



National Association of  
City Transportation Officials

NACTO BIKE SHARE  
EQUITY PRACTITIONERS' PAPER #1  
APRIL 2015



## WALKABLE STATION SPACING IS KEY TO SUCCESSFUL, EQUITABLE BIKE SHARE

Across the United States, bike share programs offer new transportation options for people at all income levels. Bike share programs extend the reach of existing transit, make one-way bike trips possible, and eliminate some barriers to riding such as bike ownership, storage, maintenance and concerns about theft. Since 2010, bike share systems have been introduced in over 30 U.S. cities and riders have taken over 36 million bike share trips.

While bike share offers clear financial benefits, low-income people are not proportionally represented among U.S. bike share users. People use bike share when it is convenient and serves the trip they are trying to make. However, in many cities, there is an insufficient number and density of stations in neighborhoods where low-income people live, making bike share an inconvenient choice for most trips.

While the bike share industry is still in its infancy, with a number of challenges to address in order to grow and thrive, good system planning can help address equity concerns by improving the quality of service. Systems that are designed with a uniformly high station density (approximately 28 stations per square mile) across a variety of neighborhood types provide a convenient transportation option throughout the coverage area and see higher usage across all income brackets.<sup>1</sup> To increase ridership among low-income populations, bike share systems must be designed to offer a meaningful transportation option. Cities should launch bike share programs that are as big as possible, densely covering a large, contiguous area that includes low-income neighborhoods, as well as employment centers and other high density areas, and has safe, welcoming places to ride.<sup>2</sup> As bike share systems are launched and expanded, protected bike lanes that take people where they want to go must be introduced as well.

## BIKE SHARE RIDERSHIP INCREASES WHEN STATIONS ARE CLOSER TOGETHER

Bike share system design – namely station density, program area layout and the presence of complementary protected bike lanes – is a key factor in ridership.<sup>3</sup> NACTO’s analysis of recent ridership data from an array of North American bike share systems shows that ridership at a station (defined as the number of trips that begin or end at the station) increases exponentially the more stations there are in close proximity.<sup>4</sup> A recent academic paper similarly found that Vélib’ could increase ridership by almost 30% if station density in Paris was increased.<sup>5</sup>

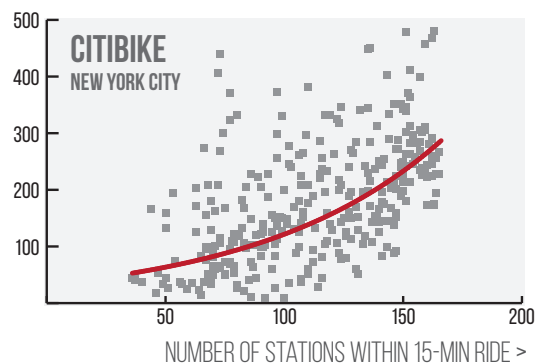
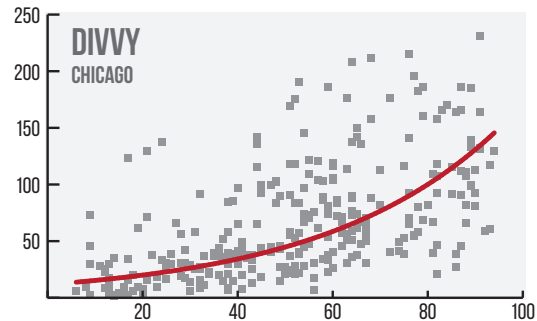
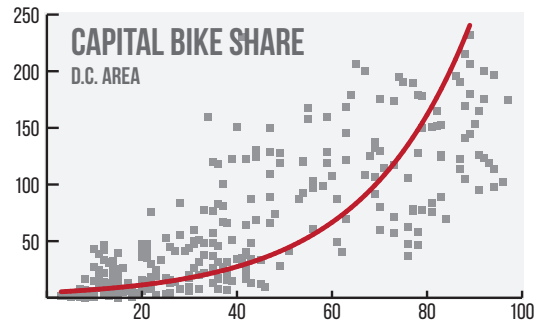
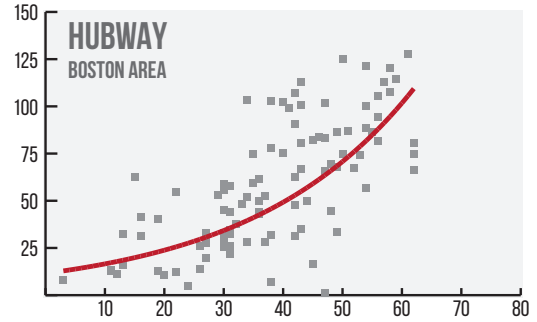
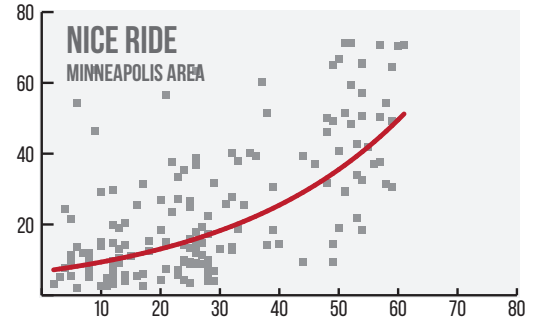
Bike share usage is predominantly driven by convenience. Thus, having more options of places to go will increase ridership overall. Placing bike share stations uniformly close together over a large area is one of the best ways to ensure that a city’s bike share system will be a real transportation option for a wide demographic of users. Conversely, a low-density system, with only a few stations within a walkable distance, will see lower ridership.

Research on transit users finds that most people will walk no more than a ½ mile to get to commuter rail, with a large drop-off beyond a ¼ mile.<sup>6</sup> The distance someone will walk to use a bike appears to be much smaller – about 1,000 feet or 5 minutes walking. The bike share systems that have the highest ridership – Paris, New York, Mexico City – have stations evenly spaced an easy walking distance apart. Since the distance that people are willing to walk to find a bike remains the same regardless of neighborhood type, the size of the stations should be adjusted, not the spacing, to address neighborhood-specific needs.<sup>7</sup> To increase ridership and system utility, bike share stations should be placed no more than 1,000 feet apart across the entire program area.

**“I THINK THE BASIC ISSUE WITH ANY BIKE SHARING IS DENSITY. IF YOU LOOK WHERE IT IS USED, THERE ARE LOTS OF STATIONS. I AM NOT GOING TO USE A SYSTEM THAT BASICALLY ONLY GIVES ME THE OPTION TO GO TO ONE OR TWO PLACES. IF THERE ARE LOTS OF STATIONS EAST OF THE RIVER, I BET IT WOULD BE USED MORE.”**

—GREATER GREATER WASHINGTON COMMENTATOR<sup>8</sup>

### SYSTEM ANALYSIS: RIDES INCREASE WITH STATION DENSITY



RIDES PER DAY TO/FROM STATION >

NUMBER OF STATIONS WITHIN 15-MIN RIDE >

## TO CREATE EQUITABLE BIKE SHARE SYSTEMS, MEET THE SERVICE QUALITY NEEDS OF LOW-INCOME RIDERS

In the United States, however, low-income neighborhoods typically have among the lowest density of bike share stations, making bike share an inconvenient option for most trips. In addition, low-income areas often have fewer protected bike lanes and less bike infrastructure overall, further restricting the pool of possible riders to only the most fearless and committed of cyclists.<sup>9</sup>

While systems around the country have experimented with deeply discounted memberships and options for low-income residents and the unbanked, less attention has been paid to ensuring that there are enough stations in low-income neighborhoods to make bike share a useful transportation option. Bike share trips are overwhelmingly short (less than 15 minutes) and local.<sup>10</sup> As a result, users need a dense network of station options from which to pick up and return a bike.

Cities must carefully select their initial coverage and expansion areas in order to maintain a high station density across the entire system. Financial limitations and political considerations often lead cities to create sprawling systems (the “one in each neighborhood” model) with low-density coverage in low-income areas instead of starting/expanding in a geographically tighter area with a higher station density. However, systems that have lower station density in low-income neighborhoods often exacerbate equity issues as stations are too far apart to provide a real transportation option for low-income riders. Such systems attempt to achieve nominally or geographically equitable bike share coverage at the expense of service quality and utility.



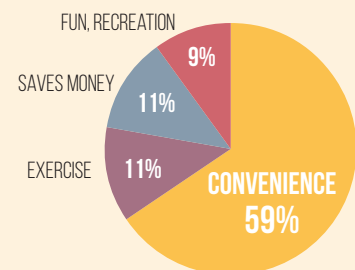
## BIKE SHARE USERS RIDE WHEN IT IS CONVENIENT

The importance of convenience to bike share users cannot be overstated. A 2013 survey of Capital Bike Share users found that 9 out of 10 reported the “ability to get around more easily or more quickly” as their primary reason for joining the program.<sup>11</sup> In New York, a 2013 intercept survey found that the majority (59%) of Citi Bike users cited “convenience, ready availability, flexibility in travel, saves time” as the thing they most valued about the program.<sup>12</sup> In a 2015 survey of Divvy members, the ability to “get around more easily/faster” was the most common reason why Chicagoans decided to join the system.<sup>13</sup> Convenience, or the lack thereof, is likely to be an even more important factor to low-income people who are deciding if they want to use their city’s bike share system, as they typically have less spare time and less disposable income than higher-wage earners.

NACTO’s System Convenience analysis can be used to identify places where bike share is less convenient and where station infill is needed to ensure quality service. The analysis measures system utility by assessing the percent of the program area that is within a convenient walking distance (1,000 feet) from a bike share station. Overall, NACTO’s analysis finds that most U.S. bike share systems provide good service at the center but that station density decreases, along with the utility of the system and ridership, further out from the core. Station density and service is often worse in low-income areas. New York’s Citi Bike is an exception: while Citi Bike does not cover the whole city, the areas that are served are evenly covered with stations. As a result, bike share in New York is equally convenient throughout the program area. Notably, the planned Citi Bike expansion will further expand coverage outside the Manhattan core while maintaining the same station density. Cities can increase ridership and provide better service for low-income residents by adding infill stations.

### WHAT DO YOU VALUE MOST ABOUT BIKE SHARE?

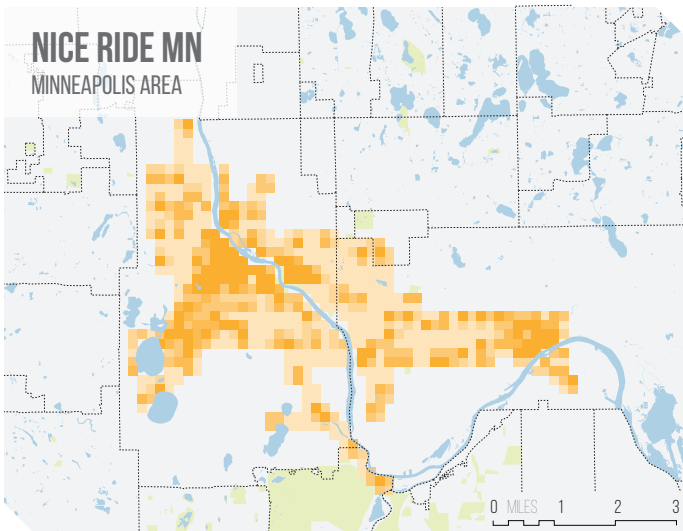
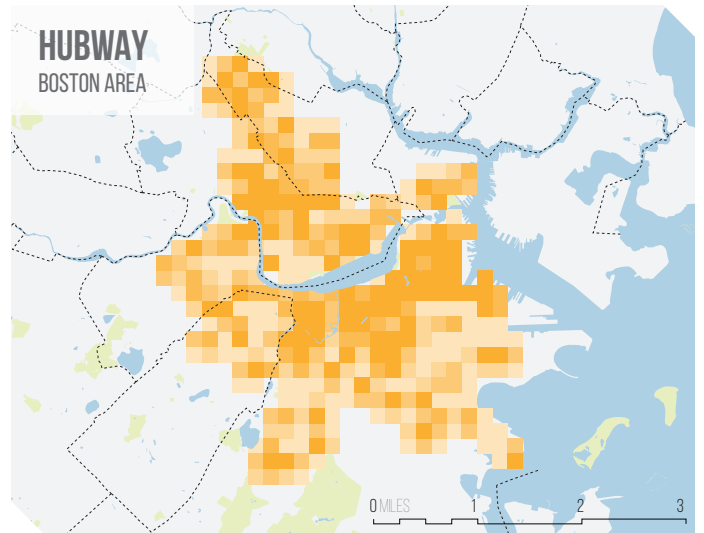
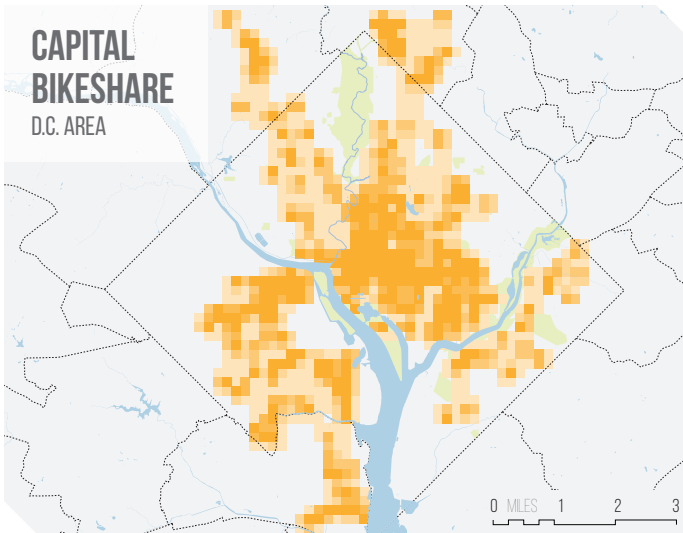
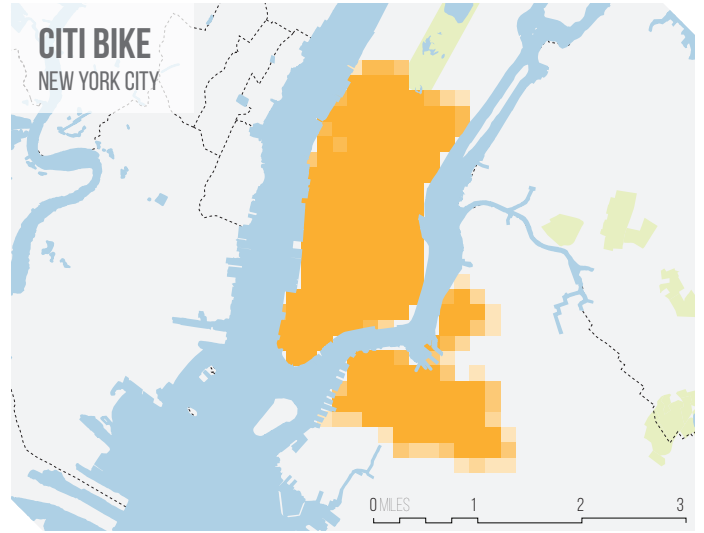
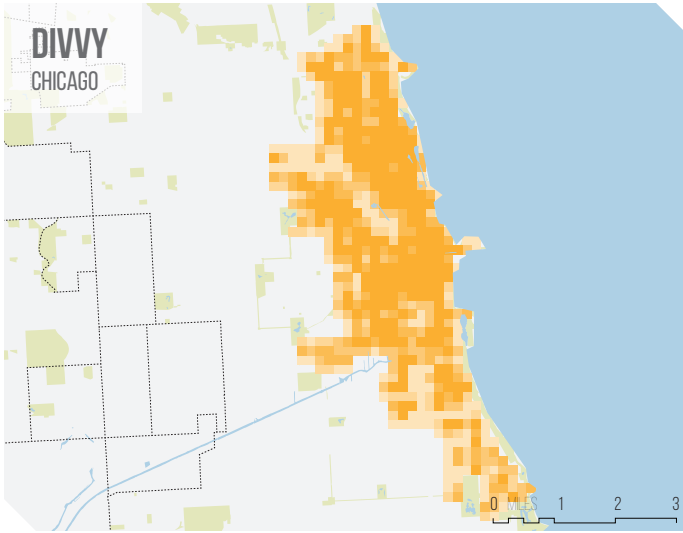
*Citi Bike, 2013*





# NACTO'S SYSTEM CONVENIENCE ANALYSIS IDENTIFIES AREAS FOR INFILL

PERCENT OF AREA WITHIN 1,000' OF A STATION



| System                           | Rides per Bike per Day <sup>a</sup> | Total Rides in 2014 | Stations per Sq. Mi. |
|----------------------------------|-------------------------------------|---------------------|----------------------|
| Vélib'                           | 5.3                                 | 39,000,000          | 33                   |
| <b>Citi Bike NYC</b>             | <b>5.2</b>                          | <b>8,894,000</b>    | <b>23</b>            |
| Ecobici Mexico City              | 5.0                                 | 7,952,000           | 22                   |
| <b>Divvy</b>                     | <b>3.8</b>                          | <b>2,455,000</b>    | <b>8</b>             |
| <b>Capital Bikeshare</b>         | <b>3.6</b>                          | <b>2,946,000</b>    | <b>4</b>             |
| <b>Hubway</b>                    | <b>3.2</b>                          | <b>1,193,000</b>    | <b>5</b>             |
| Bay Area Bike Share <sup>b</sup> | 2.5                                 | 292,679             | 11                   |
| Denver B-cycle                   | 2.2                                 | 377,000             | 5                    |
| <b>Nice Ride MN</b>              | <b>1.6</b>                          | <b>415,000</b>      | <b>4</b>             |

<sup>a</sup> Calculated from June 2014 data to account for winter closures in some systems. Figures for Hubway and Vélib' are calculated from total 2014 trips.  
<sup>b</sup> Data reflects only the San Francisco portion of the Bay Area Bike Share system.

## LESSONS FROM THE CITIES

- » **To create equitable bike share systems, cities and bike share operators must meet the service quality needs of low-income riders.** Like everyone, low-income people want convenient travel options that work for the trips they are trying to make. Bike share systems can provide this if they maintain a high station density (approximately 28 stations per square mile) across all neighborhoods in the service area, including low-income areas.
- » **In neighborhoods with fewer destinations or less activity/population density, station size should be reduced but the station spacing should remain the same.** Ensuring an even, walkable station density (a station every 1,000 feet) is what makes bike share convenient and easy to use. Instead of increasing the distance between stations, cities should adjust the station size to accommodate different types of neighborhoods.
- » **Good bike share systems have lots of stations within a short walking distance and maintain that spacing across all neighborhoods.** The distance between bike share stations should be defined by the distance people are willing to walk to find a bike – less than 5 minutes.
- » **To increase ridership in low-income areas, cities should increase station density by adding infill stations.** Cities can use NACTO's analysis to identify areas within their program area where station infill would be beneficial.
- » **Protected bike infrastructure that takes people where they want to go must be introduced with bike share system launches and expansions** to ensure that people of all cycling abilities will feel comfortable using the system.



LEARN MORE ABOUT NACTO'S  
BIKE SHARE PROGRAM AT NACTO.ORG

1 Twenty-eight stations per square mi, or a station every 1,000 feet, is the density needed to ensure a 5 minute walk between stations.  
2 Operator experience suggests that there may be places where bike share is financially infeasible because the population density is too low. In such areas, other bike interventions – such as enhanced bike parking or community based bike outreach like NiceRide's Orange Bike program – may be good substitutes.  
3 Portland State University, "Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S.," NITC-RR-583, June 2014, [http://bikeportland.org/wp-content/uploads/2014/06/NITC-RR-583\\_ProtectedLanes\\_FinalReportb.pdf](http://bikeportland.org/wp-content/uploads/2014/06/NITC-RR-583_ProtectedLanes_FinalReportb.pdf)  
4 Data is from Q2 2014  
5 Kabra, Belavina & Girotra, "Bike Share Systems: Accessibility and Availability," University of Chicago Booth School of Business, Working Paper # 15-04, 2015  
6 Regional Plan Association, "Building Transit Friendly Communities: A Design and Development Strategy for the Tri-State Metropolitan Region." August 1997, p. 11  
7 To keep rebalancing efficient, most bike share operators suggest a minimum station size of 12-15 docks.  
8 <http://greatergreaterwashington.org/post/9020/why-is-capital-bikeshare-usage-low-east-of-the-river/#comment-85804>

9 Geller, Roger, "Four Types of Cyclists," Portland Office of Transportation, 2009. <http://www.portlandoregon.gov/transportation/article/264746>  
10 Annual member trips across all major U.S. systems.  
11 Capital Bikeshare, "2013 Capital Bikeshare Member Survey Report," prepared by LDA Consulting, May 22, 2013. <http://www.capitalbikeshare.com/assets/pdf/CABI-2013SurveyReport.pdf>, p.14  
12 NYC DOT, "After first 200 days of Citi Bike, NYC DOT releases new data showing that significant numbers of New Yorkers are biking, complementing transit system," Press Release #13-67, December 12, 2013. <http://a841-tfpweb.nyc.gov/dotpress/2013/12/new-biking-data/#more-153>  
13 Chicago DOT, 2015 Divvy Annual Member Survey

#### Image Credits—

Page 1: Photo by NYC DOT  
Page 3: Photo by Steven Vance via Flickr: <https://www.flickr.com/photos/jamesbondsv/9840916195>  
Page 5: Photo by Everet Barnes via Flickr: <https://www.flickr.com/photos/perspective/5711762129>

*This paper is made possible by a grant from The JPB Foundation to further the conversation around equity in bike share.*