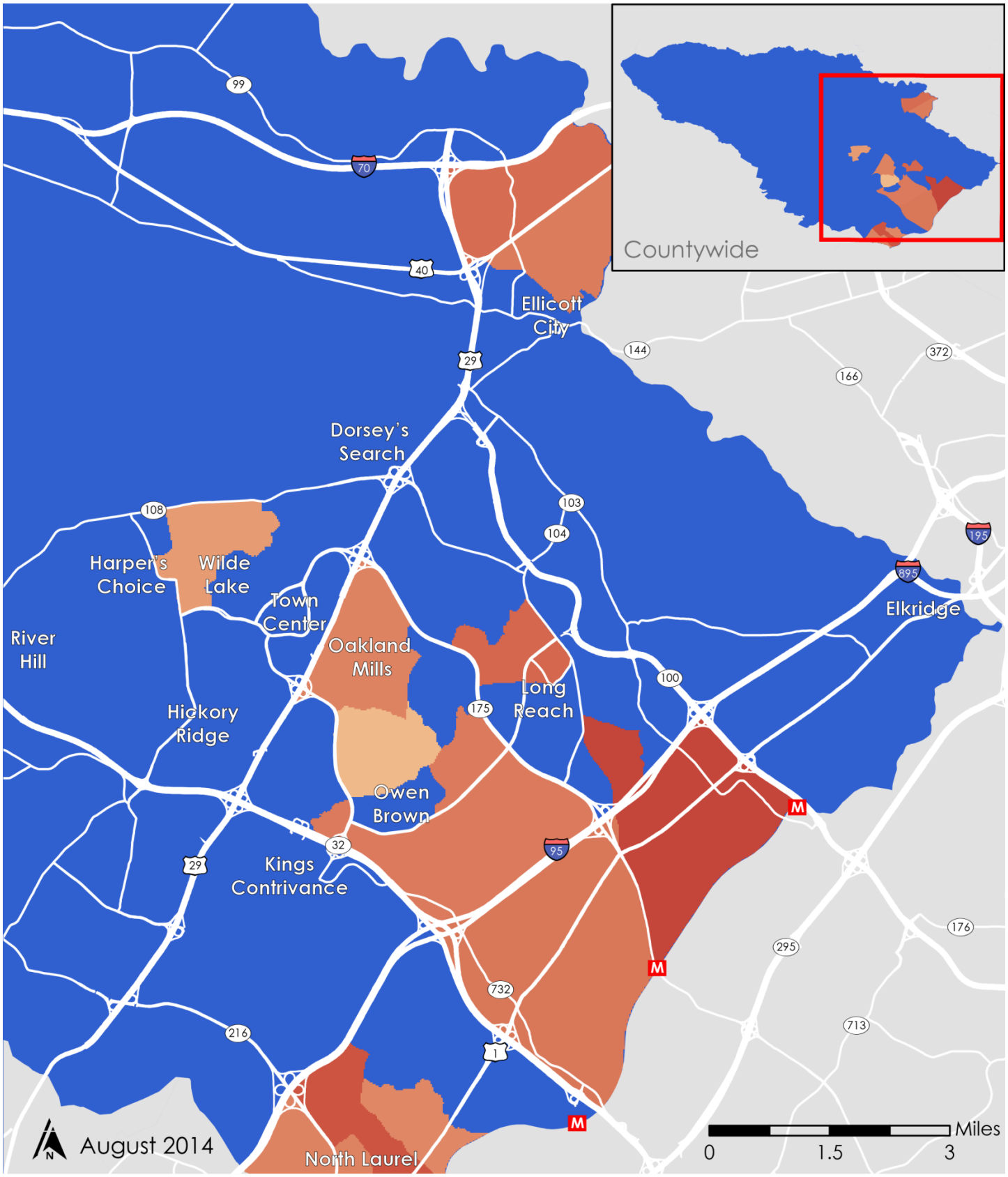
The specific areas with the highest concentration of at-place employment include Howard General Hospital, Howard Community College, Ellicott City (where most county employees are concentrated), and at Johns Hopkins APL campus and at Columbia Gateway.

Employer	Estimated Employees
Howard County Public Schools	7,553
Johns Hopkins APL	4,700
Howard County Government	2,877
Verizon Wireless	2,877
Lorien Health Systems	2,200
Howard County General Hospital	2,000
Howard Community College	1,728
SAIC	1,060
Giant Food	1,050
The Columbia Association	900

Table 3 – Top Employers in Howard County[91].

89 Bike Sharing in the United States: State of the Practice and Guide to Implementation. Federal Highway Administration. United States Department of Transportation. September 2012.

90 Howard County Comprehensive Annual Financial Report For the Fiscal Year Ended June 30, 2013.
91 Howard County Comprehensive Annual Financial Report For the Fiscal Year Ended June 30, 2013.



Equity

BIKE HOWARD

Bike Share Feasibility Study

Source: 2008-2012 American Community Survey 5-Year Estimates. File DP05 Demographic and Housing Estimates; DP03 Selected Economic Characteristics. U.S. Censu Bureau.

Figure 11 - Howard County Social Equity Analysis (Concentration of Minority and Low-Income Populations)

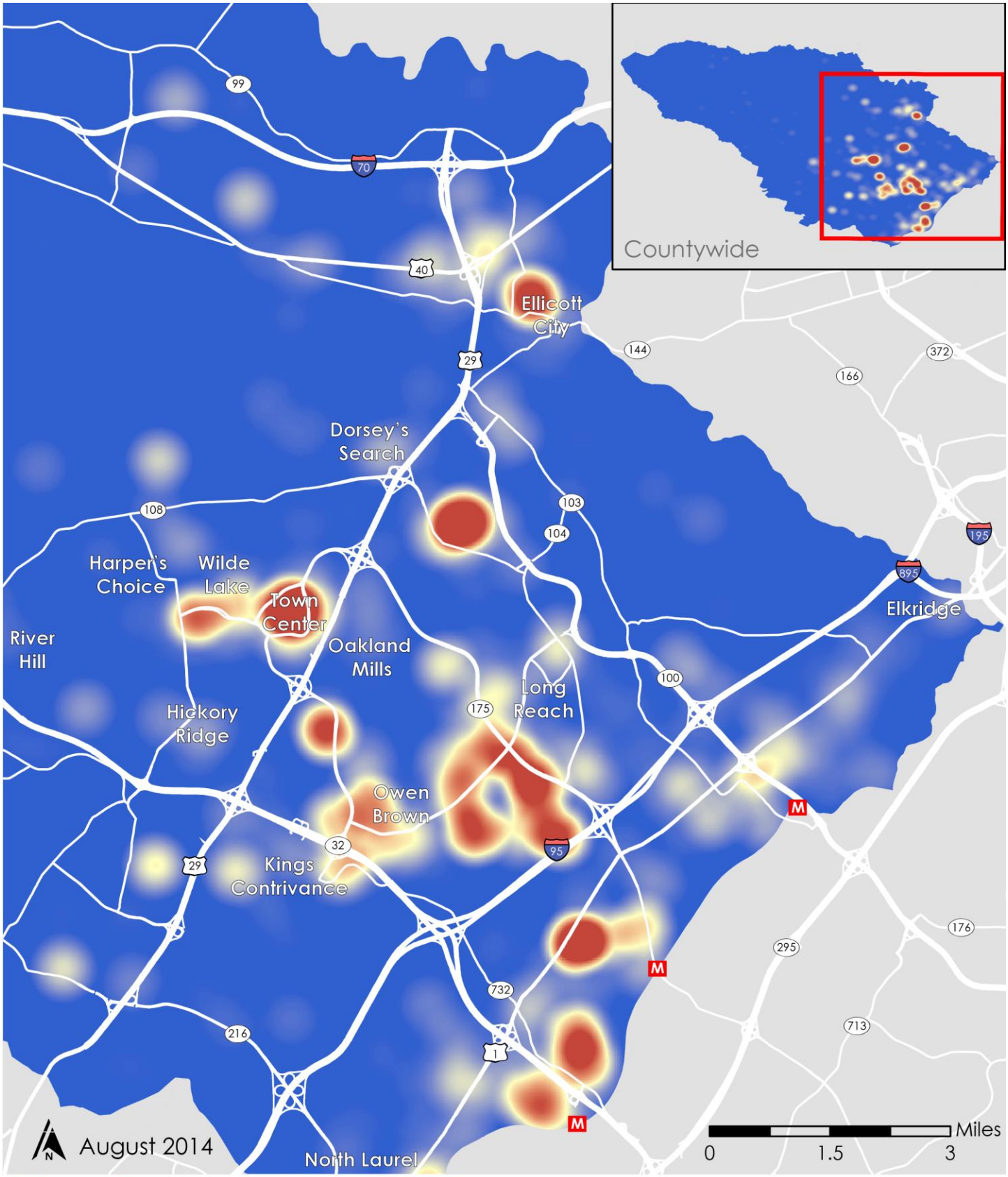


Figure 12 - Howard County Employment Density

FUTURE DEVELOPMENT

The above data represents current conditions in Howard County. However, there is significant planned residential, retail, restaurant and office development in Downtown Columbia over the next few years. Following is the planned development:

- Six new and reconfigured downtown neighborhoods including Warfield, The Mall, The Lakefront and Lakefront Core, The Crescent, Merriweather-Symphony Woods, and Symphony Overlook.
- New and improved connections to existing Town Center neighborhoods of Vantage Point, Banneker, Warfield Triangle and Lakefront.
- Mixed-use development with up to 5,500 new residential units, 4.3 million square feet of commercial office space, 1.25 million square feet of retail space and 640 hotel rooms. Increased street connectivity with dedicated facilities for all modes, including new sidewalks, bicycle facilities, bike parking, on-and off-street parking facilities for automobiles.
- Expanded green space throughout the Mall neighborhood.
- Increased access and connectivity to The Lakefront and Lakefront Core around Lake Kittamaqundi and the public spaces adjacent to the lake.
- Pathway connection between the Lakefront and Symphony Woods, and Blandair Park to Howard County General Hospital.
- Mix of retail, office, hotel/convention and residential uses in the new Symphony overlook neighborhood.

These developments will significantly increase both employment and residential density in Downtown Columbia.

Challenges:

- Lower population and employment densities in Western areas of the County and areas outside the more urbanized central and eastern parts of the County may present a challenge for implementing bike share.
- Areas with high employment densities (Columbia Town Center and Ellicott City) are not currently co-located with areas of high residential density.

Opportunities:

- Areas in parts of the County exhibit high employment densities and residential densities similar to peer cities with bike share systems.
- High average income demographic is characteristic of early adopters of bike share system.
- Significant planned development in the near future in Downtown Columbia will increase both residential and employment density.
- There are a number of geographic areas that exhibit relatively high concentrations of low-income and minority populations (i.e., Jessup, North Laurel, Oakland Mills, Owen Brown, Harpers Choice and North Ellicott City as shown in **Figure 11**) which may benefit from increased mobility and connectivity to jobs provided by a bike share system.

TRANSPORTATION MODE SHARE

As a mainly suburban county, 81% of Howard County residents utilize single-occupancy vehicles to get to and from work as noted on **Figure 13.**[92] This level is on par with suburban areas around the country.[93]

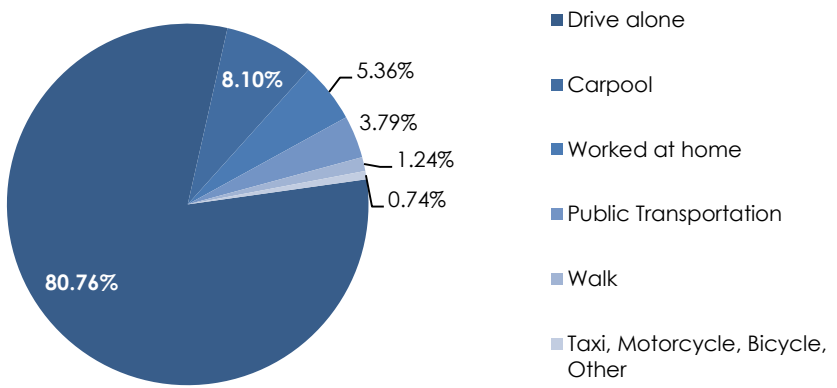


Figure 13 - Transportation Mode Share in Howard County

92 US Census Bureau. 2008-2012 American Community Survey 5-Year Estimates File B08101 Means of Transportation to Work By Age.

93 US Census Bureau. 2008-2012 American Community Survey 5-Year Estimates File B08101 Means of Transportation to Work By Age.

Automobile dependence may also be influenced by existing parking regulations, as on- and off-street parking is abundant and affordable throughout the County.

Public transportation throughout the County is currently provided by the Maryland Transit Administration (MTA), Howard County Transit, Regional Transit Agency and by Central Maryland Regional Transit in the form of commuter buses, local buses and MARC commuter trains. With three MARC train stops along its eastern border, Howard County residents are linked to jobs in the Washington DC and Baltimore areas. In urban areas, placement of bike share stations linking or in close proximity to transit facilities is recommended to help increase the number of connections to and from transit. However, in Howard County, commuter train stations tend to be located far from the areas of sizeable population and employment density, reducing the potential for first- and last-mile connections to these stations. It is important to note that these locations are zoned for future Transit Oriented Developments with the potential to increase both residential and commercial densities around MARC stations.

Existing bus transit operations include over 10 different transit routes with fares from $1-$2, resulting in a transit mode share of approximately 4%. While there are various transit services linking Howard County residents to jobs in Washington DC and Baltimore, there are several drawbacks to the system, including long headways, no weekend service, and only partial coverage of the County. **Figure 14** maps the geographic locations within the County with the highest ridership and most frequent service. As Downtown Columbia is the central node of all the bus services in the County (and bus stops in the area experience the some of the highest ridership in the County),[94] implementing bike share in this area may open the opportunity for first- and last-mile connections to and from this location. The high density of transit use in Columbia Town Center, and lack thereof in Ellicott City, is reflected in **Figure 14.**

Challenges:

- High dependency on single occupancy vehicles for most of commute to work trips recorded (see **Figure 13**).
- Low parking rates and availability of free on-street parking encourage increased use of SOV's.
- Infrequent bus transit service and limited number of routes throughout the County.
- MARC commuter rail stations are relatively far from the areas that exhibit the highest residential and employment density, and connectivity to them is challenging.

Opportunities:

- Downtown Columbia is the central node of many of the bus services in the County, opening the opportunity for first- and last-mile connections to and from this location.
- County residents without access to a vehicle represent an important demographic for bike share implementation, as it could help serve as a convenient and flexible complement to existing public transit services.

BICYCLE INFRASTRUCTURE

A well connected network of bicycle-friendly facilities encourages increased bike share ridership, and while a fully implemented network is preferred, experience by other jurisdictions has indicated that it is not necessary to have a complete network to implement a bike share program.[95] Existing peer jurisdictions have been able to implement both a bike share program while continuing to expand their bicycle infrastructure in parallel. However, as Columbia Association and Howard County look to implement a bike share program, it will be important to provide a core network of low-stress connections between various areas of the County to encourage bicycle trips between them.

Bicycle conditions in Howard County are highly varied. While many rural roadways are narrow and largely without shoulders, many have low traffic volumes and remain popular bicycling destinations for recreational bicyclists.

94 Data provided by Howard County Department of Planning and Zoning. Includes ridership data. (Average monthly boarding and alighting Feb - May 2013).

95 Bike Sharing in the United States: State of the Practice and Guide to Implementation. Federal Highway Administration. United States Department of Transportation. September 2012.

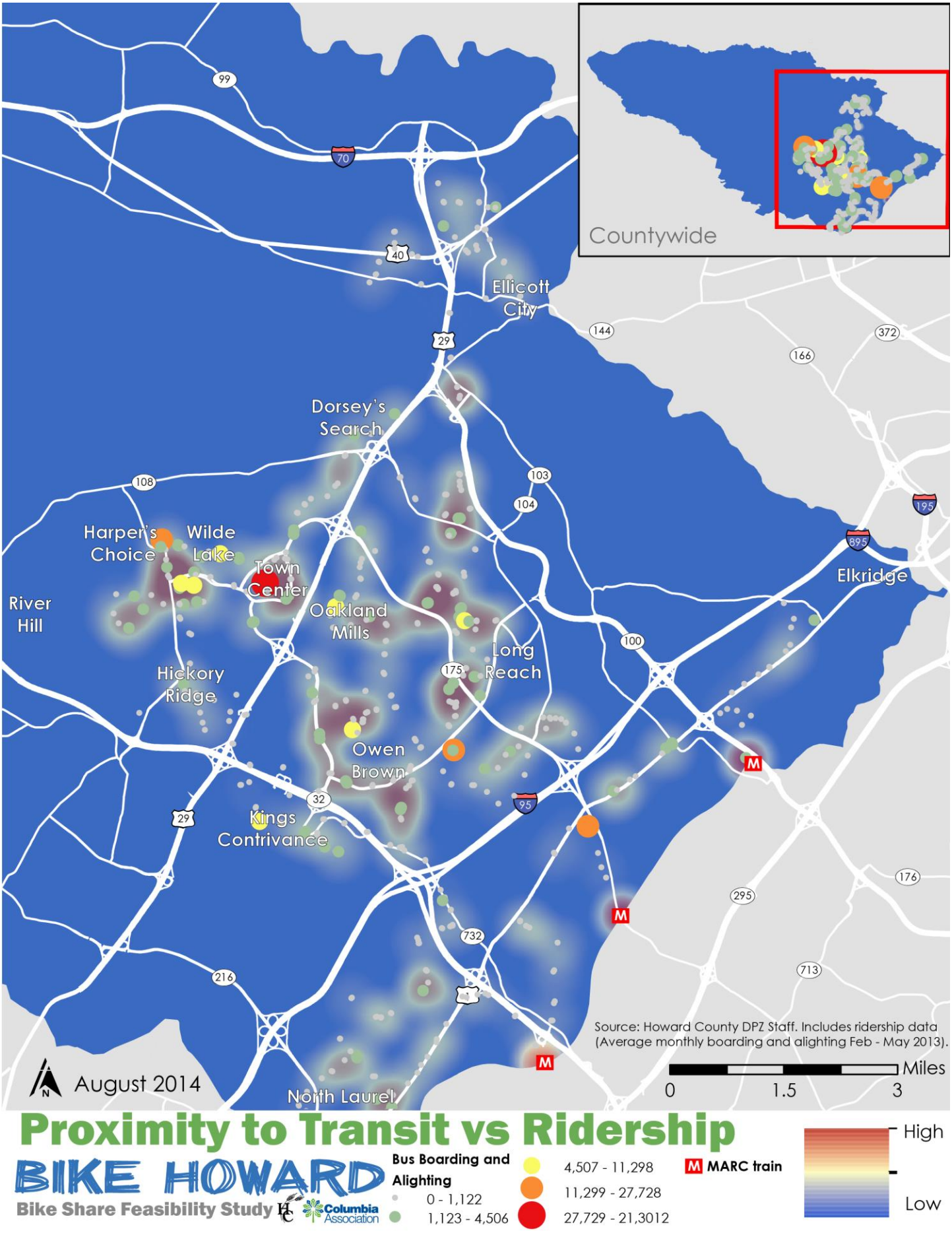


Figure 14 - Howard County Transit Availability vs. Ridership

Figure 15 – Downtown Columbia Trail Along Little Patuxent Parkway (under construction)

In the Central and Eastern parts of the County, most large arterial roadways exhibit difficult cycling conditions due to large traffic volumes, high traffic speeds and/or lack of space available for cycling. However, collector roadways and neighborhood streets tend to display comfortable bicycling conditions due to their low traffic volumes, low speeds, and the presence of traffic calming infrastructure.

The County and Columbia Association have an extensive network of off-road facilities including trails and shared use pathways centered on Columbia and extending south to Savage along the Little Patuxent River. While most pathways provide a comfortable riding experience, the pathway system is narrow and steep in places. **Figure 16** depicts a heat map of areas of the county with the most concentration of bicycle friendly facilities including sharrows, bicycle lanes, and trails/pathways. Additionally, there is little way-finding, making it difficult for residents and visitors to navigate the system. The County has also implemented a small number of on-road facilities such as bicycle lanes, and many of its roadways include paved and striped shoulders that are sufficiently wide for some cyclists to use. **Table 4** provides an estimate of the number of miles of existing facilities.

One of the County's major issues related to bicycling is the high number of the barriers to connectivity, including major highways (e.g., Interstate 95, Route 29) with few comfortable connecting crossings between activity centers. Furthermore street design in major roadways like Route 32 and Snowden River Parkway encourage motorists to speed while not currently offering safe connections for pedestrians and bicyclists. Finally, the existing network of off-road facilities that includes pathways and trails currently offers limited connectivity to some activity centers.

To increase connectivity between activity centers around the central Columbia core, the Howard Hughes Corporation is working to construct a new 3.25 mile trail system connecting Howard County General Hospital to Blandair Park. This trail is expected to provide a seamless and comfortable connection for pedestrians and bicyclists alike and help increase access to and from key locations within Columbia. Phase 1 of the project is currently underway (see **Figure 15**) and later phases are in the design review process.

Facilities	Estimated Miles
Paved Pathways	151
Bicycle Lanes	3
Paved and Striped Shoulder	42

Table 4 – Existing Bicycle-Friendly Facilities[96]

Finally, it has been documented in local plans that that many of the existing pathways are missing site appropriate signage guiding riders to points of interest and destinations.[97] Columbia Association and Howard County have begun implementation of a robust way-finding program based on the recommendations contained in the County Bicycle Master Plan.

Challenges

- Existing major highways act as barriers to connectivity.
- Incomplete way-finding and signage program.
- Street design encourages high speed of motorists.

Opportunities:

- Limited but increasing bicycle friendly facilities network.
- Transportation plans calling for the expansion of bicycle and pedestrian facilities throughout the County.

96 BikeHoward. Howard County Bicycle Master Plan. DRAFT. February 2014

97 BikeHoward. Howard County Bicycle Master Plan Draft. May 2014. Obtained from http://bikehoward.files.wordpress.com/2012/06/bike-howard-draft-may-20141.pdf and Columbia Association Active Transportation Action Agenda. Obtained from http://www.columbiaassociation.org/transparency/master-plans/active-transportation on August 15, 2014.

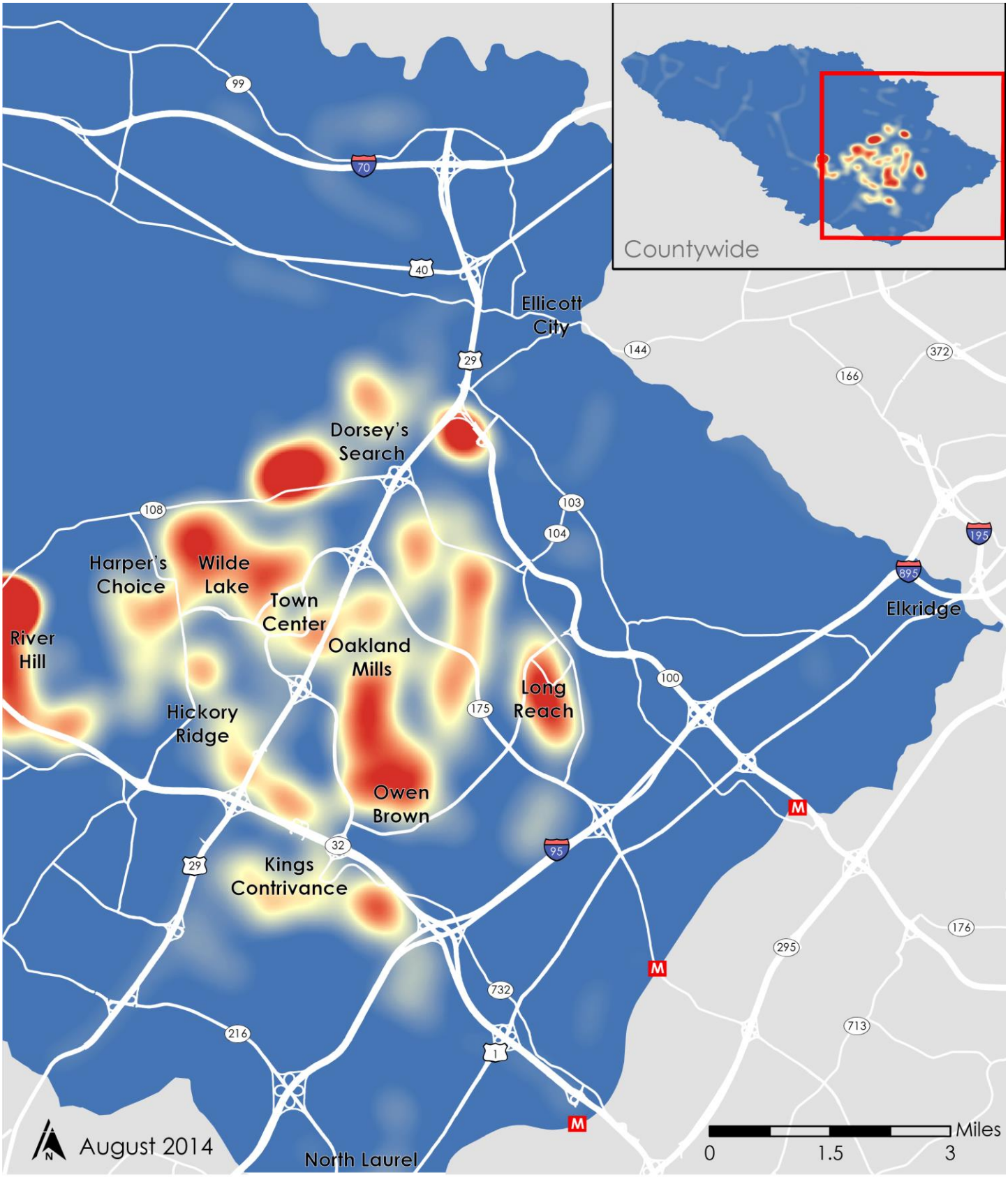


Figure 16 - Howard County Proximity to Existing Bicycle Infrastructure

TOURISM

Figure 17 - Ellicott City is one of the most visited destinations in Howard County

In addition to residents, bike share represents a potential opportunity for Howard County to provide car-free recreational opportunities for visitors. These riders are important to a bike share system, as tourist-generated revenue generally provides approximately two-thirds (2/3) of user-generated revenues in peer jurisdictions with existing bike share programs.[98]

According to the Howard County Tourism and Promotion Office (*Visit Howard County*), Howard County tourism generated over $549 million in sales related to lodging, food and beverage, retail, recreation and transportation expenditures in 2012.[99] In the County, the major visitor destinations include Merriweather Post Pavilion, Historic Ellicott City, State Parks and various high usage trails. With over 3.25 million visitors attending events and local attractions like Merriweather Post Pavilion, Patapsco Valley State Park, Howard County Fair and over 20 different agro-tourism attractions, the County's tourism revenues continue to rise at a rate of over 4% each year. The County is also home to various outdoor and healthy living events such as the Columbia Invitational, Lifetime Indoor Triathlon, Columbia Triathlon and the OBGC Labor Day, which help bring more than 7,000 tourists to the County. **Figure 18** presents the tourism industry sales for the past 5 years.[100]

While there are only a few hotels and conference spaces located within Downtown Columbia, there are plans to continue expanding this infrastructure and to help redevelop Downtown Columbia into a more visitor-friendly location. Furthermore the existing (and under construction) trail network will provide the opportunity for visitors to use bike share to access various locations within the Downtown.

These events and destinations present opportunities for visitors to utilize a bike share system during their stay in Howard County. The biggest challenge is to communicate with this hard-to-reach population as to the presence and location of bike share system. Reaching this population may require targeted marketing via strategic partnerships with local groups and tourist destinations. The County has a well-organized Tourism and Promotions office, which may be able to provide some in-kind services related to marketing and promotion of the bike share system.

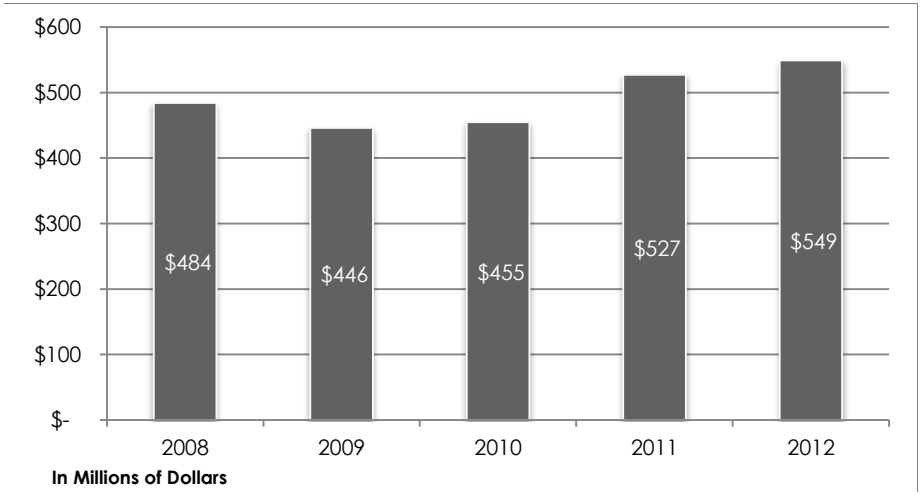


Figure 18 - Tourism Industry Sales

98 San Antonio B-Cycle. Annual Report.
99 Rachelina Bonacci. Chief Executive Officer. Howard County Tourism and Promotion. June 4, 2014.
100 Rachelina Bonacci. Chief Executive Officer. Howard County Tourism and Promotion. June 4, 2014.

Source: Boulder B-cycle


Figure 19 – Little Patuxent Branch Rail Trail is one of many Active Living destinations

Challenges:

- Reaching the visitor population may require targeted marketing via strategic partnerships with local groups and tourist destinations.

Opportunities

- The County has a number of significant destinations and events that attract a steady number of tourists who may be potential users of a bike share program.
- The County has a well-organized Tourism and Promotions office which may be able to provide some in-kind services related to marketing and promotion of the bike share system.
- Columbia Association and the County's trails and greenway network provides a strong recreational opportunity for visitors.
- There are regional destinations in the vicinity of Downtown Columbia (ex., Columbia Mall, Merriweather Post Pavilion, Howard Community College) and a short distance from the core of the pathway system, offering the opportunity for visitors to use bike share as an active transportation option connecting to these locations.

SUMMARY OF EXISTING CONDITIONS

There are several aspects of Howard County which make it conducive to a potential bike share system. These include (1) a climate conducive to yea-round cycling; (2) residential density in certain areas comparable to peer jurisdictions that have implemented bike share; (3) large employment centers; (3) a strong network of bicycle paths around the County; (4) high income demographic; (5) a low-income demographic that could benefit from a system; and (6) significant tourism to the County. However, there are also difficult challenges which include (1) an auto-oriented culture; (2) streets with high traffic volume and speeds, and limited room for bicycles; (3) low use of public transit; (4) older age demographic; and (5) few areas where employment and residential density overlap.

The current conditions are conducive for a system that may be used recreationally by residents and visitors. Because of the lack of more mixed use areas, high use of public transit, destinations around public transit stops and safe cycling connectivity between them, it is unlikely that a bike share system would be used for transportation, which is prevalent in bike share systems in more dense urban areas.

There are several developments happening that may potentially shift the use of a bike share system in Howard County towards one that is used for daily transportation needs. These developments include the construction of a bike trail to increase connectivity between activity centers around the crucial central Columbia core, as well as significant residential and commercial development in and around Downtown Columbia that will increase population and employment density in this area.

Source: Boulder Bicycle

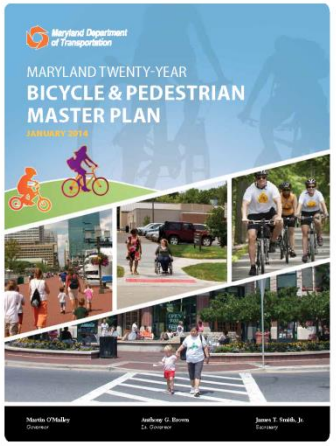
4. POLICY REVIEW

LOCAL AND REGIONAL PLANS

Plans and policies can be important measures of program compatibility with local initiatives. The following existing and future bicycle infrastructure related plans and policies that may influence the implementation of a bike share program in Howard County were reviewed for this study. Overall, the plans are supportive of bike share, either explicitly or implicitly. A short summary of the relationship of each of the following plans to bike share is included below:

- **Maryland Bicycle and Pedestrian Plan 2014** - specifically recommends bike share implementation as a 2013-2018 strategy to integrate active transportation and transit.
- **PlanHoward 2030** – does not deeply discuss bike share, but recommends the promotion of "rideshare and bike share systems, HOV programs, and expanded park and ride lots"[101] to help reduce traffic congestion, energy consumption, and greenhouse gases.
- **2009 Howard County Short-Range Transportation Development Plan** – does not explicitly mention bike share, but recommends the implementation of new transit service and expanded public transportation coverage throughout the central and eastern parts of the County.
- **Bike Howard** – The Howard County Bicycle Master Plan 2014 (DRAFT) – briefly mentions bike share. However, implementation of a bike share program can help achieve several of the plan's goals. In addition, completion of the Master Plan recommendations can greatly increase the opportunity for success of a potential bike share system.
- **Downtown Columbia Plan** – does not explicitly mention bike share, but promotes the development of a multi-modal transportation system through transit, bicycle, and pedestrian improvements. Also recommends the development of a Transportation Demand Management plan, in which bike share can play an important role.
- **Connecting Columbia: Active Transportation Action Agenda (2012)** - recommends improving the quality of existing bicycle lanes and shared-use pathways, implementation of new pathway connections to link neighborhoods and commercial centers, and for increasing the comfort, security and safety or path users.

A detailed review of these plans is included in Appendix 1.



POLICIES AND COUNTY ORDINANCES

As bike share programs are relatively new, the form of equipment, installation, and operations are not typically codified into existing zoning, permitting, and other ordinances. Howard County must therefore consider what policies and ordinances will require some updates or modifications to allow for the implementation and promotion of bike share. Furthermore, the County will need to understand the process under which potential bike share stations will be permitted and installed and will also need to understand whether the current regulations surrounding advertising and sponsorship will allow for such revenue generating avenues to help implementation of the program.

SIGNAGE

Signs are a key component of a bike share operation, as they provide information and maps of the system and directions to nearby bike share locations. In Howard County commercial districts, directional signs are permitted by a variance in all areas except in Downtown Columbia, assuming the sign or signs are necessary for the public convenience and are consistent with the intent of the ordinance. These signs must be located at intersections with a maximum allowable area of 12 square feet and there may not be more than four signs for any single business.[102] These signs may be located in the public right-of-way with approval from the Department of Inspections, Licenses and Permits.[103]

101 Plan Howard 2030. February 2013. Page 175.
[102] Howard County Code of Ordinances. Title 3-Buildings, Subtitle 5. Sec. 3.501 (c)8.
[103] Howard County Code of Ordinances. Title 3-Buildings, Subtitle 5. Sec. 3.505A (b)3.

In Downtown Columbia, commercial directional signs are allowed and must conform to the Downtown Neighborhood Design Guidelines.[104] Pedestrian directional signs can be placed on private land or in the public right-of-way and must conform to design standards that direct and inform pedestrians.[105] Public signs, or signs in a non-commercial nature in the public interest, are exempt from the provisions set forth for other signs. These signs include directional, regulatory, and information signs.[106] In all commercial districts and in all areas within Downtown Columbia, signs used to advertise a product or service at the site and location of the sign are permitted as "accessory to the building or use."[107]

The code limits the size of informational signs to two square feet for each linear foot of building frontage,[108] suggesting that this section would need to be revisited for relevance to bike share signage. The code also limits signs from encroaching in the public right of way. Given the County Code of Ordinances, it is the consultant's opinion that signs on a bike share station that provide the name or other information about bike share would be permitted by the code, pending additional interpretation of the Code.

ADVERTISING

Howard County's municipal code identifies outdoor advertising as billboards or poster panels which advertise products or businesses not connected with the site or building on which they are located.[109] Furthermore, the code limits outdoor advertising to be temporary in nature and located on unimproved property in industrial or manufacturing districts. This extends to any outdoor advertising, for example advertising on bus shelters.

General advertising (e.g., for commercial products or businesses) on a bicycle station would be considered outdoor advertising and would not be allowed by the current code. Also, in Downtown Columbia, advertising signs that are three square feet or larger and on vehicles are also prohibited by the code.[110] Unless revised, these policies will limit the County's ability to use advertising as an additional revenue source for implementing bike share.

Please note that interpretation of all zoning and advertising regulations were based on a preliminary review. It is recommended that all County regulations and ordinances be reviewed with the County attorney prior to system implementation. Additionally, Howard County engineering, planning and permitting staff should consider creating a general blanket permit to help regulate and expedite the placement of bike share facilities. Finally, it is recommended that Howard County staff work with local officials to establish a specific set of guidelines to allow for the use of bike share sponsorship and advertising.

Challenges

- Howard County's current signage ordinances may need to be updated to allow for the use of bike share advertising /informational panels on bike share stations or bicycles. Additionally, these adjustments may need to reflect the location and placement of bike share signs.
- Signage ordinances may need to be amended to allow for the use of sponsorship and advertising on bike share stations and bicycles.
- Pathway and complete street improvements are recommended to be completed as properties are redeveloped, which could leave gaps in the active transportation network.

Opportunities

- Comprehensive transportation plans aim to achieve multi-modal and active transportation goals, which will benefit implementation of a bike share system.
- State and local plans address a need to improve the bicycle network.
- Howard County recommends further expansion of its ride share and transportation demand management programs, which can include a bike share element.
- There are several federal or local funding opportunities that could contribute to a bike share system, further research is necessary.
- The multi-use, TOD, and TNC Districts all encourage mixed use development. Bike share stations located in areas with multiple uses can be used for both origin and destination bike share trips,

104 Howard County Code of Ordinances. Title 3-Buildings, Subtitle 5. Sec. 3.501 (c)8.
105 Howard County Code of Ordinances. Title 3-Buildings, Subtitle 5. Sec. 3.501 (c)8c.
106 Howard County Code of Ordinances. Title 3-Buildings, Subtitle 5. Sec. 3.503 (a).
107 Howard County Code of Ordinances. Title 3-Buildings, Subtitle 5. Sec. 3.500 (b).
108 Howard County Code of Ordinances. Title 3-Buildings, Subtitle 5. Sec. 3.501 (c) (1).
109 Howard County Code of Ordinances. Title 3-Buildings, Subtitle 5. Sec. 3.500 (d).
110 Howard County Code of Ordinance. Title 3-Buildings, Subtitle 5. Sec. 3.505 (a)10.

which can benefit the bike share system. These districts also directly or indirectly encourage walkable neighborhoods, which can also benefit bicycling.

- Developers who are interested in applying for a Community Enhancement Floating Zone (See Appendix 1) designation could be connected with a bike share operator to increase options for potential locations for bike share stations.

Source: Capital Bikeshare

5. PUBLIC ENGAGEMENT

As part of the study, the consultant team, Howard County and Columbia Association reached out to various representatives and stakeholders within the community, as well as the general public, to help determine the overall feasibility of implementing a bike share program in the County. The public engagement process encouraged input utilizing various media to shape the direction of the project and answer many questions about local sentiment towards implementation of a bike share program. The following chapter provides a summary of public and stakeholder engagement performed during the study. A full account of public engagement can be found in Appendix 2.

STAKEHOLDER ENGAGEMENT

A series of interviews and targeted meetings were conducted in May 2014 with community and regional stakeholders. The purpose of these meetings was to explore the possible opportunities and challenges of implementing a bike share program in the County. A number of representatives from different County agencies were invited to participate in the following stakeholder group meeting or interviewed individually:

- **Public-sector partners** – Howard County Office of Transportation, Howard County Department of Planning and Zoning, Howard County Department of Licensing and Permits, Columbia Association, Howard County Department of Recreation and Parks
- **Local non-governmental organizations:** Bicycle Advocates of Howard County, Transportation Advocates, Horizon Foundation
- **Representatives from Howard County's economic development and tourism offices** – Howard County Economic Development Authority, Howard County Tourism, Howard Hughes Corporation, Howard County Chamber of Commerce
- **Large Employers** – Howard County Community College, National Security Agency (NSA), Howard General Hospital

PUBLIC INPUT

Public feedback was received utilizing a number of engagement tools, including a project website; an online survey which allowed residents to share their thoughts on possible bike share implementation and their bicycle riding patterns; a crowdsourcing map that enabled community members to select potential bike share locations; a community workshop, where the public at large was able to ask questions about how bike share systems operate throughout the country; and targeted interviews with local stakeholders and agencies (see previous section).Participants were asked to discuss what they saw as the opportunities and challenges faced by bike share in the County and consequentially the discussion brought up a number of goals participants felt bike share should strive to achieve. A number of common themes emerged from each of the meetings which helped frame the discussion of the feasibility of bike share in Howard County. The following is a summary of opportunities and challenges that emerged from these targeted meetings. A full account of each meeting can be found in Appendix 2.

COMMUNITY WORKSHOP

A public meeting was held on May 1, 2014 at the Owen Brown Community Center. The meeting was attended by 25 community members, including bicycle advocates and bicycle shop representatives, as well as officials from the Maryland Department of Transportation. The workshop included a short presentation outlining the scope of the project, an introduction to bike share and systems around the U.S., and a short summary of preliminary findings. In this open house participants were also asked to comment on what the goals and objectives for a potential bike share program in Howard County should be. Finally, participants were asked to suggest potential station locations in printed maps and through the use of the online crowdsourcing map.

ONLINE SURVEY

To reach out to additional Howard County residents, an online survey was created. The survey was designed to understand bicycling practices of residents in Howard County, and to help gauge public sentiment about bike share and its potential implementation in the County. The survey included 30 questions and was promoted through various online sources including the project website, social media as well as print and online news media.

The survey was divided into four major categories: i) current bicycle usage; ii) opinions about bike share; iii) potential goals and objectives; and iii) demographic and employment information. The survey was

open from April 3 through June 13, 2014 and received a total of 152 responses.

FEEDBACK SUMMARY

Following is a summary of feedback received from the public engagement exercises described above. Views from both the public and stakeholders towards implementation of a bike share program throughout the County were mixed. The public survey results showed 48.1% of respondents responding positively to the possibility of implementing a bike share program and 51.9% reacting negatively.

Opportunities

Opportunities cited were:

- Bike share can be a means to further promote active living and healthy initiatives.
- By increasing connectivity and access to various "active living" destinations, a bike share program could allow residents to explore local parks, lakes and trails.
- The County has an extensive trail network that connects to recreational facilities, village centers, parks and destinations, especially throughout Columbia.
- Bike share could provide a last-mile connection to transit, taking commuters to and from the MARC train to their homes, destinations and work places, including the National Security Agency (NSA) in Ann Arundel County.
- Residents could potentially use bike share for non-work trips as well, providing improved access to the County's extensive library system, local recreation centers, and retail destinations.
- Bike share can be an additional amenity that sets the community apart from its peers around the region to help attract and retain a well-educated, mobile, and highly-competitive workforce.
- As the County attracts hundreds of thousands of visitors a year to festivals and concerts, bike share could encourage people to explore more areas of the County when they visit.
- Bike share could provide additional mobility options for low-income households without access to an automobile and help connect residents to jobs, services, and retail they otherwise could not reach.

Challenges

Challenges cited were:

- It is unknown how bike share could function in a lower density, suburban area with wide arterial roads which in some instances act as barriers for bicyclists and pedestrians alike.
- Bike share stations initiated in 2013 in the suburban areas of Montgomery County, MD are, to date attracting little ridership
- As driving is the most convenient way to get around in Howard County, there is less incentive to adopt bike share as a means of travel compared to places like Washington DC.
- Although the County has a large number of existing separated trails and pathways, it has only a small number on-street cycling facilities in the shape of bicycle lanes and sharrows.
- The existing width on many of streets and arterials, which can encourage higher driving speeds and can be a hostile environment for biking.
- The lack of wayfinding on the trail system makes it hard to navigate even for longtime residents.
- The County's hilly topography was identified as another barrier to biking.
- There are regulatory hurdles to implementation in Howard County. These include the existing Sign Code, which currently prohibit selling ad space on bike share stations, a potential source of operating revenue, and village center covenants make it difficult to create one unified station design that conforms to these varied restrictions.

Goals and Objectives

The following goals and objectives emerged from input from stakeholders and the general public as the most important to focus on::

- Improving public health by encouraging physical activity
- Promoting a safe cycling culture in the County
- Providing a transportation alternative to driving while enhancing the mobility of residents and visitors
- Reducing parking demands in places like the Howard County Community College and downtown Columbia
- Encouraging visitors to explore the County, especially tourists attending local concerts or fairs
- Providing a last-mile connection to transit

- Making Howard County more economically competitive by focusing on the livability aspects of bike share
- Expanding the on-road bicycle facility network

Integration with Other Systems
As many Howard County residents work in Baltimore and Washington DC, there was interest in integrating with one or the other, but not a strong inclination in either direction. As of Spring 2014 there were 68 Howard County residents signed up as annual members of Capital Bikeshare However, participants noted that integration concerns should not limit the technology options considered during this study, specifically suggesting that smart bikes (bikes that do not need stations) remain a consideration for the County despite the fact that they may not be integrated with the DC or Baltimore systems, under current technological conditions.

Private-Sector Funding Opportunities
Feedback from stakeholders included discussion of potential funding sources for capital and operations. Stakeholders felt that there were a number of potential funding partners in the community that could help support a potential bike share system. Major institutions like Howard County Community College and the General Hospital would make excellent partners as they have existing transportation needs that bike share could support. In addition, the County has a strong employer base that might be interested in sponsoring in bike share including APL, Verizon or Lorien Health Systems, which make up three of the largest employers in Howard County (see Employment section). Developers may also be interested in funding bike share as a way to reduce parking requirements or offer additional amenities to their residents. Finally, with a vast number of non-profit organizations and foundations focused on active living and health initiatives, stakeholder recognized that active living funding should be targeted.

Potential Bike Share Usage
According to the online public survey, 44.3% would use the bike share system to run errands; 40.2% would use it to exercise; 36.1% of residents would use bike share bicycles to go shopping or eating out; and, a combined 30.3% responded positively to using the system to directly commute to work or in combination with existing transit options (i.e., MARC, local bus or commuter bus). Almost half (49.6%) of residents would not use a bike share program were it available throughout Howard County.

Pricing
Results of the online survey indicated that Howard County residents indicated they would pay an average of $58 and $12 for annual and daily memberships respectively. This annual membership is lower than the current Capital Bikeshare price ($75), but the daily pass is higher than the existing Capital Bikeshare price (currently at $7 per day). Such pricing is indicative of a recreation-oriented system that would be used occasionally by residents, but not on an everyday basis for transportation needs.

Station Locations
A crowdsourcing map was launched on April 3, 2014 as a companion to the project website. The "wikimap" allowed users to suggest locations for possible bike share stations and to provide commentary on other people's suggestions. The map remained open for comment until June 13, 2014. Two hundred and forty five (245) unique station location suggestions were received in this time period. **Table 5** provides a list of the top 10 most suggested station locations. **Figure 20** shows a map of the suggested station locations.

Table 5 - Top 10 Most Suggested Station Locations

Location	Likes
Downtown Columbia/ The Mall at Columbia	15
Merriweather Post Pavilion	12
Wilde Lake Village Center	10
Howard County Community College	8
Howard County General Hospital	8
Centennial Lake	6
Dorsey's Search Village Center	6
Oakland Mills Village Center	4
Maple Lawn	4
Savage MARC Station	4

The largest number of station suggestions were located throughout many of the destinations within Columbia. Downtown Columbia, Merriweather and Wilde Lake Village Center received significant support (as evidenced by **Figure 20**). Following the public comment period, station

suggestions were aggregated with demographic and infrastructure data to produce a demand analysis map (see the Demand Analysis section).

Stakeholder discussion about station location generally focused on Columbia along the corridor that includes downtown Columbia, Howard County Community College, and Howard County General Hospital, which are undergoing significant growth and development, and have parking constraints. Lakes and recreation areas around Columbia, such as Lake Elkhorn, Lake Kittamaqundi, Wilde Lake and Centennial Lake, were also identified as potential locations to facilitate "lake-to-lake" trips. Finally, participants saw opportunities for bike share along the Route 1 corridor, in Maple Lawn, and between MARC stations and the National Security Agency (NSA).

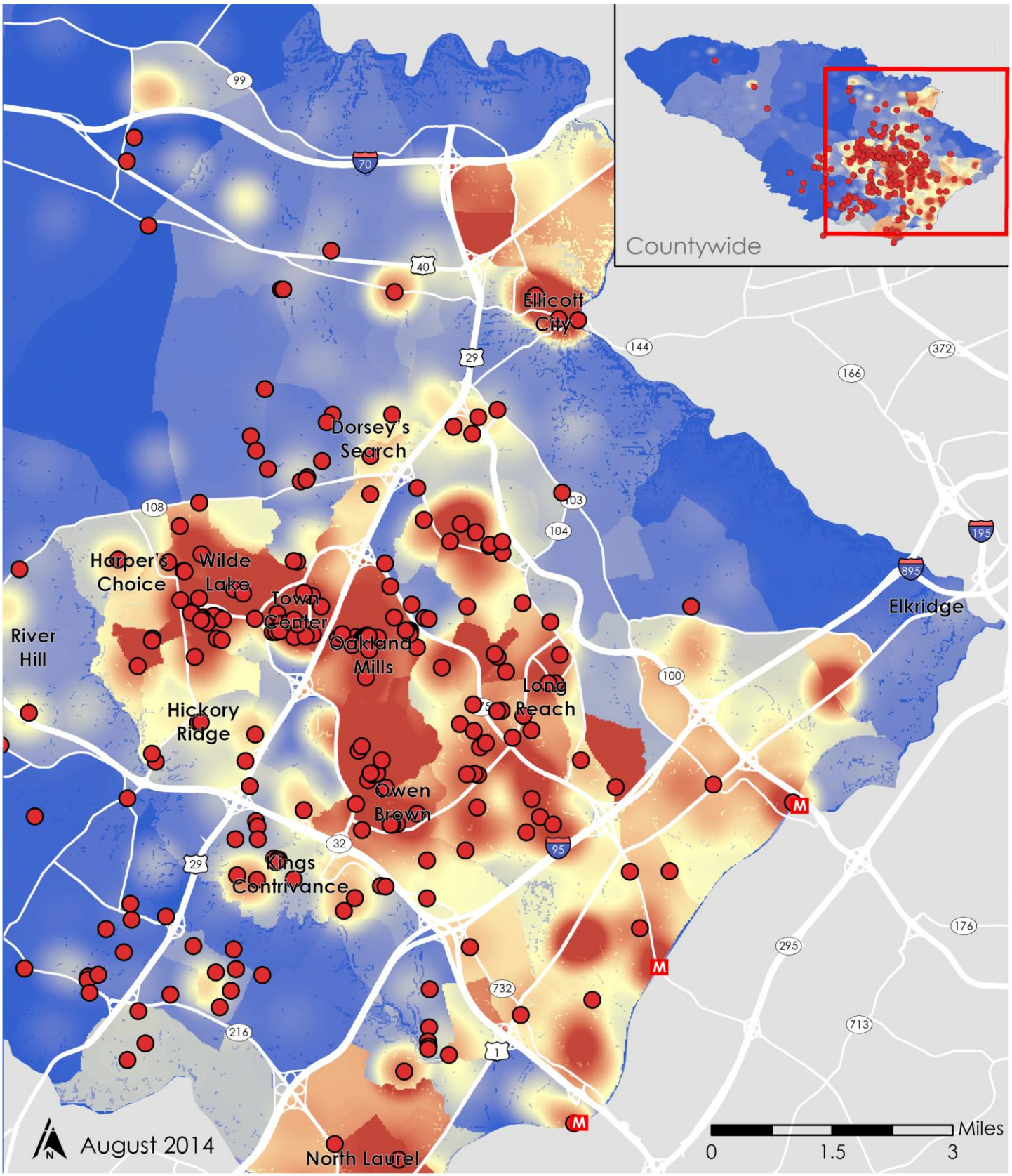


Figure 20 - Howard County Publicly Suggested Station Locations

6. DEMAND ANALYSIS

Evaluating various factors that impact potential bike share demand is an important element in determining the feasibility of a bike share program. This section explains how the demand analysis was undertaken and the different data sources used.

The demand analysis was performed using data obtained from the U.S. Census and the Howard County Department of Planning and Zoning (DPZ). Using these datasets, a heat mapping analysis assigned points to various factors to identify areas with the highest potential demand for bike share ridership in the County. Points were assigned to different geographic areas based on the concentration of people, jobs, attractions, available infrastructure, and other factors.

INDICATORS

Experience from existing bike share programs in the U.S. suggests that a mix and density of population, jobs and activities maximizes the potential for bike share usage. To this end, nine indicators were selected to measure the suitability of a bike share program in Howard County. These are listed in Table 6 along with the sources and scale of the data used.

To determine where bike share would be most successful, a weighted sum analysis was conducted in GIS for all of the variables listed below. A more detailed explanation of why each variable was selected follows.

- **Employment density** – job density measurements indicate where most people are during the day. As with most transportation infrastructure, higher density yields greater efficiencies.
- **Population density** – high population densities provide a pool of potential bike share riders. Trips originating from home may include commuting, recreational, or personal business trips.
- **Proximity to destinations** – various destinations act as trip generators for bike share users. Seven different attraction types were considered including locations for Howard Community College, Downtown Columbia, libraries, parks, pools, shopping centers, village centers. These were assigned different scores based on their relative size and attractiveness to bike share.
- **Bicycle mode share** – bicycle mode share within the County was used to understand areas that may be more conducive to new bicycle and bike share trips.
- **Proximity to transit** – in U.S. cities with existing programs, bike share has been able to provide an on-demand "last mile" extension of the existing transit system. In these cities, a high percentage of bike share trips are linked to other transit trips.
- **Proximity to existing bicycle infrastructure** – the presence of on- and off-street bicycle facilities is correlated with higher rates of bicycling or willingness to bike[111] and a well-connected network of bicycle-friendly facilities can encourage increased bike share ridership. The location of bicycle lanes, minor and major trails (minor referring to smaller connecting trails that may not be completely paved) and pathways were used to compile this indicator.
- **Topography** – Terrain and slope can have a significant impact on the amount of bicycling. Bicycle ridership has been shown to be reduced by up to 10-to-15% with a 10% increase in the degree of slope.[112] Given bike share bicycles weigh significantly more than most private bicycles (approximately 40-to-50 pounds each) a 5% slope was selected as the threshold for when this variable has an impact on bike share ridership.
- **Equity** – Bike share systems have typically launched in high demand areas such as downtowns and among more affluent populations. However, geographic and social equity have become important considerations for new and existing bike share systems. The analysis considers two variables associated with traditionally underserved populations: median household income and the percentage of non-white populations.

111 Geller, Roger. Four Types of Bicyclists. Portland Office of Transportation. Retrieved from https://www.portlandoregon.gov/transportation/article/237507 April 28, 2014.

112 Parkin, J., Ryley, T. J., & Jones, T. J. (2007). Barriers to Cycling: An Exploration of Quantitative Analysis. In D. Horton, P. Rosen, & P. Cox (Eds.), Cycling and Society (pp. 67-82). Burlington, Vermont: Ashgate Publishing Company.

Table 6 - Indicators

Indicator	Scale	Data Source	Information Included
Employment Density	Census Tract	US Census Bureau. Longitudinal Employer-Household Dynamics. Area Profile Analysis in 2011 by Primary Jobs.	Number of workers by place of employment
Population Density	Census Tract	US Census Bureau. File S0101 Age and Sex. 2008-2012 American Community Survey 5-Year Estimates	Number of people per Census Tract
Destinations	Geo-located Points	GIS Data (CORE Places) provided by Howard County DPZ Staff	Location of community college, libraries, parks, pools, Downtown Columbia, shopping centers, village centers.
Bicycle Mode Share	Census Tract	US Census Bureau. B08101 Means of Transportation to work by age. 2006-2010 American Community Survey 5-Year Estimates and 2010 Transportation Analysis Zones provided by Howard County DPZ Staff	Percentage of residents bicycling to work
Proximity to Transit	Geo-located Points and Lines	Location of Bus Stops provided by Howard County DPZ Staff. Includes ridership data (boarding and alighting)	Existing bus stops, MARC train locations
Proximity to Existing Infrastructure	Lines	Howard County Bicycle Master Plan and Howard County DPZ Staff	Existing trails, pathways and bicycle lanes[113]
Topography	Slope Angle	Howard County DPZ Staff (Disc 3) Ancillary Data	Topographic data (slope angle)
Equity	Census Tract	US Census Bureau. File DP05 ACS Demographic and Housing Estimates. DP03 Selected Economic Characteristics. 2008-2012 American Community Survey 5-Year data	Number of minority (non-white) residents and number of residents with median household income under $26,000 for a family of four[114]
Public Comments	Geo-located Points	Howard County Bikeshare Crowdsourcing map	Public suggestions for bike share stations

113 Although many roadways throughout the County include wide enough shoulders to accommodate bicycling, the width of paved shoulders varies from one section of roadway to another, therefore, the analysis did not include paved shoulders.
114 Based on the 2011 Federal Poverty Guidelines located under Howard County Health Department Website. http://www.howardcountymd.gov/DisplayPrimary.aspx?id=4294969248.

- **Public Comments** – Public comments received via the crowdsourcing website[115] and from the public meeting were used to identify those locations in the County where the public would like to see bike share stations.

METHODOLOGY

A demand analysis or "heat map" was constructed using the data above and following the following process (see **Figure 21**):

1. Developed GIS maps for each of the nine demand indicators (see above). Individual variable maps are included in Appendix 4.
2. Within each indicator, different areas or features were scored based on their relative performance against other areas, e.g., census tracts with population densities in the top quartile were scored higher than those in the middle and bottom quartiles.
3. Weightings were assigned to each indicator based on previous research and bike share planning to account for the relative influence each is expected to have on potential bike share ridership in Howard County. Weighting factors and methodology are shown in **Table 7**.
4. Weighted scores for each indicator were combined to create an aggregated score and then mapped to create a heat map for Howard County.

To account for the difference between area and point or linear variables, a half mile buffer was added around point and linear features, which is thought to be the distance a potential bike share rider might walk to access a bicycle.[116]

The final heat map for Howard County is shown on the figure below and shows that the areas of the County with the highest potential for bike share use include:

- Town Center and Downtown Columbia
- Howard County Hospital and Howard County Community College campus
- Village of Oakland Mills

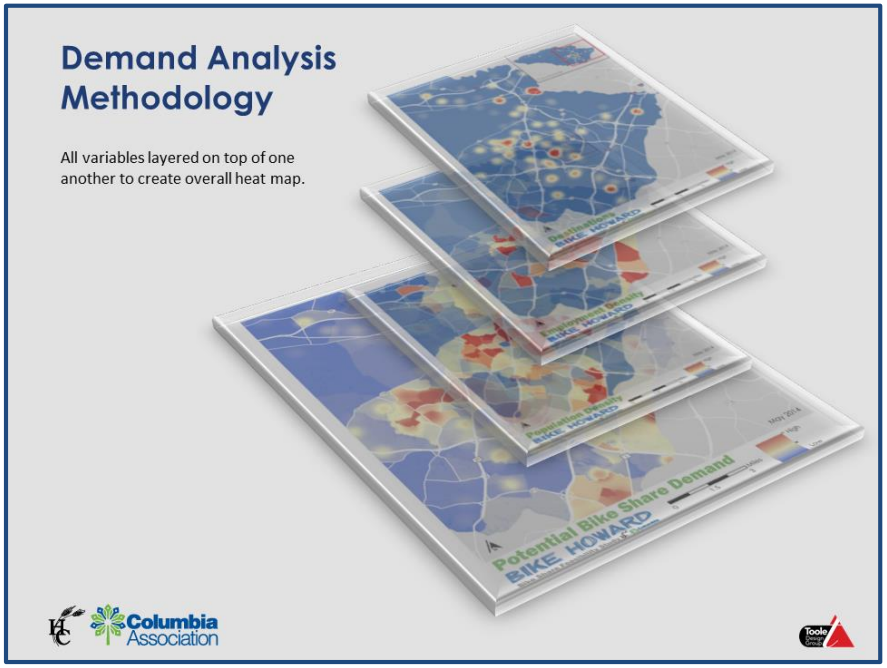


Figure 21 - Demand Analysis Methodology

- Village of Owen Brown
- Village of Wilde Lake
- Historic Ellicott City
- US-1 Corridor
- North Laurel/Savage

In future phases of the study, the results of the demand analysis will be used to identify the initial service area, as well as inform potential system phasing, and identify general areas for bike share station locations.

115 http://wikimapping.net/wikimap/HoCoBikeshare.html
116 Bike Sharing in the United States. State of the Practice and Guide to Implementation. Page 18. Federal Highway Administration. September 2012.

Table 7 - Heat Mapping Scoring and Methodology

Variable	Points	Weights[117]	Methodology
Employment Density	20	19%	Census tracts grouped into quartiles based on their employment density. Census tracts assigned scores based on which quartile they fall, e.g. top quartile = 20/20, bottom quartile = 2.2/20.
Population Density	20	19%	Census tracts grouped into quartiles based on their population density. Census tracts assigned scores based on which quartile they fall, e.g. top quartile = 20/20, bottom quartile = 2.2/20.
Destinations	17	16%	Point locations based on information provided by Howard County. These locations include: Howard Community College, Downtown Columbia, libraries, parks, pools, shopping centers, Columbia Association Village Centers (e.g., Dorsey's Search, Harper's Choice, Wilde Lake, Town Center, Oakland Mills, Owen Brown, Long Reach). Scores graduated from the maximum score within a ½ mile radius from the point location and decreasing out to ¼ mile radius from the point location.
Bicycle Mode Share	10	10%	Census tracts grouped into quartiles based on their bicycle mode share. Census tracts assigned scores based on which quartile they fall, e.g. top quartile = 10/10, bottom quartile = 1.2/10.
Proximity to Transit	10	10%	Transit stops grouped into quartiles based on annual ridership data. Stops (bus and MARC) assigned scores based on which quartile they fall, e.g. top quartile = 10/10, bottom quartile = 1.5/10. Scores graduated from the maximum score within a ½ mile radius from the point location and decreasing out to ¼ mile radius from the point location.
Proximity to Existing Bicycle Infrastructure	10	10%	Bikeways coded as line segments. 5 points assigned to every line segment that has a bikeway. Scores graduated from the maximum score within a ¼ mile radius from the line segment and decreasing out to ½ mile radius from the line segment.
Public Comments	3	3%	Scores graduated from the maximum score within a ½ mile radius from the point location and decreasing out to ¼ mile radius from the point location.
Equity	12	13%	Census tracts grouped into quartiles based on their median household income (lower than $26,000) and the percentage of non-white populations. Census tracts assigned scores based on which quartile they fall, e.g. top quartile = 12/12, bottom quartile = 2/12.
TOTAL	**102**	**100%**	**Combined total of above scores**
Topography	-3		Areas of the County with average slopes of 5% or higher received a reduction in score of 3 points.

117 Weightings were assigned to each indicator based on previous research and bike share planning to account for the relative influence each is expected to have on potential bike share ridership in Howard County.

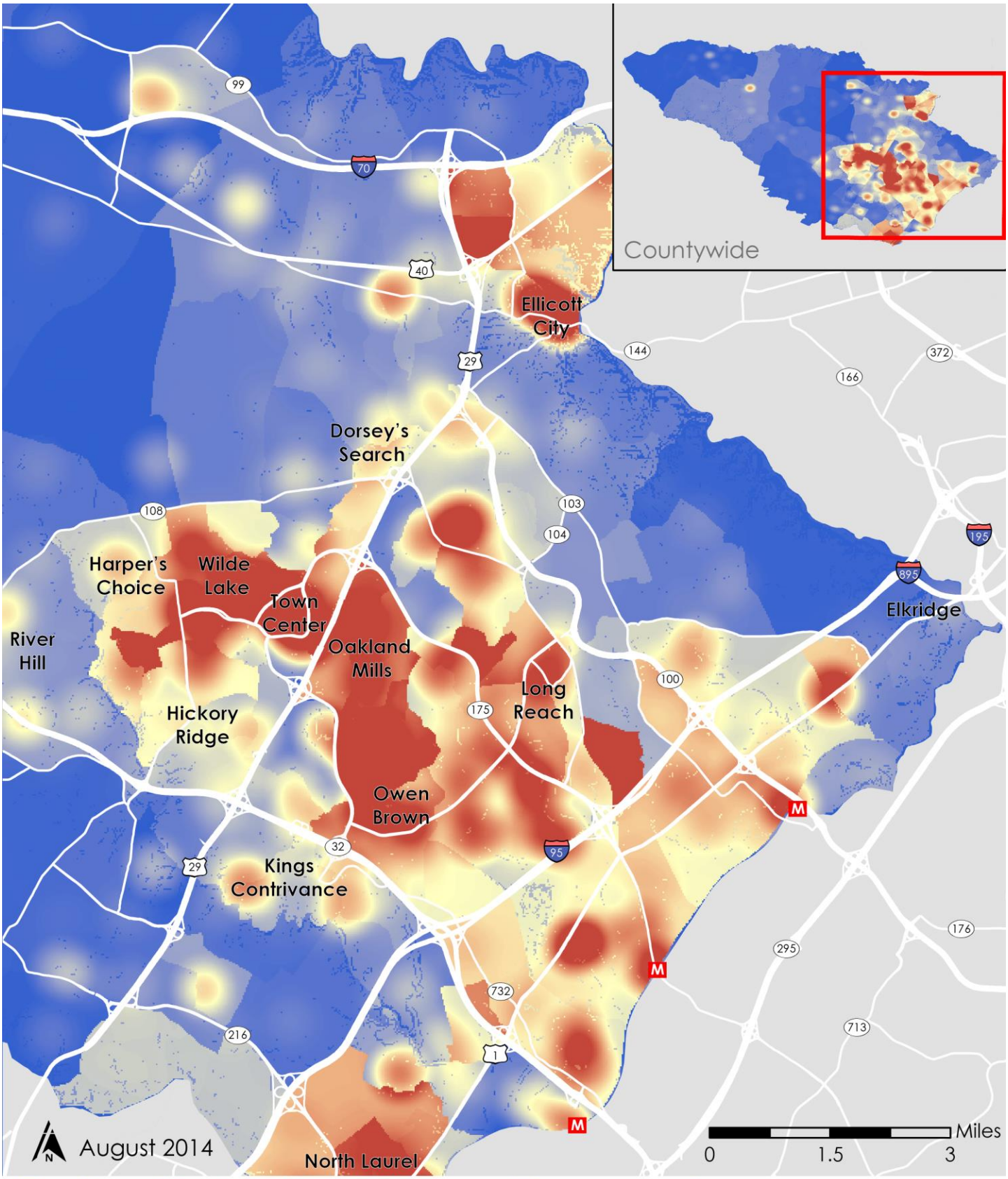


Figure 22 - Howard County Potential Bike Share Demand

7. FEASIBILITY RECOMMENDATION

As discussed in the introduction, during the development of the grant application, Columbia Association and Howard County developed the following goals for a potential bike share program:

1. Improve access to transit systems and expand transportation options for County residents.
2. Increase the convenience and visibility of bicycle use for short distance trips so cycling can more readily become a popular daily transportation mode
3. Enhance public health by reducing air pollution and promoting active lifestyles
4. Enhance the quality of life for Howard County residents by supporting bicycling as a fun and convenient transportation mode

In consideration of geographic, population, employment, existing bicycling infrastructure, local plans and ordinances, as well as public feedback, the overall analysis of feasibility is that a recreation- and health-oriented bike share system (supporting Goals #3 and #4) is currently FEASIBLE. To this end, a recreational- and health-oriented bike share system can be implemented Howard County in the near-term. Reasons why a recreational- and health-oriented system in Howard County can be successful are:

- There is a moderately interconnected network of trails and pathways throughout the most populated areas of the County which are mostly used for recreational purposes. A bike share program may be able to increase use of these facilities.
- While the trail system does not currently have a strong wayfinding system, it is already being improved. A bike share system would further enhance visibility and overall awareness of cycling in Howard County.
- There are a significant number of annual visitors in some parts of the County including Downtown Columbia (including Merriweather Post Pavilion), Ellicott City, and a good number of lakes and parks within Howard County. These visitors would be likely to use a bike share system to enhance their experience of Howard County.

Under current conditions, a transportation focused bike share system (supporting Goals #1 and #2) is found to be NOT FEASIBLE. However, it is anticipated that a more transportation-oriented system can be implemented in the future. It is important to note that a proposed initial system designed with recreation and health in mind will still provide some components of transportation and mobility to residents. Based on examples from around the U.S. especially those in less dense jurisdictions, residents tend to find creative ways to utilize a bike share system serving a utilitarian transportation function, such as workday lunch trips. As discussed earlier, conditions are quickly changing in Howard County and may lead to the transformation of a bike share system from a recreational system to a transportation-oriented system. Should the County consider expanding its focus to serving as a transportation-oriented bike share program, it is recommended that the following issues be addressed:

- Increase connectivity between destinations and to- and from-public transit. With the completion of the Downtown Columbia Trail Project (currently under construction), increased connectivity between activity centers will support bike share ridership for transportation.
- Further develop an interconnected network of on- and off-street bicycle friendly facilities. Ongoing development of on- and off-street safe bicycle infrastructure is strongly recommended, even after implementation. This will allow users to more comfortably ride between existing destinations.
- Increased mixed-use development, as well as the reconfiguration of neighborhoods in and around Downtown Columbia should continue. The current development plans of 5,500 new residential units, 4.3 million square feet of commercial office space, 1.25 million square feet of retail space and 640 hotel rooms supports the fact that people use bike share for different reasons: where they live, work, play and transit. Although this development need not be 100% completed to support a bike share system, it should at least be partially implemented prior to installation of a transportation-oriented bike share system.

CHARACTERISTICS OF A HEALTH- AND RECREATION-ORIENTED BIKE SHARE SYSTEM

As described above, this report has found that a recreational- and health-oriented bike share system can be implemented Howard County in the near-term. Following are some recommendations as to how such a system may vary from a "standard" dense, urban transportation-oriented system:

- **Station Locations:** Stations should be located mostly at or near trail entrances to bring visibility to these trails and encourage usage. These station locations may be more sparsely located than the station density in most urban bike share systems.
- **Signage:** Each station should have visible signage with easy-to-understand directions about the bike share system, safety tips, rules and regulations, and encouragement of helmet-wearing.
- **Wayfinding:** Each station should have wayfinding maps showing trails, streets with bicycle safety ratings, other bike share stations and nearby destinations (including businesses) accessible by bicycle.
- **Standard Ride Time:** The system should include a longer standard ride greater than 30 minutes to accommodate recreational rides.
- **Helmet Distribution:** The system should include strong partnerships with local shops for helmet distribution for recreational riders, and can consider Inclusion of helmet vending machines (which are planned for Seattle's upcoming bike share system).
- **Pricing Structure:** A simplified pricing structure should be employed that is transparent to recreational users similar to other similar bike share systems such as Broward County, Florida.
- **Bicycle Specifications:** The system may incur more usage if the bicycles are more conducive to longer rides and/or more hilly topographic conditions, either through a lighter bicycle (standard bike share bicycles are 40-50 lbs.) or pedal-assist bicycles (not currently available in bike share systems, but may be in the upcoming years).
- **Visitor Outreach:** Significant outreach to visitors via Visit Howard County, events and hotels.
- **Online Presence Promoting Trails:** Online presence via website and social media encouraging use of the trail system, safety while riding, highlighting events and recreational opportunities.

EVOLVING TO A TRANSPORTATION-ORIENTED SYSTEM

Based on current bicycle infrastructure and mixed use development plans in Howard County, as discussed above, it is expected that a more transportation-oriented system can be implemented in the future. This system will build from the strong culture and visibility created by the recreational system, but will add the following characteristics:

- **Station Density:** A denser network of stations located at a mix of residential, transit, employment and visitor trip sources and destinations to encourage short point-to-point trips;
- **Additional Pricing Options:** An enhanced pricing structure that includes options for high usage members who may use it on a regular basis for employment commuting, as well as corporate sponsorships and memberships for businesses located at or near bike share stations;
- **Access Program:** An access program for lower-income users who may utilize bike share for employment commuting;
- **Online Presence Promoting Commuting:** Strong online presence via a website and social media that encourages additional transportation-oriented ridership of a system;
- **Regional Integration:** Potential integration with other regional systems (Baltimore and/or Washington DC);
- **Business Outreach:** Events and local business partnerships that reach out to employers and residents highlighting uses of a bike share system; and
- **Transportation Partnerships:** Partnerships with the transit agencies and car- and ride-share companies for co-promotions.

It should be noted that although the term "stations" is regularly referred to throughout this section of the feasibility study, there is no recommendation for either a smart-bike or a smart-dock system. Should a smart-bike system be chosen, it is strongly encouraged that this system includes highly visible hubs to make any system more effective. Further analysis of the two different technologies will be undertaken in the Business Plan.